ANALYSIS OF PERFORMANCE FACTORS OF TRACK AND FIELD ATHLETES

A THESIS
SUBMITTED TO THE JADAVPUR UNIVERSITY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
IN PHYSICAL EDUCATION
FACULTY OF ARTS

By

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DEDICATED

TO

MY

FATHER, MOTHER, WIFE

&

DAUGHTER

DECLARATION

I do hereby declare that the research work entitled "ANALYSIS OF PERFORMANCE FACTORS OF TRACK AND FIELD ATHLETES" is an original work done by me under the supervision of Dr. ATANU GHOSH Assistant Professor, Jadavpur University which was approved by the research committee.

To the best of my knowledge, this thesis is not substantially the same as those, which have already been submitted for a degree or other academic qualification at any other universities.

Date: **(ARUP MAHATO)**

CERTIFICATE

Certified that the Thesis entitled **"ANALYSIS OF PERFORMANCE FACTORS OF TRACK AND FIELD ATHLETE"** submitted by me for the award of the Degree of Doctor of Philosophy in Arts at Jadavpur University is based upon my work carried out under the Supervision of **Dr. Atanu Ghosh**, Assistant Professor, Department of Physical Education, Jadavpur University, Kolkata and that neither this thesis nor any part of it has been submitted before for any degree or diploma anywhere / elsewhere.

Countersigned by the Supervisor

Dated:

Signature of the Candidate

Dated:

Acknowledgement

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Place: ***ARUP MAHATO***

Date: ***Research Scholar***

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LIST OF ABBREVIATION

sec	: Second/Seconds
m	: Meter/Meters
cm	: Centimeter/Centimeters
n	: Number
kg	: Kilogram
mm	: Millimeter/Millimeters
SD	: Standard Deviation
Fig	: Figure
Df	: Degree of freedom
SS	: Sum of square
MSS	: Mean of sum square
Std. Error	: Standard Error
Sig	: Significant
NS	: Not significant
SCAT	: Sports competition Anxiety Test
LDS	: Least significance difference
SCAT	: Sports competition anxiety test

CHAPTER - I

INTRODUCTION

1.1 General Introduction

1.2 Statement of the Problem

1.3 Purpose of the Study

1.4 Significance of the Study

1.5 Delimitation of the Study

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1.7 Hypothesis

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CHAPTER - I

INTRODUCTION

In this chapter includes the general introduction which was related with the present study, where the researcher tried to find out the basic concept of track and field events. This chapter also includes the statement of the problem, limitation, delimitations of the present study, definition of the related terms and hypothesis, significance of the studies were included.

1.1 GENERAL INTRODUCTION

Track and field is a sport which includes athletic contests established on the skills of running, jumping, and throwing. The name is derived from the sport's typical venue: a stadium with an oval running track enclosing a grass field where the throwing and some of the jumping events take place. Track and field is categorized under the umbrella sport of athletics, which also includes road running, cross country running, and walking. The foot racing events, which include sprints, middle- and long-distance events, race walking and hurdling, are won by the athlete with the fastest time. The jumping and throwing events are won by the athlete who achieves the greatest distance or height. Regular jumping events include long jump, triple jump, high jump and pole vault, while the most common throwing events are shot put, javelin, discus and hammer. There are also "combined events" or "multi events", such as the pentathlon consisting of five events, heptathlon consisting of seven events, and decathlon consisting of ten events. In these, athletes participate in a combination of track and field events. Most track and field events are individual sports with a single victor; the most prominent team events are relay races, which typically feature teams of four. Events are almost exclusively divided by gender, although both the men's and women's competitions are usually held at the same venue. If a race has too many people to run all at once, preliminary heats will be run to narrow down the field of participants.

Track and field are one of the oldest sports. In ancient times, it was an event held in conjunction with festivals and sports meets such as the Ancient Olympic Games in Greece. In modern times, the two most prestigious international track and

field competitions are athletics competition at the Olympic Games and the IAAF World Championships in Athletics. The World Athletics is the international governing body. Records are kept of the best performances in specific events, at world and national levels, right down to a personal level. However, if athletes are deemed to have violated the event's rules or regulations, they are disqualified from the competition and their marks are erased. In North America, the term track and field may be used to refer to other athletics events, such as the marathon, rather than strictly track-based events.

The sport of track and field has its roots in human prehistory. Track and field-style events are among the oldest of all sporting competitions, as running, jumping and throwing are natural and universal forms of human physical expression. The first recorded examples of organized track and field events at a sports festival are the Ancient Olympic Games. At the first Games in 776 BC in Olympia, Greece, only one event was contested: the stadion foot race. The scope of the Games expanded in later years to include further running competitions, but the introduction of the Ancient Olympic pentathlon marked a step towards track and field as it is recognized today it comprised a five-event competition of the long jump, javelin throw, discus throw, stadion foot race, and wrestling.

In athletics and track and field, sprints (or dashes) are racing over short distances. They are among the oldest running competitions. The first 13 editions of the Ancient Olympic Games featured only one event the stadion race, which was a race from one end of the stadium to the other. There are three sprint events, the 100, 200, and 400mts. These events have their roots in races of imperial measures altered to metric: the 100 m evolved from the 100-yard dash, the 200 m distances came from the furlong (or 1/8 of a mile), and the 400 m from 440-yard dash or quarter-mile. The 60 meters is a common indoor event and it is an indoor world championship event. Less common events include the 50 meters, 55 meters, 300 meters, and 500 meters which are used in some high school and collegiate competitions in the United States. The 150 meters, though rarely competed, has a star-studded history: Pietro Mennea set a world best in 1983.

Olympic champions Michael Johnson and Donovan Bailey went head-to-head over the distance in 1997, and Usain Bolt improved Mennea's record in 2009.The

Olympics have changed considerably since beginnings in ancient Greece. At first, only Greeks were allowed to compete; now the Olympics are a worldwide event. The ancient Greek Olympics had few events in comparison to modern Olympics. No winter sports existed, and while individual competition dominated the ancient Olympics, the modern version includes team sports. Nevertheless, one thing has remained constant throughout history, and that is that sprinting has always played an important part in the Olympics. The first Greek Olympics took place in 776 B.C. It lasted for one day and featured sacrifices in honour of the Greek gods, especially Zeus. The only athletic event was a sprint from one end of the race course to the other. It was called a stadion, or Stade, and its distance was about 630 feet. This single running race continued to be the only athletic event in several successive Olympics. Like their modern counterpart, the Greek Olympics occurred every four years. For about 400 years, each Olympiad was named after the athlete who had won the running race in the last Olympics. For example, because an athlete named Koroibos was the victor in the first Olympics in 776, the subsequent four-year period was called the Olympiad of Koroibos four-year period between Olympic Games became a Greek measure of time called the Olympiad. There was also a sprint twice as long as a Stade. However, the original Stade continued to be the chief event, and its popularity continued until Emperor Theodosius who abolished the games in 394 A.D.

1.1.1. HISTORY OF SPRINT

Sprinting is running over a short distance in a limited period of time. It is used in many sports that incorporate running, typically as a way of quickly reaching a target or goal, or avoiding or catching an opponent. Human physiology dictates that a runner's near-top speed cannot be maintained for more than 30–35 seconds due to the depletion of phosphocreatine stores in muscles, and perhaps secondarily to excessive metabolic acidosis as a result of anaerobic glycolysis.

In athletics and track and field, sprints (or dashes) are races over short distances. They are among the oldest running competitions. The first 13 editions of the Ancient Olympic Games featured only one event—the stadion race, which was a race from one end of the stadium to the other. There are three sprinting events which are currently held at the Summer Olympics and outdoor World Championships: the 100 meters, 200 meters, and 400 meters. These events have their roots in races of

imperial measurements which were later altered to metric: the 100 m evolved from the 100-yard dash, the 200 m distance came from the furlong (or ⅛ mile), and the 400 m was the successor to the 440-yard dash or quarter-mile race.

At the professional level, sprinters begin the race by assuming a crouching position in the starting blocks before leaning forward and gradually moving into an upright position as the race progresses and momentum is gained. The set position differs depending on the start. Body alignment is of key importance in producing the optimal amount of force. Ideally the athlete should begin in a 4-point stance and push off using both legs for maximum force production. Athletes remain in the same lane on the running track throughout all sprinting events, with the sole exception of the 400 m indoors. Races up to 100 m are largely focused upon acceleration to an athlete's maximum speed. All sprints beyond this distance increasingly incorporate an element of endurance.

The 60 meters is a common indoor event and it is an indoor world championship event. Less common events include the 50 meters, 55 meters, 300 meters, and 500 meters which are used in some high school and collegiate competitions in the United States.

Factors Influencing Speed

Mobility of the nervous system:

- CNS undergoes rapid excitation and inhibition, so that rapid contraction and relaxation of muscles is made possible.
- Prolong period under maximum speed cause unusual tension in the body called irradiation.
- Adapting a definite sequence of CNS regulation causes speed barrier.

Explosive Strength:

- It has high trainability to performance.
- It further depends on muscle composition, muscle size and muscle coordination.

Technique:

- ❖ Unlearnt movements can’t be done with good speed.
- ❖ Movement- speed can’t be done without speed.

Bio-chemical reserve and metabolic process:

- ❖ Phosphagen stores, presence of non-oxidative enzymes in the working muscles and Flexibility anaerobic capacity influences speed ability.

Flexibility:

- ❖ Stretch ability of the muscles and mobility of the joints effect speed.
- ❖ No internal resistance allows speed.
- ❖ It allows full utilization of explosive strength.

Psychological factors:

- ❖ Concentration, motivation, attitude etc. effect speed performance.

1.1.2. HISTORY OF LONG JUMP

The long jump is the only known jumping event of Ancient Greece's original Olympics' pentathlon event.

After investigating the surviving depictions of the ancient event, it is believed that unlike the modern-day event, athletes were only allowed a short running start. The athletes carried a weight in each hand, which were called halteres (between 1 and 4.5 kg). These weights were swung forward as the athlete jumped in order to increase momentum. It is commonly believed that the jumper would throw the weights behind him in mid-air to increase his forward momentum. Swinging them down and back at the end of the jump would change the athlete's centre of gravity and allow the athlete to stretch his legs outward, increasing his distance. The jumpers would land in what was called **a** *skamma* ("dug-up" area) (Miller, 66). The idea that this was a pit full of sand is wrong. Sand in the jumping pit is a modern invention (Miller, 66).

The long jump was considered one of the most difficult of the events held at the Games since a great deal of skill was required. Music was often played during the

jump and Philostratus says that pipes at times would accompany the jump so as to provide a rhythm for the complex movements of the athlete. Philostratos is quoted as saying,

"The rules regard jumping as the most difficult of the competitions, and they allow the jumper to be given advantages in rhythm by the use of the flute, and in weight by the use of the halter." (Miller, 67). Most notable in the ancient sport was a man called Chionis, who in the 656BC Olympics staged a jump of 7.05 metres (23 feet and 1.7 inches).

There has been some argument by modern scholars over the long jump. Some have attempted to recreate it as a triple jump. The images provide the only evidence for the action so it is better received that it was much like today's long jump.

The long jump has been part of modern Olympic competition since the inception of the Games in 1896.

In 1914, Dr. Harry Eaton Stewart recommended the "running broad jump" as a standardized track and field event for women.[4] However, it was not until 1928 that the women's long jump was added to the Olympic athletics programme.

Factors influencing on Long Jump

- The Athlete must have sprinting ability.
- Having good explosive strength.
- Having good Flexibility.
- Good Technique.

1.1.3 HISTORY OF JAVELIN THROW

Then javelin was part of the pentathlon of the Ancient Olympic Games beginning in 708 BC in two disciplines, distance and target throw. The javelin was thrown with the aid of a thong, called *ankle* wound around the middle of the shaft. Athletes would hold the javelin by the thong and when the javelin was released this thong unwound giving the javelin a spiralled flight. Throwing javelin-like poles into targets was revived in Germany and Sweden in the early 1870s. In Sweden, these poles developed into the modern javelin, and throwing them for distance became a common event there and in Finland in the 1880s. The rules continued to evolve over

the next decades; originally, javelins were thrown with no run-up, and holding them by the grip at the centre of gravity was not always mandatory. Limited run-ups were introduced in the late 1890s, and soon developed into the modern unlimited run-up.

Factors Influencing Javelin

You need a bit of running. Shot putting plus a bit of strength training- yes, a bit of everything you should be an all-rounder like a multi-event athlete. This is the advice Fatima Whitbread the 1987 world champion gives to young javelin throwers.

A javelin thrower will certainly not achieve top performances with a bit of training However Whitbread's reference to multi-event athletes highlights the great demands of javelin technique javelin throwing is the only throwing discipline to have an approach run and the need for haunt throwing co- ordination whilst running at full speed. The specific throwing and strength requirements which set the parameters for good javelin throwing are:

Power		Speed		Co - ordination
Special throwing strength	+	Speed of action	+	Rhythm
Maximum strength		Acceleration		Timing (linking movements)

Unlike discus throwing and shot putting, javelin throwing is less dependent on the height. Weight and maximum strength of the athlete, then as a result of the long run – up on power and special throwing strength.

The light weight of the competition javelin requires exceptional special speed and throwing strength in the extensors of the leg and arm and in particular in the muscles of the torso. This is because the javelin needs to be accelerated to 30-35 meters per second. The relatively high run-up speed and the additional acceleration in the five-stride rhythm require on the one hand a high degree of sprinting and

DIFFERENT FACTORS RELATED TO PERFORMANCE

PHYSICAL FACTORS

Physical factors mean bodily dispositions. In man, physical factors comprise of body size, shape, composition, physical fitness and proportion. One can be identifying an individual's according to their physical appearance. Some people are

taller and some are shorter, some are fair and some are black, some are thinner and some are healthier, so many dimensions are there by which one can differentiate human being in different groups. Greek philosopher Plato more than 2000 years ago stated about individual difference that no two persons are born alike (Nazimuddin, 2015). Individuals are differing not only according to the interaction of the genetic codes and environmental factors but the difference is seen in male and female also. The genetic codes and environmental factors are strongly correlated with physical characteristics of male and female in terms of shape, size, composition, proportion and physical fitness.

PSYCHOLOGICAL FACTOR

Sports Competition Anxiety:

Sport psychology as an emerging field of psychology, is viewed as an attempt to understand, describe and explain the behavior of sports persons in athletic setting both in practice and in competition, with a view to enhance performance" (Kamlesh, 1998)

In modern competitive sports, psychological preparation of a team is as important as teaching them different skills of a game using scientific methods. Now a days, teams are prepared not only to play, but to win the competition, for coaches feel that good mental and psychological preparation for competition is a necessary component for success. (Agyajit, 1991)

Anxiety plays an important role in athletic performance. Whether its effect is positive or negative depends on how an individual perceives the situation. Athletes with low anxiety level have been known to perform better in sprinting performance. A moderate level of anxiety is seen as less for the acquisition and performance of skills. The levels of anxiety either too high or too low tend to inhibit learning and performance in sprinting.

Anxiety is a natural part of competition at any level. But in the case of young and immatures athletes, anxiety can have a harmful effect on performance. It is the challenge in sports participation, which produces anxiety. Anxiety may be a positive motivating force or it may interfere with successful performance in sports. Anxiety is

likely to be greater in higher competitive sports than relatively in non-competitive sports, participants are expected to win and great demands are made upon them to succeed. (S. Sivaramakrishnan et.al., 1999)

Attitude:

Serious athletes devote hours to conditioning, perfecting techniques, honing skills for their particular sport and practice. This is true that the inherent talent and physical training can take an athlete far. But another important part of the maximizing your athletic achievements is having the right attitude.

If you are an athlete and enjoying the competitive sports, developing the positive mental attitude can be help to give you an edge. Emotions, both sad and happy can be affect cognitive functioning along with your energy level and others aspect of your physical performance.

When negativity rules the day because you are dealing with the injury, or being or say criticized of your coach it can be actually tough to drum up the optimism that can be help your success. So that, if you would like to take your sports performance to the next level, then try to some of these mental strategies for reversing negativity and getting the rid of self-limiting beliefs.

Personality Hardiness:

Hardiness is a personality construct composed of three traits – control, commitment, and challenge that are theorized to make one resilient in the face of stress. Individuals high in hardiness tend to believe and act as if life experiences are controllable (control), to engage meaningfully in life activities and to appraise these activities as purposeful and worthy of investment even in the face of adversity (commitment), and to view change in life as a challenge toward growth and development rather than as a threat to security (challenge). Based on existential personality theory, the combination of these characteristics is believed to provide individuals with the courage and motivation to cope adaptively with life stress, thereby buffering its adverse effects on health.

External Factors

These are things largely beyond our control:

- Environment - the weather can affect your performance either positively or negatively. For example, a good wind will improve a sailor's performance but may impair a tennis player's performance
- Equipment - better equipment will help your performance, but even then, sometimes equipment can go wrong!
- Technology - the use of technology in sport is increasing with the use of better equipment and video and computer technology for technique analysis
- Other players - an opponent's or team mates' performance can have an effect on our own. For example, a team mate performing well may inspire us to do the same
- Officials - a poor decision from an umpire or referee can either spur us on to perform better or make us think there is no point trying.

Justification of selection of such a topic

Track and field athletics has got many events with different types of requirements in respect of body build, motor fitness, psychological makeup and other performance factors. So there have been lot of research works in this area to identify pre-qualities and specialities of each of these areas. But still research has required to find out the differences among the difference groups of activities. Such as running, jumping and throwing in respect of their performance factors, may be body build, motor fitness, psychological makeups and such as. On this basis of this ideas is study of helpful.

1.2. STATEMENT OF THE PROBLEM

With this background concept, in the present study, an attempt has been made to observe the physical parameters, motor fitness, psychological parameters and best performance of sprinters, long jumpers and javelin throwers, so, the present study was stated as **"ANALYSIS OF PERFORMANCE FACTORS OF TRACK AND FIELD ATHLETES"**.

1.3. PURPOSE OF THE STUDY

The purpose of the present study is:

- ❖ To compare the selected physical parameters, selected motor fitness and selected psychological parameters of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers.
- ❖ To find out the selected physical parameters, selected motor fitness and selected psychological status of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers.
- ❖ To observe the relationship of selected physical parameters, selected motor fitness and selected psychological parameters with best performance of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers.
- ❖ Analysis of performance factors with selected physical parameters of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers.
- ❖ Analysis of performance factors with selected motor fitness of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers.
- ❖ Analysis of performance factors with selected psychological parameters of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers.

1.4. SIGNIFICANCE OF THE STUDY

- ❖ This study would significant to assess their motor fitness and psychological status, at the same time it can also be able to indicate the components in which they have lacuna.
- ❖ This study would help to understand the motor fitness and psychological status of the state level players of different district in West Bengal.
- ❖ The result of study would provide an opportunity for Physical Education Teacher and Coaches, to spot out the latent talents of the students and to select potential students for different track and field events.
- ❖ The result would provide some information that will lead to farther study and research.

1.5. LIMITATION OF THE STUDY

- The subject's dietary habit was one of the limiting factors for the present study.
- The emotional levels of different subject for the present study were other limiting factors.
- Subjects past experience about their performance were another limiting factors for the study
- Socio economic status of the subjects was one of the most important limiting factors.
- Most of the subjects were from different region of West Bengal, this was another limiting factor for the study.

1.6. DELIMITATION OF THE STUDY

- G**eographical delimitation**: The study was delimited to the state of West Bengal only.
- Su**bjective Delimitation:** Only 90 State level male athletes (30 from Sprinters, 30 from long jumpers and 30 from Javelin throwers) were considered as subjects for the present study.
- Only 100-meter sprinter were selected as a subject of sprinters.
- **Criterion Delimitation:** Only height, weight and best performance were considering as selected physical parameters, selected motor fitness was measured only by speed, leg explosive strength, agility, reaction time and coordination. The selected psychological parameters were measured only by sports competition anxiety, attitude and personality hardiness.

1.7. HYPOTHESIS

The study was based on following hypothesis:

- H0 There would be no significant difference in subject's motor fitness among the selected track and field groups of athletes.
- H1 There would be a positive relationship between motor fitness and best performance
- H1 There would be a positive relation between sports competition anxiety, attitude and personality hardiness with best performance

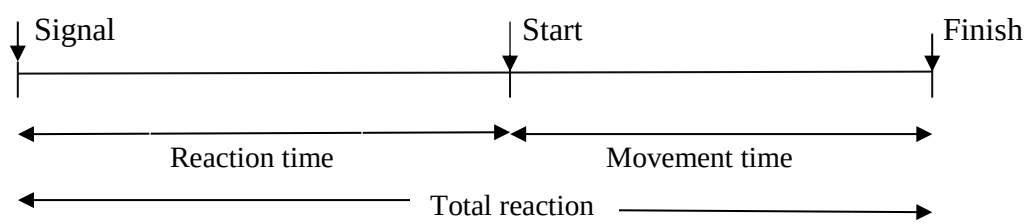
1.8. DEFINITION OF RELATED TERMS

Speed: Speed is considered as the distance covered per unit time. Speed may be either movement speed or locomotion speed. In the present study the locomotion speed was considered. If distance remains constant, time taken to cover the distance become the measure of speed. In the present study time taken to cover 50 yards considered as the measure of speed.

Leg explosive strength: leg explosive strength is called leg power. It is the maximum possible strength by leg muscle within a short time interval leg power is considered as a vital physical fitness component for games and sports. Leg power can be measured by field test like standing broad jump, squat jump etc. in the present study the jumping distance in the standing broad jump test were considered as the measure of the leg power.

Agility: Agility is the quickness and readiness of movement. It is the ability to change the position of the body with skill and control when faced with some sort of stimulus or opposing movement. Agility requires a combination of skill such as co-ordination. Explosive strength and acceleration speed is measured by zigzag run. In the present study the time taken to complete 4x10 yards shuttle run was considered as the measure of agility.

Reaction time: Reaction time is the ability to respond quickly with proper posture and control to a stimulus such as sound or sight. In many instances, quickness is more important than straight ahead speed.



Co-ordination: coordinative abilities are primarily depended on the motor control and regulation process of CNS. The theory off motor co-ordination, therefor, is the basis for understanding the nature of coordinative abilities (Blume 1978, Meinel and Schnable 1987).

Psychology:

"Psychology is the scientific study of the activities of the individual in relation to his environment**" (Woodworth 1992).**

Sports Psychology:

Weinberg and Gould (2010) explain the Sports Psychology, "the Sport psychology is an interdisciplinary science that draws on knowledge from many related fields including biomechanics, physiology, kinesiology and psychology. It involves the study of how psychological factors affect performance and how participation in sport and exercise affect psychological and physical factors".

Anxiety:

Bouras and Holt (2010) explain the Anxiety, "Anxiety is a feeling of uneasiness and worry, usually generalized and unfocused as an overreaction to a situation that is only subjectively seen as menacing".

Sports Competition Anxiety:

"A tendency to perceive competitive situation as threatening and to respond to these situations with feelings of apprehension or tension in sports competitive anxiety"

(Martin's et al. 1982).

Attitude:

"A mental and neural state of readiness organized through experience, expecting a direction or dynamic influence upon the individual's response to all subjects with which it is related."

G.W. Allport, Handbook of Social Psychology (Worcester, Mass University Press, 1935), p.810

Psychological Hardiness:

Hardiness as a personality trait having the components of commitment, challenge and control and is found to be associated with strong resistance to negative feeling induced by adverse circumstance.

CHAPTER – II

REVIEW OF LITERATURE

2.1 Literatures Related to Motor Fitness

2.2 Literatures Related to Psychological Parameters

CHAPTER - II

REVIEW OF RELATED LITERATURE

This investigator has attempted in this chapter to locate the literature related to this study. A summary of the writings of recognized authorities and of provides research provides evidence with what is already known and what is still unknown and interested. A careful review of research through journals, books, dissertations, internet and other sources of information in the problem to the investigation provide the important steps in the planning of any research study.

To avoid the risk of duplication, to discover research allied to the problem, to provide ideas, theories, to identify research procedure and statistical analysis of data employed by the other investigator conducted a literature was available in the form of books, journals, reviews and other documents. A brief review of such study has been presented in this chapter. For the purpose of better understanding the literature has been presented in two separate sections as follows:

2.1 Literatures Related to Motor Fitness

Takanashi (2021) examined the relationship between jump ability and athletic performance of athletic throwers based on data taken over two years. The data of 24 first- and second-year male university throwers was compiled to examine the relationship regarding athletic performance. In summary, the three events of standing long jump (SLJ), squat jump (SJ), and counter-movement jump (CMJ) always showed a positive correlation with athletic performance in the two-year measurement. Next, SJ was most relevant to the athletic performance of the five jump measurement items. Standing triple jump (STJ) and rebound jump (RJ) did not improve in two years, and no association with athletic performance was seen. These results suggest that simple explosive exercises, such as SLJ, SJ, and CMJ, are effective for evaluating the physical fitness of throwers. The vertical jump capability is particularly useful for evaluating athletic performance. The innovation of this study is found in SJ, which exerts power from a stationary state, and could be significant in optimizing athletic performance, which can be enhanced through modified training practices that incorporate SJ.

Yeasir Arafat, Jannatul Ferdaus Rickta and Fatima Tus Johora Mukta (2020) said that fitness is the ability of the individual to live a healthy, satisfying, useful, and more productive life. The term motor has been defined as the relationship between the central nervous system and the muscle. Motor fitness is sometimes referred to as skill related fitness. The significance of this study would indicate the motor fitness difference between a sprinter and a long-distance runner. The motor fitness measured as speed was measured by the 50-metre dash test; agility was measured by the 4x10-metre shuttle run test, leg explosive strength was measured by the standing broad jump test; and basic endurance was measured by the 800-metre run test. The raw data were analyzed following standard statistical techniques. The sprinter group appeared to be significantly better than the long-distance group in speed, agility, and leg explosive strength, but the long-distance runner group is better than the sprinter group in the endurance test.

Muhammad Asyraf Abd Rahim, Ernie Leong Yen Lee, Nor Fazila Abd Malek, Dusanee Suwankhong & Ali Md Nadzalan (2020) find out the relationship between selected physical fitness levels and long jump performance. Thirty male (n = 30) active university long jumpers were recruited as participants in this study. Participants performed a one repetition maximum (1RM) squat, vertical jump, horizontal jump, 30m sprint, sit and reach flexibility test with the long jump performance. Pearson Correlation was used to determine the relationship between each test and the long jump performance. Results showed that all physical fitness tests were found to be significantly correlated to long jump performance, with 1RM squat, horizontal jump, and sit and reach flexibility tests having a high correlation, while vertical jump and 30m sprint tests had a moderate correlation. Findings demonstrated the importance of physical fitness training to improve performance in the long jump.

Degati (2017) finds out the relationship between selected physical fitness variables and the performance of Ethiopian junior sprinters and middle-distance athletes across genders. The subjects for the present study consisted of 240 sprinters and middle-distance athletes, ranging in age from 14 to 20 years of age. For the purpose of the study, the total population has been drawn from three different athletic centers. To achieve the objectives of the present study, moments of Pearson correlation have been used. From the results, it has been found that 40-metre sprint speed has a positive relationship with 100-metre best performance for both male and female athletes.

However, sit and reach have a positive correlation, but broad jump has a negative correlation with the female 100-metre best performance. Speed endurance was significantly correlated positively with the best 400-meter performance for male athletes. However, the wall squat sit has a negative correlation and the 40-metre speed test has a positive one, but both had a significant correlation with the performance of female athletes. 40-metre speed and 300-metre speed endurance have a negative and significant correlation with male 800-metre performance. Whereas, only 300-metre speed endurance has a significant positive relationship with the 800-metre best performance of a female runner. Wall squat sit is found to be significantly correlated negatively to the 1500-metre performance of male athletes. Other physical fitness variables have no correlation. However, none of the physical fitness variables used in this study have a relationship with the best performance of female athletes.

Kaur and Singh (2016) found out the relationship between motor fitness parameters and performance among 100-metre female sprinters. Female 100m sprinters from universities and states were purposefully chosen as subjects for this study.The age range of the female sprinters was 18–25 years. The female sprinters were assessed for motor fitness components, i.e., muscular leg strength, muscular back strength, cardiovascular endurance, muscular endurance flexibility, speed, agility, balance, power, and reaction time. Correlation analysis revealed that the power r (p 0.01) had a significant relationship with the performance among 100-metre female sprinters. All the other motor fitness components, i.e., muscular leg strength, muscular back strength, cardiovascular endurance, muscular endurance, flexibility, speed, agility, balance, and reaction time, were not significantly associated with performance among the 100-metre female sprinters.

Ngetich and Rintaugu (2013) determined the selected physical fitness components (coordinative ability, speed, strength, cardiovascular endurance, and flexibility) can be utilised as prediction factors of long jump performance. Measurements were observed on 50 selected long jumpers sampled from the Indira Gandhi Institute of Physical Education and Sport Sciences, University of Delhi. Tests included the shuttle run, 50-metre dash, standing broad jump, 12-minutes walk/run (cooper-test) and sit and reach. Analysis was done using a t-test and product moment correlation at the 0.05 level of significance. Findings showed a significant relationship between running broad jump and cardiovascular endurance (r = 0.41), coordination

ability (r = -0.50), explosive leg strength (r = 0.43), and speed (r = -0.48), but no significant differences in arm and shoulder endurance (r = 0.17). It was concluded that performance in cardiovascular endurance, coordination ability, explosive leg strength, speed, and flexibility are related to running broad jump performance. The study recommends that training programmes for long jumpers be systematic and scientific in developing physical fitness components.

Lena Lämmle, Susanne Tittlbach, Jennifer Oberger, Annette Worth and Klaus Bös (2010) observed that motor performance ability (MPA) has been viewed as a multidimensional tool involving such specific components as strength, endurance, flexibility, and coordination. This model was tested in the years 2003 and 2006 in a city in Germany with participants ages 6–17, for a grand total of 2,840. The new test battery focused on the different motor dimensions of strength, endurance, coordination under precision demands, coordination under time pressure, and flexibility. Factor analysis was employed on the collected data. Significant effects were seen in each of the examined factors, and this is essential in health care.

Crewther, Lowe, Weatherby, Gill and Keogh (2009) compared the neuromuscular performance (speed, power, and strength) of elite rugby union players, by position, and examined the relationship between player performance and salivary hormones, by squad and position. Thirty-four professional male rugby players were assessed for running speed (10-m, 20-m, or 30-m sprints), concentric mean (MP), and peak power (PP) during a 70-kg squat jump (SJ) and 50-kg bench press throw (BT), and estimated 1 repetition maximum (1RM) strength for a box squat (BS) and bench press (BP). Based on these findings, it was suggested that training to increase whole-body and muscle mass might facilitate general performance improvements. Training prescription might also benefit from acute and chronic hormone monitoring to identify individuals likely to respond more to hormonal change.

Requena B, González-Badillo JJ, de Villareal ES, Ereline J, García I, Gapeyeva H, Pääsuke M. (2009) determined muscle strength and power output characteristics in a group of professional soccer players and identified their relationships with 2 functional performance tests (vertical jumping height and 15-m sprint time). Maximal strength and power indices attained against different loads in barbell back squat exercise, isometric maximal force of the knee extensor and plantar

flexor muscles, isokinetic peak torque of the knee extensor muscles, vertical jumping height in squat and counter-movement jumps, and 15-m sprint time tests were assessed in 21 semi-professional soccer players (age 20 +/- 3.8 years). It was concluded that in semi-professional soccer players, (a) isometric and isokinetic muscle strength assessed in an open kinetic chain were not movement specific enough to predict performance during a more complex movement, such as a jump or sprint, and (b) concentric half-squat exercise was principally related to the functional tests selected when it was performed against external loading within the range of the load in the case of which the maximal power output was attained.

Claudio Robazza, Melinda Pellizzari, Maurizio Bertollo and Yuri L. Hanin (2008) determined the impact of emotions on athletic performance within the frameworks of the Individual Zones of Optimal Functioning (IZOF) model and the directional perception approach. Intensity, functional impact, and hedonic tone of self-confidence, trait and state anxiety, idiosyncratic emotions, and bodily symptoms were assessed in high level track and field athletes and Italian swimmers. There are three standards of performance (good, average, and poor), derived from retrospective self-ratings across one to three competitions, that were used as independent variables in the analysis of variance of intensity, intra-individual, and direction scores of anxieties, idiosyncratic emotions, bodily symptoms, and self-confidence. Subsequently, intra-individual scores were categorized as near or too distant from optimal or dysfunctional zones and entered as the independent variable in the analysis of direction scores. The findings provided support for the predictions stemming from both the IZOF model and the directional approach, as well as help in interpreting the direction of anxiety and other idiosyncratic emotions within the IZOF framework. Athletes tended to perceive emotional levels approximating an individual's optimal zone as facilitative and pleasant, and emotional levels approximating an individual's dysfunctional zone as debilitative and unpleasant.

Ronnestad, Kvamme, Sunde, and Raastad (2008) compared the effects of combined strength and plyometric training with strength training alone on power-related measurements in professional soccer players. Subjects in the intervention team were randomly divided into 2 groups. Group ST (n = 6) performed heavy strength training twice a week for 7 weeks in addition to 6 to 8 soccer sessions a week. Group ST+P (n = 8) performed a plyometric training programme in addition to the same

training as the ST group. The control group (n = 7) performed 6–8 soccer sessions a week. The results suggest that there are no significant performance-enhancing effects of combining strength and plyometric training in professional soccer players performing 6 to 8 soccer sessions a week, compared to strength training alone. However, heavy strength training leads to significant gains in strength and power-related measurements in professional soccer players.

Rousanoglou, Georgiadis, and Boudolos (2008) determined the relationships between muscular strength and vertical jumping performance in young women (14–19 years), track and field jumpers (n = 20), and volleyball players (n = 21). Results indicate the dissimilarity in the relationships between the knee extensor muscular strength and jumping performance in the young female track and field jumpers and volleyball players. Smirniotou et al. (2008) determined the relationship between strength - power parameters and sprint performance and predicted sprint times from strength-power parameters. Twenty-five male young sprinters participated in this study. Squat jump (SJ), counter-movement jump (CMJ), drop jump height (DJH), repeated jump (RJ), and 100-metre sprint time from a block start, including reaction time (RT) and times at 10 metres, 30 metres, and 60 metres, were measured. Reactive strength index (RSI), the difference between counter-movement and squat jump (CMJ-SJ), and the mean velocities of the intermediate sections 0–10 m, 10–30 m, 30–60 m, and 60–100 m (V0–10, V10–30, V30–60, and V60–100) were also calculated. In conclusion, performance at the 100-metre sprint is strongly associated with strength-power parameters. The best predictor of the overall performance is probably SJ (or CMJ).

Vescovi and McGuigan (2008) assessed the relationships between various field tests in female athletes. Altogether, 83 high school soccer athletes, 51 college soccer athletes, and 79 college lacrosse athletes completed tests for linear sprinting, countermovement jumping, and agility in a single session. Linear sprints and agility tests (Illinois and pro-agility) were evaluated using infrared timing gates, while countermovement jump height was assessed using an electronic timing mat. Pearson's product-moment correlation coefficients (r) were used to determine the strength and directionality of the relationship between tests, and coefficients of determination (r2) were used to examine the amount of explained variance between tests. The results of this study indicate that linear sprinting, agility, and vertical jumping are independent

locomotor skills and suggest a variety of tests ought to be included in an assessment protocol for high school and college female athletes.

Jacque L Barnes 1, Brian K Schilling, Michael J Falvo, Lawrence W Weiss, Andrea K Creasy, Andrew C Fry. (2007) conducted research with the title Relationship of Jumping and Agility Performance in Female Volleyball Athletes." The principal purposes of this study were to (1) identify possible predictors of court-sport–specific agility performance, (2) quantify horizontal and vertical force during a COD task, and (3) examine performance differences among National Collegiate Athletic Association I, II, and III Division athletes. To conduct this study, 29 collegiate female volleyball players went through a novel agility test, countermovement (CM) and drop jump tests, and an isometric leg extensor test. The subjects were divided as follows: I (n = 9), II (n = 11), and III (n =9). The agility test consisted of 4 - 5-metre sprints with three repetitions of 1800 turns, including one on a multiaxial force platform, which allowed the kinetic properties of the COD to be identified. The data was analysed using the One-way ANOVA formula. This study indicates that individuals with greater CM performance also have quicker agility times and suggests that training predominantly in the vertical domain may also yield improvements in certain types of agility. This may hold true even if such agility requires a horizontal component.

Vescovi (2007) conducted a study on the relationships between sprinting, agility, and jump ability in female athletes. The results indicated that the relationship between counter movement jump height and linear sprinting was stronger with the longer distances than the shorter distances and showed a stronger relationship within the college athletes than the school soccer players.

Vescovi and Guigan (2007) conducted a study on the relationships between sprinting, agility, and jump ability in female athletes. The results indicated that the relationship between countermovement jump height and linear sprinting was stronger with the longer distances than the shorter distances and showed a stronger relationship within the college athletes than the school soccer players.

Carry (2005) conducted a study on the long jump. Most young athletes will have difficulty performing the hitch-kick because it requires considerable speed and sufficient time in the air to perform it well. However, an elementary long jump and a

rudimentary form of the hang technique are well within the reach of young athletes. Remember that the most important requirements in this event are speed and springing abilities. An athlete does not have to perform a hitch-hick or a hang to jump a good distance.

Cronin and Hansen (2005) investigated the relationship between strength and power and measures of first-step quickness (5-m time), acceleration (10-m time), and maximal speed (30-m time). The maximal strength (3 repetition maximum [3RM]), power (30-kg jump squat, countermovement, and drop jumps), isokinetic strength measures (hamstring and quadriceps peak torques and ratios at 60 degrees (-1) and 300 degrees (-1), and 5-, 10-, and 30-m sprint times of 26 part-time and full-time professional rugby league players (age 23.2 +/- 3.3 years) were measured. To examine the importance of the strength and power measures on sprint performance, a correlational approach and a comparison between the means of the fastest and slowest players were used. It was suggested that improving the power to weight ratio as well as plyometric training involving countermovement and loaded jump squat training may be more effective for enhancing sport speed in elite players.

Little and Williams (2005) assessed 106 professional soccer players for their 10-m sprint (acceleration), flying 20-m sprint (maximum speed), and zigzag agility performance. Although performance in the three tests was significantly correlated ($p = 0.0005$), the coefficients of determination (r (2)) between the tests were just 39, 12, and 21% for acceleration and maximum speed, acceleration and agility, and maximum speed and agility, respectively. 33 respectively. Based on the low coefficients of determination, it was concluded that acceleration, maximum speed, and agility are specific qualities that are relatively unrelated to one another. The findings suggested that specific testing and training procedures for each speed component should be utilised when working with elite players.

Qiong Zhou, Zu-Hua Xie, Teng-Fei Yao, Wen-Juan WU, Jia-Li Xu and Jiang-Hua Li. (2005) conducted a kinematics study on the technical parameters demonstrated by Chinese and foreign elite female long jumpers, which showed that the main methods of improving long jump results were as follows: increasing the absolute

speed during the run-up and the angle of take-off, as well as achieving an optimal relationship between the initial velocity and the angle of take-off.

Rogers (2005) investigated a study on the long jump. This is an event that requires speed and powerful jumping abilities. Speed is self-evident, but power needs to be defined as a very fast application of force, in other words, a combination of speed and strength. The long jumper is required to generate maximum controllable speed on the run to achieve the best results. The maximum controllable speed is determined by the athlete's sprint speed and how quickly maximum force can be applied to the ground at the take-off board. Therefore, the training emphasis will focus on the development of (1) sprint speed, (2) muscular strength, and (3) power.

Xie (2005) conducted a study on the effect of speed utilisation ratio in the long jump run-up of Chinese female long jumpers. The run-up speed of 49 elite female long jumpers was investigated. It was found that the main factor affecting long jump results was the utilisation ratio of speed in the run-up. It was determined that the approximate scope of the speed utilisation ratio for achieving excellent long jump results was between 95.6% and 98.2%, which provides a scientific basis of reference for coaches.

Sleivert and Taingahue (2004) investigated the relationship between sprint start performance (5-m time) and strength and power variables. Thirty male athletes [height: 183.8 (6.8) cm, and mass: 90.6 (9.3) kg; mean (SD)] each completed six 10-m sprints from a standing start. Sprint times were recorded using a tethered running system, and the force-time characteristics of the first ground contact were recorded using a recessed force plate. It was concluded that, concentric force development is critical to sprint start performance and that, accordingly, maximal concentric jump power is related to sprint acceleration.

Wislff, Castagna, Helgerud, Jones, and Hoff (2004) determined whether maximal strength correlates with sprint and vertical jump height in elite male soccer players. Seventeen international male soccer players (mean (SD) age 25.8 (2.9) years, height 177.3 (4.1) cm, weight 76.5 (7.6) kg, and maximal oxygen uptake of 65.7 (4.3) ml/kg/min) were tested for maximal strength in half squats, sprinting ability (0-30 m and 10 m shuttle run sprint), and vertical jumping height. It was concluded that, maximal strength in half squats determines sprint performance and jumping height in

high level soccer players. High squat strength did not imply reduced maximal oxygen consumption.

2.2 Literatures Related to Psychological Parameters

Dolly and Singh (2017) compared the university to the gymnasts' wills to earn and pastime laissez faire financial anxiety. To finish the layout, a purposive sampling campaign has been used. The chunk of the layout has been busy from the All India Enshrine University Gymnastic (M & W) Championship held at Panjabi College Chandigarh from February 1 to February 5, 2017. As topics for this stop, on the fourth, two university candidly gymnasts were hired, which included twenty-one steep performers and twenty-one macho performers. The participants in the study ranged in age from 17 to 25 years old. The will to earn questionnaire, prolonged by use, was implemented to look at the nature of the will to earn and to hold a candle to the candidly of game-related loose enterprise tension (SCAT, exaggerated by Martens et al. (1990)). To face out the divided loyalty in the freely expressed will to benefit and recreation in democracy, the fear of carrying out an activity with an individualistic pattern's' show was implemented at the hand of Statistical Product and Provider Answers (SPSS) detail 20.0. The immediate sense of rhyme or motive came into existence at 0.05. The verification of the display diamond inside the difficult shows that having to do with distinction turned into relaxation on the road of advantage to gain and sport opposition tension, as indicated by Largesse (2016), in the relationship between anxiety and performance. The present paper tries to investigate the level of anxiety among student players of different sports (football, volleyball, and basketball) representing different universities at intercollegiate games held at Haromia University in 2013. A survey was carried out on one hundred and eighty-two student players (n = 182) out of 300 participants, representing various universities and from different parts of Ethiopia. Only male players aged between 18 to25 years were selected for the study. Maximum effort and meticulous care were taken while recording the measurements with precision and accuracy. The Sports Competitive Anxiety Test (SCAT) was used to measure anxiety levels among football and other players. To compare anxiety between football, volleyball, and basketball, one way analysis of variance (ANOVA) was employed, with the level of significance set at 0.05. The results revealed that anxiety levels showed a significant difference for the three baseball games. The anxiety level for football players was found to be highest among others (F = 31.97, p 0.05). This implies that football

games, by their very nature, are anxiety-inducing. This necessitates the need for anxiety alleviation intervention before the tournament for successful performance and achievement in the

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Rakshit (2016) conducted the study of 40 (forty) athletes, out of whom 10 sprinters, 10 middle distance runners, 10 jumpers, and 10 throwers were selected purposefully from different clubs in the Burdwan district. They generally participate in various district-level and college competitions. The variables of this study were speed, abdominal strength, and agility. The age of the subject was 18–20 years. The clubs are located in various places around the Burdwan. To calculate the results, an ANOVA was used at the 0.05 level of significance, and to identify the significance differences among the means, a post-hoc test was used to identify the significance differences among the means. The result of this study was that there was a significant difference in speed, abdominal strength, and agility among sprinters, jumpers, throwers, and middle-distance runners.

Robazza C, Pellizzari M, Bertollo M, Hanin YL. (2008) determined the impact of emotions on athletic performance within the frameworks of the Individual Zones of Optimal Functioning (IZOF) model and the directional perception approach. Intensity, functional impact, and hedonic tone of self-confidence, trait and state anxiety, idiosyncratic emotions, and bodily symptoms were assessed in high level track and field athletes and Italian swimmers. There are three standards. Performance ratings (good, average, and poor), derived from retrospective self-ratings across one to three competitions), were used as independent variables in the analysis of variance of intensity, intra-individual, and direction scores of anxieties, idiosyncratic emotions, bodily symptoms, and self-confidence. Subsequently, intra-individual scores were classified as near or too distant from optimal or dysfunctional zones and entered as the independent variable in the analysis of direction scores. The findings provided support for the predictions stemming from both the IZOF model and the directional approach, as well as help in interpreting the direction of anxiety and other idiosyncratic emotions within the IZOF framework. Athletes tended to perceive emotional levels approximating an individual's optimal zone as facilitative and pleasant, and emotional levels approximating an individual's dysfunctional zone as debilitative and unpleasant.

Richard Mullen, Lew Hardy and Andrew Tattersall (2005) investigated the effects of anxiety on motor performance. The aim of the study was to examine the conscious processing hypothesis as an explanation of the anxiety/performance relationship. Findings indicated that performance was impaired in the high anxiety shadowing and tone counting conditions, supporting an attentional threshold interpretation.

Russell (2001) studied the relationship between competitiveness and par atelic dominance on the intensity and directions of precompetitive state anxiety. Competitiveness appears to be important in moderating the appraisal of anxiety and outcome, while goal expectancy may moderate the relationship between anxiety appraisal and par atelic dominance.

Mullen and Hardy (2000) examined an alternative explanation for the robustness under stress of implicit task performance. They tested this interpretation while controlling for a further rival hypothesis generated by Eysenck's Processing Efficiency Theory. They also examined the effect of increased state anxiety on the

kinematic processes underlying performance breakdowns. For task performance, they found evidence that 48 partially supported the conscious processing hypothesis, while the results of the kinematic analysis of the putting stroke were equivocal. Analysis of self-reported effort scores provided partial support for processing efficiency theory.

Parfitt and J. Pates (1998) conducted the study considered the influence of competitive anxiety and self-confidence state responses upon components of the performance. Twelve basketball players were trained to self-report their cognitive anxiety, self-confidence, and somatic anxiety as a single response on several occasions immediately before going on court to play. Performance was recorded through video recording, and aspects of performance that could be characterised as requiring either largely anaerobic power or working memory were measured. The results showed that, as anticipated, somatic anxiety positively predicted performance that involved self-confidence, anaerobic demands and not cognitive anxiety, which was the principal predictor of the performance scores with working memory demands. And it also showed that different competitive state responses exert differential effects upon aspects of actual performance. Identifying these differences will be helpful in recommending intervention strategies designed to facilitate performance.

Shepperd and Kashani (1991) conducted a study on personality hardiness with 150 (75 males, 75 females) adolescents as subjects. They opined that low- stress males had few physical and psychological symptoms than their levels of commitment and control and high – stress males experienced more problems when they were low rather than high in either commitment or control and personality hardiness did not interact with stress in the prediction of health outcomes among females.

Mizes (1988) High in commitment and control people showed fewer psychological disturbances than who possess low commitment and control in the study.

CHAPTER – III

METHODOLOGY

CHAPTER – III

METHODOLOGY

In this chapter methodology is a document part and failure or success of any research work is directly related with appropriate procedure. The responsibility and validity of his findings. On the other hand, selection of procedure and conduction are a great significance too. Methodology is one in which different programmes are indicated and carried out and logical conclusions can be drowned. Methodology can be determined on the basis of hypothesis and objective of the study. The various aspects of methods and materials are presented in this chapter.

3.1 THE SUBJECTS

The subject for the present study was selected purposively from different districts of West Bengal, India. For the study different track and field athletes were selected. Some of them were sprinters, long jumpers, and javelin throwers, they have more than 05(five) years of experience in these events. Most of them were participated in a regular basis in different State level competition. Total number of thirty (30) male players were selected for each group. Age range 14 to 20 years.

The data for present study was collected from West Bengal athletic meet 2017 to 2019, which was organised by Athletic Association of West Bengal, at Kolkata SAI Complex.

Performance Ability:

The subject's performance ability was measured on the basis of their state level meet in track and field events.

3.2 CRITERION MEASURE

For the study three different criteria were conducted. There are:

3.2.1 Physical Parameters:

i) Age - On the basis of their Madhyamika pariksha admit card or birth certificate

ii) Height (cm) – by measuring tape or Stadiometer

iii) Weight (kg) - Weighing machine

iv) Best Performance – Sports certificate

3.2.2 Motor fitness parameters:

i) 50-Meter Dash (Second) – To measure the sprinting ability of the subject

ii) SBJ (Meter) – To measure leg explosive strength of the subject

iii) Shuttle Run (4x10 Meter) – To measure the agility of the subject

iv) Nelson hand reaction test (Second) – To measure the reaction ability of the subject

v) Jonson and Nelson speed pass co-ordination test (Second) – To measure Coordination

3.2.3 Psychological Parameters:

I) Sports competition Anxiety: measured by standardized questionnaire developed by Martens et al. 1990

II) Attitude: measured by standardized questionnaire developed by Harold M, Barrow and Rosemary McGee, 1979

III) Personality Hardiness: measured by standardized questionnaire developed by Singh, 2008

3.3 PROCEDURE FOR ADMINISTERING TEST

The procedure for measuring the tests was presented below:

i) Measurement of personal data

ii) Measurement of motor fitness parameters

iii) Measurement of Psychological parameters

3.3.1 MEASUREMENT OF PERSONAL DATA

For personal data the investigator had considered age, height, weight and best performance. Which had been collected through standard procedures.

3.3.1.1 Age (Years)

The subjects are measured on the basis of their birth certificate or M.P. admit card. After collecting the subjects birth certificate there are was collected in nearest years.

3.3.1.2 Height (cm)

Height is the perpendicular distance between the transverse planes of the vertex and the interior aspects of the feet **(Marfell -Jones et. al., 2006)**

Figure: 01

Objective of the test: To obtain the height of a subject.

Equipment used: Stadiometer.

Procedure of the obtain data: The subject stood with the heels together and the heels buttocks and upper part of the back touching wall putting the scale upon the vertex touching the wall height was measured. The height was measured in centimetre (cm).

Score: Score was recorded to the nearest 0.05 cm.

3.3.1.3 Weight (kg)

Weight is another important and mostly used anthropometric measurement for individual of all ages.

Figure: 02

Objective: To obtain the mass of a subject.

Equipment used: Standard weighing machine.

Procedure of obtain data: The subject stood on the weighing machine having hands by their sides after removing shoes and excess clothing.

Score: Score was recorded to the nearest 0.05 kg.

3.3.1.4 Best Performance

The best performance was measured on the basis of subject's high-sports performance certificate.

3.3.2 MEASUREMENT OF MOTOR FITNESS PARAMETERS

3.3.2.1 50-Meter Dash

Speed: Speed is considered as the distance covered per unit time. Speed may be either movement speed or locomotion speed. In the present study the locomotion speed was considered. If distance remains constant, time taken to cover the distance become the measure of speed. In the present study time taken to cover 50 meters considered as the measure of speed.

Figure: 03

Objective: To measure speed or sprinting ability.

Equipment's: Two (2) stopwatches, wooden clapper and measuring tape.

Procedure: An area was marked 50 meter in a sandy track. Two parallel lines of 10 meter were drawn 50 meters apart, considering one as the starting line. The subject was asked to perform the run up after that took position behind the starting line. Two

(2) subjects were performed the 50 (meter) in one time. The starter used the command (ready) and at the same time clapper sound the subjects took off and finish at the end line. Only one trail was permitted.

Scoring: The score was elapsed time to the nearest tenth of a second between the starting signal and at the time of subject crossed the finish line.

3.3.1.2 Standing Broad Jump (Harold M, Barrow and Rosemary McGee, 1979)

Leg Explosive strength: Explosive training is training that combines strength and speed to increase, your power output. The types of exercise used to build quick explosive power are movements that require a maximum or near maximum power output from the athlete in a short amount of time.

Figure: 04

Objectives: To measure the leg explosive strength.

Equipment's: A measuring tape.

Procedure: The subject could at a stretch, with one maximum effort along forward arm swing and landing in front. There was a one meter take off line mark on the edge of the sand pit. The subject is asked to stand behind the marked line with his feet slightly apart and parallel. The subject can take a crouch position by bending his

knees forward and swinging his arms backward then took jump foreword as forward as possible.

Scoring: The distance between the nearest heel mark and the starting line was recorded. Three trials were recorded in centimetres**. (Harold M, Barrow and Rosemary McGee, 1979)**

3.3.1.3 Shuttle Run (4x10 Meter)

Agility: Agility is the quickness and readiness of movement. It is the ability to change the position of the body with skill and control when faced with some sort of stimulus or opposing movement. Agility requires a combination of skill such as co-ordination. Explosive strength and acceleration speed is measured by zigzag run. In the present study the time taken to complete 4x10 meter shuttle run was considered as the measure of agility.

Figure: 05

Objectives: To measure the agility of the subjects.

Equipment: A stop watch, two wooden blocks (2’’x2’’x4’’) and one clapper

Agility is the fitness and readiness of movement. It is the ability to change the position of body with skill and control condition when faced with some sort of stimulus or opposing movement.

In generally agility requires a combination of skills such as coordination, explosive strength and acceleration speed measured by zig-zag run.

Procedure: Marking of two parallel lines with three meters in length ware drawn ten meters apart considering one as starting line or point. The subject asked to stand as starting point with the wooden blocks placed on the other edge of the line on the standing signal of clapper, the subject run to the wooden block and lifted one block and return to the starting line. As the subject return to be second block, lifted it and sprinted across the starting line. Subject then returned to the second block. Lifted it and sprinted across the starting line on the way back.

Scoring: The elapsed time recorded as scoring in second.

3.3.1.4 Nelson Hand Reaction Test (Johnson and Nelson, 1988)

Reaction time: Reaction time is the ability to respond quickly with proper posture and control to a stimulus such as sound or sight. In many instances, quickness is more important than straight ahead speed.

Figure: 06

Objective: To measure reaction time of the subject.

Equipment: Table, scale etc.

Procedure: Subjects sits with his forearm and hand rested comfortably on the table. The tips of the thumb and index finger ware held in ready position to pinch position about three-four inches beyond the edge of the table. The upper edge of the thumb and index finger should be in horizontal position. The tester holds the scale near to the top of the scale, getting it hanged between the subject's thumb and index finger. The base line should be even with the upper surface of the subject thumb. Subject was reacted by catching the scale when it was released.

Scoring: Three trials are given and best of the score was taken into consideration score was taken in centimetre. **(Johnson and Nelson, 1988)**

3.3.1.5 JOHNSON AND NELSON SPEED PASS COORDINATION TEST

Coordination: Coordination is primarily depending upon the motor control and regulation process and CNS (central nervous system). The theory of motor coordination therefore, is the basis for understanding the nature of coordinative abilities (Blume 1978, Meinan and Schnable 1987)

Figure: 7

Objective: To measure the subject's coordination ability.

Equipment: Basketball, measuring tape, a marked wall etc.

Procedure: The subject will stand behind the line drawn 9 feet from the wall and holding the basketball on the signal to begin passes the ball against the wall or rapidly as possible in 30 seconds one chance is given to each player. One point counted each of good or legal hit. If the standing line is crossed hit is not counted but the basketball is still in play.

Scoring: The stopwatch started as soon as the first pass hits the wall and is stopped when the last pass within 30 seconds completed. The scoring is the number of legal hits on or above the wall in one final. **(Blume 1978, Meinel and Schnable 1987)**

3.2.3 MEASUREMENT OF PSYCHOLOGICAL PARAMETERS

3.2.3.1 Competition Sports Anxiety

By analysing an athlete's responses to a series of statements about how she/he feels in a competitive situation, it is possible to determine their level of anxiety. A test that provides such functionality is the Sports Competition Anxiety Test (SCAT) (**Martens et al. 1990**)

Objective: To find out the amount of anxiety.

Equipment and Materials:

Anxiety was assessed through the Sports Competition Anxiety Test questionnaire. (SCAT) **Procedure:**

Sports Competition Anxiety Test questionnaire (SCAT) prepared by Rainer Martens has been widely used for measuring anxiety related to sports situation in most of the advanced countries. The test was reliable and valid and designed to measure the degree of anxiety prior to the competition. The SCAT questionnaire was administered to all the subjects. Each subject was asked to answer all the 15 items of the tests and was instructed to express the choice most honestly. The SCAT has fifteen items out of which five are spurious questions, which have been added to the questionnaire to diminish biased responses. The subjects were instructed to respond to each item according to how they generally feel in competitive sports situations. 72 Every statement had three possible responses as mentioned below.

a. Hardly ever
b. Sometimes
c. Often

The ten test items, which were taken for scoring purpose, are 2, 3, 5, 6, 8, 9, 11, 12, 14 and 15. The remaining items were spurious items, which were not taken for scoring purpose are 1, 4, 7, 10 and 13.

The scholar scrutinized the completed questionnaires in order to ensure that the subject had responded to every item and there was no question left unanswered. The items 2,3,5,8,9,12,14 and 15 were evaluated in a uniform manner using the following key.

Response		**Score**
Rarely	=	1
Sometimes	=	2
Often	=	3

In case of items 6,11 scoring was carried out using the following key.

Often	=	1
Sometimes	=	2
Rarely	=	3

However, spurious question i.e., 1, 4, 7, 10 and 13 were not scored out as suggested by Rainer Martens.

Scores obtained by each subject on each statement was added up and that represented one's total score on sports competition anxiety.

There were no right or wrong answers. The subjects were not allowed to spend too much time on any statement. The subjects were asked to choose the word that described the best opinion that they usually feel while participating in sports and games. **(Comparative analysis of selected motor, physiological and psychological variables among inter-collegiate sprinters jumpers and throwers, Raghavan. G,2008)**

3.2.3.2 Attitude (Harold M, Barrow and Rosemary McGee, 1979)

Attitudes are predispositions to actions and so their proper development is important to the total development of the individual. They are acquired concurrently with activity and often have tremendous influence on performance. Not every student can be a championship performer, but each can develop a favourable attitude towards activity.

Edgington Attitude Scale

Purpose: To measure the attitudes of high school freshman boys toward physical education. Four objectives ware identified:

A) Physical development
B) Mental development
C) Motor development
D) Human relationships

Procedure: The concepts for the statements used in this attitude scale were selected from the areas of the four general objectives and were intended to measure the extent to which the student attitudes indicated these objectives were being achieved.

Evaluation:

The scale was revised 3 times, once after a jury had ruled on the favourableness or unfavourableness of each item. The remaining items were administered to 107 ninth grade boys. Likert's method of internal consistency was used to study the items. The second administration involved 109 different ninth-grade boys. Again, items were dropped which did not meet the standard of construct validity was established by comparing the scores of the 15 boys selected by their instructors as having the most favourable attitude and the scores of the 15 boys with the most unfavourable attitude. The chi square results were significant at the 1% level of confidence.

The reliability coefficient for the final form was .92 computed on the split-haves and

the Spearman Brown Prophecy Formula.

Level and sex:

Designed for ninth-grade boys. Probably suitable for secondary school boys and girls.

Uses:

To ascertain favourable and unfavourable attitudes. To strengthen favourable attitudes and remove or change unfavourable ones. To reduce unfavourable attitudes because they are ''obstacles to learning''. To alter instruction because of attitudes and to alter attitudes through instruction.

Directions:

Attached you will find a list of statements about physical education. Feelings about these statements vary among people. There are no right or wrong answers. Please answer each statement according to your own feelings about physical education.

Please put your answers on the provided answer sheet. You are to cross out the box on the answer sheet to indicate how strongly you agree or disagree with each statement. The numbers in the boxes on the answer sheet are there to guide you. They stand for the following:

+3 = very strongly agree	-3 = very strongly disagree
+2 = strongly agree	-2 = strongly disagree.
+1 = agree	-1 = disagree

From Edgington, C.W.: Development of an attitude scale to measure attitudes of high school Freshman boys towards physical education. Ed. D., Colorado state college, Greeley, 1965. Used by permission of the university of Northern Colorado and the author.

3.2.3.3 Personality Hardiness (Singh, 2008)

Hardiness usually measures the personality structure comprising of three related general depositions viz. Commitment, control, and challenge that functions as a resistance resource in the counter with stressful condition (Kobasa et al, 1982). Bengali version of psychological hardiness scale of Singh (2008) was used.

Objective of the test: To assess the degree or magnitude of psychological hardiness.

Test Application: Satisfactory for both boys and girls in any age group above xii classes to M.A. and onwards.

Reliability: Test re-tests reliability 0.862, internal consistency reliability 0.792

Validity: Content validity 0.74

Tools used: A Bengali version questionnaire of psychological hardiness scale of Singh (2008) was used for data collection. The reliability value using both versions was r = 0.92.

Test Administration: The subjects were clearly instructed prior to the test and they were requested co-operate as best as possible from their end. It was administered in group or individual basis according to subjects' availability. No prescribed time limit was fixed for completing the test. However, it was said that ordinarily, 15 to 20 minutes required for answering all the items. It consisted of 30 items and no items contained right or wrong option and it supposed to know the reaction of individual in different situations. So, each item had to be responded in one of the five alternatives. No item had to be left out. They were assured that their answers will be kept confidential and the matter not to be used accepts the research purpose only.

Score: The score (s) of the subjects on each item were added to obtain a total score.

(Comparative study on physical and psychological profiles of height weight matched athlete and non-athlete, Mondal, Pallob Kumar, 2017)

3.4 STATISTICAL PROCEDURE

The obtained data in form of digital score will be treated statistically to get results and to draw conclusions. The mean and SD will be considered as descriptive statistics.

Analysis of variance (ANOVA) was employed to find out significant difference. If any significant different will be occur then post hoc test will be employed to calculate the pair wise comparisons between the groups.

Multiple co-relation and Multiple regression was employed. In all the cases 0.05 level of significance was fixed to test the hypothesis.

For statistical calculation Statistical Procedure for Social Sciences (SPSS) Verson-23 was used.

CHAPTER- IV

RESULT AND DISCUSSION

4.1 Personal Data

4.2 Motor Fitness Parameters

4.3 Psychosocial Parameters

4.4 The Results

4.5 Discussion of the Results

4.6 Testing of the Hypothesis

CHAPTER- IV

RESULT AND DISCUSSION

In this chapter, all collected data have been presented. Results obtained from statistical analysis of data and there after interpretation of results based on experience and existing knowledge of the field has also been presented in this chapter. All these aspects have been described according to the dimension for the purpose of the study.

4.1 Personal Data:

Personal data of the subjects were height, weight and best performance in sports of three different groups. The height, weight and best performance of the subjects were presented in Table-1 in the form of Mean and standard deviation (Mean ± SD) value.

Table -1: Personal data of the subjects of three groups

Group / Variables	Sprinters (Mean ± SD)	Long Jumpers (Mean ± SD)	Javelin Throwers (Mean ± SD)
Height (Cm)	168.76 ± 2.17	168.16 ± 3.20	168.63 ± 2.93
Weight (Kg)	60.33 ± 4.56	59.66 ± 3.66	61.33 ± 3.15
Best Performance (Score)	49.87 ±10.32	49.96 ± 9.86	49.99 ± 10.00

Table-1 represents the mean and SD (Mean ± SD) values of personal data of the subjects of three different groups (sprinters, long jumpers and javelin throwers**)** of the study. Analyzing the data, it appears that the Mean and SD values of sprinters, long jumpers and javelin throwers in height were 168.76 ± 2.17, 168.16 ± 3.20 and 168.63 ± 2.93 cm respectively.

The Mean and SD values of sprinters, long jumpers and javelin throwers in weight were 60.33 ± 4.56, 59.66 ± 3.66 and 61.33 ± 3.15 kg respectively and the best performance of sprinters, long jumpers and javelin throwers were 49.87± 10.32, 96 ± 9.86 and 49.99 ± 10.00 respectively.

The Mean and SD values of Sprinters, Long jumpers and Javelin Throwers in Height, Weight and Best Performance were presented in figure no -8.

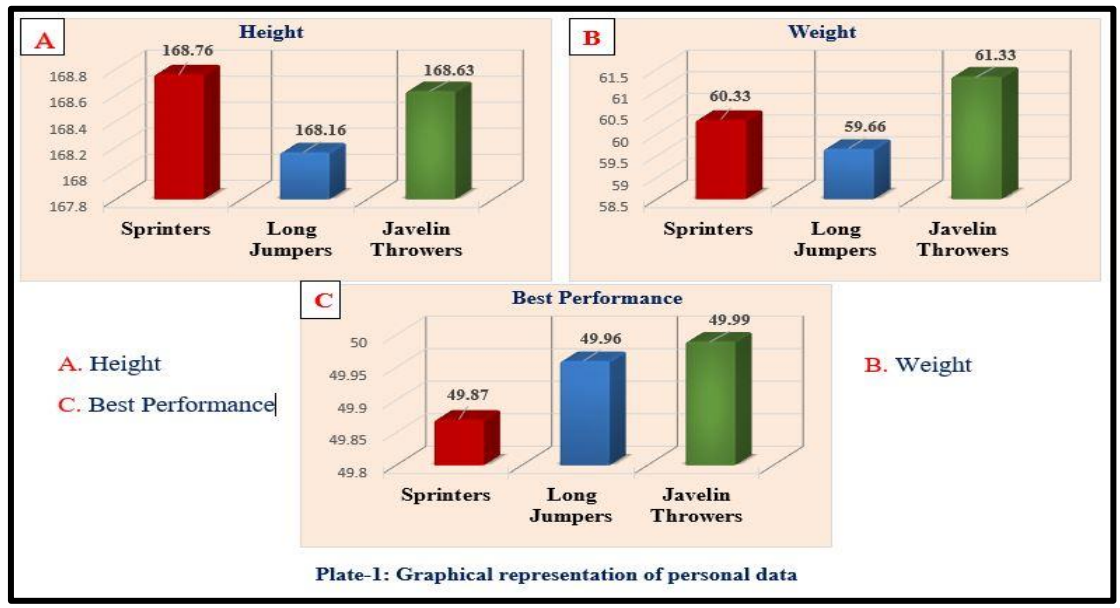

Fig. No. 8: Mean and SD values of Sprinters, Long Jumpers and Javelin Throwers in Height, Weight and Best Performance

From the above analysis it was clearly depicted that the mean and SD values of Sprinters, Long jumpers and Javelin throwers in Height, Weight and Best Performance were not similar and in order to find out the significance of statistical difference among the groups analysis of variance was used and Table no - 2 shows the results.

Table-2: ANOVA on Personal data of three groups

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Height (cm)	Between Groups	2	5.95	2.97	0.37	0.68
	Within Groups	87	684.50	7.86		
	Total	89	690.45			
Weight (kg)	Between Groups	2	42.22	21.11	1.43	0.24
	Within Groups	87	1282.00	14.73		
	Total	89	1324.22			
Best Performance (score)	Between Groups	2	0.22	0.11	0.01	0.99
	Within Groups	87	8814.45	101.31		
	Total	89	8814.67			

$F_{0.05}$ (2, 87) =3.10, *Significant at 0.05 level

The calculated F-values among Sprinters, Long jumpers and Javelin throwers in Height, Weight and Best Performance were 0.37, 1.43 and 0.01 respectively. All the values were less than the tabulated F-value and the tabulated F-value was 3.10 at 0.05 level of significant. Therefore, there was no significant difference among the groups in height, weight and best performance.

4.1.1 Relationship between personal data and best performance of sprinters, long jumpers and javelin throwers.

The relationship between personal data and the best performance was calculated and results have been presented in Table-3.

Table-3: Relationship of Height and Weight with Best Performance of three groups

Variable	Coefficient correlation with best performance		
	Sprinters	Long Jumpers	Javelin Throwers
Height (cm)	.110	.300	.039
Weight (kg)	.137	.346	.155

***Significant at 0.05 level with at 28 of confidence, ** significant at 0.01 level of confidence, NS=Not Significant**

Table-3 shows that the coefficient of correlation between height and best performance of three different groups. The coefficient of correlation between height and best performance for three different groups were .110 (sprinters), .300 (long jumpers) and .039 (javelin throwers) respectively which were positively corelated with the best performance, but did not find any significant relation with performance.

The coefficient of correlation of weight and best performance for sprinters, long jumpers and javelin throwers were .137, .346 and .155 respectively which were positively corelated with the best performance, but did not find any significant relation with performance.

4.2 Motor Fitness

To measure the motor fitness of each subject of the study, the selected parameters such as speed, leg explosive strength, agility, reaction time and coordination

were measured. Table-4 represent the descriptive statistics of the motor fitness variables of three different groups of the study.

Table-4: Descriptive statistics of motor fitness variables of three groups

Groups → / Variables ↓	Sprinters (Mean ± SD)	Long Jumpers (Mean ± SD)	Javelin Throwers (Mean ± SD)
Speed (sec)	6.10 ± 0.12	6.24 ± 0.24	7.72 ± 0.54
Leg-Explosive Strength (m)	2.52 ± 0.08	2.70 ± 0.16	2.26 ± 0.16
Agility (sec)	8.24 ± 0.43	9.56 ± 0.58	10.29 ± 1.11
Reaction Time (sec)	14.76 ± 1.92	17.10 ± 2.09	17.73 ± 2.29
Co-ordination (n)	24.10 ± 2.89	26.16 ± 3.21	28.16 ± 2.93

The mean and SD values of speed among sprinters, long jumpers and javelin throwers were 6.10 ± 0.12, 6.24 ± 0.24 and 7.72 ± 0.54 sec respectively.

In case of leg explosive strength among sprinters, long jumpers and javelin throwers were 2.52 ± 0.08, 2.70 ± 0.16 and 2.26 ± 0.16 meters respectively.

The mean and SD values among sprinters, long jumpers and javelin throwers were 8.24 ± 0.43, 9.56 ± 0.58 and 10.29 ± 1.11 sec respectively.

The mean and SD of reaction time among sprinters, long jumpers and javelin throwers were 14.76 ± 1.92, 17.10 ± 2.09 and 17.73 ± 2.29 sec respectively.

In case of coordination among sprinters, long jumpers and javelin throwers were 24.10 ± 2.89, 26.16 ±3.21 and 28.16 ± 2.93 respectively.

From the above analysis it can be clearly depicted that the mean and SD values of the sprinters, long jumpers and javelin throwers in speed, leg explosive strength, agility, reaction time and coordination were not similar. However, ascertain the degree of differences among the sprinters, long jumpers and javelin throwers in speed, leg explosive strength, agility, reaction time and coordination, the Analysis of variance and the follow up post-hoc least significant difference (LSD) was calculated and presented in the below tables.

The Mean and SD values of Sprinters, Long jumpers and Javelin throwers in Motor fitness were presented in figure no -9.

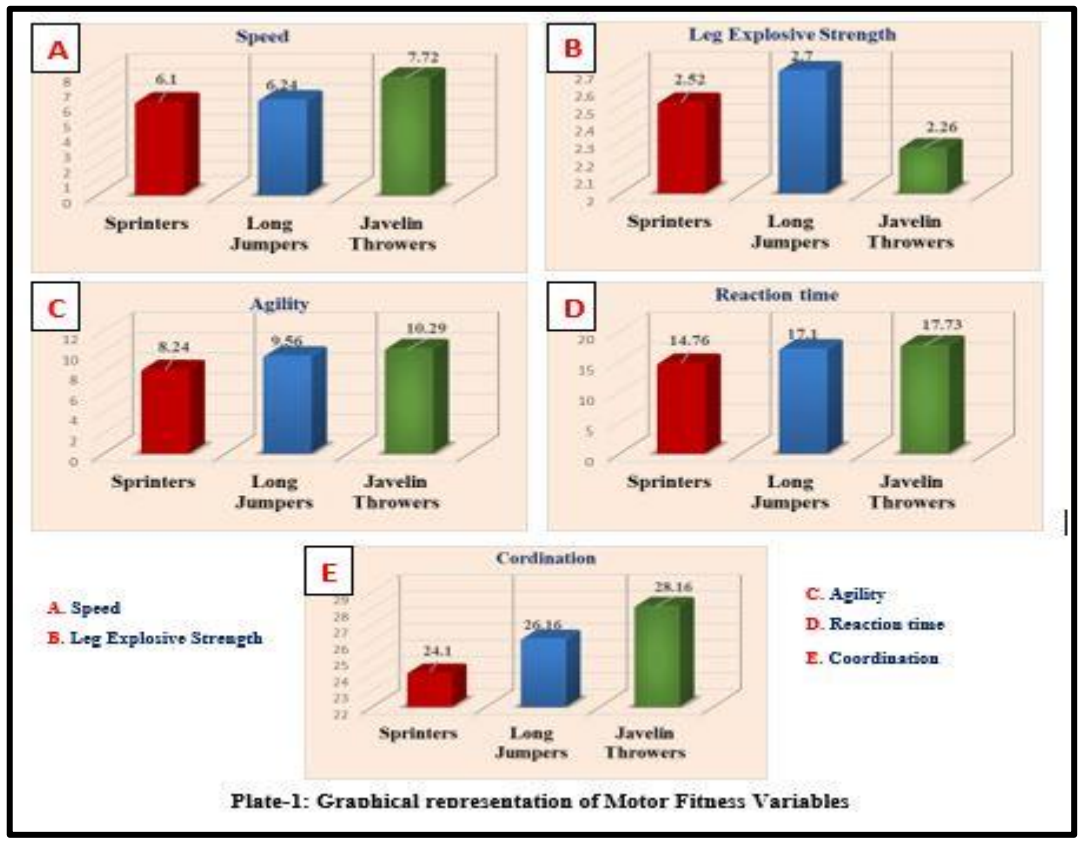

Fig. No. 9: Mean and SD values of Sprinters, Long Jumpers and Javelin Throwers in Motor Fitness

4.2.1 Speed (sec)

In order to find out the significance of statistical difference in Speed among the three different groups, the Analysis of Variance was used and it has been presented in Table-5.

Table-5: ANOVA among Sprinters, Long jumpers and Javelin throwers in Speed

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Speed (sec)	Between Groups	2	48.00	24.00	194.48*	.00
	Within Groups	87	10.73	0.12		
	Total	89	58.74			

$F_{0.05}$ (2, 87) =3.10, *Significant

Table-5 represents the ANOVA on speed of three different groups. The calculated F-value of speed was 194.48, which was greater than the tabulated F - value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in speed of three different groups was

found statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-6.

Table - 6: Post-hoc LSD comparison of speed (sec) of three groups

Group (Mean)		Mean Difference	Std. Error	t-ratio	Sig. level
Sprinters (6.10)	Long Jumpers (6.24)	0.14	0.04	2.70*	0.00
	Javelin Throwers (7.72)	1.62	0.10	15.78*	0.00
Long Jumpers (6.24)	Javelin Throwers (7.72)	1.48	0.10	13.58*	0.00

***$t_{0.05}$ (58) =2.00, *significant, NS = not significant**

Table-6 represents the post-hoc LSD comparisons between mean score of speed of different three groups. It revels from the result that the calculated t-value of all the inter-groups comparisons was greater than the tabulated t-value ($t_{0.05}$ 58-2.00). Therefore, the difference was found statistically significant at 0.05 level of significance.

From the above analysis it was showed that the Speed of the sprinters was significantly better than long jumpers and javelin throwers. It was also found that long jumpers had possesses greater speed than javelin throwers.

4.2.2 Leg Explosive Strength (m)

In order to find out the significance of statistical difference in Leg Explosive Strength among the three different groups, the Analysis of Variance was used and it has been presented in Table 7.

Table -7: ANOVA on Leg explosive strength (m) of three groups

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Leg explosive strength (m)	Between Groups	2	2.91	1.46	70.32*	.00
	Within Groups	87	1.80	0.02		
	Total	89	4.72			

$F_{0.05}$ (2, 87) =3.10, *Significant

Table -7 represents the ANOVA on Leg explosive strength of three different groups. The calculated F - value of leg explosive strength was 70.32, which was greater

than the tabulated F value ($_{F0.05}$ 2, 87 = 3.10). Therefore, the difference in leg explosive strength of three different groups was statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-8.

Table - 8: Post-hoc LSD comparison of Leg explosive strength (m) of three groups

Group (Mean)		Mean Difference	Std. Error	t-ratio	Sig. level
Sprinters (2.52)	Long Jumpers (2.70)	0.18	0.03	5.24*	0.00
	Javelin Throwers (2.26)	0.26	0.03	7.65*	0.00
Long Jumpers (2.70)	Javelin Throwers (2.26)	0.44	0.04	10.29*	0.00

***$t_{0.05}$ (58) =2.00, *significant, NS = not significant**

Table-8 represents the post hoc LSD comparisons between mean score of leg explosive strength of different three groups. It revels from the result that the calculated t-value of all the inter-groups comparison was greater than the tabulated t-value ($t_{0.05}$ 58- 2.00). Therefore, the differences were found statistically significant.

From the above analysis it was showed that the explosive strength of the long jumpers was significantly better than sprinters and Javelin throwers. It was also found that sprinters had possesses greater leg explosive strength than Javelin throwers.

4.2.3 Agility (sec)

In order to find out the significance of statistical difference in Agility among the three different groups, the Analysis of Variance was used and it has been presented in Table - 9.

Table -9: ANOVA on Agility (sec) of three groups.

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Agility (sec)	Between Groups	2	64.52	32.26	54.27*	.00
	Within Groups	87	51.71	0.59		
	Total	89	116.23			

$F_{0.05}$ (2, 87) =3.10, *Significant

Table - 9 represents the ANOVA on Agility of three different groups. The calculated F value of agility was 54.27, which was greater than the tabulated F-value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in agility of three different groups was found statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-10.

Table-10: Post-hoc LSD comparison of agility (sec) of three groups

Group (Mean)		Mean Difference	Std. Error	t-ratio	Sig. level
Sprinters (8.24)	Long Jumpers (9.56)	1.32	0.13	9.79*	
	Javelin throwers (10.29)	2.05	0.21	9.35*	
Long Jumpers (9.56)	Javelin throwers (10.29)	.73	0.23	3.18*	

***t 0.05 (58) =2.00, *significant, NS = not significant**

Table -10 represents the post-hoc LSD comparisons between mean score of agility of three different groups. It revels from the result that the calculated t-ratio of all the inter-groups comparison was greater than the tabulated t-value ($t_{0.05}$ 58-2.00). Therefore, all the differences were found statistically significant.

From the above analysis it was showed that the agility of the sprinters was significantly better than long jumpers and Javelin throwers. It was also found that long jumpers had possesses greater agility than Javelin throwers.

4.2.4 Reaction Time (sec)

In order to find out the significance of statistical difference in Reaction Time among the three different groups, the Analysis of Variance was used and it has been presented in Table 11.

Table-11: ANOVA on reaction time (sec) of three groups

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Reaction time (sec)	Between Groups	2	146.58	73.29	16.49*	.00
	Within Groups	87	386.69	4.44		
	Total	89	533.27			

$F_{0.05}$ (2, 87) =3.10, *Significant

Table-11 represents the ANOVA on reaction time of three different groups. The calculated F value of reaction time was 16.90, which was greater than the tabulated F - value ($_{F0.05}$ 2, 87 = 3.10). Therefore, the difference in reaction time of three different groups was found statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-12.

Table-12: Post-hoc LSD comparison of reaction time (sec) of three groups

Group (Mean)		Mean Difference	Std. Error	t-ratio	Sig. level
Sprinters (14.76)	Long Jumpers (17.10)	2.34	0.51	4.49*	.00
	Javelin Throwers (17.73)	2.97	0.54	5.43*	.00
Long Jumpers (17.10)	Javelin Throwers (17.73)	0.63	0.56	1.12^{NS}	0.26

***t $_{0.05}$ (58) =2.00, *significant, NS = not significant**

Table-12 represents the post-hoc LSD comparisons of reaction time of three different groups. Among the three post-hoc LSD mean differences, statistically significant difference existed in two cases as calculated t ratio was greater than the tabulated t-ratio ($t_{0.05}$ 58-2.00), those were between sprinters and long jumpers (t ratio-4.49), sprinters and javelin throwers (t ratio - 5.43) respectively.

From the above analysis it was showed that the reaction time of the sprinters was significantly better than long jumpers and javelin throwers. It was also found that there was no significant difference found between long jumpers and javelin throwers.

4.2.5 Coordination (n)

In order to find out the significance of statistical difference in Coordination among the three different groups, the Analysis of Variance was used and it has been presented in Table-13.

Table-13: ANOVA on coordination (n) of three groups

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Coordination (n)	Between Groups	2	248.08	124.04	13.60*	.00
	Within Groups	87	793.03	9.11		
	Total	89	1041.12			

$F_{0.05}$ (2, 87) =3.10, *Significant

Table-13 represents the ANOVA on coordination of three different groups. The calculated F value of coordination was 13.60, which was greater than the tabulated F-value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in coordination of three different groups was statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-14.

Table-14: Post-hoc LSD comparison of coordination (n) of three groups

Group (Mean)		Mean Difference	Std. Error	t-ratio	Sig. level
Sprinters (24.10)	Long Jumpers (26.16)	2.06	0.78	2.61*	0.01
	Javelin Throwers (28.16)	4.06	0.75	5.40*	0.00
Long Jumpers (26.16)	Javelin Throwers (28.16)	2.00	0.79	2.51*	0.01

***t 0.05 (58) =2.00, *significant, NS = not significant**

Table-14 represents the post-hoc LSD comparisons between mean score of coordination of three different groups. It reveled from the result that the calculated t-ratio value of all three inter group comparisons were greater than the tabulated t-value ($t_{0.05}$ 58-2.00); Therefore, all the differences were found statistically significant.

From the above analysis it was showed that the coordination of the Javelin throwers was significantly better than sprinters and long jumpers. It was also found that long jumpers had possesses greater coordination than sprinters.

4.2.6 Relationship between selected motor fitness and best performance of sprinters, long jumpers and javelin throwers.

The relationship between selected motor fitness and the best performance was calculated and results have been presented in Table-15.

Table-15: Relationship of motor fitness with Best Performance of three groups

Motor fitness variable	Coefficient correlation with best performance		
	Sprinters	Long Jumpers	Javelin Throwers
Speed (sec)	.641**	$.120^{NS}$	$.029^{NS}$
Leg explosive strength (m)	$.282^{NS}$	.394*	$.064^{NS}$
Agility (sec)	.537**	$.160^{NS}$	$.047^{NS}$
Reaction time (sec)	$.111^{NS}$	$.074^{NS}$	$.268^{NS}$
Coordination (n)	$.307^{NS}$	$.210^{NS}$	$.230^{NS}$

***Significant at 0.05 level, ** sig. at 0.01 level, NS=Not Significant**

Table-15 shows that the coefficient of correlation between motor fitness and best performance of the three different groups. In case of sprinter, the relationship of speed and agility with best performance were found to be r = .641, r = .537, which were significant at 0.05and 0.01 level. The leg explosive strength, reaction time and coordination exhibited a positive but not significant correlation with best performance of the sprinters. The speed and agility of the sprinters were significantly correlated with the best performance.

In case of long jumpers, the relationship of leg explosive strength with best performance were found to be r =.394, which were significant at 0.05 level. The speed, agility, reaction time and coordination exhibited a positive but not significant correlation with best performance of long jumpers.

In case of javelin throwers, the relationships of all the selected motor fitness variables with best performance were found a positive but not significant correlation with best performance.

4.2.7 Regression between Motor Fitness and Best Performance of three groups.

Table-16: Regression analysis between Motor Fitness and Best performance of Sprinters

Sl. No	Variables	R	R Square	R Square Change
1.	Speed	0.641	0.411	0.411
2.	Speed and Leg Explosive Strength	0.654	0.428	0.017
3.	Speed, Leg Explosive Strength and Agility	0.678	0.459	0.031
4.	Speed, Leg Explosive Strength, Agility and Reaction Time	0.698	0.487	0.028
5.	Speed, Leg Explosive Strength, Agility, Reaction Time and Co-ordination	0.714	0.509	0.022

From the table-16, it was found that the multiple regression for predictors such as speed, leg explosive strength, agility, reaction time and coordination is 0.714 which produce highest multiple regressions with best performance of state level sprinters. R-square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order.

1. About 41.1% of the variation in the best performance was explained by the regression model with one predictor speed.
2. About 42.8% of the variation in the best performance was explained by the regression model with two predictors, speed and leg explosive strength. An additional 1.7% of the variance in the best performance is contributed by leg explosive strength.
3. About 45.9% of the variation in the best performance was explained by the regression model with three predictors, speed, leg explosive strength and agility. An additional 3.1% of the variance in the best performance is contributed by agility.
4. About 48.7% of the variation in the best performance was explained by the regression model with four predictors, speed, leg explosive strength, agility and reaction time. An additional 2.8% of the variance in the best performance is contributed by reaction time
5. About 50.9% of the variation in the best performance was explained by the regression model with five predictors, speed, leg explosive strength, agility, reaction time and coordination. An additional 2.2% of the variance in the best performance is contributed by coordination.

Table-17: Regression analysis between Motor Fitness and Best performance of Long Jumpers

Sl. No	Variables	R	R Square	R Square Change
1.	Speed	0.348	0.121	.121
2.	Speed and Leg Explosive Strength	0.397	0.158	.037
3.	Speed, Leg Explosive Strength and Agility	0.436	0.190	.032
4.	Speed, Leg Explosive Strength, Agility and Reaction Time	0.443	0.196	0.006
5.	Speed, Leg Explosive Strength, Agility, Reaction Time and Co-ordination	0.476	0.227	0.031

From the table-17, it was found that the multiple regression for predictors such as speed, leg explosive strength, agility, reaction time and coordination is 0.476 which produce highest multiple regressions with best performance of state level long jumpers.

R square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order.

1. About 12.1% of the variation in the best performance was explained by the regression model with one predictor speed.
2. About 15.8% of the variation in the best performance was explained by the regression model with two predictors, speed and leg explosive strength. An additional 3.7% of the variance in the best performance is contributed by leg explosive strength.
3. About 19.0% of the variation in the best performance was explained by the regression model with three predictors, speed, leg explosive strength and agility. An additional 3.2% of the variance in the best performance is contributed by agility.
4. About 19.6% of the variation in the best performance was explained by the regression model with four predictors, speed, leg explosive strength, agility and reaction time. An additional 0.06% of the variance in the best performance is contributed by reaction time
5. About 22.7 of the variation in the best performance was explained by the regression model with five predictors, speed, leg explosive strength, agility, reaction time and coordination. An additional 3.1% of the variance in the best performance is contributed by coordination.

Table-18 Regression analysis between Motor Fitness and Best performance of Javelin Throwers

Sl. No	Variables	R	R Square	R Square Change
1.	Speed	0.029	0.001	0.001
2.	Speed and Leg Explosive Strength	0.093	0.009	0.008
3.	Speed, Leg Explosive Strength and Agility	0.123	0.015	0.006
4.	Speed, Leg Explosive Strength, Agility and Reaction Time	0.369	0.137	0.122
5.	Speed, Leg Explosive Strength, Agility, Reaction Time and Co-ordination	0.389	0.151	0.014

From the table 18, it was found that the multiple regression for predictors such as speed, leg explosive strength, agility, reaction time and coordination is 0.389 which produce highest multiple regressions with best performance of state level javelin throwers. R square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order.

1. About 0.01% of the variation in the best performance was explained by the regression model with one predictor speed.
2. About 0.09% of the variation in the best performance was explained by the regression model with two predictors, speed and leg explosive strength. An additional 0.08% of the variance in the best performance is contributed by leg explosive strength.
3. About 1.5% of the variation in the best performance was explained by the regression model with three predictors, speed, leg explosive strength and agility. An additional 0.06% of the variance in the best performance is contributed by agility.
4. About 13.7% of the variation in the best performance was explained by the regression model with four predictors, speed, leg explosive strength, agility and reaction time. An additional 12.2% of the variance in the best performance is contributed by reaction time
5. About 15.1% of the variation in the best performance was explained by the regression model with five predictors, speed, leg explosive strength, agility, reaction time and coordination. An additional 1.4% of the variance in the best performance is contributed by coordination.

4.3 Psychological Parameters

Psychosocial parameters were measured by sports competition anxiety, attitude, and personality hardiness.

4.3.1 Sports Competition Anxiety (score)

Mean and standard deviation (Mean ± SD) as descriptive statistics of sports competition anxiety of sprinters, long jumpers and javelin throwers have been presented in Table19.

Table-19: Descriptive statistics of sports competition anxiety (score) of three groups

Groups → / Variables ↓	Sprinters (Mean ±SD)	Long Jumpers (Mean ± SD)	Javelin Throwers (Mean ± SD)
Sports Competition Anxiety (score)	21.23 ± 3.18	20.26 ± 2.46	18.10 ± 2.72

Table-19 represents the mean and SD (Mean ± SD) values of sports competition anxiety of the subjects of three different groups. The mean and SD values of sprinters, long jumpers and javelin throwers in sports competition anxiety were 21.23 ± 3.18, 20.26 ± 2.46 and 18.10 ± 2.72 respectively.

From the above it can be clearly depicted that the mean and SD values of the sprinters, long jumpers and javelin throwers in sports competition anxiety was not similar. In order to find out difference among the groups, the analysis of variance and the follow up post-hoc least significant difference (LSD) was calculated and presented in the table-20.

The Mean and SD values of Sprinters, Long jumpers and Javelin Throwers in Sports Competition Anxiety were presented in figure no -10.

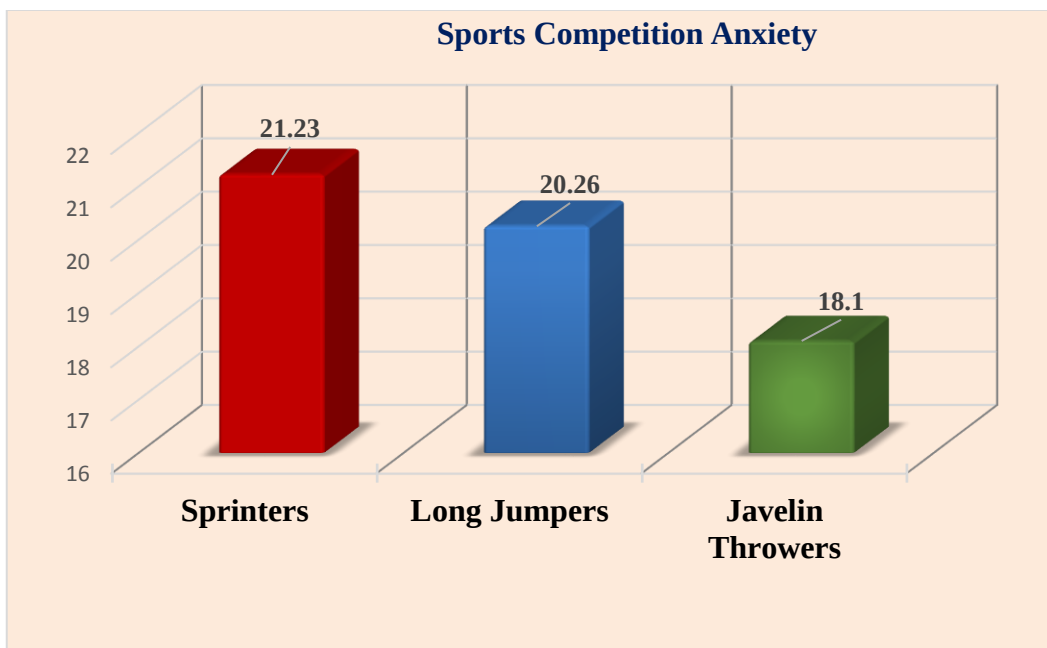

Fig. No-10: Graphical representation of Mean and SD values of Sprinters, Long Jumpers and Javelin Throwers in Sports Competition Anxiety

Table-20: ANOVA on sports competition anxiety (score) of three groups

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Sports Competition Anxiety (Score)	Between Groups	2	154.46	77.23	9.82*	.00
	Within Groups	87	683.93	7.86		
	Total	89	838.40			

$F_{0.05}$ (2, 87) =3.10, *Significant

Table-20 represents the ANOVA on sports competition anxiety of three different groups. The calculated F-value of sports competition anxiety was 9.82, which was greater than the tabulated F-value ($F_{0.05}$ 2, 87 =3.10). Therefore, the difference in sports competition anxiety of three different groups was statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-21.

Table-21: Post-hoc LSD comparison of sports competition anxiety (score) of three groups

Group (Mean)		Mean Difference	Std. Error	t-ratio	Sig. level
Sprinters (20.83)	Long Jumpers (20.27)	0.96	0.73	1.31^{NS}	0.19
	Javelin Throwers (18.10)	3.13	0.76	4.10*	0.00
Long Jumpers (20.27)	Javelin Throwers (18.10)	2.16	0.67	3.23*	0.00

***$t_{0.05}$ (58) =2.00, *significant, NS = not significant**

Table-21 represents the post hoc LSD comparisons between mean score of sports competition anxiety of different three groups. Among the three post-hoc LSD mean differences, statistically significant difference existed in two cases as calculated t-ratio was greater than the tabulated t-ratio ($t_{0.05}$ 58-2.00); those were between sprinters and javelin throwers (t-value = 4.10), long jumpers and javelin throwers (t-value = 3.23) respectively.

From the above analysis it can be showed that there was no significant difference exists between Sprinters and Long jumpers in sports competition anxiety. But in case of Sprinters and Javelin throwers and Long jumpers and Javelin throwers a

significant difference were found and the sprinters and long jumpers showed more anxiety than javelin throwers.

4.3.2 Attitude (score)

Mean and standard deviation (Mean ± SD) as descriptive statistics of attitude of sprinters, long jumpers and javelin throwers have been presented in Table 22.

Table-22: Descriptive statistics of attitude (score) of three groups

Groups → / Variables ↓	Sprinters (Mean ± SD)	Long Jumpers (Mean ± SD)	Javelin Throwers (Mean ± SD)
Attitude (Score)	300.63 ± 25.46	290.10 ± 16.60	284.40 ± 24.07

Table 22 represents the mean and SD values of attitude of the subjects of three different groups of the study. The mean and SD values of sprinters, long jumpers and javelin throwers in attitude were 300.63 ± 25.46, 290.10 ± 16.60 and 284.40 ± 24.07 respectively.

From the above analysis it can be clearly depicted that the mean and SD values of the sprinters, long jumpers and javelin throwers in attitude was not similar and in order to find out the differences among the group, the Analysis of variance and the follow up post-hoc least significant difference (LSD) was calculated and presented in the table-23.

The Mean and SD values of Sprinters, Long jumpers and Javelin Throwers in Attitude were presented in figure no - 11.

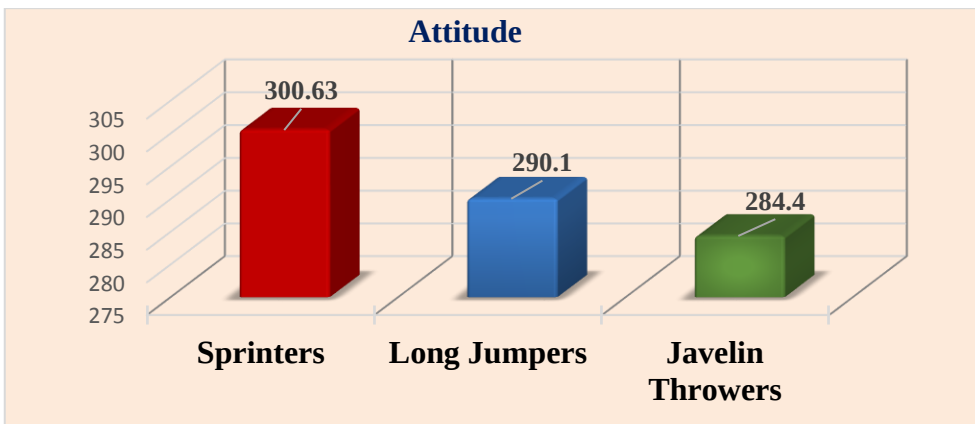

Fig. No-11: Graphical representation of Mean and SD values of Sprinters, Long Jumpers and Javelin Throwers in Attitude

Table-23: ANOVA on attitude (score) of three groups

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Attitude (Score)	Between Groups	2	4069.62	2034.81	4.05*	0.02
	Within Groups	87	43612.86	501.29		
	Total	89	47682.48			

$F_{0.05}$ (2, 87) =3.10* Significant

Table-23 represents the ANOVA on attitude of three different groups. The calculated F-value of attitude was 4.05, which was greater than the tabulated F-value ($_{F0.05}$ 2, 87 = 3.10). Therefore, the difference in attitude of three different groups was statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-24.

Table-24: Post-hoc LSD comparison on attitude (score) of three groups

Group (Mean)		Mean Difference	Std. Error	t-ratio	Sig. level
Sprinters (300.63)	Long Jumpers (287.33)	10.53	5.55	1.89^{NS}	0.06
	Javelin Throwers (284.40)	16.23	6.39	2.53*	0.01
Long Jumpers (287.33)	Javelin Throwers (284.40)	5.70	5.34	1.06^{NS}	0.29

***$t_{0.05}$ (58) =2.00, *significant, NS = not significant**

Table-24 represents the post hoc LSD comparisons between mean score of attitudes of different three groups. Among the three post-hoc LSD mean differences, statistically significant difference existed only one cases as calculated t-ratio was greater than the tabulated t-value ($t_{0.05}$ 58-2.00); those were sprinters and javelin throwers (t-ratio 2.53). However, in the remaining two post-hoc LSD mean differences i.e., between sprinters and long jumpers (t-value = 1.89), and long jumpers and javelin thrower (t-value = 1.06), the difference were not statistically significant.

From the above analysis it can be showed that there were no significant difference exists between sprinters and long jumpers, long jumpers and javelin throwers in Attitude. But in case of sprinters and javelin throwers a significant difference was found and the sprinters showed more attitude than javelin throwers.

4.3.3 Personality Hardiness (Score)

Mean and standard deviation (Mean ± SD) as descriptive statistics of different dimension of personality hardiness of sprinters, long jumpers and javelin throwers have been presented in Table - 25.

Table-25: Descriptive statistics of personality hardiness (score) with its three dimensions of three groups

Groups → / Dimension ↓	Sprinters (Mean ± SD)	Long Jumpers (Mean ± SD)	Javelin Throwers (Mean ± SD)
Commitment	36.80 ± 4.36	35.70 ± 4.06	37.13 ± 3.23
Control	36.33 ± 4.44	36.03 ± 3.74	37.13 ± 3.45
Challenge	35.73 ± 3.87	35.83 ± 4.27	37.30 ± 3.56
Personality Hardiness	108.86 ± 11.19	107.56 ± 11.91	111.56 ± 10.03

Table-25 represents the mean and SD values of different dimension of personality hardiness of three different groups. The mean and SD values of sprinters, long jumpers and javelin throwers in commitment were 36.80 ± 4.36, 35.70 ± 4.06 and 37.13 ± 3.23 respectively.

In case of ability to control, the mean and SD values were for sprinters, long jumpers and javelin throwers were 36.33 ± 4.44, 36.03 ± 3.74 and 37.13 ± 3.45 respectively.

The mean and SD values of sprinters, long jumpers and javelin throwers in challenge were 35.73 ± 3.87, 35.83 ± 4.27 and 37.30 ± 3.56 respective.

In case of personality hardiness, the mean and SD values of sprinters, long jumpers and javelin throwers were 108.86 ± 11.19, 107.56 ± 11.91 and 111.56 ± 10.03 respectively.

From the above analysis it can be clearly depicted that the mean and SD values of the sprinters, long jumpers and javelin throwers in personality hardiness was not similar and in order to find out the difference among the group, the analysis of variance and the follow up post-hoc least significant difference (LSD) was calculated and presented in the table-26.

The Mean and SD values of Sprinters, Long jumpers and Javelin Throwers in Personality Hardiness were presented in figure no - 12.

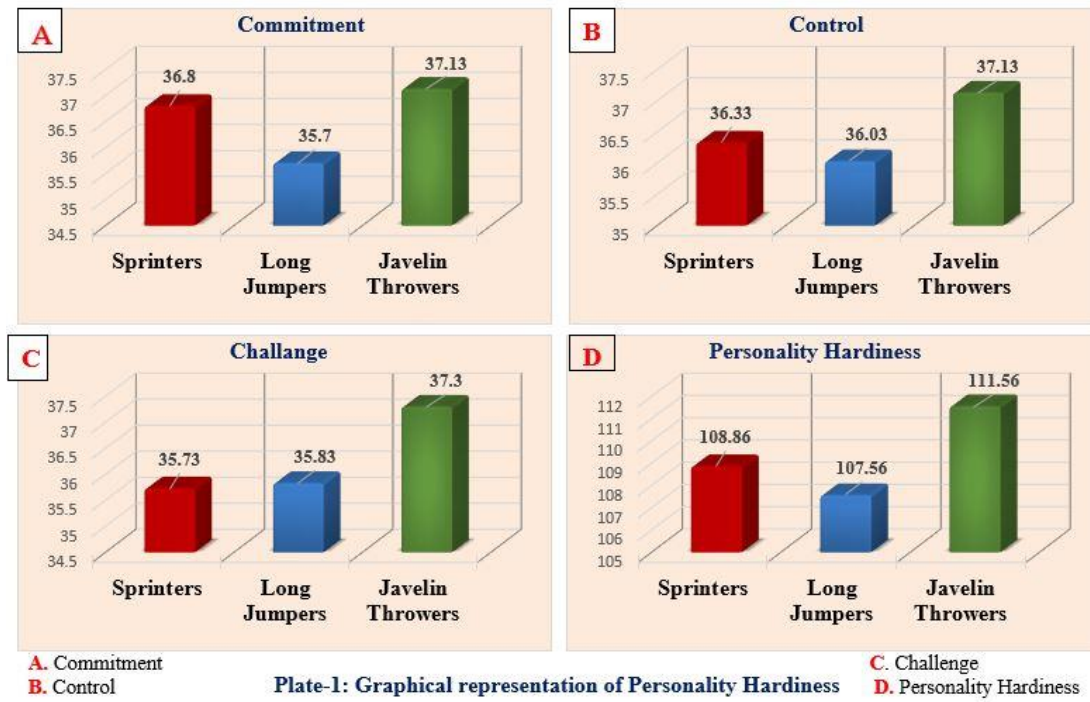

Fig. No-12: Graphical representation of Mean and SD values of Sprinters, Long Jumpers and Javelin Throwers in Personality Hardiness.

Table-26 ANOVA on personality hardiness (score) of three groups

Variable	Sources of variation	Df	SS	MSS	F-value	p-value
Commitment	Between Groups	2	33.75	16.87	1.10	0.33
	Within Groups	87	1334.56	15.34		
	Total	89	1368.32			
Control	Between Groups	2	19.40	9.70	0.63	.53
	Within Groups	87	1325.10	15.23		
	Total	89	1344.50			
Challenge	Between Groups	2	46.15	23.07	1.50	0.22
	Within Groups	87	1334.33	15.33		
	Total	89	1380.48			
Personality Hardiness	Between Groups	2	250.75	125.37	1.02	0.36
	Within Groups	87	10672.90	122.67		
	Total	89	10923.65			

$F_{0.05}$ (2, 87) =3.10* Significant

The calculated F value of commitment was 1.10, which was less than the tabulated F-value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in commitment of three different groups was not statistically significant at 0.05 level of significant. The calculated F value of control was 0.63, which was less than the tabulated F-value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in control of three different groups was not statistically significant.

The calculated F value of challenge was 1.50, which was less than the tabulated F-value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in challenge of three different groups was not statistically significant.

The calculated F value of personality hardiness was 1.02, which was less than the tabulated F-value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in personality hardiness of three different groups was not statistically significant at 0.05 level of significance.

From the above analysis the it can be clearly depicted that there were no significant difference exists among the groups in Commitment, Control, Challenge and Personality Hardiness.

4.3.3.1. Relationship of the psychological parameters with best performance of sprinters, long jumpers and javelin throwers

The relationship of psychological parameters with the Best Performance was correlated and results have been presented in table-27.

Table-27: Relationship of Psychological Parameters and Best Performance of three groups

Psychological parameters	Coefficient correlation with best performance		
	Sprinters	Long Jumpers	Javelin Throwers
Sports Competition Anxiety	$.142^{NS}$	$.263^{NS}$	$.358^{NS}$
Attitude	$.169^{NS}$	$.024^{NS}$	$.024^{NS}$
Personality Hardiness	$.055^{NS}$	.526**	$.178^{NS}$

***Significant at 0.05 level, ** sig. at 0.01 level, NS=Not Significant**

From the table-27 shows that coefficient of correlation between psychological parameters and best performance of the three different groups. In case of sprinters, the relationship of all psychological parameters with best performance were executed a positive insignificant correlation in performance of sprinters.

In case of long jumpers, the relationship of personality hardiness with best performance were found to be r = .526 which were positively significant at 0.01 level of confidence. The sports competition anxiety and attitude executed a positive insignificant correlation in performance of long jumpers.

In case of javelin thrower, the relationship of all psychological parameters with best performance were executed a positive insignificant correlation in performance of javelin throwers.

4.3.3.2 Regression between Psychological Parameter and Best Performance of Sprinters, Long Jumpers and Javelin throwers

Table-28: Regression analysis between Psychological Parameters and Best performance of Sprinters

Sl. No	Variables	R	R Square	R Square Change
1.	**Sports Competition Anxiety**	0.142	0.020	0.020
2.	**Sports Competition Anxiety and Attitude**	0.231	0.053	0.033
3.	**Sports Competition Anxiety, Attitude and Personality Hardiness**	0.242	0.059	0.006

Table 28, it was found that the multiple regression for predictors such as sports competition anxiety, attitude and personality hardiness is 0.242 which produce highest multiple regressions with best performance of state level sprinters. R square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order.

1. About 2.0% of the variation in the best performance was explained by the regression model with one predictor sports competition anxiety.

2. About 5.3% of the variation in the best performance was explained by the regression model with two predictors, sports competition anxiety and attitude. An additional 3.3% of the variance in the best performance is contributed by attitude.

3. About 5.9% of the variation in the best performance was explained by the regression model with three predictors, sports competition anxiety, attitude and personality hardiness. An additional 0.6% of the variance in the best performance is contributed by personality hardiness.

Table-29: Regression analysis between Psychological Parameters and Best performance of Long Jumpers

Sl. No	Variables	R	R Square	R Square Change
1.	**Sports Competition Anxiety**	0.263	0.069	0.069
2.	**Sports Competition Anxiety and Attitude**	0.363	0.131	0.062
3.	**Sports Competition Anxiety, Attitude and Personality Hardiness**	0.536	0.288	0.219

From the table 29, it was found that the multiple regression for predictors such as sports competition anxiety, attitude and personality hardiness is 0.536 which produce highest multiple regressions with best performance of state level long jumper. R square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order.

1. About 6.9% of the variation in the best performance was explained by the regression model with one predictor sports competition anxiety.

2. About 13.1% of the variation in the best performance was explained by the regression model with two predictors, sports competition anxiety and attitude. An additional.6.2% of the variance in the best performance is contributed by attitude.

3. About 28.8% of the variation in the best performance was explained by the regression model with three predictors, sports competition anxiety, attitude and personality hardiness. An additional 21.9% of the variance in the best performance is contributed by personality hardiness.

Table-30: Regression analysis between Psychological Parameters and Best performance of Javelin Throwers

Sl. No	Variables	R	R Square	R Square Change
1.	**Sports Competition Anxiety**	0.358	0.128	0.128
2.	**Sports Competition Anxiety and Attitude**	0.368	0.135	0.007
3.	**Sports Competition Anxiety, Attitude and Personality Hardiness**	0.442	0.195	0.060

From the table 30, it was found that the multiple regression for predictors such as sports competition anxiety, attitude and personality hardiness is 0.442 which produce highest multiple regressions with best performance of state level javelin throwers. R square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order.

1. About 12.8% of the variation in the best performance was explained by the regression model with one predictor sports competition anxiety.
2. About 13.5% of the variation in the best performance was explained by the regression model with two predictors, sports competition anxiety and attitude. An additional 0.7% of the variance in the best performance is contributed by attitude
3. About 19.5% of the variation in the best performance was explained by the regression model with three predictors, sports competition anxiety, attitude and personality hardiness. An additional 6.0% of the variance in the best performance is contributed by personality hardiness.

4.4 THE RESULTS

There were three groups of performance factors in this study – physical, motor fitness and psychological.

Analysis of data leads to the following results.

A. Physical parameters – height and weight were the selected factors in this group.

I. Height and weight did not show any significant relation with performance, but height and body weight show positive relation with performance of three difference groups.

II. Analysis of inter-group variation in these parameters indicated that there was no significant difference between three difference groups. In case of height the mean value of sprinters was slightly higher than other two groups. In case of weight the mean value of javelin throwers was heavier than both the sprinters and long jumper's groups.

B. Motor fitness parameters – speed, leg explosive strength, agility, reaction time and coordination were the selected parameters in this group.

I. Results indicated that performance of sprinters had significant correlation with speed, agility and reaction time. Long jumpers exhibited significant correlation of performance with leg explosive strength. Javelin throwers group exhibited no significant correlation of performance with motor fitness.

II. Regression analysis indicated that the performance of sprinters exhibited 50.9% dependence on motor fitness; performance of long jumpers exhibited 22.7% dependence on motor fitness and performance of javelin throwers exhibited only 15.1% dependence on motor fitness.

III. Analysis of inter-group variation in different selected motor fitness components indicated that sprinters group was significantly better than both the groups of long jumpers and javelin throwers in speed as well as agility and reaction time. But the differences between long jumper and javelin throwers groups in case of reaction time were not statistically significant.

IV. Long jumpers group showed significantly better in leg explosive strength than both the other groups – the sprinters and javelin throwers. The difference between sprinters and javelin throwers groups was also statistically significant.

V. In coordination the javelin throwers group was found to be significantly better than both of sprinters and long jumpers groups. The difference between sprinters and long jumpers groups was also statistically significant.

C. Psychological Factors – Sport**s** competitive anxiety, attitude and personality hardiness were the selected psychological factors.

I. The group of javelin thrower exhibited significantly lesser sports competitive anxiety than both groups of sprinters and long jumpers. But the sprinters and long jumper's groups were not statistically significant in this factor.

II. Second psychological factor was attitude. The sprinters group was found to be significantly higher than the groups of javelin throwers. But the difference between sprinters and long jumpers and also long jumpers and javelin throwers groups was not statistically significant in this factor.

III. The third psychological factor was personality hardiness. This component was analyzed into its four dimensions – commitment, control, challenge, and personality hardiness. Analysis of inter-group difference indicated that there was no statistically significant difference in four of these dimensions – commitment, control, challenge, and personality hardiness.

IV. Analysis of relationship between performance and selected psychological factors exhibited that there was significant positive relation of personality hardiness with performance for long jumper's group. In personality hardiness the sprinters and javelin throwers groups exhibited positive correlation. In the sprinters and javelin throwers groups also exhibited positive correlation for all psychological factors with performance.

V. Regression analysis indicated that the performance of sprinters exhibited 5.9% dependence on psychological factors; performance of long jumpers exhibited 28.8% dependence on psychological factors and performance of javelin throwers exhibited only 19.5% dependence on psychological factors.

4.5 DISCUSSION OF THE RESULTS:

As per the result of the study there was no statistical difference among selected groups of athletes- Sprinters, Long jumpers and Javelin throwers in selected parameters height and weight.

This may be due to the fact that all groups of performers within same age ranged and the basic element require for this track and field event are also similar.

Regarding motor fitness the sprinter group was found significantly better than the other two groups- long jumpers and javelin throwers. This results also supported by Harpreet Singh (2018). This may be due to the fact that the sprinting speed is the dominant factor for sprinting.

The long jumper's group was found to be significantly better than other two groups- sprinters and javelin throwers. Similar results also suggested by Norjali Wazir, M. R. W., Samsu, R., Yaacob, A., Martuan, S. Z. and Ishkandar, C. D. M. (2022). This may be due to fact that leg explosive strength most dominant motor fitness factor in running long jump.

The coordination ability was found to be significantly better for javelin thrower than other two groups. This may be due to fact that the technique of javelin throw requires more coordination because of involvement of approach running and throwing actions.

Psychological factors:

In the present study SCAT, Attitude and Personality hardiness are analyzed. The result indicated that the sprinters and long jumpers' group had higher sports competitive anxiety than the javelin groups. Similar results have been reported by Aneesh Rajappan, Dr. V. A. Manickam, (2016). This may be due to the fact that the sprinting performance is more uncertain and risk oriented. In sprinting there is a single chance to complete the event in comparison with 6 trials in javelin throw.

In Attitude sprinters group was found to be significantly higher than the javelin thrower groups. This may be due to the fact that sprinting requires more attention and involvement for the events than the events if throwing.

The results indicated that all the three groups- sprinters, long jumpers and javelin throwers exhibited positive correlation with the selected psychological parameters- SCAT, Attitude and Personality hardiness.

The regression analysis indicates that the performance for sprinter, long jumpers and javelin throwers groups had 54.2% dependence on selected psychological factors.

4.6 TESTING OF HYPOTHESIS:

The 1st hypothesis was that there would be no significant difference in motor fitness among difference groups of Track and Field athletes. On the basis of result, it had been found that sprinters were found to be better in speed, agility and reaction time. Long jumpers were found to better in leg explosive strength and javelin throwers was found to be better in coordination. But in other cases, the difference was found to be insignificant. So, on the basis of result obtain the 1st hypothesis was partially accepted.

According to the 2nd hypothesis it was assumed that there would be positive relationship between motor fitness and best performance. Results of the present study indicated that significant positive correlation for best performance with speed and agility for sprinters and leg explosive strength for long jumpers. For the other cases the relationship was not statistically significant. So, on the basis of result 2nd hypothesis was partially accepted.

The 3rd hypothesis was that there would be positive relation between sports performance and selected psychological parameters- SCAT, Attitude and Personality hardiness. On the basis of results there was only significantly positive relationship found between sports performance and personality hardiness for long jumpers. So, on the basis of result the 3rd hypothesis was also partially accepted.

CHAPTER – V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the study

5.2 Conclusion

5.3 Recommendation

CHAPTER – V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF THE STUDY

Conjunction with festivals and sports meets such as the Ancient Olympic Games in Greece. In modern times, the two most prestigious international track and field competitions are athletics competition at the Olympic Games and the World Championships in Athletics. The World Athletics is the International Governing Body. Records are kept of the best performances in specific events, at world and national levels, right down to a personal level. However, if athletes are deemed to have violated the event's rules or regulations, they are disqualified from the competition and their marks are erased. In North America, the term track and field may be used to refer to other athletics events, such as the marathon, rather than strictly track-based events.

In athletics and track and field, sprints (or dashes) are races over short distances. They are among the oldest running competitions. The first 13 editions of the Ancient Olympic Games featured only one event—the stadion race, which was a race from one end of the stadium to the other. There are three sprinting events which are currently held at the Summer Olympics and outdoor World Championships: the 100 meters, 200 meters, and 400 meters. These events have their roots in races of imperial measurements which were later altered to metric: the 100 m evolved from the 100-yard dash, the 200 m distance came from the furlong (or $\frac{1}{8}$ mile), and the 400 m was the successor to the 440-yard dash or quarter-mile race.

At the professional level, sprinters begin the race by assuming a crouching position in the starting blocks before leaning forward and gradually moving into an upright position as the race progresses and momentum is gained. The set position differs depending on the start. Body alignment is of key importance in producing the optimal amount of force. Ideally the athlete should begin in a 4-point stance and push off using both legs for maximum force production. Athletes remain in the same lane on the running track throughout all sprinting events, with the sole exception of the 400 m indoors. Races up to 100 m are largely focused upon acceleration to an athlete's

maximum speed. All sprints beyond this distance increasingly incorporate an element of endurance.

The long jump was considered one of the most difficult of the events held at the Games since a great deal of skill was required. Music was often played during the jump and Philostratus says that pipes at times would accompany the jump so as to provide a rhythm for the complex movements of the athlete. Philostratos is quoted as saying, "The rules regard jumping as the most difficult of the competitions, and they allow the jumper to be given advantages in rhythm by the use of the flute, and in weight by the use of the halter." (Miller, 67). Most notable in the ancient sport was a man called Chionis, who in the 656BC Olympics staged a jump of 7.05 metres (23 feet and 1.7 inches).

The javelin throw is a field athletics event, a spear like object is known at a distance from the following sector. Javelin for hunting and war javelin throwing is through to have been a sport enjoyed by Greeks. Javelin throwers competed while riding horses, which served to further increase the skill required in the sport. The javelin saw its introduction to the sporting world in the games of the Ancient Greeks in around 500 BC, with a much lighter design than their military counterparts, the objective was to achieve the greatest distance. Currently, javelin throwing is practiced only as a sport event. The event demands good speed as well as flexibility and power on the part of the athletes competing. The men javelin throw was introduced Modern Olympic as field event since 1908 and now a days it is one of the most popular throwing events in sports arena.

Sports performance depends on so many groups of factors such as endogenic factor, exogenic factor, technique-tactics factor, physical fitness factor, psychological factors etc. In top level competition psychological factors plays an important role for achieving their goal. For the present study the selected psychological parameters were sport competition anxiety, attitude and personality hardiness.

In modern competitive sports, psychological preparation of a team is as important as teaching them different skills of a game using scientific methods. Now a days, teams are prepared not only to play, but to win the competition, for coaches feel that good mental and psychological preparation for competition is a necessary component for success. (Agyajit, 1991)

Anxiety plays an important role in athletic performance. Whether its effect is positive or negative depends on how an individual perceives the situation. Athletes with low anxiety level have been known to perform better in sprinting performance. A moderate level of anxiety is seen as less for the acquisition and performance of skills. The levels of anxiety either too high or too low tend to inhibit learning and performance in sprinting.

Serious athletes devote hours to conditioning, perfecting techniques, honing skills for their particular sport, and practice, practice, practice. And this is true that the inherent talent and physical training can take an athlete far. But another important part of the maximizing your athletic achievements is having the right attitude.

If you are an athlete and enjoying the competitive sports, developing the positive mental attitude can be help to give you an edge. Emotions, both sad and happy can be affect cognitive functioning along with your energy level and others aspect of your physical performance. When negativity rules the day—because you are dealing with the injury, or being or say criticized of your coach—it can be actually tough to drum up the optimism that can be help your success. So that, if you would like to take your sports performance to the next level, then try to some of these mental strategies for reversing negativity and getting the rid of self-limiting beliefs.

Hardiness is a personality construct composed of three traits – control, commitment, and challenge – that are theorized to make one resilient in the face of stress. Individuals high in hardiness tend to believe and act as if life experiences are controllable (control), to engage meaningfully in life activities and to appraise these activities as purposeful and worthy of investment even in the face of adversity (commitment), and to view change in life as a challenge toward growth and development rather than as a threat to security (challenge). Based on existential personality theory, the combination of these characteristics is believed to provide individuals with the courage and motivation to cope adaptively with life stress, thereby buffering its adverse effects on health.

With this background concept, in the present study, an attempt has been made to observe the physical parameters, motor fitness, best performance and psychological parameters of sprinters, long jumpers and javelin throwers, so, the present study was

stated as **"ANALYSIS OF ERFORMANCE FACTORS OF TRACK AND FIELD ATHLETES"**.

The purpose of the present study was: I. To compare the selected physical parameters, selected motor fitness and selected psychological parameters of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers. II. To find out the selected physical parameters, selected motor fitness and selected psychological status of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers. III. To observe the relationship of selected physical parameters, selected motor fitness and selected psychological parameters with best performance of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers. IV. Analysis of performance factors with selected physical parameters of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers. V. Analysis of performance factors with selected motor fitness of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers. VI. Analysis of performance factors with selected psychological parameters of different track and field athletes. i.e., Sprinters, Long jumpers and Javelin throwers.

The significance of the study was- I. This study would significant to assess their motor fitness and psychological status, at the same time it can also be able to indicate the components in which they have lacuna. II. This study would help to understand the motor fitness and psychological status of the state level players of different district in West Bengal. III. The result of study would provide an opportunity for Physical Education Teacher and Coaches, to spot out the latent talents of the students and to select potential students for different track and field events. IV. The result would provide some information that will lead to farther study and research.

The limitation of study was- I. The subject's dietary habit was one of the limiting factors for the present study. II. The emotional levels of different subject for the present study were other limiting factors. III. Subjects past experience about their performance were another limiting factors for the study. IV. Socio economic status of the subjects was one of the most important limiting factors. V. Most of the subjects were from different region of West Bengal, this was another limiting factor for the study.

The delimitation of the study was- I. Geographical delimitation: The study was delimited to the state of West Bengal only. II. Subjective Delimitation: Only 90 State level male athletes (30 from Sprinters, 30 from long jumpers and 30 from Javelin throwers) were considered as subjects for the present study. III. Only 100-meter sprinter were selected as a subject of sprinters. Criterion Delimitation: Only height, weight and best performance were considering as selected physical parameters, selected motor fitness was measured only by speed, leg explosive strength, agility, reaction time and coordination. The selected psychological parameters were measured only by sports competition anxiety, attitude and personality hardiness.

This study was confined with following hypothesis- I. H_0: There would be no significant difference in subject's motor fitness among the selected track and field groups II. H_1: There would be a positive relationship between motor fitness and best performance. III. H_1: There would be a positive relation between sports competition anxiety, attitude and personality hardiness with best performance.

METHODOLOGY

Methodology can be determined on the basis of hypothesis and objective of the study. The various aspects of methods and materials are presented in this chapter. The subject for the present study was selected purposively from different districts of West Bengal, India. For the study different track and field athletes were selected. Some of them were sprinters, long jumpers, and javelin throwers; they have more than 05(five) years of experience in these events. Most of them were participated in a regular basis in different State level competition. Total number of thirty (30) male players were selected for each group. Age range 14 to 20 years. The data for present study was collected from West Bengal athletic meet 2017 to 2019, which was organized by Athletic Association of West Bengal, at Kolkata SAI Complex.

Performance Ability:

The subject's performance ability was measured on the basis of their state level meet in track and field events.

For the study three different criteria were conducted. There are:

Physical Parameters:

I) Age - On the basis of their Madhyamika paprikash admit card or birth certificate

II) Height (cm) – by measuring tape or Stadiometer

III) Weight (kg) - Weighing machine

IV) Best Performance

Motor fitness parameters:

I) 50-meter dash (Second) – To measure the sprinting ability of the subject

II) SBJ (Meter) – To measure leg explosive strength of the subject

III) Shuttle Run (4x10 yard) – To measure the agility of the subject

IV) Nelson hand reaction test (Second) – To measure the reaction ability of the subject

V) Jonson and Nelson speed pass co-ordination test (Second) – To measure Coordination

Psychological Parameters:

I) Sports competition Anxiety: measured by standardized questionnaire developed by Martens et al. 1990

II) Attitude: measured by standardized questionnaire developed by Harold M, Barrow and Rosemary McGee, 1979

III) Personality Hardiness: measured by standardized questionnaire developed by Singh, 2008

Statistical Procedure

The obtained data in form of digital score was treated statistically to get results and to draw conclusions. The mean and SD were considered as descriptive statistics. Analysis of variance (ANOVA) was employed to find out significant difference. For identifying significant difference post hoc test was employed to calculate the pair wise comparisons between the groups. Multiple correlation and Multiple regression were employed as relationship and predictive statistics. In all the cases 0.05 level of

significance was fixed to test the hypothesis. For statistical calculation Statistical Procedure for Social Sciences (SPSS) Verson-23 was used.

Results obtained from statistical analysis of data and there after interpretation of results based on experience and existing knowledge of the field has also been presented in this chapter. All these aspects have been described according to the dimension for the purpose of the study.

From table no-1 it was clearly depicted that the mean and SD values of Sprinters, Long jumpers and Javelin throwers in Height, Weight and Best Performance were not similar and in order to find out the significance of statistical difference among the groups analysis of variance was used and **Table no - 2** shows the results. The calculated F-values among Sprinters, Long jumpers and Javelin throwers in Height, Weight and Best Performance were 0.37, 1.43 and 0.01 respectively. All the values were less than the tabulated F-value and the tabulated F-value was 3.10 at 0.05 level of significant. Therefore, there was no significant difference among the groups in height, weight and best performance.

Table-3 shows that the coefficient of correlation between height and best performance of three different groups. The coefficient of correlation between height and best performance for three different groups were .110 (sprinters), .300 (long jumpers) and .039 (javelin throwers) respectively which were positively corelated with the best performance, but did not find any significant relation with performance. The coefficient of correlation of weight and best performance for sprinters, long jumpers and javelin throwers were .137, .346 and .155 respectively which were positively corelated with the best performance, but did not find any significant relation with performance.

From table no-4 it can be clearly depicted that the mean and SD values of the sprinters, long jumpers and javelin throwers in speed, leg explosive strength, agility, reaction time and coordination were not similar. However, ascertain the degree of differences among the sprinters, long jumpers and javelin throwers in speed, leg explosive strength, agility, reaction time and coordination, the Analysis of variance and the follow up post-hoc least significant difference (LSD) was calculated and presented in the below tables.

Table-5 represents the ANOVA on speed (sec) of three different groups. The calculated F-value of speed was 194.48, which was greater than the tabulated F - value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in speed of three different groups was found statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in **table-6**. The post-hoc LSD comparisons between mean score of speed of different three groups. It revels from the result that the calculated t-value of all the inter-groups comparisons was greater than the tabulated t-value ($t_{0.05}$ 58-2.00). Therefore, the difference was found statistically significant at 0.05 level of significance. From the above analysis it was showed that the Speed of the sprinters was significantly better than long jumpers and javelin throwers. It was also found that long jumpers had possesses greater speed than javelin throwers.

Table -7 represents the ANOVA on Leg explosive strength (m) of three different groups. The calculated F - value of explosive strength was 70.32, which was greater than the tabulated F value ($_{F0.05}$ 2, 87 = 3.10). Therefore, the difference in leg explosive strength of three different groups was statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-8. The **table-8** represents the post hoc LSD comparisons between mean score of leg explosive strength of different three groups. It revels from the result that the calculated t-value of all the inter-groups comparison was greater than the tabulated t-value ($t_{0.05}$ 58- 2.00). Therefore, the differences were found statistically significant. From the above analysis it was showed that the leg explosive strength of the long jumpers was significantly better than sprinters and Javelin throwers. It was also found that sprinters had possesses greater explosive strength than Javelin throwers.

Table - 9 represents the ANOVA on Agility (sec) of three different groups. The calculated F value of agility was 54.27, which was greater than the tabulated F-value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in agility of three different groups was found statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in **table-10.** Table -10 represents the post-hoc LSD comparisons between mean score of agility of three different groups. It revels from the result that the calculated t-ratio of all the inter-groups comparison was greater than the tabulated t-value ($t_{0.05}$ 58-2.00). Therefore, all the

differences were found statistically significant. From the above analysis it was showed that the agility of the sprinters was significantly better than long jumpers and Javelin throwers. It was also found that long jumpers had possesses greater agility than Javelin throwers.

Table-11 represents the ANOVA on reaction time (sec) of three different groups. The calculated F value of reaction time was 16.90, which was greater than the tabulated F - value ($_{F0.05}$ 2, 87 = 3.10). Therefore, the difference in reaction time of three different groups was found statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-12. The table-12 represents the post-hoc LSD comparisons of reaction time of three different groups. Among the three post-hoc LSD mean differences, statistically significant difference existed in two cases as calculated t ratio was greater than the tabulated t-ratio ($t_{0.05}$ 58-2.00); those were between sprinters and long jumpers (t ratio-4.49), sprinters and javelin throwers (t ratio - 5.43) respectively. From the above analysis it was showed that the reaction time of the sprinters was significantly better than long jumpers and javelin throwers. It was also found that there was no significant difference found between long jumpers and javelin throwers.

Table-13 represents the ANOVA on coordination of three different groups. The calculated F value of coordination was 13.60, which was greater than the tabulated F-value ($F_{0.05}$ 2, 87 = 3.10). Therefore, the difference in coordination of three different groups was statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-14. The table-14 represents the post-hoc LSD comparisons between mean score of coordination of three different groups. It reveled from the result that the calculated t-ratio value of all three inter group comparisons were greater than the tabulated t-value ($t_{0.05}$ 58-2.00); Therefore, all the differences were found statistically significant. From the above analysis it was showed that the coordination of the Javelin throwers was significantly better than sprinters and long jumpers. It was also found that long jumpers had possesses greater coordination than sprinters.

Table-15 shows that the coefficient of correlation between motor fitness and best performance of the three different groups. In case of sprinter, the relationship of speed and agility with best performance were found to be r= .641, r= .537, which were

significant at 0.05 & 0.01 level. The leg explosive strength, reaction time and coordination exhibited a positive but not significant correlation with best performance of the sprinters. The speed and agility of the sprinters were significantly correlated with the best performance. In case of long jumpers, the relationship of leg explosive strength with best performance were found to be r=.394, which were significant at 0.05 level. The speed, agility, reaction time and coordination exhibited a positive but not significant correlation with best performance of long jumpers. In case of javelin throwers, the relationships of all the selected motor fitness variables with best performance were found a positive but not significant correlation with best performance.

From the table-16, it was found that the multiple regression for predictors such as speed, explosive strength, agility, reaction time and coordination is 0.714 which produce highest multiple regressions with best performance of state level sprinters. R-square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order. 1. About 41.1% of the variation in the best performance was explained by the regression model with one predictor speed. 2. About 42.8% of the variation in the best performance was explained by the regression model with two predictors, speed and leg explosive strength. An additional 1.7% of the variance in the best performance is contributed by leg explosive strength. 3. About 45.9% of the variation in the best performance was explained by the regression model with three predictors, speed, leg explosive strength and agility. An additional 3.1% of the variance in the best performance is contributed by agility. 4. About 48.7% of the variation in the best performance was explained by the regression model with four predictors, speed, leg explosive strength, agility and reaction time. An additional 2.8% of the variance in the best performance is contributed by reaction time 5. About 50.9% of the variation in the best performance was explained by the regression model with five predictors, speed, leg explosive strength, agility, reaction time and coordination. An additional 2.2% of the variance in the best performance is contributed by coordination.

From the table-17, it was found that the multiple regression for predictors such as speed, explosive strength, agility, reaction time and coordination is 0.476 which produce highest multiple regressions with best performance of state level long jumpers. R square values showed that the percentage of contribution of predictors to the best

performance (dependent variable) in the following order. 1. About 12.1% of the variation in the best performance was explained by the regression model with one predictor speed. 2. About 15.8% of the variation in the best performance was explained by the regression model with two predictors, speed and leg explosive strength. An additional 3.7% of the variance in the best performance is contributed by leg explosive strength. 3. About 19.0% of the variation in the best performance was explained by the regression model with three predictors, speed, leg explosive strength and agility. An additional 3.2% of the variance in the best performance is contributed by agility. 4. About 19.6% of the variation in the best performance was explained by the regression model with four predictors, speed, leg explosive strength, agility and reaction time. An additional 0.06% of the variance in the best performance is contributed by reaction time 5. About 22.7 of the variation in the best performance was explained by the regression model with five predictors, speed, leg explosive strength, agility, reaction time and coordination. An additional 3.1% of the variance in the best performance is contributed by coordination.

From the table 18, it was found that the multiple regression for predictors such as speed, explosive strength, agility, reaction time and coordination is 0.389 which produce highest multiple regressions with best performance of state level javelin throwers. R square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order. 1. About 0.01% of the variation in the best performance was explained by the regression model with one predictor speed. 2. About 0.09% of the variation in the best performance was explained by the regression model with two predictors, speed and leg explosive strength. An additional 0.08% of the variance in the best performance is contributed by leg explosive strength. 3. About 1.5% of the variation in the best performance was explained by the regression model with three predictors, speed, leg explosive strength and agility. An additional 0.06% of the variance in the best performance is contributed by agility. 4. About 13.7% of the variation in the best performance was explained by the regression model with four predictors, speed, leg explosive strength, agility and reaction time. An additional 12.2% of the variance in the best performance is contributed by reaction time. 5. About 15.1% of the variation in the best performance was explained by the regression model with five predictors, speed, leg explosive strength, agility, reaction time and

coordination. An additional 1.4% of the variance in the best performance is contributed by coordination.

Table-19 represents the mean and SD (Mean ± SD) values of sports competition anxiety of the subjects of three different groups. The mean and SD values of sprinters, jumpers and javelin throwers in sports competition anxiety were 21.23 ± 3.18, 20.26 ± 2.46 and 18.10 ± 2.72 respectively. From the above it can be clearly depicted that the mean and SD values of the sprinters, long jumpers and javelin throwers in sports competition anxiety was not similar. In order to find out difference among the groups, the analysis of variance and the follow up post-hoc least significant difference (LSD) was calculated and presented in the **table-20.** The table-20 represents the ANOVA on sports competition anxiety of three different groups. The calculated F value of sports competition anxiety was 9.82, which was greater than the tabulated F-value ($_{F0.05}$ 2, 87 =3.10). Therefore, the difference in sports competition anxiety of three different groups was statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in **table-21**. The table-21 represents the post hoc LSD comparisons between mean score of sports competition anxiety of different three groups. Among the three post-hoc LSD mean differences, statistically significant difference existed in two cases as calculated t-ratio was greater than the tabulated t-ratio ($t_{0.05}$ 58-2.00); those were between sprinters and javelin throwers (t-value=4.10), long jumpers and javelin throwers (t-value=3.23) respectively. From the above analysis it can be showed that there was no significant difference exists between Sprinters and Long jumpers in sports competition anxiety. But in case of Sprinters & Javelin throwers & Long jumpers and Javelin throwers a significant difference were found and the sprinters and long jumpers showed more anxiety than javelin throwers.

Table 22 represents the mean and SD values of attitude of the subjects of three different groups of the study. The mean and SD values of sprinters, long jumpers and javelin throwers in attitude were 300.63±25.46, 290.10±16.60 and 284.40 ± 24.07 respectively. From the above analysis it can be clearly depicted that the mean and SD values of the sprinters, long jumpers and javelin throwers in attitude was not similar and in order to find out the differences among the group, the Analysis of variance and the follow up post-hoc least significant difference (LSD) was calculated and presented in the table-23. **The table-23** represents the ANOVA on attitude of three different

groups. The calculated F-value of attitude was 4.05, which was greater than the tabulated F-value ($_{F0.05}$ 2, 87 = 3.10). Therefore, the difference in attitude of three different groups was statistically significant at 0.05 level of confidence and the follow up post-hoc test, least significant difference (LSD) was calculated and presented in table-24. **Table-24** represents the post hoc LSD comparisons between mean score of attitudes of different three groups. Among the three post-hoc LSD mean differences, statistically significant difference existed only one cases as calculated t-ratio was greater than the tabulated t-value ($t_{0.05}$ 58-2.00); those were sprinters and javelin throwers (t-ratio 2.53). However, in the remaining two post-hoc LSD mean differences i.e., between sprinters and long jumpers (t-value=1.89), and long jumpers and javelin thrower (t-value = 1.06), the difference were not statistically significant. From the above analysis it can be showed that there were no significant difference exists between Sprinters and Long jumpers, Long jumpers and Javelin throwers in Attitude. But in case of Sprinters and Javelin throwers a significant difference was found and the sprinters showed more attitude than javelin throwers.

Table-25 represents the mean and SD values of different dimension of personality hardiness of three different groups. The mean and SD values of sprinters, long jumpers and javelin throwers in commitment were 36.80 ± 4.36, 35.70± 4.06 and 37.13 ± 3.23 respectively. In case of ability to control, the mean and SD values were for sprinters, long jumpers and javelin throwers were 36.33 ± 4.44, 36.03 ± 3.74 and 37.13 ± 3.45 respectively. The mean and SD values of sprinters, long jumpers and javelin throwers in challenge were 35.73 ± 3.87, 35.83 ± 4.27 and 37.30 ± 3.56 respective. In case of personality hardiness, the mean and SD values of sprinters, long jumpers and javelin throwers were 108.86 ± 11.19, 107.56±11.91 and 111.56 ±10.03 respectively. From the above analysis it can be clearly depicted that the mean and SD values of the sprinters, long jumpers and javelin throwers in personality hardiness was not similar and in order to find out the difference among the group, the analysis of variance and the follow up post-hoc least significant difference (LSD) was calculated and presented in the **table-26**. The calculated F value of commitment was 1.10, which was less than the tabulated F-value ($F_{0.05}$ 2, 87= 3.10). Therefore, the difference in commitment of three different groups was not statistically significant at 0.05 level of significant. The calculated F value of control was 0.63, which was less than the tabulated F-value ($F_{0.05}$ 2, 87= 3.10). Therefore, the difference in control of three different groups was not statistically significant. The calculated F value of challenge was 1.50, which was less than the tabulated F-value ($F_{0.05}$ 2, 87= 3.10). Therefore, the

difference in challenge of three different groups was not statistically significant. The calculated F value of personality hardiness was 1.02, which was less than the tabulated F-value ($_{F0.05}$ 2, 87= 3.10). Therefore, the difference in personality hardiness of three different groups was not statistically significant at 0.05 level of significance. From the above analysis the it can be clearly depicted that there were no significant difference exists among the groups in Commitment, Control, Challenge and Personality Hardiness.

From the table-27 shows that coefficient of correlation between psychological parameters and best performance of the three different groups. In case of sprinters, the relationship of all psychological parameters with best performance were executed a positive insignificant correlation in performance of sprinters. In case of long jumpers, the relationship of personality hardiness with best performance were found to be r= .526 which were positively significant at 0.01 level of confidence. The sports competition anxiety and attitude executed a positive insignificant correlation in performance of long jumpers. In case of javelin thrower, the relationship of all psychological parameters with best performance were executed a positive insignificant correlation in performance of javelin throwers.

Table 28, it was found that the multiple regression for predictors such as sports competition anxiety, attitude and personality hardiness is 0.242 which produce highest multiple regressions with best performance of state level sprinters. R square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order. 1. About 2.0% of the variation in the best performance was explained by the regression model with one predictor sports competition anxiety. 2. About 5.3% of the variation in the best performance was explained by the regression model with two predictors, sports competition anxiety and attitude. An additional 3.3% of the variance in the best performance is contributed by attitude. 3. About 5.9% of the variation in the best performance was explained by the regression model with three predictors, sports competition anxiety, attitude and personality hardiness. An additional 0.6% of the variance in the best performance is contributed by personality hardiness.

From the table 29, it was found that the multiple regression for predictors such as sports competition anxiety, attitude and personality hardiness is 0.536 which produce highest multiple regressions with best performance of state level long jumper. R square values showed that the percentage of contribution of predictors to the best performance

(dependent variable) in the following order. 1. About 6.9% of the variation in the best performance was explained by the regression model with one predictor sports competition anxiety. 2. About 13.1% of the variation in the best performance was explained by the regression model with two predictors, sports competition anxiety and attitude. An additional.6.2% of the variance in the best performance is contributed by attitude. 3. About 28.8% of the variation in the best performance was explained by the regression model with three predictors, sports competition anxiety, attitude and personality hardiness. An additional 21.9% of the variance in the best performance is contributed by personality hardiness.

From the table 30, it was found that the multiple regression for predictors such as sports competition anxiety, attitude and personality hardiness is 0.442 which produce highest multiple regressions with best performance of state level long jumper. R square values showed that the percentage of contribution of predictors to the best performance (dependent variable) in the following order. 1. About 12.8% of the variation in the best performance was explained by the regression model with one predictor sports competition anxiety. 2. About 13.5% of the variation in the best performance was explained by the regression model with two predictors, sports competition anxiety and attitude. An additional 0.7% of the variance in the best performance is contributed by attitude 3. About 19.5% of the variation in the best performance was explained by the regression model with three predictors, sports competition anxiety, attitude and personality hardiness. An additional 6.0% of the variance in the best performance is contributed by personality hardiness.

4.4 THE RESULTS

There were three groups of performance factors in this study – physical, motor fitness and psychological.

Analysis of data leads to the following results**.**

A. Physical parameters – height and weight were the selected factors in this group.

I. Height and weight did not show any significant relation with performance, but height and body weight show positive relation with performance of three difference groups.

II. Analysis of inter-group variation in these parameters indicated that there was no significant difference between three difference groups. In case of height the

mean value of sprinters was slightly higher than other two groups. In case of weight the mean value of javelin throwers was heavier than both the sprinters and long jumper's groups.

B. Motor fitness parameters – speed, leg explosive strength, agility, reaction time and coordination were the selected parameters in this group.

I. Results indicated that performance of sprinters had significant correlation with speed and agility. Long jumpers exhibited significant correlation of performance with leg explosive strength. Javelin throwers group exhibited no significant correlation of performance with motor fitness.

II. Regression analysis indicated that the performance of sprinters exhibited 50.9% dependence on motor fitness; performance of long jumpers exhibited 22.7% dependence on motor fitness and performance of javelin throwers exhibited only 15.1% dependence on motor fitness.

III. Analysis of inter-group variation in different selected motor fitness components indicated that sprinters group was significantly better than both the groups of long jumpers and javelin throwers in speed as well as agility and reaction time. But the differences between long jumper and javelin throwers groups in case of reaction time were not statistically significant.

IV. Long jumpers group showed significantly better in leg explosive strength than both the other groups – the sprinters and javelin throwers. The difference between sprinters and javelin throwers groups was also statistically significant.

V. In coordination the javelin throwers group was found to be significantly better than both of sprinters and long jumper's groups. The difference between sprinters and long jumper's groups was also statistically significant.

C. Psychological Factors - Competitive anxiety, attitude and personality were the selected psychological factors.

I. The group of javelin thrower exhibited significantly lesser sports competitive anxiety than both groups of sprinters and long jumpers. But the sprinters and long jumper's groups were not statistically significant in this factor.

II. Second psychological factor was attitude. The sprinters group was found to be significantly higher than the groups of javelin throwers. But the difference between sprinters and long jumpers and also long jumpers and javelin throwers groups was not statistically significant in this factor.

III. The third psychological factor was personality hardiness. This component was analyzed into its four dimensions – commitment, control, challenge, and personality hardiness. Analysis of inter-group difference indicated that there was no statistically significant difference in four of these dimensions – commitment, control, challenge, and personality hardiness.

IV. Analysis of relationship between performance and selected psychological factors exhibited that there was significant positive relation of personality hardiness with performance for long jumper's group. In personality hardiness the sprinters and javelin throwers groups exhibited positive correlation. In the sprinters and javelin throwers groups also exhibited positive correlation for all psychological factors with performance.

V. Regression analysis indicated that the performance of sprinters exhibited 5.9% dependence on psychological factors; performance of long jumpers exhibited 28.8% dependence on psychological factors and performance of javelin throwers exhibited only 19.5% dependence on psychological factors.

Discussion of the Results

As per the result of the study there was no statistical difference among selected groups of athletes- Sprinters, Long jumpers and Javelin throwers in selected parameters height and weight.

This may be due to the fact that all groups of performers within same age ranged and the basic element require for this track & field event are also similar.

Regarding motor fitness the sprinter group was found significantly better than the other two groups- long jumpers and javelin throwers. This results also supported by Harpreet Singh (2018). This may be due to the fact that the sprinting speed is the dominant factor for sprinting.

The long jumpers group was found to be significantly better than other two groups- sprinters and javelin throwers. Similar results also suggested by Norjali Wazir, M. R. W., Samsu, R., Yaacob, A., Martuan, S. Z. and Ishkandar, C. D. M. (2022). This may be due to fact that leg explosive strength most dominant motor fitness factor in running long jump.

The coordination ability was found to be significantly better for javelin thrower than other two groups. This may be due to fact that the technique of javelin throw requires more coordination because of involvement of approach running and throwing actions.

Psychological factors:

In the present study SCAT, Attitude and Personality hardiness are analyzed. The result indicated that the sprinters and long jumpers' group had higher sports competitive anxiety than the javelin groups. Similar results have been reported by Aneesh Rajappan, Dr. V. A. Manickam, (2016). This may be due to the fact that the sprinting performance is more uncertain and risk oriented. In sprinting there is a single chance to complete the event in comparison with 6 trials in javelin throw.

In Attitude sprinters group was found to be significantly higher than the javelin thrower groups. This may be due to the fact that sprinting requires more attention and involvement for the events than the events if throwing.

The results indicated that all the three groups- sprinters, long jumpers and javelin throwers exhibited positive correlation with the selected psychological parameters- SCAT, Attitude and Personality hardiness.

The regression analysis indicates that the performance for sprinter, long jumpers and javelin throwers groups had 54.2% dependence on selected psychological factors.

Testing Of Hypothesis

The 1st hypothesis was that there would be no significant difference in motor fitness among difference groups of Track and Field athletes. On the basis of result, it had been found that sprinters were found to be better in speed, agility and reaction time. Long jumpers were found to better in leg explosive strength and javelin throwers was found

to be better in coordination. But in other cases, the difference was found to be insignificant. So, on the basis of result obtain the 1st hypothesis was partially accepted.

According to the 2nd hypothesis it was assumed that there would be positive relationship between motor fitness and best performance. Results of the present study indicated that significant positive correlation for best performance with speed and agility for sprinters and leg explosive strength for long jumpers. For the other cases the relationship was not statistically significant. So, on the basis of result 2nd hypothesis was partially accepted.

The 3rd hypothesis was that there would be positive relation between sports performance and selected psychological parameters- SCAT, Attitude and Personality hardiness. On the basis of results there was only significantly positive relationship found between sports performance and personality hardiness for long jumpers. So, on the basis of result the 3rd hypothesis was also partially accepted.

5.2 CONCLUSION

On the basis of the results and findings of the study the following conclusions are drawn-

A. Physical parameters – height and weight were the selected factors in this group.

   I. Height and weight did not show any significant relation with performance, but height and body weight show positive relation with performance of three difference groups.

   II. Analysis of inter-group variation in these parameters indicated that there was no significant difference between three different groups. In case of height the mean value of Sprinters was slightly higher than other two groups. The Javelin throwers was heavier than both the sprinters and long jumper's groups.

B. Motor fitness parameters – speed, leg explosive strength, agility, reaction time and coordination were the selected parameters in this group.

   I. Results indicated that performance of sprinters had significant correlation with speed and agility. Long jumpers exhibited significant correlation of performance with leg explosive strength. Javelin throwers group exhibited no significant relation of performance with motor fitness.

II. Regression analysis indicated that the performance of sprinters exhibited 50.9% dependence on motor fitness; performance of long jumpers exhibited 22.7% dependence on motor fitness and performance of javelin throwers exhibited only 15.1% dependence on motor fitness.

III. Analysis of inter-group variation in different selected motor fitness components indicated that Sprinters group was significantly better than both the groups of long jumpers and Javelin throwers in speed as well as agility and reaction time. But the differences between long jumper and javelin throwers groups in case of reaction time were not statistically significant.

IV. Long jumpers group showed significantly better in leg explosive strength than both the other groups – the Sprinters and Javelin throwers. The difference between Sprinters and Javelin throwers groups was also statistically significant.

V. In coordination the Javelin throwers group was found to be significantly better than both of Sprinters and Long jumper's groups. The difference between Sprinters and Long jumper's groups was also statistically significant.

C. Psychological Factors - Competitive anxiety, attitude and personality hardiness were the selected psychological factors.

I. The group of Javelin thrower exhibited significantly lesser sports competitive anxiety than both groups of Sprinters and Long jumpers. But the Sprinters and Long jumper's groups were not statistically significant in this factor.

II. Second psychological factor was attitude. The sprinters were significantly higher than Javelin throwers in Attitude. But the difference between sprinters and long jumpers and also long jumpers and javelin throwers groups was not statistically significant in this factor.

III. The third psychological factor was personality hardiness. This component was analyzed into its four dimensions – commitment, control, challenge and personality hardiness. Analysis of inter-group difference indicated that there was no statistically significant difference in four of these dimensions – commitment, control, challenge, and personality hardiness.

IV. Analysis of relationship between performance and selected psychological factors exhibited that there was significant positive relation of personality hardiness with performance for long jumper's group. In personality hardiness the sprinters and javelin throwers groups exhibited positive correlation. In the sprinters and javelin throwers groups also exhibited positive correlation for all psychological factors with performance.

V. Regression analysis of psychological factors with performance indicated that the sprinters group had 5.9% dependence on these factors for performance. The long jumpers group exhibited 28.8% dependence and the javelin throwers group had 19.5% dependence with the psychological factors with performance.

5.3 RECOMMENDATIONS:

With the help of results derived from the present study, the following recommendations can be made.

1. It is recommended to the coaches, trainers and physical educators to adopt these findings to improve the selected parameters among their athletes.
2. A similar study may be attempted by selecting the national or international level athletes as the subjects.
3. A similar study may be conducted on the female subjects.
4. It is helpful for the coaches and physical educators for identifying talent on the basis of motor fitness factors that influence the performance of Running, Jumping and Throwing.
5. It is useful for the coaches to give special importance on the improvement of psychological factors such as personality hardiness, attitude and sports competition anxiety.

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APPENDICES

APPENDIX – I

Data Collection Certificates

MUGBERIA GANGADHAR MAHAVIDYALAYA

ESTD.—1964

P. O.-Bhupatinagar ☐ *Dist.—Purba Medinipur*

S. T. D. Code--- 03220 ✆ Ph. No. : 270236 Pin- 721425 (W. B.)

Ref.no.— M.G.M./ / /2022-2023 *Dated:* 24/05/2022

From: The Principal

TO WHOM IT MAY CONCERN

This is to certify that ***ARUP MAHATO****, a Ph.D. Research Scholar of the Department of Physical Education, Jadavpur University, Jadavpur, Kolkata, West Bengal had collected data for his Ph. D. Research Work from the student of Mugberia Gangadhar Mahavidyalaya on "****ANALYSIS OF PERFORMANCE FACTORS OF TRACK AND FIELD ATHLETES****" at Mugberia Gangadhar Mahavidyalaya, Bhupatinagar, Purba Medinipur on 24/05/2022(one day).*

I wish his all success in life.

Mugberia Gangadhar Mahavidyalaya ESTD.-1964 Purba Medinipur Bhupatinagar

24.05.2022

Dr. SWAPAN KUMAR MISRA
Principal
Principal
Mugberia Gangadhar Mahavidyalaya

Dakshin Dinajpur District Sports Association
(Affiliated to CAB, WBDSF, IFA, W.B.A.A., BTTA, W.B.B.A., WBVA & B.A.B.F.)
Registration No. : S/1L/47172
P.O. Balurghat, Dist. Dakshin Dinajpur, Pin - 733101
Website : www.dakshindinajpurdsa.in E-mails : cabdakshindinajpur@gmail.com, amitabhaghosh1962@gmail.com

TO WHOM IT MAY CONCERN

This is to certify that Shri. Arup Mahato, Research Scholar of Jadavpur University, Department of Physical Education, undergoing his research work in the topic of "ANALYSIS OF PERFORMANCE FACTORS OF TRACK AND FIELD ATHLETES" under the guidance of Dr. Atanu Ghosh (Dept. Of Physical Education, University of Jadavpur), has collected some necessary data on athletes of (State and National level) Dakshin Dinajpur District on 23/03/2021 to 25/03/2021 for his research work from my organisation (Dakshin Dinajpur District Sports Association).

He is very enthusiastic, sincere and diligent research scholar. I wish him success in life.

12.12.2021

(Signature)
AMITABHA GHOSH
Hony. General Secretary
Dakshin Dinajpur DSA

District Magistrate
PRESIDENT
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WEST BENGAL ATHLETIC ASSOCIATION

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C.A.B. Gate No. : 10, Eden Gardens, Kolkata - 21
Tele-Fax : (033) 2248-3772

WBAA / 68 State Meet/2018/ TO

Date: 11.08.2019

To whom it may concern

This is to certify that Mr. Arup Mahato is a senior research scholar at the Department of Physical Education at Jadavpur University. He has shared his ability and expertise with state-level athletes by gathering some pieces of information. In this regard, he is collecting some necessary data. He worked at our SAI complex from the 8th to the 11th of August for the aforementioned practical work.

I wish him for bright and successful academic development.

Sportingly yours,

(KAMAL KR.MAITRA)
HONY. SECRETARY

WEST BENGAL ATHLETIC ASSOCIATION

Behind Kshudiram Anusilan Kendra
C.A.B. Gate No. : 10, Eden Gardens, Kolkata - 21
Tele-Fax : (033) 2248-3772

WBAA / 68 State Meet/2018/ TO

Date: 05.08.2018

To whom it may concern

This is to certify that Mr. Arup Mahato is a senior research scholar at the Department of Physical Education at Jadavpur University. He has shared his ability and expertise with state-level athletes by gathering some pieces of information. In this regard, he is collecting some necessary data. He worked at our SAI complex from the 2nd to the 5th of August for the aforementioned practical work.

I wish him for bright and successful academic development.

Sportingly yours,

(KAMAL KR.MAITRA)
HONY. SECRETARY

APPENDIX – II

Psychological Questionnaires

Sports Competition Anxiety Test

Read each statement below, decide if you "Rarely", Sometimes" or "Often" fell this way when competing in your sport, tick the appropriate box to indicate your response.

SL.NO		Rarely	Sometimes	Often
1.	Competing against others is socially enjoyable			
2.	Before I compete, I feel uneasy			
3.	Before I compete, I worry about not performing well			
4.	I am a good sportsman when I compete			
5.	When I compete, I worry about making mistakes			
6.	Before I compete, I am calm			
7.	Setting a goal is important when competing			
8.	Before I compete, I get a queasy feeling in my stomach			
9.	Just before competing, I notice my heart beats faster than usual			
10.	like to compete in games that demands a lot of physical energy			
11.	Before I compete, I feel relaxed			
12.	Before I compete, I am nervous			
13.	Team sports are more exciting that individual sports			
14.	I get nervous wanting to start the game			
15.	Before I compete, I usually get uptight			

Athlete's Name: SCAT Score:

Personality Hardiness

Name: D.O.B:		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	**Score**
Sports Discipline: Sex: [√] M [ ] F [ ]							
Birth order: 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] 5th [ ] 6th [ ]							
College/Institution:							
Sl. No	*Items*						
1	I give immense importance to the values of my life.						
2	I fully control my deeds.						
3	I can strongly confront any situation.						
4	I like to react similar to my values.						
5	I control my emotions.						
6	Whoever try to make me frighten, I never taken aback from my target.						
7	From the very first I have believed in me that I must get achievement in any type of my works.						
8	I control myself in adverse situation.						
9	I never took a back from my approach.						
10	My personality is always commendatory in my friend circle.						
11	The behavior of my friends is elegant and sober to me.						
12	Any kind of challenge acts as an encouragement to me.						
13	Whatever I do, at first, I make plan and then finished with great importance.						
14	I control over the revelation of my thoughts.						
15	I feel very happy in moving forward by accepting any kind of challenge.						
16	My family life is so happy.						
17	My family members are very unhappy for my over controlling power and rude behavior.						
18	Comparatively I feel very happy in tough and critical works.						
19	I do all type of work in this believe that on one day I must get success.						
20	I do not have control over my behavior.						
21	I am not frightened to do any risky work.						
22	People know me as a successful person.						
23	Sometimes I can't decide that what I should do or what I shouldn't do in my life.						
24	My self-confidence encourages me in accepting any kind of challenging works.						
25	Usually, my family members make quarrel with me by means.						
26	My friends behave indifferently with me.						
27	My opponents are afraid of my rivalries figure.						
28	Usually, my belief proves to be false.						
29	I think a controlling lifestyle make person happier.						
30	My family feels pride for my rivalry's mentality.						

Athlete's Name: Personality Hardiness Score:

ATTITUDE SCALE FOR HIGH SCHOOL FRESHMAN BOYS

SL.NO		Very Strongly Agree	Strongly Agree	Agree	Very Strongly Disagree	Strongly Disagree	Disagree
1.	Physical education is mainly concerned with muscle building						
2.	Physical education should be eliminated from the curriculum						
3.	Physical education is too strenuous for the average student						
4.	Knowledge of various sports learned in Physical education help students to become more understanding spectators						
5.	Physical education should develop in students an understanding of the importance of exercise to health						
6.	Respect for human personality should be one of the qualities sought in a physical education class						
7.	Credit should not be given for physical education						
8.	Physical education has little value and should be eliminated						
9.	Skills learned in physical education are of value in social life						

SL.NO		Very Strongly Agree	Strongly Agree	Agree	Very Strongly Disagree	Strongly Disagree	Disagree
10.	Cooperation is not necessary in physical education activities						
11.	Physical education is not as important as other academic classes						
12.	Emotional expressions can be brought under control through participation in games						
13.	Physical education helps students to develop poise						
14.	The main purpose of physical education is to cause fatigue in students						
15.	Physical education should not be considered a part of general education						
16.	The intellectual processes are related to the physical processes of the body						
17.	Physical education should be a required subject						
18.	Physical education should introduce only activities that are useful during the clcnage						
19.	Grades should not be given in Physical education						
20.	A students should learn to respect his opponent in physical education						

SL.NO		Very Strongly Agree	Strongly Agree	Agree	Very Strongly Disagree	Strongly Disagree	Disagree
21.	Physical education helps students adapt to group situation						
22.	Physical education dose little in developing desirable standards of conduct						
23.	Tolerance, obedience, and respect for the right of others are learned in Physical education						
24.	Physical education should be an elective subject after the ninth grade						
25.	Exercise is of little importance in maintaining good health						
26.	There is a scientific basis for physical education						
27.	To participate in games is undignified						
28.	Physical education once or twice a week is inadequate						
29.	Written tests should be given in physical education						
30.	Physical education is mainly concerned with team games						
31.	Physical education should be required in every grade						

SL.NO		Very Strongly Agree	Strongly Agree	Agree	Very Strongly Disagree	Strongly Disagree	Disagree
32.	Students have little opportunity in physical education to receive recognition and status						
33.	Physical education class provide opportunities to make friends						
34.	Physical conditioning is an important part of the physical education class						
35.	No real learning takes place in a physical education class						
36.	Physical education is harmful if an individual is physically weak						
37.	Credit should be given for physical education						
38.	Physical education has little to offer for the unskilled individual						
39.	Varsity athletes should be excused from physical education class						
40.	The program in physical education should be organized so there is progression in the learning of skill						
41.	Calisthenics should be eliminated from physical education						

SL.NO		Very Strongly Agree	Strongly Agree	Agree	Very Strongly Disagree	Strongly Disagree	Disagree
42.	Participants in physical education learn to cooperate as member of students						
43.	Physical education is important in the growth and development of students						
44.	The Physical education program should include activities leading to sports appreciation						
45.	Activities in physical education offer students opportunities to make quick decisions and responses						
46.	Physical education contributes to physical development						
47.	Physical education should be a relaxation period between academic class						
48.	The activities in the physical education program do little to develop physical fitness						
49.	The program in physical education is the same year after year						
50.	Students get all the physical activity they need outside of school						

SL.NO		Very Strongly Agree	Strongly Agree	Agree	Very Strongly Disagree	Strongly Disagree	Disagree
51.	Taking a long walk would be a good substitute for physical education						
52.	Learning the rules of activities is an important part of physical education						
53.	The rules of sportsmanship should be practiced in physical education						
54.	Physical education is not an important phase of education						
55.	There is little carry – over value from physical education						
56.	Physical education classes should not be free play periods						
57.	Flexibility is important in physical education						
58.	Some calisthenics should be included in physical education						
59.	Physical education is needed for a complete education						
60.	Little intelligence is required for physical education						
61.	Physical education classes should provide challenging activities						
62.	Physical education is a waste of time in school						

SL.NO		Very Strongly Agree	Strongly Agree	Agree	Very Strongly Disagree	Strongly Disagree	Disagree
63.	Individual sports learned in physical education can be useful in later life						
64.	Physical education is mainly for the physically gifted						
65.	Coordination can develop in physical education						
66.	Strength cannot be developed in physical education						

Athlete's Name: Attitude Score:

Appendix III

International Journal of Physical Education, Sports and Health

Online ISSN Number: 2394-1693

Print ISSN Number: 2394-1685

CODEN Number: IJPEJB

★ Indexed Journal ★ Refereed Journal ★ Peer Reviewed Journal

International Journal of Physical Education, Sports and Health

Peer Reviewed Journal, Refereed Journal, Indexed Journal

P-ISSN: 2394-1685 | E-ISSN: 2394-1693 | CODEN: IJPEJB, Impact Factor (RJIF): 5.38

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Study on psychological hardiness of state level sprinter and javelin thrower

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Abstract
The present study was made to find out the psychological hardiness between State Level Sprinter and Javelin Thrower". A total of 30 sprinters and 30 javelin throwers were selected from different district of West Bengal. The age of the subject ranged from 16 to 21 yrs. Old. To measure the psychological hardiness of the player was used to Bengali version of psychological hardiness scale which was developed by Singh (2008) was administered on a selected sample. Descriptive statistics along with a t-test was used to analyze the result of the study. The level of significance was 0.05 levels. Results revealed that there was no significant difference between Sprinters and Javelin throwers.

Keywords: Psychological hardiness, sprinter, long jumper

Introduction
Track and field is a sport which includes athletic contests established on the skills of running, jumping, and throwing. The name is derived from the sport's typical venue: a stadium with an oval running track enclosing a grass field where the throwing and some of the jumping events take place. Track and field is categorized under the umbrella sport of athletics, which also includes road running, cross country running, and walking. The foot racing events, which include sprints, middle- and long-distance events, race walking and hurdling, are won by the athlete with the fastest time. The jumping and throwing events are won by the athlete who achieves the greatest distance or height. Regular jumping events include long jump, triple jump, high jump and pole vault, while the most common throwing events are shot put, javelin, discus and hammer.

Maddi (2006) defines hardiness as, "a cognitive/emotional amalgam constituting a learned, growth-oriented, personality buffer" (P. 160). It consists of cognitive, emotional, and behavioral features and describes the capability of individuals to maintain a healthy status during turbulent times (Bartone, Kelly, & Matthews, 2013). The theoretical background of hardiness stems from the work of Kobasa and Maddi (1977), Heidegger (1986), Frankl (1960), and Binswanger (1963) on existential philosophy and psychology (Bartone *et al*., 2013). It broadly describes how individuals view themselves and their surroundings (Bartone *et al*., 2013). Existential psychology iterates the importance of an individual's continuous search for meaning and purpose within an ever-changing and unpredictable environment (Maddi, 2004). Existentialists believe that courage is required to accomplish this goal and psychological hardiness has the necessary components to facilitate courage in individuals. Psychological hardiness consists of the following three attitudes: control, commitment, and challenge. Control deals with the belief that an individual can control, manipulate, or influence events and is rooted within Lefcourt's (1973) control beliefs and Rotter's concept of locus of control (Rotter, Seeman, & Liverant, 1962). A high level of control leads to individuals with a high level of self-efficacy that they positively influence change within a new situation (Bartone, 2013). Commitment refers to individuals' belief that they are involved in something desirable. It is influenced by Antonovsky's (1974) sense of coherence and White's (1959) self-awareness and striving for competence. The primary benefit to developing a hardiness-commitment is the acquisition of a sense of internal balance and confidence. This enables an individual to develop a realistic assessment during times of trial (Bartone *et al*., 2013). In addition, commitment can influence increased attention and adaptability within dynamic environments, leading to the

generation of creative alternative responses to situations. 5 Finally, challenge stems from Maddi's (1967) 'ideal identity' and Fiske and Maddi's (1961) variety in experience. It encompasses a positive outlook on change and a belief that it is an exciting opportunity to excel (Skomorovsky & Sudom, 2011). Individuals are motivated to learn and embrace the challenges of new things. Individuals with a high level of hardinesschallenge flourish within novel experiences and view them as an opportunity for growth. Psychological hardiness is not innate and has been proven that it can be learned (Maddi, 2007). Hardiness training has been validated throughout the literature in various populations. The nursing community has embraced the positive effects of hardiness training. A study by Henderson (2015) demonstrated that hardiness education of nurses helped prevent burnout and stress. The training increased hardiness scores as measured by the Personal Views Survey Third Edition Revised (Maddi *et al*., 2006) and as hardiness increased, burnout and stress decreased. Another hardiness training study used the 30-item Cognitive Hardiness Scale and showed similar effects (Rowe, 1999). The authors employed a 6-week hardiness program designed to curb burnout in 325 health-care providers. The results revealed lower symptoms of burnout in individuals that received the training as compared to the control group at two and six months post-training. Hardiness training has been offered to undergraduates at the University of California as a quarter courses.

Psychological hardiness, alternatively referred to as personality hardiness, or cognitive hardiness in the literature, is a personality style first introduced by Suzanne C. Kobasa in 1979 (Kobasa, S.C., 1979). In the early days of hardiness research, it was usually defined as a personality structure comprising the three related general dispositions of commitment, control, and challenge that functions as a resistance resource in the encounter with stressful conditions (Kobasa, S.C., 1979; Kobasa, S.C., *et al*., 1982). Lately, Maddi has characterized hardiness as a combination of three attitudes (commitment, control, and challenge) that together provide the courage and motivation needed to turn stressful circumstances from potential calamities into opportunities for personal growth (Maddi, S.R., 2004, 2006). While acknowledging the importance of the three core dimensions, Barton considers hardiness as something more global than mere attitudes (Bartone, P.T., 2006). Hardiness is often considered an important factor in psychological resilience or an individual-level pathway leading to resilient outcomes (Bartone, P.T., Hystad, S.W., 2010; Bonanno, G.A., 2004). Although early studies relied almost exclusively on male business executives, over the years this buffer-effect has been demonstrated in a large variety of occupational groups as well as non-professionals, including military groups (Bartone, P.T., 2000; Westman, M., 1990), teachers and university staff (Klag, S., *et al*., 2004; Nishizaka, S., 2002), firefighters (Jimenez, B.M., *et al*., 2006), and students (Hystad, S.W., *et al*., 2009). Still, not every investigation has been able to demonstrate such moderating, or buffering, effects and there is a debate whether the effects of hardiness are interactive or primarily independent of levels of stress. (Klag, S., *et al*., 2004; Funk, S.C., 1992; Sinclair, R.R., *et al*., 2000).

Objective of the Study

1. To find out the different psychological hardiness factors between Sprinter and Javelin throwers.
2. To find out the psychological hardiness between Sprinter and Javelin throwers.

Methodology

Sample: The subject for the present study was selected randomly from different districts West Bengal, India. For the study different track and field groups were selected. Some of them are sprinters, and javelin throwers. Most of them were participated in a regular basis in different state level competition. A total of 30 sprinters and 30 javelin throwers were selected from different district of West Bengal. The age of the subject ranged from 16 to 21 yrs. Old.

Tools used: For the present study, the researcher has selected "Psychological Hardiness" as one of the variables of the study. The researcher reviewed various Psychological Hardiness developed in India and abroad. Finally, the researchers have selected the Psychological Hardiness scale which was developed by Singh (2008), which was administered for measuring the different dimension of Psychological Hardiness factors as commitment, control, and challenge.

Statistical Procedure

Descriptive statistical measures like mean and standard deviation were used in order to describe the nature of the sample taken. To determine the differences, if any, between Sprinters and non-Sprinters adolescents, the independent t-test was calculated. Statistical significance was tested at 0.05 level of confidence. All the statistical analysis was done with the help of SPSS version 23 windows.

Result and Discussion

Table 1: Showing different psychological hardiness factor between sprinters javelin throwers

Psychological Hardiness	Group	N	Mean± SD	t- value	Level of significance
Commitment	Sprinters	30	115.9±14.60	1.97	Not Significant at 0.05 level
	Javelin throwers	30	109.7±9.18		
Control	Sprinters	30	108.3±12.15	2.37*	Significant at 0.05 level
	Javelin throwers	30	115.7±12.0		
Challenge	Sprinters	30	109.2±10.81	0.04	Not Significant at 0.05 level
	Javelin throwers	30	109.3±8.22		
Psychological Hardiness	Sprinters	30	111.13±12.65	0.15	Not Significant at 0.05 level
	Javelin throwers	30	111.57±10.03		

From the table-1 first objective was to find out the Psychological Hardiness between Sprinters and Javelin throwers. It observed that the mean value of two different groups seems to differ from each other on different Psychological Hardiness factors of commitment, Control, Challenge, and Psychological hardiness. The mean ±SD value obtained by the group of Sprinters on commitment, control, Challenge, and Psychological hardiness were 115.9 ±14.60, 108.3 ±12.15, 109.2 ±10.81, 111.13 ±12.65. The Javelin throwers were respectively 109.7 ±9.18, 115.7 ±12.0, 109.3

±8.22 & 111.57 ±10.03.

But on the basis of mean observation, it would not be clear whether these differences are really significant or not. To determine the differences, if any, between Sprinters and Javelin throwers, the independent t-test was calculated. The obtained 't' value of Commitment, challenge & Psychological Hardiness was found to be not significant at 0.05 level of significance but only Control factor was found to be significant at 0.05 level of significance.

Discussion

Table1 indicates the no significant difference between Sprinters and Javelin throwers on the dimension of Commitment, control, challenges, and psychological hardiness, but result also indicated Control factor was found to be significant. Both the group did not differed statistically significantly of Commitment, control, challenges, and psychological hardiness, but the mean value of Sprinter slightly higher in Commitment than the javelin throwers, but the mean value of javelin thrower slightly higher in challenge and psychological hardiness then the sprinter. On the other hand, javelin throwers had significantly higher in control ability than the sprinters. From the table it evident that there was no significant difference sprinters and javelin throwers in commitment. Challenge and psychological hardiness, whereas significant difference was found in control. Roth and Cohen (1986) studied the effects of psychological hardiness and its components and skill on competitive anxiety and self-confidence. Castle (2001) studied over a 100 college going athlete and non-athletes he observed that psychological hardiness of the athletes were better than the non-athletes and significant differences were observed. In this regard Kobasa (1979) believes that some people choose sport as a means for reducing tension and stress and although this is not the best strategy, it is more effective than emotion focused coping. Almost 16 present of athletes use emotion-focused coping strategy, indicating their lack of control over incoming stressors (Intl. Res. J. Appl. Basic. Sci. Vol., 817-821, 2012). But in the present study the subjects were selected from different sport discipline and due to their nature of the games the psychological aspects were developed differently. For while no significant difference were observed in Psychological hardiness between state level, sprinters and javelin throwers.

Conclusion

1. No significant difference was found between sprinter and javelin throwers in commitment.
2. In control Javelin throwers had significantly better than sprinters.
3. No significant difference was found between sprinter and javelin throwers in challenge.
4. No significant difference was found between sprinter and javelin throwers in psychological hardiness.

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STUDY ON PSYCHOLOGICAL HARDINESS OF STATE LEVEL LONG JUMPER AND JAVELIN THROWER

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ABSTRACT

The present study was made to find out the psychological hardiness between State Level Long Jumper and Javelin Thrower". A total of 30 Long Jumpers and 30 javelin throwers were selected from different district of West Bengal. The age of the subject ranged from 16 to 21 yrs. Old. To measure the psychological hardiness of the player was used to Bengali version of psychological hardiness scale which was developed by Singh (2008) was administered on a selected sample. Descriptive statistics along with a t-test was used to analyze the result of the study. The level of significance was 0.05 levels. Results revealed that there was no significant difference between Long Jumpers and Javelin throwers.

Key Words: Psychological Hardiness, Long Jumper, Javelin Thrower

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INTRODUCTION

Track and field is a sport which includes athletic contests established on the skills of running, jumping, and throwing. The name is derived from the sport's typical venue: a stadium with an oval running track enclosing a grass field where the throwing and some of the jumping events take place. Track and field is categorized under the umbrella sport of athletics, which also includes road running, cross country running, and walking. The foot racing events, which include sprints, middle- and long-distance events, race walking and hurdling, are won by the athlete with the fastest time. The jumping and throwing

events are won by the athlete who achieves the greatest distance or height. Regular jumping events long jump, triple jump, high jump and pole vault, while the most common throwing events are shot put, javelin, discus and hammer.

"Athletes build personality?" This statement is made more obtained by the diehard supporters of the social development benefit of athletics – than any other statement. Since the beginning of sports, we have clung to the belief that a participant in Athletics in building character strange necessary in the real world. Outstanding athletes have been made National heroes. Because they are constantly in the public eye, athletes had to learn to live up to our expectations. They are requiring being co – operative and competitive; to accept victory and defect in a sporting manner, the pressure to win has become so intense that some people have begun to question their value of Athletes.

Hardy individuals do not appraise events as risky, but positive and controllable **(Anshel, 2001; Ghorbani, 1995)**. Anshel came to similar conclusions regarding approach and avoidance coping in young student athletes. Evaluating the psychological characteristics Olympics champions, **Anshel (2001)** define psychological hardiness as a mental skill that can play a significant role in the performance of athletes.

OBJECTIVE OF THE STUDY

I. To find out the different psychological hardiness factors between Long jumper and Javelin throwers.

II. To find out the psychological hardiness between Long jumper and Javelin throwers.

METHODOLOGY

Sample: The subject for the present study was selected randomly from different districts West Bengal, India. For the study different track and field groups were selected. Some of them are Long jumpers, and Javelin throwers. Most of them were participated in a regular basis in different state level competition. A total of 30 Long jumpers and 30Javelin throwers were selected from different district of West Bengal. The age of the subject ranged from 16 to 21 yrs. old.

Tools used: For the present study, the researcher has selected "Psychological Hardiness" as one of the variables of the study. The researcher reviewed various Psychological Hardiness developed in India and abroad. Finally, the researchers have selected the Psychological Hardiness scale which was developed by

Singh (2008), which was administered for measuring the different dimension of Psychological Hardiness factors as commitment, control, and challenge.

Statistical Procedure: Descriptive statistical measures like mean and standard deviation were used in order to describe the nature of the sample taken. To determine the differences, if any, between Long Jumpers and non-Long Jumpers adolescents, the independent t-test was calculated. Statistical significance was tested at 0.05 level of confidence. All the statistical analysis was done with the help of SPSS version 23 windows.

RESULT AND DISCUSSION

Table 1: Showing different psychological hardiness factor between long jumpers and javelin throwers

Psychological Hardiness	Group	N	Mean± SD	t- value	Level of significance
Commitment	Long jumpers	30	109.3 ±10.12	**0.16**	Not Significant at 0.05 level
	Javelin throwers	30	109.7 ±9.18		
Control	Long jumpers	30	103.9 ±11.16	**3.94***	**Significant at 0.05 level**
	Javelin throwers	30	115.7 ±12.0		
Challenge	Long jumpers	30	109.5 ±14.43	**0.07**	Not Significant at 0.05 level
	Javelin throwers	30	109.3±8.22		
Psychological Hardiness	Long jumpers	30	107.57±11.91	**1.41**	Not Significant at 0.05 level
	Javelin throwers	30	111.57±10.03		

From the table-1 first objective was to find out the Psychological Hardiness between Long jumper and Javelin throwers. It observed that the mean value of two different groups seems to differ from each other on different Psychological Hardiness factors of commitment, Control, Challenge, and Psychological hardiness. The mean ±SD value obtained by the group of Long jumpers on commitment, control, Challenge, and Psychological hardiness were

109.3 ±10.12, 103.9 ±11.16, 109.5 ±14.43, 107.57±11.91. The Javelin throwers were respectively 109.7 ±9.18, 115.7 ±12.0, 109.3±8.22 & 111.57 ±10.03. But on the basis of mean observation, it would not be clear whether these differences are really significant or not. To determine the differences, if any, between Long jumpers and Javelin throwers, the independent t-test was calculated. The obtained 't' value of control was found to be significant at 0.05 and 0.01 level of significance. Commitment, challenges, and psychological hardiness was found to be not significant.

DISCUSSION

Table1 indicates the no significant difference between Long jumper and Javelin throwers on the dimension of Commitment, control, challenges, and psychological hardiness, but result also indicated Control factor was found to be significant. Both the group did not differ statistically significantly of Commitment, control, challenges, and psychological hardiness, but the mean value of Long Jumpers lightly higher in Commitment than the javelin throwers, but the mean value of javelin thrower slightly higher in challenge and psychological hardiness then the sprinter. On the other hand, javelin throwers had significantly higher in control ability than the Long Jumpers. From the table it evident that there was no significant difference Long Jumpers and javelin throwers in commitment. Challenge and psychological hardiness, whereas significant difference was found in control. Roth and Cohen (1986) studied the effects of psychological hardiness and its components and skill on competitive anxiety and self-confidence. Castle (2001) studied over a 100 college going athlete and non-athletes he observed that psychological hardiness of the athletes were better than the non-athletes and significant differences were observed. In this regard Kobasa (1979) believes that some people choose sport as a means for reducing tension and stress and although this is not the best strategy, it is more effective than emotion focused coping. Almost 16 present of athletes use emotion-focused coping strategy, indicating their lack of control over incoming stressors (Intl. Res. J. Appl. Basic. Sci. Vol., 817-821, 2012). But in the present study the subjects were selected from different sport discipline and due to their nature of the games the psychological aspects were developed differently. For while no significant difference was observed in Psychological hardiness between state level, long jumper and javelin throwers.

CONCLUSION

1. No significant difference was found between Long jumper and Javelin throwers in commitment.
2. In control Javelin throwers had significantly better than Long jumper.
3. No significant difference was found between Long jumper and Javelin throwers in challenge.
4. No significant difference was found between Long jumper and Javelin throwers in psychological hardiness.

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