CHAPTER - I
INTRODUCTION
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INTRODUCTION

1.1. HISTORY OF CRICKET

The name cricket probably originated from the Anglo-Saxon Word "Crice". The origin of cricket is expressed in many conflicting conclusions due in a measure. To the very name of the game, while all the logical evidence proves to the Englishmen as the investigator of the game, some historians think the name cricket was derived from "Croquet" as the game that was popular in France before the beginning of cricket. In 13th century the word 'creg' concerned with cricket came in Dictionary.

It was pointed out that there is a word in French "criquet" pronounced "Krickey" and that is the evidence that France created the game and named it English historians while considering that cricket originated and developed in England do not know the exact date when it was first played or how it gained its name. One authority thought that it came from "crice" which was a word in old English meaning staff. This appears to be far patched because staff was to describe a marker used in laws bowls.

The king library of London is drawing dated 1344, showing a cricket bowler and also a batter facing him. The batter has his bat upside down resting on the ground in waiting position. This established cricket as well organised and commanding sport at that time. Historians are quite certain that the game originated in between 12th and 13th centuries.

The first recorded match was played in the year 1710 at Cambridge University and in the year 1744, when a match was played between "kent" and England on the Artillery ground the complete score sheet has been prepared. In the year 1755 another match was played at Bakinghamshire which was recorded, in the same year "star and Gartex" club started forming.
laws. Melbourn Cricket Club was formed in the year 1787 where a great deal of history of cricket can be learned by visiting the pavilion of the present lords cricket ground.

During 17th century itself under arm bowling was in action, the round arm bowling came into action during 1835 and the over hand bowling was started in 1874. In the 17th century only one umpire was used to control the game.

There was no prepared pitch but the caption who won the toss used to select a particular space in the open area. In the 17th century the wicket dimension was two feet wide and one feet height. with periodical changes in the year 1744, 1777, 1798, 1817 and 1931 the height of the stumps was changed to 28 inches and width to 9 inches after adding the 3rd stumps in 1777. The use of one bail on the stumps was replaced by adding the second bail in the year 1810.

The original weight of the ball was 5 ounces and in the year 1774 the weight was increased to 5½ ounces or to a maximum of 5 3/4 ounces and circumference was fixed to a minimum of 9 inches and maximum of 9½ inches. In the year 1744 one over consists of 4 balls only but in the year 1889 it was increased to 5 balls and in the 19th century it was changed to 6 balls.

Earlier there was no fixed size of the bat but in the year 1840 the size was limited to 38 inches length and to 4½ inches width. There was no rule regarding the size of the handle. The first test match was played in Australia in the year 1876-77 which was acknowledged.

1.2. HISTORY OF INDIAN CRICKET

Cricket was played in India over 200 year’s ago. English people brought the game into India. These English people were soldiers and officers of the “East India Company”. They settled in four major cities of India 1) Bombay 2) Calcutta 3) Madras 4) Some where in Central India.
English men have played the game in India for many years. In 1751 a match was played between English settler’s and representing British army and in 1797 one more match was played in India by the soldiers of East India Company.

The first cricket club in India which is the second oldest club in the world was formed in Calcutta in 1792. In 1846 at Madras the second cricket club was formed and in 1848 the oriental cricket club was formed by parsees with the guidance of “Sir Baragi Tata” and “Sir Cow Ji Jahangir”. The team was purely of parsees, they toured England in the year 1886-88.

Hindus took the game and formed the team as Hindu Gymkhana, later it was named as P.J. Gymkhana in the year 1894. This Gymkhana has popularised the game by the support of Jivandas who has given lot of funds. When P.J. Gymkhana came into exgistance Maharaja of Patiala took more Interest.

In 1905 Mohamadans formed the club and named it as Mohamadan Gymkhana and later it was changed as Islam Gymkhana. From the year 1912 parsees, Hindus, Mohamadans started playing cricket between them, it was named as Quadrangular.

In 1928 a meeting was held by De Mello who was an anchor to form a cricket board. He called all the princes and interested persons to Simla for meeting. Maharaja of Patiala was the chairman of the meeting. They decided to send a team to England under the banner of B.C.C.I. Maharaja of Por Bandar has been made as captain.

As the game became more popular all over the country some important tournaments like Ranji Trophy, Deeleep Trophy, Irani Trophy, Moinuid Dowla, Vizzy Trophy, CK Naidu under 22 and 19, Coach- Behar-Trophy and Inter University Tournaments have come up.
1.3. RANJI TROPHY

The Board of control for cricket in India held a meeting at Simla during the year 1934, and decided to have a new tournament on provincial and state basis. It should be called the Ranji Trophy in order to perpetuate the memory of the late Maharajah Ranjitsingh of Nawanagar. Maharaja of Patiala responded and announced the donation of a gold cup.

The first match of the Ranji Trophy was played at Madras cricket club Chepauk on 4th November 1934 between Madras and Mysore. Ranji Trophy is the most popular cricket tournament in India. It is known as the national champion ship of India for the Ranji Trophy. Selection of the Indian cricket team is usually made on the basis of player's performance in the Ranji Trophy tournament matches.

The Ranji Trophy matches are played at the zonal level i.e. South zone, East zone, West zone and North zone. Four best teams from each zone will be selected to represent for the All India Ranji Trophy Champion ship. Around 27 teams are participations in the tournament.

1.4. FUNDAMENTAL SKILLS IN CRICKET

As in many other games, there are many fundamental skills in cricket. They are

1. Batting
2. Bowling
3. Fielding

1.5. BATTING

a. Vertical Batting Strokes
b. Horizontal Batting Strokes
1.5.1. Vertical Batting Strokes

1. Forward defence
2. Back foot defence
3. Cover drive
4. Mid off drive
5. Straight drive
6. Mid on drive
7. Front foot leg glance
8. Back foot leg glance
9. Moving out drive
10. Back foot attacking shot

1.5.2. Horizontal Batting Strokes

1. Sweep
2. Pull
3. Hook
4. Front foot square cut
5. Back foot square cut
6. Late cut

1.6. BOWLING

a. Fast Bowling
b. Spin Bowling

1.6.1. Fast Bowling

1. In Swing
2. Out Swing
3. In Cutter
4. Out Cutter
1.6.2. Spin Bowling

1. Off Break or Off Spin
2. Leg Break or Leg Spin
3. Googly
4. Top Spin

1.7. FIELDING

a. Defensive Fielding
b. Offensive Fielding

1.7.1. Defensive Fielding

1. Long Barrier
2. Orthodox

1.7.2. Offensive Fielding

1. Chasing & Throwing
2. Catching
3. Cover Fielding
4. Slip Fielding

1.8. IMPORTANCE OF FUNDAMENTAL SKILLS

As the study deals with the kinetic and kinematic analysis, it becomes necessary to explain the fundamental skills.

1.8.1. Batting

It is the ability of the Batsmen to select the correct ball either to drive or to play defence by proper mechanism, timing, ball sense, concentration, and
with confidence and courage. A good batsman with sound technique and patience can stay at the wicket for a longer time and can score good runs ultimately helping his team either to win the match or to make a draw. As the one day matches are gaining so much of importance and popularity the Batsmen with sound technique and patience along with the Biomechanical principles involved can score good number of runs in the minimum number of balls or over's.

1.8.2. Bowling

No two bowler's are alike. The grip may be the same but the run up or the delivery action may differ. The common principles for good bowling are

1. Correct grip
2. Smooth and Economical run up
3. Well balanced delivery action making full use of height and body
4. Fluent Follow through

With the development of the game and with the passage of time so many variations have come in bowling. Good bowling is very much important. To make a batsman out or to make the batsmen not to score at a faster rate, or not to allow the batsmen to settle at the wicket for a long time a good bowling with sound technique is of very much important. With the involvement of Biomechanical principals and sound technique, variation in bowling can be developed which in turn helps the bowlers to check the batsmen from scoring runs at the faster rate and also helps his team to win a match by making the batsmen out.

1.8.3. Fielding

In modern cricket game, fielding has gained lot of importance. A good bowler or a batsmen may be kept out of the team due to his poor performance in fielding. A better fielding side not only saves the runs but also can see their
team winning the match. A good fielder can convert a difficult catch into a simple catch and makes the batsmen out or he can stop a powerfully hit ball from crossing the boundary. With the involvement of the Biomechanical principles this fundamental aspect of fielding which is of very much important can be developed.

1.9. FUNDAMENTAL SKILLS CHOSEN FOR THE STUDY

The fundamental skills chosen for the study are batting and bowling in cricket.

1. Batting
2. Bowling

1.10. BATTING AND ITS IMPORTANCE

The main object of batting is to execute the principles of correct technique which is the foundation of good batsmanship. An attempt has been made to describe what may be called the perfect stroke, a mastery of which is essential to accomplish. To execute a perfect stroke proper mechanism and timing are very important.

Batting is of very much important in cricket. A good batsmen with sound technique, proper mechanism and timing will convert a good ball bowled by the bowler into an easy one and can execute the strokes freely all around the ground. Sometimes a good bowler who is in good form can be hit all along the ground or can be hit out of the ground by the application of the biomechanical principles in batting.

To score quick runs in a limited number of balls or to score a big individual score in a test match or to see his team winning in a one day match or a test match batting is of very much important. A sound technique in batting builds, confidence, develops courage and brings encouragement in the batsmen.
1.10.1. Types of Batting Techniques

1. Forward defence
2. Back foot defence
3. Cover drive
4. Mid off drive
5. Straight drive
6. Mid on drive
7. Front foot leg glance
8. Back foot leg glance
9. Moving out drive
10. Back foot attaching shot
11. Sweep
12. Pull
13. Hook
14. Front foot square cut
15. Back foot square cut
16. Late cut

1.11. BOWLING AND ITS IMPORTANCE

In cricket one of the most important skill is bowling. Though there are different ways of delivering the ball most of the bowlers will be doing the over arm bowling. With the advancement of the game so many variations have come in bowling. In the present days the one day matches have gained lot of importance. As quick scoring of runs is important, at the same time to stop scoring of runs at a faster rate and to make the batsmen out a good bowling with sound technique is of very much important. By using the biomechanical principles the bowler can develop sound technique, variation and control over his bowling which helps him to contain the batsman from scoring runs at a faster rate and also helps his team to win a match.
1.11.1. Types of Bowling Techniques

1. Fast Bowling
   a. Inswing
   b. Outswing
   c. Leg cutter or out cutter
   d. Off cutter or in cutter

2. Spin Bowling
   a. Off spin or off break
   b. Leg spin or leg break
   c. Googly
   d. Top spin

This study aims for the kinetic and kinematic analysis of batting and bowling performance in cricket.

Kinetic is a branch of Biomechanics, similarly kinematics which is the study of motion is also a branch of biomechanics. So it becomes necessary for the investigator to explain biomechanics and its importance is sports.

1.12. BIO-MECHANICS

The human body which is very complex is subject to both mechanical and biological laws and principles. How effectively and efficiently it performs is dependent upon both its mechanical and biological function. Behind every successful technique there is a fundamental scientific concept or natural law. It is commonly determined in short that biomechanics is the science of underlying technique. To derive maximum advantage from sports, one needs to have a proper scientific knowledge and this is proved by sports biomechanics because a knowledge of biomechanics detects the root cause of faults that may arise in this use.

The term biomechanics has been defined as follows.
Biomechanics is that area of study where the knowledge and methods of mechanics are applied to the structure and functions of the living human system.¹

Biomechanics is the science concerned with the internal and external forces acting on a human body and the effects produced by these forces.²

The internal and external forces acting on human body determines how the parts of that body move during the performance of motor skills.

When the word biomechanics is divided into its separate parts "Bio" from Greek refers to life or living things and "Mechanics" refers to the field of Newtonian physics and the force that act as animate and inanimate bodies of motion. Biomechanics utilizes the application of scientific principles of physics in order to understand the movement and action of human bodies and objects.

1.12.1. Need and Importance of Biomechanics

This study aims for the kinetic and kinematic analysis of batting and bowling technique in cricket. Kinetic is a branch of Biomechanics. Similarly kinematics which is a study of motion is also a branch of biomechanics. so it becomes necessary for the investigator to explain biomechanics and its importance in sports.

The science of biomechanics is concerned with the forces that act on human body and the effects these forces produce. Physical Education teacher’s and coaches are like wise concerned with forces and effects. Their ability to


teach the basic technique of sport or physical activity depends very largely on their application of both the effects they are trying to produce and the forces that cause them.

Scientific principles of coaching and teaching is to determine the proper application of the mechanics to physical activities in order to obtain the most effective and efficient performance. This approach eliminates the hit or miss methods that prevail so often. Competition in the field of sports has developed to such a high degree that no coach or player can afford to neglect the application of scientific principles that can give him an advantage over or at least keep him apace with his opponents.

Biomechanics helps to understand the nature of sports movements on the basis of laws and the principles of mechanics. In short just as motor learning regarded as acquisition of skills the biomechanics as the service undertaking technique.

A knowledge of physiology equips them to make sound judgement concerning the amount and type of training to prescribe in a given case. A knowledge of biomechanics equips them to choose appropriate techniques and to detect the root causes of faults that may arise in their use.

Biomechanics offers important scientific knowledge that can improve performance and the best coaches are taking advantage of this knowledge.

Biomechanics is also concerned with motion of the objects. The study of mechanics includes the study of factors relating to non moving systems or characterised by study or motion. In turn dynamics can involve a kinematic or kinetic approach. Kinematics is concerned with studies of time and space factors in motion such as velocity and acceleration, where as kinetics is involved with the force that act on a system, such as gravity and muscles.
Biomechanical principles can be employed to analyse the individual movements and to determine the most effective timing of the sequence the one that leads to the greatest force or highest speed as the case may be. This information can be used to help an athlete to find the proper rhythm for his performance or to locate the hitch in the sequence that has caused him to lose his rhythm.

Biomechanical research deals largely, with the anatomical, mechanical and physiological analysis of performance, both in terms of local muscular action and gross body movements.

No attempt has been made to resolve all the questions raised by such a designation for the analysis of performance might take direction other than purely biomechanical studies. At present to serve the purpose biomechanics of sports movements has become highly technical by using complex methods of experimentations.

1.13. KINEMATICS

Kinematics is that branch of biomechanics that is concerned with the motion of bodies. It deals with such things as how far a body moves, how fast it moves and how consistently it moves. It is not at all concerned with what causes a body to move in the way it does.

Kinematics is divided into two

1. Linear kinematics deals with the kinematics of translation or linear motion.

2. Angular kinematics deals with the kinematics of rotation or angular motion.\(^3\)

\(^3\) *Ibid*, p. 13.
1.13.1. Importance of Kinematics

Kinematics is a necessary introduction to kinetics since ability to describe motion is a prerequisite to an understanding of relation between force and motion.

Kinematics is one of the most basic areas of physics. In fact the definitions and methodology provide the foundation on which most of physics rest.

Kinematics is concerned with studies of time and space factors in motion such as velocity and acceleration whereas kinetics is involved with the force that acts on a system, such as gravity and muscles.

To understand what happens in a jump an attempt to analyse it the coach or physical education teacher must first get acquainted with certain relationship of kinematic parameters such as speed, force, power, distance, acceleration, etcetera. The kinematic analysis will help to know the influence of each kinematic parameter and will give a correct direction to improve each factor.

1.14. KINETICS

Kinetics is based on kinematics and incorporates into the analysis, the effects of force and movements that cause the motion.\(^4\)

Kinetics is the study of the forces acting on a body that influences its movement.\(^5\)

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\(^5\) Kreighbaun and Katharine, Op cit, p.5.
Kinetic energy is the energy a body or object has because of its motion.\textsuperscript{6}

The formula to find out the kinetic energy as per Ellen Kreighbaun and Katharine M. Barthels is

\[ KE = \frac{1}{2} mv^2 \]

where

- \( KE \) = is kinetic energy
- \( M \) = is mass
- \( V \) = is velocity\textsuperscript{7}

1.14.1. Importance of Kinetics

In any physical activity, work is performed and energy is expended. The amount of energy possessed by each individual for performing work is limited.

Work is the product of force times the distance through which that force moves a load.\textsuperscript{8}

Work done is represented by the formula

\[ W = f \times d \]

where

- \( w \) = work
- \( f \) = force
- \( d \) = distance\textsuperscript{9}

\textsuperscript{6} Ibid., p. 71.

\textsuperscript{7} Ibid.,

\textsuperscript{8} Ibid., p. 70.

\textsuperscript{9} Ibid.,
If the weight of the body and the velocity with which it moves is known the energy expended can be calculated.

The formula showing its relationship between work done (w) and energy is

\[ w = fd = \frac{1}{2} mv^2 = \text{kinetic energy} \]

where

\[ f = \text{force, in pounds, applied in the direction of the motion or the effective force.} \]
\[ d = \text{distance, in feet, over which the force acts} \]
\[ m = \text{mass of the body} \]
\[ v = \text{velocity of the body in the direction of force} \]

Kinetic energy equals half the mass of weight divided by the gravity of the body being moved times the velocity of movement squared or

\[ KE = \frac{1}{2} mv^2 \]

since

\[ \frac{v_1}{t} = a \quad \text{and} \quad d = \frac{v_2}{2a} \]

then

\[ w = fd = \frac{mv \times v^2}{2v} = \frac{mv \times v^2}{\frac{2}{2}} = \frac{1}{2} mv^2 \]

The principles of kinetic energy is valuable in checking the validity of the theories and techniques for top performance. It enables the athlete to perform at the top with most efficient expenditure of energy. The most efficient expenditure of energy may point the way to even better performance.

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The techniques performed in accordance with the laws of physic produce the best results with the least expenditure of energy.

1.15. KINEMATIC VARIABLES CHOSEN FOR BATTING

1. Speed
2. Force
3. Power
4. Acceleration
5. Angle of Lean

1.15.1. Speed and its Importance

The rate at which a body moves from one location to another is usually described with reference to its speed.

Speed is obtained by dividing the distance covered by the time taken.

\[ S = \frac{L}{t} \]

where

- \( S \) = average speed
- \( L \) = length of path (that is the distance covered)
- \( t \) = time

Speed is the performance prerequisite to do motor action under given conditions (movement task, external factors, Individual prerequisite) in minimum of time.\(^{11}\)

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11 Hay, Opct, p. 2.

In Cricket the importance of speed is enormous. Every aspect in Cricket requires top speed for the execution of various skills the attainment of maximum speed is important in batting, bowling and fielding. In batting the number of run’s scored by the batsmen is considered as his performance. Runs can be scored in the form of one’s, two’s, three’s, four’s and sixer’s.

Scoring runs in the form of one’s, two’s and three’s is possible by running at the maximum speed in between the wickets. A ball hit forcibly straight to the fielder may not produce a run but a high speed of running in between the wickets for a defensively played ball will help the batsmen to add to his performance, while batting, the batsman has to drive or pull the ball, in order to pull or drive the ball the attainment of maximum speed in the downswing of the bat in the minimum time is very important. Speed abilities are very important because certain other abilities depend on it to a lesser or greater extent and thus speed plays an important role in cricket.

1.15.2. Force and its Importance

Force is the function of mass and acceleration. A body’s state of being “at rest” or “in motion” can be changed by the force of some other body.

A body at rest can be made to move when another body exerts a force on it. Similarly a body in motion can be slowed down, speeded up or have the direction of its motion altered if another body exerts a force on it.

In Cricket batting the kinematic principle force is very important. In order to change the direction of the ball which is coming on to the batsman the batsman has to go for a higher back lift of the bat. If the back lift is not higher the batsmen cannot put more force on the ball and also the impact will not be proper.
If the time is not sufficient for a higher back lift of the bat the batsman has to use the force of the wrist to change the direction of the incoming ball. While running in between the wickets the batsmen has to use the mass of the body and his acceleration to get more force. If proper force is not applied while running, the speed in running between the wickets is reduced and it may lead to run out. So the kinematic principle force is an important variable in batting.

1.15.3. Power and its Importance

Power in the product of force times the speed with which that force is applied.

\[ P = \frac{F \times d}{t} = \frac{F \times d}{t} = F \times V \]

where

- \( P \) is Power
- \( F \) is Force applied
- \( D \) is distance force is applied
- \( T \) is time force is applied
- \( V \) is speed force is applied

out of all the conditional abilities (speed, strength, endurance, etcetera) power is one of the most important factor in sports, because the other condition, coordinative abilities are affected, to a lesser or greater extent by the power ability. Depending upon the magnitude and type of resistance to be tackled in various sports, the sportsmen of different sports need different levels of speed, endurance, technique, tactics and other coordinative abilities is impossible if the sportsmen lack the requisite amount of power.

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13 Kreighbaun and Katharine, Op cit, p.68.

In Cricket the Kinematic principle power is very much important. For the batsman to score runs he has to hit the ball with full power. The power into the stroke comes by shifting the body weight. A batsmen having sound technique but no power cannot hit the ball properly. This lack of power in the stroke leads to a simple catch or to a single run where there is a chance for a four or to clear the ground for a six. Hence power is an important factor in batting.

1.15.4. Acceleration and its Importance

The rate at which the velocity changes with respect to time is called acceleration.\(^{15}\)

The importance of acceleration in batting cannot be neglected. As the performance in cricket batting is recognised only by scoring runs, the batsman has to run between the wickets to get runs in the form of one's, two's and three's. So when there is a chance for one and half run by accelerating the speed in running between the wickets and by changing the direction of the body at the faster rate, the batsman can convert one and half run into two. Taking quick singles the batsmen can accelerate the scoring rate. Hence the kinematic principle of acceleration is regarded as an important variable.

1.15.5. Angle of Lean and its Importance

In running, the angle of lean of the body is more forward than in walking. As in walking, the forward lean should be from the ankles so that the trunk is kept in line with the driving leg. This forward lean reduces the air pressure against the body and puts the center of gravity more ahead of the driving foot enlarging the forward component of the propulsive force. Also the forward lean combined with additional bending of the supporting knee as the body passes over it, reduces the up and down bobbings of the body which would occur with the greater propulsive force if the angle of lean of the body is more upright. The faster the run the more forward the angle of the body.\(^{16}\)

\(^{15}\) Hay, Op cit, p.18.

In Cricket the kinematic principle of angle of lean is a very important factor. While playing defence or driving the ball, the batsman has to lean towards the ground and on to the ball by shifting his body weight from rear leg to the front leg by raising the rear leg heel, this helps the batsmen to get more power into the stroke. If the batsmen is not leaning properly on to the ball there won't be much power in the stroke and the chances are more in giving a catch to the nearest fielder. While running in between the wickets for a quick run the batsmen has to lean forward to drag the bat into the batting crease to get saved from the run out and also to turn back faster for the second run. Thus the angle of lean is an important factor in batting.

1.16. KINEMATIC VARIABLES CHOSEN FOR BOWLING

1. Speed
2. Force
3. Acceleration
4. Angle of Lean
5. Power
6. Spin

1.16.1. Speed and its Importance

Speed is the ability to execute motor action under given condition, in minimum possible time.¹⁷

Speed is the performance prerequisite to do motor action under given condition (movement task, external factors, individual prerequisite) in minimum time.¹⁸

¹⁷ Hardayal Singh, Op cit, p.5.

Every aspect in Cricket requires speed. The bowler initially starts his bowling run up slowly as he comes close to the bowling crease he accelerates his speed to get momentum and force. The acceleration in his run up and forward lean at the time of the delivery of the ball will give more force and power to the ball resulting to bowl at the fastest rate of speed. Speed is the primary requisite in bowling.

1.16.2. Force and its Importance

Force is some thing that causes or tends to cause a change in the motion or shape of an object or body.\(^{19}\)

The kinematic principle force is a very important factor in Cricket bowling. In order to get more force the bowler swings his bowling arm at the faster rate before delivering the ball. In case of fast bowlers where there is more force behind the ball the forward movement of the ball will be faster, this forward movement can be obtained by dragging the fingers along the seam of the ball because dragging of the fingers will help the bowler to change the direction of the ball in the air which is moving in the forward direction. Thus force plays an important role in Cricket.

1.16.3. Acceleration and its Importance

The rate of change of velocity of a body is called acceleration.\(^{20}\)

In Cricket the bowlers moves towards the bowling crease, initially he walks a few strides and as he comes close to the popping crease / bowling crease he accelerates his run up to gain more momentum. This gain in momentum developed through acceleration of his run up helps the bowler to

\(^{19}\) Kreighbaun and Katharine, Loc.Cit, p. 68.

\(^{20}\) Hay, Loc.Cit, p. 18.
bowl the ball at the fastest rate of speed. In fast bowling, acceleration plays an important role. Knowing the importance of acceleration it has been selected as a variable.

### 1.16.4. Angle of Lean and its Importance

Angle of lean is a very important factor in cricket. In bowling we can observe the backward lean and also the forward lean. The forward lean is more important in bowling. By leaning backward and forward the bowler is shifting his body weight on to the front foot. This shifting of body weight and leaning forward helps the bowler to get more force and power, which ultimately helps the bowler to bowl the ball at the fastest rate of speed. The forward lean also helps the bowler to have more control on the ball so that the bowler can deliver a more effective and a good ball to the batsman. If the forward lean is not proper there won't be much control on the ball and results in a bad delivery of the ball to the batsmen. Hence angle of lean is an important factor in bowling.

### 1.16.5. Power and its Importance

Power is the capacity of an individual to bring into play maximum muscle contraction at the fastest rate of speed.\(^{21}\) Power is one of the most importance factor in sports, because the other conditional abilities coordinative abilities are affected to a lesser or greater extent by the power ability.

In cricket bowling the kinematic principle of power is very much important. In fast bowling, bowler has to deliver the ball at the fastest rate of speed by his total body power as well as his shoulder and wrist power. A bowler having good technique but no power, cannot deliver the ball at the fastest rate of speed. Spin bowlers also uses the power of their shoulder or wrist to bowl a faster ball

as a variation in the spin bowling. Considering the above importance of power it has been selected as a variable.

1.16.6. Spin and its Importance

Spin plays a dual role in sports. It has a stabilizing effect that holds an object on course or resists a change in the direction of the axis of the body. The spin in the direction of the desired curve is always faster. When the ball spins a noticeable curve results.

In cricket the kinematic principle of spin is of very much important. Spin is used entirely in a different manner to change the direction of the ball. The direction is changed not in the flight but by the use of the floor. Spin and floor are used to slow down or to speed up the ball. In cricket the change in the direction of the ball helps the bowler to cheat the batsmen from playing the ball and also helps the bowler to get a wicket.

1.17. PURPOSE OF THE STUDY

With the introduction of the one day match’s cricket has gained lot of importance in the field of sports and games. To cope up with the speed of the game the, involvement of the kinetic and kinematic variables such as speed, force, power, acceleration, angle of lean and spin has become very important for the development of the performance of the players.

There is inconsistency in the performance of the player’s either in batting or in bowling. This may be due to so many unknown factors. To overcome such factors lot of research has to be done. But very little research has been done in the field of cricket analysing the batting and bowling technique kinetically and kinematically. The researcher being a cricket player and also a trained coach strongly believes that the kinetic and kinematic variables has important role in batting and bowling performance.
Descriptive analysis of the Cricket performance or Biomechanical analysis of Cricket performance is rarely done. Very little research has been done on batting or bowling performance in Cricket. Kinetic and Kinematic analysis of either batting or bowling is rarely conducted and this motivated the investigator to do this research.

1.18. STATEMENT OF THE PROBLEM

The primary purpose of the study was to analyse batting and bowling performance in cricket both kinetically and kinematically.

The secondary purpose was to find out whether there was any relationship between the cricket batting performance bowling performance and the selected kinetic and kinematic parameters namely, speed, force, power, acceleration, angle of lean and spin.

1.19. HYPOTHESES

1. It was hypothesised that there may not be significant relationship between batting performance in cricket and the kinetic and kinematic variables.
2. It was further hypothesised that there may not be significant relationship among the kinetic and kinematic variables involved in batting.
3. It was also hypothesised there may not be significant relationship between spin bowling performance in cricket and the kinetic and kinematic variables.
4. It was further more hypothesised that there may not be significant relationship among the kinetic and kinematic variables involved in spin bowling.
5. It was also hypothesised there may not be significant relationship between fast bowling performance in cricket and the kinetic and kinematic variables.
6. It was further more hypothesised that there may not be significant relationship among the kinetic and kinematic variables involved in fast bowling.
1.20. SIGNIFICANCE OF THE STUDY

1. The biomechanical analysis of cricket batting and bowling is first of its kind and hence the results of the study may reveal the importance of kinetics and kinematics and its application in cricket.

2. This study may help to find out the reasons for the failure of the batsmen or bowler in a particular match.

3. Appropriate qualification of various aspects of bowling performance, batting performance and kinetics and kinematics may lead to better understanding of the relation between kinetic and kinematic variables and performance.

4. The study may contribute to the body of knowledge in the specialised area of batting and bowling.

5. The relationship between bowling performance in cricket and the kinetic and kinematic factors may be understood from the results of the study.

6. The results of the study may be helpful to know about force, speed, power, acceleration, angle of lean and spin in relation to the batting and bowling performance in cricket.

7. From the results of the study, the relationship between batting performance in cricket and the kinetic and kinematic variable may be understood.

1.21. DELIMITATIONS

1. The study was conducted on men cricketers only.

2. The study was conducted on 30 batsmen, 30 fast bowlers and 30 spin bowlers who have participated in the Ranji Trophy Cricket Tournament.

3. Only the selected kinetic and kinematic factors namely speed, force, power, acceleration, angle of lean and spin were chosen for analysis.

4. The bowling analysis was made with the video analysis.

5. The subjects were selected randomly from among the participants in the Ranji Trophy Tournament.

6. The data for the bowling analysis was collected by asking the bowlers to bowl on a standard turf wicket (i.e. Pitch)
1.22. LIMITATIONS

1. The food habits of the subjects which may have an effect on the results of the study were not taken into consideration and that was considered as limitation.

2. The atmospheric temperature was not taken into account while collecting data and that was considered as limitation.

3. The nature of the cricket pitch, its wear and tear were not taken into consideration and that was considered as limitation.

4. The daily routine of the players which may have an effect on the results of the study was considered as limitation and no motivational technique was used during collection of data.

5. Bowling performance was analysed with the video analysis, minor editing errors which might have occurred was considered as a limitation.

6. The study was conducted with out any reference or enquiry about the subjects status of training and methodology of training.

1.23. DEFINITION OF THE TERMS

1.23.1. Kinetics

Kinetic energy is the energy a body or object has because of its motion.

\[ KE = \frac{1}{2} mv^2 \]

where

- KE is kinetic energy
- m is mass
- v is velocity \(^{22}\)

\(^{22}\) Kreighbaun and Katharine, Opcit, p.71.
1.23.2. Kinematics

It is a science of motion. It deals with such things as

1. How far a body moves
2. How fast a body moves
3. How consistently a body moves

It is not concerned at all with what causes the body to move in the way it does.23

Kinematics is a branch of dynamics that deals with the geometry and time dependent aspects of motion with out considering the force causing the motion.24

1.23.3. Cricket

Cricket is a game played with bat and ball between two teams of 11 players each on a large field, which centers upon two upright wickets each defended by a batsman. A bowler throws (a straight arm usually over hand delivery) the ball, attempting to put out the batsman by hitting the wicket or in other ways. Runs are scored each time the batsman exchange portion without being put out.25


24 Ozkaya, Op cit, p.4.

Cricket is a team game played on grass pitch, in which ball is bowled at wicket defended with bat by player of other team.\textsuperscript{26}

1.23.4. Batting

It is the ability of the batsman to select the right ball either to defend or to drive away by proper mechanism, timing, ball sense, concentration, courage and with confidence.

1.23.5. Bowling

It is the ability of the bowler to bowl a ball to the batsmen with proper variation, in correct length and direction to make the batsman out.

1.23.6. Speed

Speed is the performance prerequisite to do motor action under given condition in minimum time.\textsuperscript{27}

1.23.7. Force

A body's state of being "at rest" or "in motion" can be changed by the action of some other body. The pushing or pulling effect that the other body has and that causes the change is termed as force.\textsuperscript{28}

\textsuperscript{26} Little Oxford Dictionary (7th Ed; New Delhi, Oxford University Press, YHCA Library Building, 1998), p.147.

\textsuperscript{27} Hardayal Singh, Loc.Cit, p.115.

\textsuperscript{28} Hay, Op.cit, p.15.
1.23.8. Acceleration

The rate at which the velocity changes with respect to time is defined as acceleration.

\[ a = \frac{vf - vi}{t} \]

vf = Final Velocity
vi = Initial Velocity
t = time
a = Acceleration

1.23.9. Power

Power is the product of force times the speed with which that force is applied.

Power is the rate during which physical work is performed.

\[ p = \frac{f \times d}{t} = \frac{d}{t} = f \times \frac{V}{t} \]

F = force
V = velocity

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*Kreighbaun and Katharine, Op cit, p.72.*
1.23.10. Spin

Spin is the pressure on one side of the ball and is reduced on the other side depending upon the nature of spin.\(^{31}\)

1.23.11. Angle of Lean

When the athlete runs on a curve the centrifugal force is provided by the runner spike digging into the track surface. The force acting inward on the feet would topple the runners outward, if he did not lean inward enough to balance the outward reaction of his body. The angle of lean from the vertical must be approximately the same as the angle of horizontal.\(^{32}\)

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