Chapter – I

INTRODUCTION

Now a day’s sportmen are being trained by highly sophisticated means for excellent performance in their concerned sports. Athletes are exposed to training methods which have proved beneficial for achieving higher standards. Much progress has been made in the acquisition of knowledge about training methods and techniques of cricket. In training, players are required to undergo specific exercises which are being prescribed for fullest and optimum development in cricket.

The bowling is in essence a very simple movement but to achieve its perfection calls for a degree of rhythm and co-ordination of the most exact and unusual order. To bowl at the pace of “Larwood” or “Hall” both great fast bowlers played for England and West Indies respectively is an enormous physical feat and to spin with the accuracy of “Barnes” or ‘O’ Reilly is a matter of quite exceptional dexterity\(^1\).

Bowlers are born or made: Both in the sense that some people are born with the ability to bowl fast or to spin a ball in a certain fashion, assets which scarcely any other living person should acquire no matter how much he tried\(^2\).

\(^1\) Jan Peebles, **Straight from Shoulder** (London Hutchinson and Co. Publication (1968) p. 53.

Denis Lillie, the greatest fast bowler listed ten most important qualities needed to be a fast bowler in the following order of priority where the first three were:

i) The ability to bowl fast

ii) Stamina and Physical Fitness

iii) “Killer instinct.

Because these are the predominant factors for fast bowling. Not only Dennis Lillie, but the great fast bowlers like Bob Willis, Imran Khan, admit that ‘the ability to bowl fast’ is the first and prime criteria of fast bowling.

In the beginning of cricket there was no specific training method for pace bowlers and spinners. As cricket became more popular and competitive, the demand of pace bowlers and spinners have changed. To fulfill their demands different training methods came into existence according to the pace bowlers need, like for medium fast bowlers there is a specific training method and a different training method for spinners.

It is a known fact that indices and physical variables play a very vital role in most of the games. Therefore, a cricket coach should select his squad invariably.

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In order to study the physical and biomechanical variables of a successful performance of cricket players in pace bowling attempts have been made in past, but in India no study has been conducted in this direction Therefore, there was a need to conduct an elaborate study on cricket players of different levels.

All movements of material bodies, both the men and animals are subject, without exception, to the law of the mechanics as every movement involves mechanical movements and the locomotion of parts of mass in space and time. It is the only first task of science to recognize this it is necessary to make this qualification, because movements is not only locomotion, but is also a change in quality in fields above the purely mechanical.\(^5\)

Biomechanics is an applied form of mechanics and consequently the methods used to investigate it must be derived from those of mechanics. However, biomechanics have not developed in the wake of mechanics but as a bordering science in other scientific discipline such as anatomy, physiology and technique of sports.\(^6\)

Biomechanics aims to explain the mechanics of life and living from molecules to organism everything must obey the laws of mechanics. Clarification of mechanic many things, Biomechanics helps us to

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\(^5\) Garland Hochmuth, "Biomechanics of Athletic Movement" (Berlin: Sportverloug, 1984) p. 39

\(^6\) Ibid. p. 9.
appreciate life. It sensitize us to observe nature. It is a tool for design and invention of devices to improve the quality of life. It is useful tool a valuable tool, an unavoidable tool. It is necessary part of biology and engineering\textsuperscript{7}.

The role that sports biomechanics can play is becoming more widely understood in the sports community and the demand for service increasing, researchers in sports biomechanics will have to consider carefully how much time they can devote to the provision of scientific service without impairing their performance as scholar researchers. To avoid the problems inherent in this situation, it may be necessary to develop programme of study for the training of technicians in sports biomechanics, technician who can provide the kind of services sought by sporting kind\textsuperscript{8}.

The role of Biomechanics in attaining high performance can not be over looked. Since it is the only scientific which help to identify the faults in performing technique very precisely. There are basically two method by which motor skill can be analysed. They are the qualitative and quantitative method. High speed movie film for exactness has been used extensively to examine in great details of the movements of the body which occur to fast for the human eye to detect. In many of the elite sport


\textsuperscript{8} Gerland Ho\textsuperscript{c}hmuth, "\textit{Biomechanics of Athletic Movement}\textsuperscript{b} (Berlin: Sportverlough, 1984), p. 9.
training and research institute around the world, force applied during high
caliber sporting event, while the analysis tasks faced by the coach and
predominantly qualitative in nature\textsuperscript{9}.

On of the most dramatic changes in bowling came about in 1990
when English spinner Bernard Bosanquet first bowled the googly, or
basic. This was an off break bowled with a leg break action. This ball has
confounded batsmen around the word ever since, and in used
extensively by Australian leg break bowlers\textsuperscript{10}.

Joseph\textsuperscript{11} studied the relationship of power, agility, flexibility and
measurement of selected body, parts to volleyball playing ability and
found that the power was the most reliable single variable in predicting
playing ability in volleyball. Arm length and leg length were also reliable.
Flexibility and agility had insignificant relationship to the playing ability.

Flexibility in another vital component of physical fitness which helps
in synchronizing various movements. Moreover, flexibility is an essential
part of life, even to a lay man, who may get possible injury for a fall while
performing daily activities. Reasonably higher degree of flexibility is
necessary for better performance in bowling discipline in Cricket, as it is

\textsuperscript{9} Moria Mc Pherson, "A Systematic Approach to Skill Analysis", Sports

\textsuperscript{10} Maccomm Andrews, The Encyclopedia of Australian Cricket (Golden Press

\textsuperscript{11} V.K. Joseph, "Relationship of Power, Agility, Flexibility and Measurement of
Selected Body Segments to Volleyball Playing Ability" (Unpublished Master's Thesis,
Jiwaji University, 1983).
considered that greater amount of flexibility makes the movements smooth and saves extra expenditure of energy and reduces the resistance that must be overcome performing the running action\textsuperscript{12}.

Tipton\textsuperscript{13} suggested that flexibility aids in gaining a long stride in running. Great flexibility in the ankle, hip and trunk may overcome some of the disadvantages of possessing legs which are not extremely long, short legs and inflexible joints area poor combination for running performance. Keeping the rate of leg movements consistent, the speed of running can be enhanced by lightening the stride.

It is a craft an art, demanding real study and applications. Fundamental to skillful bowling is a workable, repeatable bowling action that allows the bowler to command accuracy in both length and directions. This accuracy is the very foundation of fast bowling. Three general classifications are there is fast bowling i.e. fast, medium fast and the medium. Fast bowlers attempt to deceive the batsman by sheer speed combined with deviation of both in the air and off the wicket. The approach run of medium fast bowlers is almost the same as that of the fast bowlers, but with fingers and wrist an attempt is made to deviate the


\textsuperscript{13} C. Alley Tipton, \textit{Track and Field Athletics} (St. Louis: C.V. Mosby Company, 1968), p. 50.
ball sharply off the wicket, in the hope that the sudden directional change may deceive the batsman\textsuperscript{14}.

Round arm and over arm bowling is a combination of momentum, gathered from a running start, and the sling of the arm, augmented by the turn of the shoulder and the arch of the back. The question of momentum of great importance, for although it is possible to bowl the ball some distance from a stand-still, it is quite impossible to achieve some speed. Almost very fast bowler of unquestionable delivery has run over a dozen yards, as it is desirable to gain momentum progressively if the bowler is to be sufficiently balanced and co-ordinated to utilize it when he reaches the crease. A notable exception was “Water Brealy”, eminent cricket player of Lancashire country in England, who ran only about seven yards, but was endowed with such strength of thigh that he could leap over a billiards table from a standing start even so, he would hardly qualify for the highest class in terms of pure pace. Momentum, if in a lesser degree, is essential for the slower bowler to spin and propel the ball twenty two yards, takes considerable efforts\textsuperscript{15}.

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\textsuperscript{14} Jack Fingleton, \textit{Fingleton on Cricket} (London Allen and Mobley Publication, 1972) p. 11.

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Indices have wide application as one of the essential parameters consisting the selective diagnostics of all games and sports. It is always a great task for coaches to specify the amplitude of their trainees for different positions in games and sports, viz forward, backward, the midfielders that is among his trainees which players to be placed at forward line and which for the defensive position according to their physique, ability, amplitude and physical fitness. In cricket it is not necessary that a tall person having good physique will be a good fast bowler. Likewise, there is no specific physique characteristics on which spinners can be distinguished from others. Anyone of them can be a good spinner or speedster. Indices and physical variables play very vital role in most of the games an sports\textsuperscript{17}.

Cricket is the most popular and richest in history of all ball games, there is no exact record available which shows when and by whom cricket


\textsuperscript{17} The International Webstar New Encyclopedia Dictionary of the English Language and Library of Useful Knowledge, S.V. Cricket.
was started in England. It is essentially an English game. Old work shows that it is as old as 13th Century\textsuperscript{18}.

There is lot of truth in the often used statement that “great fast bowlers are born and not made”. This is because to the a fast bowler require certain physical attributes such as size, stamina, speed and skill are not always passed on directly from father or mother to son or daughter, but there are qualities that run in the family lines that certainly are inherited of these attributes some, more than others, can be modified by the environment, particular the training environment. For instance stamina can be increased by endurance training, and skill and technique can be improved by consistent practice. On the other hand there is speed, which is quite a bit harder to change, and size, which in a well nourished individual is basically determined at birth\textsuperscript{19}.

Cricket history is adorned with example of great fast bowlers who where not particularly tall nor impressively built. In the matter of physique do not be discouraged if one does not seem to measure up to the ideal. For example [on] might think to be tall and strong in order to bowl really fast. This seems logical since one needs height to get the lift of the pitch and also strength and stamina to keep going. Ye Harold


Larwood, one of the fastest and best bowlers of all time capable of lifting the ball viciously at breath taking speed stood only five ft eight inches. True he was tremendously strong, especially in those vital back muscle\textsuperscript{20}.

As has been said to a high degree of people are born with the potential quality. It depends largely on the muscle fibre one possess, together with the amount and type of training they are prepared to do. This muscle fibre make up waves from person to person and studies have revealed that there are two types of fibres: the slow contracting or enduring type and the fast contracting type. The percentage of slow and fast contracting fibres can not be altered, but training can improve the quality of each fibre and how it is put to use by nervous system. Fast bowlers need both slow contracting (for stamina) and fast contracting (for explosiveness) fibres\textsuperscript{21}.

The explosive power that is so vital to fast bowling comes from the strength of the muscles involved and the speed at which they can be made to contract. The fast bowlers need strength in the legs and torso. Strength is required in the abdominal, shoulder and arm muscles. For that explosive movement of the bowling action. A strong back adds an excellent stabilizing force\textsuperscript{22}.


\textsuperscript{22} Ibid., p. 22.
For medium fast bowling, it required magnificent co-ordination of the whole body and limbs as to gather momentum for the final delivery at the end of the beautiful rhythmic run-up, as well as, the power and speed in the wide sweeping area of the shoulders and arm\textsuperscript{23}.

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The World "Cricket" itself has become to mean in English Language "Good Sportsmanship" it is in that cricket indeed any game


Should be played. We play to win of course and try out most to do so, but even more than that we play cricket to maintain the high standards of sportsmanship\textsuperscript{25}.

Amongst sports sciences bio-mechanics offer an important scientific knowledge that can improve the performance of the athletes and sportsmen. The knowledge of biomechanics helps to understand the nature of sports movements and law and principles of biomechanics involved in the execution of sports skills\textsuperscript{26}.

The role of biomechanics in attaining high performance cannot be over looked, since it is the only scientific field which helps to identify the faults in performing techniques very precisely. There are basically two methods by which motion skills can be analyzed, the qualitative method and the quantitative method. The best method to evaluate technique is called cinematography. This is quantitative method which is very accurate but at the same time costly and time consuming. This method cannot be applied by all coaches working in the field for the betterment of performance due to its cost involvement. The other method which is yet to be fully explored is qualitative analysis. This method involves


comparatively very low cost and is equally valid in identifying the sequence of movements and faults\textsuperscript{27}.

It is further to be mentioned that sports biomechanics is more widely understood in the sports community and the demand for service increasing, researchers in sports biomechanics will have to consider carefully how much time they can devote to the provision of scientific services without impairing their performance as scholar researchers. To avoid the problems inherent in this situation, it may be necessary to develop programmes to study for the training of technicians in sports biomechanics; technicians who can provide the kind of services sought by sporting bodies\textsuperscript{28}.

A major consideration for any sport biomechanics quantitative analysis procedure is the degree to which the measurement process itself alters the movement sequence being studied. Film analysis would certainly be considered one of the least invasive of all the biomechanical measurement tools, and for this reason has become the measurement tool of choice for most researchers. However, the process of film analysis is not without problems of it own. While these errors might individually be quit small, they prove to be very troublesome in any numerical


differentiation process that is used to determine velocity and acceleration for the digitized coordinate point\textsuperscript{29}.

**Statement of the Problem**

The purpose of the study was to determine the effect of physical and biomechanical variables on the performance of pace bowlers in cricket.

**Delimitations**

1. The study was delimited to the cricket players of 17-25 years of age consisting of these groups:
   
   i) Beginners (College Level)
   
   ii) Intermediate (University Level)
   
   iii) Advanced (National Level)

2. Study was confined to the pace bowlers only.

3. The physical and biomechanical variables were:

**Physical Variables**

i) Standing height

ii) Arm Length

iii) Leg Length

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iv) Grip Strength

v) Arm Strength

vi) Explosive Strength of Leg

vii) Running Speed

viii) Flexibility

(a) Hip Flexibility

(b) Shoulder Flexibility

Biomechanical Variables

i) Angular Kinematics

a) Angle of Wrist Joint

b) Angle of Shoulder Joint

c) Angle of Hip Joint

d) Angle of Knee Joint

e) Angle of Ankle Joint

ii) Height of C.G.

iii) Height of Release

iv) Duration of Flight

v) Velocity of the Ball
Limitations

1. Non availability of sophisticated instrument was considered as one of the limitation of this study.

2. Weather and climatic conditions were other limitations.

3. Absence of motivational device was also considered as one of the limitation of the study.

Hypothesis

It was hypothesized that there may not be significant effect of physical and biomechanical variables on the performance of pace bowlers in cricket.

Definition and Explanation of the Terms

Physical Variables

Physical variables refers to these factors such as height, weight, length, width and measurement of certain body parts.

Biomechanics

Biomechanics is the science which deals with internal and external forces which comes into play during execution of movement and effect produce by these forces.\textsuperscript{30}

Center of Gravity

The center of gravity of any object is that point at which all of the weight of an object may be concentrated\textsuperscript{31}.

Strength

Mathew\textsuperscript{32} has defined strength as the force that the muscle of group of muscles can exert against a resistance in one maximal effort.

Clarke\textsuperscript{33} has defined strength as the capability of overcoming a resistance of acting against it by muscular tension (the term capability is used in the sense of functional potential).

Explosive strength, which is a distinguished feature apart from strength is defined as an ability of muscle group of overcome resistance with speed\textsuperscript{34}.

Flexibility Variables

Flexibility is the ability of an individual to move the body its parts through as wide a range of motions as possible without under strain to the articulation and muscle attachment\textsuperscript{35}.


For the purpose of this study flexibility is the extent of the range of movement of articulating body segments of a joint. It is specific to a joint and generizable only as a profile of the specific joint measured. It is limited by the extensibility muscles and ligaments surrounding a particular joint.

**Velocity**

“Velocity is defined as displacement for unit time in a particular direction”.

Velocity of ball in fast bowling can be defined as the speed with which the ball is projected to cover a distance of 22 yards (playing length) in Cricket.\(^{36}\)

**Significance of the Study**

1. The present study may indicate the physical and biomechanical variables as predictors for successful pace bowling in cricket.

2. The result of this study will propose a bio-mechanical model for an ideal pace bowling in cricket.

3. The study will be helpful for physical education teachers, sports scientists and coaches for selection and training for the cricket players.

\(^{36}\) Fingleton, *Fingleton on Cricket*, p. 12.