Chapter I
INTRODUCTION

"If everyone is moving forward together,
Then success takes care of itself."

Henry Ford

By nature, human beings are competitive and ambitious for the excellence in all athletes’ performance. Not only every man but also every nation wants to show their supremacy by challenging the other man or nations. This challenge stimulates, inspires and motivates the entire nation to sweat and strive to run faster, jump higher, throw faster and exhibit greater speed, strength, endurance and skills in the present competitive sports world.

This can only be possible through scientific, systematic and planned sports training, as well as, channelizing them into appropriate games and sports by finding out their potentialities (Carl & Daniel, 1969).¹

Sports by their nature are enjoyable, challenging and absorbing, and require a certain amount of skills and physical condition (Dineash Seten et. al., 1956).² In the order of human values, conquest in the field of sports holds a unique plane. It is the combination of success, victory, triumph and domination of mover other team mates and friends. The sublimity of competition is in the loser’s acclaim for the winners, which along with the friends will acknowledge both defeat and triumph³.

Volleyball has become a very popular game throughout the world. It has the world’s second most popular sports and it is an international game that requires great skill and complex strategy, but it can be adapted to any level of play and it is always fun (Dumphy & Wilde, 2000).⁴ Volleyball, which is an excellent team sport, has been widely accepted as a highly competitive, as well as, recreational game throughout the

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world. It is now recognized as one of the most breathtaking and dramatic sport of the Olympics, both from the players and spectators viewpoint.

Volleyball is the game that is played by all ages and both sexes indoor and outdoor. It is highly competitive and requires high level of fitness. Competitive Volleyball is all action game with none of the players acting as involuntary spectators as seen in the others games. The popularity of volleyball has grown in the past two decades and the game continues to build momentum at all competitive levels (Scates and Linn, 2003).

The game is one of the leading sports, as far as; the registered players and millions of spectators are concerned. At the time of the inception of this great game of volleyball, it was merely a recreational one. But in the last few decades, it is considered as one of the most breath holding and dynamic sport in the world.

Today, volleyball occupies a place among the most popular sport in the world. It caters to the highest level of competition for players of both sexes of different age groups, providing thrilling and spectacular environment to spectators and above all it enjoys the status of a very healthy recreational sport for people of all groups till date. Volleyball, as one of the most amazing sport, includes fast movements, jumpings, landings and sudden shifts which need high power and strength for optimized performance (De almeida & Soarres, 2003).

Volleyball is a sport played by two teams on a playing court divided by a net. There are different versions available for specific circumstances in order to offer the versatility of the game to everyone. The object of the game is to send the ball over the net in order to ground it on the opponent's court, and to prevent the same effort by the opponent. The team has three hits for returning the ball (in addition to the block contact). The ball is put in play with a service: hit by the server over the net to the opponents. The rally continues until the ball is grounded on the playing court, goes "out" or a team fails to return it properly. In Volleyball, the team winning a rally

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scores a point (Rally Point System). When the receiving team wins a rally, it gains a point and the right to serve, and its players rotate next position clockwise.

Though, it is also widely played as a relaxation and recreational game, it involves high competition which requires the highest level of physical fitness, technical and tactical perfection with a strong mental make-up.

The main elements of modern volleyball are the velocity and variety of play, height of action above the net and perfection of skill. These elements are achieved through systematic, scientific and extensive training imparted by highly qualified coaches and trainers with scientific support from various fields.

During the past few decades' volleyball game has changed tremendously, not only in rule, techniques and concepts but also in the physical and anthropometrical measurements of the players.

In volleyball, technical and tactical skills, anthropometric characteristics and individual physical performance capacities are most important factors that contribute to the success of a team in competitions (Hakkinen, 1993). Volleyball players require well-developed muscular strength, power and endurance, speed, agility, and flexibility, and have a high level of jumping ability, fast reaction time and swift movements. Considerable demand is also placed on the neuromuscular system during sprints, jumps (blocking and spiking), and high-intensity court movements that occur repeatedly during competition.

Versatility and speediness are the trend of development in modern volleyball sport. “Versatility” means that the athletes should not only be well-prepared for their specific position, but also possess’ high level of all-round skills in serving, setting, spiking, blocking and defense. “Speediness” requires the athletes to be able to move quickly to the optimal place on the court. Speediness and agility in tactics, as the key

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factors, work together to make suddenness the feature of modern volleyball sport (Huang, 1992)\textsuperscript{13}.

Optimal physique is apparently an advantage to volleyball performance. Only when a volleyball team is collectively equipped with the entire ideal anthropometric characteristics can the team win the dominance in a game (Chen, 2005)\textsuperscript{14}.

Volleyball is a unique game where all the players have to play the six positions in the court. Every player should change his position in turn except the libero, which means every player on the court should be able to serve, set, pass, spike and block. So it is essential for the players to possess physique and physical performance that allow them to play their roles most effectively. Therefore, the physical fitness level should be the same for all the players. Optimal physique is apparently an advantage to volleyball performance. Only when a volleyball team is collectively equipped with all the ideal anthropometric characteristics can the teams win the dominance. The height over the net is a decisive factor for volleyball, determined by the athletes’ stature and jumping height, and shown in blocking height and spiking height. All these bring forward the demand for specific physique of volleyball athletes.

The height over the volleyball net always means the mastery of the game. The height is decided by the combination of an athlete’s body height and the jumping height, and is usually is shown in blocking height and spiking height. A team will lose its capacity of winning a score if there is a lack of predominance over the net (Tian, 2006)\textsuperscript{15}.

Today the preparation of an athlete for top notch achievement is a completely dynamic state characterized by a high level of physical and physiological efficiency and degree of perfection of the necessary skills and knowledge, technique and tactical preparation. An athlete arrives at this stage only as a result of appropriate training. Thus, athletes training today are a multisided process of expedient use of aggregate action so as to influence the development of an athlete and ensure the necessary level of participation\textsuperscript{16}.

\textsuperscript{13} Huang FZ (1992) Training Direction for Coaches. People's Sports Press.
The players of the volleyball should be tall enough, very fast in movements and reactions, agile, flexible with a great ability to jump. The player must have an ability to jump many times as at the net or from the outside of the attack line or from the service area. The advanced performers of this game are required to perform all the skills with minimum possible errors. Volleyball is the game of transition from defense to offence and vice-versa.

In modern volleyball, there is a strong demand of specialized players like ace attackers, setters centre blockers and specialized defensive player as libero.

There is a situation specific pattern of play in addition to specific offensive, as well as, defensive responsibilities. For a success, over an equally trained and efficient opponent, the importance of individual group and team tactics in all parts of the game is all the more important.

Volleyball is an excellent team sport which requires the player's specific responsibilities in a concrete, planned and systematic offensive and defensive pattern of play. In addition to those, players' action is largely determined by the action of opponent.

The game of volleyball gives a broad opportunity for the improvement of explosive strength, speed, agility, flexibility, neuro-muscular skills and coordination in relation to every movement like jumping, running, bending and all other combining related movements.

Height and reach are the most important factors in today's game. The players having extraordinary heights like more than 2 meters are dominating the game. It is vitally important to spike, block or to set the ball high above the net than the opponent. Height of action above net call for tall players, good jumping ability and perfect skills for spiking, blocking, setting and even at the time of servicing (hitting) the ball as high as possible.

Specific physical characteristics or anthropometric profiles indicate whether the player would be suitable for the competition at the highest level in a specific sport or not (Claessens, L. et. al.).
Anthropometric measurement is defined as a set of noninvasive, quantitative techniques for determining an individual's body fat composition by measuring, recording, and analyzing specific dimensions of the body, such as height and weight; skin-fold thickness; and bodily circumference at the waist, hip, and chest\(^\text{17}\).

Anthropometric parameters are of great importance in the selection of appropriate athletes for appropriate sports. The primary reason for determining an athlete's body composition is to obtain information that may be beneficial in improving athletic performance\(^\text{18}\). Body composition and weight are two of the many factors that contribute to optimal exercise performance. Taken together, these two factors may affect an athlete's potential for success within a given sport. Body weight can influence an athlete's speed, endurance and power, whereas, body composition can affect an athlete's strength, agility, and appearance. Most athletes require a high strength-to-weight ratio to achieve optimal athletic performance, and because body fat adds to weight without adding to strength, low body fat percentages are often emphasized within many sports\(^\text{19}\).

An athlete's anthropometric characteristics represent important prerequisites for successful participation in any given sport. It has been suggested that volleyball players at different positions have different anthropometric characteristics, especially in height. Successes in sport competitions have been associated with specific anthropometric characteristics\(^\text{20}\).

Anthropometric measurements are widely used to assess and predict performance in various sports. Anthropometric measurements and morphological characteristics play an important role in determining the success of a sportsperson (Wilmore & Costill, 1999; Keogh, 1999)\(^\text{21}\). An athlete's anthropometric and physical

\(^\text{17}\) [www.medicaldictionary.thefreeonlinedictionary.com](http://www.medicaldictionary.thefreeonlinedictionary.com).
characteristics may represent important prerequisites for successful participation in any given sport (Gualdi-Russo & Zaccagni, 2001)\textsuperscript{22}.

Generally, the body dimensions of the player are understood as information on player's body built. Specifically, they may be referred to as the primary factor determining the level of player's game skills. The anthropometric parameters, either longitudinal or circumferential, of individual body segments underlie the body built, proportionality, robustness or gracile skeleton and muscular development (Urban, 2010)\textsuperscript{23}. Anthropometric measurements affect the level of athletic achievement during the competitions as there is a relationship between measurements and physical multi-level performance skills (Nabieh, Mohamed, 2010)\textsuperscript{24}.

It can be assumed that an athlete's anthropometric characteristics can in some way influence his/her level of performance, at the same time helping to determine a suitable physique for a certain sport (Carter & Heath, 1990)\textsuperscript{25}.

Anthropometric characteristics for success may not only be different from sport to sport, but also within various playing positions in team sports. The knowledge of anthropometric characteristics also allows the athlete and the coach to make adaptations in his/her training method to attain the optimal physical attributes for best performance.

In fact, the information regarding the anthropometric status of an athlete is essential for two main reasons, firstly, to design an effective training program, and, secondly, to select the event-specific talents in the athletes. Some anthropometric characteristics, e.g. length and breadth measurements, are genetically determined and can hardly be changed with the effects of a training program. Various anthropometric characteristics were found to be closely associated with excellent performance\textsuperscript{26}.

Physical fitness is an inseparable part of sports performance and achievements. The quality of its utilization value is directly proportional to the level

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\textsuperscript{26} Mikulic, P. (2008). Anthropometric and physiological profiles of rowers of varying ages and ranks. Kinesiology, 40(1), 80-88.}

of performance. That means the greater the level of fitness, the greater the ability of a person to attain higher level of performance\textsuperscript{27}.

Physical structures of volleyball players are mainly assessed through measuring anthropometric parameters such as standing height, body mass index and some other physical factors related to performance skills like jumping ability, agility, strength and endurance (Zhang, 2010)\textsuperscript{28}.

Uppal defines physical fitness as “The capacity to carryout reasonably well various forms of physical activities without being unduly tired and includes qualities important to the individual’s health and well being\textsuperscript{29}.”

Physical fitness is, in a very broad sense, determined by the individual’s capacity for optional work and motor and sport performance (Astrand & Rodahl, 1986)\textsuperscript{30}. The United States President’s Council on physical fitness and sports defined the terms physical fitness as “the ability to carry out daily tasks with vigor and alertness without undue fatigue, with ample energy to enjoy leisure time pursuits, and to meet unforeseen emergencies” (Clarke, 1971)\textsuperscript{31}.

Physical fitness is an inseparable part of sports performance and achievements. The quality of its utilization value is directly proportional to the level of performance. That means the greater the level of fitness, the greater will be the ability of a person to attain higher level of performance. Players are required to have good physical fitness that will enable successful performance at the competitive level. The sport specific technical skills in sports are predominant factors. The physical fitness of a player, however, can be a decisive determinant of success during competition (Smekal et al., 2001)\textsuperscript{32}.

The game of Volleyball offers opportunities for the development of strength, endurance, speed, agility, and neuro-muscular skills and immediate action along with

\textsuperscript{28} ZHANG, Y. An investigation on the anthropometry profile and its relationship with physical performance of elite Chinese women volleyball players, MSc thesis, Southern Cross University, Lismore, NSW; 2010.
\textsuperscript{29} A.K, Uppal,” Physical Fitness – How to Develop”, (New Delhi, Friends Publication (India), 1990), p.4
many precise educational outcomes. The game of volleyball requires a conditioning programme, which develops flexibility, muscular strength, power and agility, all of which must be integrated to achieve the optimum skill performance from each player.

The game provides an ample opportunity for the development of strength, speed, endurance, agility, neuro-muscular skill and coordination by various actions involved in it. Such actions are running, jumping, bending, stretching and other movements, which call for balance and carryout values, and thus it meets all the requirements of an excellent form of physical activity.

Nowadays, elite volleyball players are quicker, stronger and in better physical condition than before which could be a result of year-round training and developing skills that add strength, power and fitness specific to their sport (Scates and Linn, 2003).

Anthropometric and physical parameters have been found to discriminate among successful athletes in different sports. However, work with pre-adolescent athletes has demonstrated clearly that the identification of talented performers is not possible by anthropometrical and physical measures before the adolescent growth period due to their instability. Talent detection and identification models that rely on anthropometrical and physical measures would only work if the measurement of the key variables occurred once it was known that their relative values between individuals were stable. Gender difference at the onset of peak values would also need to be acknowledged. Unfortunately, such models would be problematic to develop due to the stability of many factors e.g., posture, flexibility and speed which are accepted as being important to success in various sporting events, since they have not been studied in a systematic way. Further, the delayed identification of individuals into sports would likely be resisted due to clear correlation that has been established between the number of years of deliberate practice and success. Additionally, whilst anthropometrical and physical talent detection and identification models determinants of performance rather than potential, recent research, has questioned the ability of

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physiological and anthropometrical factors to distinguish among athletes in different events.

Volleyball is a team sport which requires specific anthropometric characteristics of players for elite performance, particularly in relation to dominance over the net. Volleyball coaches have been paying greater attention on anthropometric characteristics in recruitment of potential players. In sports related research, anthropometric methods are widely applied in the recruitment of potential athletes. There is a lack of information regarding the anthropometric and physical performance variables of volleyball players playing on different positions.

OBJECTIVES OF THE STUDY

For the purpose of analysis of anthropometric and physical parameters of volleyball players playing at different positions, the following objectives have been framed:

- To compare the anthropometric and physical parameters of volleyball players playing at different positions.
- To develop anthropometric and physical profile of national level male volleyball players position wise (Attacker, Blocker, Universal, Setter and Libero).
- To develop a logistic regression model for obtaining the significant parameters contributing to different playing positions in volleyball.

RESEARCH QUESTIONS

The entire analysis in this chapter has been carried out in order to address the following three research issues:

- Is there any significant difference in anthropometric and physical variables of volleyball players playing at different positions?
- What are the unique characteristics of anthropometric and physical parameters of volleyball players in respect to their playing position?

What are the contributions of different parameters towards different playing positions in volleyball?

**DELIMITATIONS**

For effective control, reliable results and feasibility, the area of the study was delimited to certain extents, which are mentioned below:

The present study was delimited to:

- National male Indian volleyball players with their age ranging between 19 - 33 years.
- Anthropometric and physical parameters of volleyball players at different positions.

<table>
<thead>
<tr>
<th>Anthropometric Variables</th>
<th>Physical Variables</th>
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<tbody>
<tr>
<td>1. Height</td>
<td>1. Speed</td>
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<tr>
<td>2. Weight</td>
<td>2. Explosive Leg Strength</td>
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<td>3. Arm Length</td>
<td>3. Shoulder Strength</td>
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<td>5. Palm Width</td>
<td>5. Flexibility</td>
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<td>6. Arm Girth Relaxed</td>
<td>6. Abdominal Strength</td>
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<td>7. Arm Girth Flexed</td>
<td>7. Body Composition</td>
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<td>8. Fore arm Circumference</td>
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<td>9. Wrist Circumference</td>
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<td>10. Chest Circumference</td>
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<td>11. Thigh Circumference</td>
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<td>12. Calf Circumference</td>
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<td>13. Ankle Girth</td>
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<td>14. Leg Length</td>
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<td>15. Foot Length</td>
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The study was further delimited to the following positions:

- Attacker
- Blocker
- Universal
- Setter
- Libero
LIMITATIONS

Certain factors like regions, age, dietary patterns, daily routine, lifestyle, habits etc, which might have had an effect on the results of the study couldn’t be controlled and therefore these were considered to be the limitations of the study.

HYPOTHESES

On the basis of available literature, available research finding, expert’s opinion, researcher’s own understanding of the problem, it was hypothesized that:

- There will be a significant difference in anthropometric and physical variables of volleyball players in different positions.
- The logistic regression model developed for finding the likelihood of a subject to become a good volleyball player in different positions will be significant and efficient.

DEFINITION AND EXPLANATION OF TERMS

Volleyball positions determine what your role is out on the court during a game. Each player has a specific job to do and each position works with the teammates to make the best play possible. Three of the players are positioned on the front court and three on the back court. Players have to rotate clockwise whenever their team wins serve so their positions on the court will change.

Setter:

The setter’s main job is to put the ball in the perfect place for the attackers. Typically they will take a pass from another player and take the second touch. They will try to put the ball softly in the air at just the right height for an attacker to spike the ball into the opponent's court.\(^{37}\)

Attacker:
The attacker (opposite hitter) attack from near the left antenna. The outside hitter is usually the most consistent hitter of the team and scores the most points in the team. He carries the responsibility of hitting the ball against a solid block when the pass is off the net.

Libero:
The libero is a fairly new position in volleyball. The libero is a back row specialist who is allowed to play back court only. The libero wears a different color shirt in the team and is allowed to enter and exit the game without substitution request. The libero can replace any player on the court and most often replaces middle blockers. The libero is not allowed to serve the ball.

Blocker:
Blocker is usually a very tall member of the team. Plays mostly in middle front and perform very fast attack that usually takes place near the setter. He is specialized in blocking, since he must attempt to stop equally fast plays from his opponents and then quickly set up a double block at the sides of the court.

Speed:
The Oxford dictionary of Sport Science and Medicine defines speed as “the ability to perform a movement quickly”. In volleyball, speed of movement of various body segments and running speed for a very short distance are of great importance.

Agility:
Agility is “the ability to change the body’s position rapidly and accurately without losing balance”. It is the ability to change the direction of the body and its parts rapidly. Agility is a combination of several athletic traits such as recreation time, strength, speed, movement, power and coordination. Its display becomes essential in such movements as dodging, zigzag, running, stopping and changing body positions quickly.

Flexibility:

Flexibility is "the range of movement possible around a joint or a series of joints". According to the Oxford Dictionary of Sport Science, flexibility is "the ability to move a joint smoothly through its complete range of motion".

SIGNIFICANCE OF THE STUDY

1. This study may help in enhancing the knowledge bank regarding anthropometric and physical variables of volleyball players according to their positions.

2. The result of the study may reveal the extent to which physical and anthropometric characteristic will support an individual to become outstanding volleyball player.

3. The result of the study may be used as a screening tool in assessing the quality of player's position wise on the basis of physical and anthropometric variables.

4. This study may help the physical education teachers and coaches to develop training program for the volleyball players to achieve excellence.

5. The finding of this study may give certain guidelines based on anthropometry and physical parameter for selecting the proper player for a particular position.

6. It may be helpful for giving conditioning program and selecting scientific training methods according to their playing positions.