Chapter I

INTRODUCTION

Volleyball is relatively new as a competitive sport. The intent of its inventor, William Morgan, was to create a mild, non-contact, recreational activity that middle aged businessmen could play safely during their noon hour break (Schondell, 2002). Once enjoyed as a casual and recreational game, volleyball has developed into a powerful and complex athletic sport with techniques and tactics constantly being refined to higher levels (Gozansky, 1988). Ever since the transition from a recreation sport to a competitive event, it gradually evolved from a sport requiring motor skills and well developed physical abilities. Volleyball began to be more and more competitive with high physical, technical and tactical performances. The popularity of volleyball has grown in leaps and bounds in the past two decades, and the game continues to build momentum at the professional collegiate and scholastic level (Scates and Linn, 2003).

The quest for performance excellence in volleyball is increasing. Those associated with the sport, including players, coaches, administrators, parents, spectators, sports medicine experts, officials, media and sponsors constantly search for strategies that will make the game, grow (Kluka and Reeser, 1998). During the past decade volleyball has changed tremendously, not only in rules, techniques and concepts, but also in the physical abilities of the players. Perhaps more than any other sports, power volleyball allows expression of the player’s fullest capabilities. There is no reason to believe that the future will hold any less change and development (Selinger and Ackermann, 1986).

Performance in volleyball depends to a great extent on the successful execution or effectiveness of techniques. The different techniques involved in volleyball have their own different physical requirements. Each technique consists of specific physical elements that must be maximally developed if optimal performance is to be obtained. Consequently the players must work on a wide
ranging training programme to enhance their biomotor abilities (Gionet, 1981).

The recent international competitions demonstrated the trend in selection of players on the basis of physical characteristics in relation to specialization and game requirements. The specialized blockers who have more than 2.10 meters average height with good jumping ability started governing the net even in the Junior World Championships. This tendency made inevitable the spikers to have the identical physical characteristics as well as tremendous jumping ability to beat the blockers.

"Unloading of a powered arc
Preciseness at a critical moment
Force hammered object

............the smash" to quote Gibbs (1989) in ‘Smash’

The spike is one of the most thrilling and exciting offensive aspect of the game of volleyball for both the participants and the spectators. The ability to execute a powerful, well-placed spike is a vital offensive skill which is essential for successful individual and team performance in the game of volleyball. Since proper execution of the volleyball spike involves highly integrated and co-ordinated movement patterns, on and off the playing surface, is one of the more difficult skills to master.

The block is a team’s first line of defense. Blocking is a very explosive, dramatic manoeuvre that serves several functions. The primary function of the block is to intercept an attacked ball, either returning to the opponent’s court for a point or deflecting the ball upward and back to the court defense. Another important function of the block is to screen certain areas of the court, influencing the direction of opponent’s attack and reducing the court area that the floor defense must cover (Zeigler, 1982).

There is a significant relationship existing between the ability to reach higher above and top of the net and the spiking and blocking abilities of the players. The reach of the player during spiking and blocking is the product of his
stature and jumping ability. Though the spike jump and block jump differ in movement structure, both jumps are vertical in nature. In spiking, players use two to four steps of approach in order to develop a greater horizontal momentum which is converted into vertical momentum during take off to increase the jumping reach. In blocking, the player has to jump from the static position, or by moving towards either side, with an abbreviated arm swing.

In order to be acknowledged as a successful performance, it is important to see which are the factors contributing to that performance. In volleyball spike jump there are many important contributing factors which enable an efficient execution of the skill. In general terms, the height of a jump depends on the interaction between the physical and technical abilities of the jumper (Gambac, 1971). Physical abilities determine the potential of the jumper and the technique is the degree to which the potential is realized (Dusault, 1983).

The ability to rapidly generate force is of obvious importance in jumping performance. The relationship between the rate of force development and athletic performance has received equivocal support from researchers. (Viitasalo and Aura, 1984) reported a strong relationship between the average values of rate of force development for the quadriceps muscle group and high jumping performance, for eight nationally ranked high jumpers (Bloomfield et. al, 1994).

The explosive strength is believed to be a major contributing component to the jumping ability. Generally strength is being tested through the tests involved in isotonic and isometric means of muscle contractions. Both the testing procedures have some limitations. The isotonic tests are performed against fixed resistance in which the ability of the muscles to overcome resistance at the weakest point in the range of motion is tested. Another disadvantage of these tests is that the muscles cannot be tested at the same speed of contraction in which they usually contract in a given movement. Since in isometric means of testing, muscles contract statically, it cannot be used for testing the explosive strength.

Isokinetic tests record the torque produced throughout the entire range
of motion and allow for the identification of regions of strength or weakness within the range. In contrast, isometric tests typically give a single, representative value for the entire movement, while isometric tests are specific to a single joint angle. Recent innovations, combined with the unilateral nature of many of the isokinetic machines allow these systems to assess strength differences between alternate limbs, agonistic and antagonistic muscle groups and eccentric versus concentric movement phases.

The game of volleyball is agility sport which partially relies on leaping skills. To do well in this sport the player must be extremely agile and able to jump, so special proportions are needed to do this. These players must be tall, have long upper limbs, lower limbs and trunks and display a high crural index, that is, long lower legs in comparison to the length of their thigh. (Bloomfield et. al, 1994).

The measurement of structure and proportion of the body are called anthropometry. It has wide application as one of the essential parameters constituting the selective diagnosis of any game or sports. Measurement of body size include such descriptive information as height, weight and surface area, while measurement of body proportion describes the relationship between height and weight and among lengths, widths and circumference of various body segments. It has been found that top athletes in some sports tend to have those proportions that biomechanically aid the particular performance required (Zeigler, 1982). Apart from other factors various specific anthropometric measurements also seems to be influencing the jumping ability of the players. Shondell, (1975) established the relationship of selected anthropometric traits to successful volleyball players. Exceptions apart, most of the studies conducted in this area reveal anthropometric measurements influence the performance in volleyball. In the view of the new trend in player selection, assigning high rank for height and disregarding other aspects which used to occupy a primary role, it would be interesting to know the importance of standard anthropometric measurements in jumping performances.

It is a known fact that success of volleyball actions near and above the net greatly depend upon the reach of the player above the net which is the result of
his stature and jumping ability. Researches in the past analysed the influence of anthropometric measurements on a much wider aspect—the volleyball performance as a whole. No attempts have been made to find out the role of anthropometric measurements on varied types of jumps, since jumping ability adds to the reach and ultimately contributes to the performance in volleyball. It is especially relevant, taking account of the increase in the average height of elite players during the past two decades.

Physical fitness is a complex mixture of many interrelated factors, each important in its own way. One of the factors is flexibility—perhaps the most neglected aspect of many fitness programmes. Flexibility training is being increasingly recognized as crucial for complementing muscular strength and coordination and preventing injuries. Flexibility means the range of limb movement around joints. Flexibility plays an important part in the preparation of athletes by developing a range of movement to allow technical development and assisting in the prevention of injury (Mackenzie, 2003).

In a highly ballistic sport like volleyball, range of motion and storage of elastic energy are very important. These qualities suppose the capacity of the muscle or group of muscles, both at maximum shortening and at maximum elongation, to allow the maximum utilization of joints. It is a well established fact that flexibility is very specific to each joint. Although classified in the family of muscular qualities, flexibility is mainly limited by the concerned joint structures. Above and beyond this first determining factor, the present ability is also influenced by the extensibility of muscles or groups of muscles submitted to elongation.

Motor coordination is a complex biomotor ability associated with the process of regulation and execution aspect of a movement. The coordinative ability finds expression in the ability of the player to do movements with better quality and effect. The extent to which flexibility and coordinative abilities are developed will determine the maximal utilization of conditional abilities and technical skills. Performance requiring strength necessarily requires developing co-
ordination of strength as in the case of jumping. The development level of other biomotor abilities, such as speed, strength, endurance and flexibility, impact coordination because there is such a close relationship among them. A poor ability in one area represents a limiting factor on perfecting coordination. The performance of a less coordinated player is accompanied by an exaggerated strain, rigidity and wasted energy.

In strength determining sports, coordination helps in the application of maximum strength in short time at the right moment. Jumps in volleyball involve a high deal of technique; coordinative abilities contribute towards better learning, stabilization with variability and automatisation of the technique which determines maximum limits for performance improvement and ensures an effective use of technique and tactical abilities in the changing conditions (Kalb, 1989).

Previous studies have examined the biomechanical aspects of spike jump. Coutts (1978) examined the kinesiological and biomechanical aspects of block jump through his series of studies like 'Biomechanics of spike jump' and 'comparison of force time impulses for the sergeant jump and volleyball block jump'. Several studies have been done to establish inter-relationship of leg power and spiking and blocking performance (Rajkumar, 1985). However there is very little published research work to confirm the relationship of anthropometric and motor performance to various jumping performance in volleyball.

A great deal of research has been devoted by the researchers to know the contribution of anthropometric measurements and motor abilities to improve jump performance and the results provide a generalization regarding the contribution. The comprehension is that these abilities are treated in a very general manner in the completed studies, which rouse the need to study them analytically, considering their specificity in the game. In addition to this, taking into account the changing trends of the game, in the pattern of selection of talent, importance of specialization and related means and methodology of training excites a doubt in the mind of the scholar about the influence of the general aspects of these variables on predicting the different types of jumps. The standard strength tests and
anthropometric variables can have merely a moderate prediction (Ugarkovic et.al, 2002). This shows that a reliable performance assessment in a homogeneous group of sportsmen necessitates specificity in testing. Therefore, it seems that there still exists a gap of knowledge in this area. Hence this study was undertaken as an attempt to know more about anthropometric and motor performance variables and their relationship with spike jump and block jump performance in volleyball.

**Statement of the problem**

The purpose of the study was to analyze the anthropometric and motor performance correlates of spike jump and block jump in volleyball.

**Delimitations**

1. The study was delimitied to thirty youth and junior national level male volleyball players.
2. The study was delimitied to spikers and blockers.
3. The study was delimitied to the players aged between 18 and 21.
4. The study was confined to the following variables.

**Dependent variables:**

1. Spike jump
2. Block jump from static position
3. Block jump with side stepping
4. Block jump with cross stepping

**Independent variables:**

Strength variables:

1. Trunk flexion
2. Trunk extension
3. Right shoulder flexion peak torque 60 degrees/second
4. Right shoulder flexion peak torque 180 degrees/second
5. Right shoulder flexion power 60 degrees/second
6. Right shoulder flexion power 180 degrees/second
7. Left shoulder flexion peak torque 60 degrees/second
8. Left shoulder flexion peak torque 180 degrees/second
9. Left shoulder flexion power 60 degrees/second
10. Left shoulder flexion power 180 degrees/second
11. Right shoulder extension peak torque 60 degrees/second
12. Right shoulder extension peak torque 180 degrees/second
13. Right shoulder extension power 60 degrees/second
14. Right shoulder extension power 180 degrees/second
15. Left shoulder extension peak torque 60 degrees/second
16. Left shoulder extension peak torque 180 degrees/second
17. Left shoulder extension power 60 degrees/second
18. Left shoulder extension power 180 degrees/second
19. Right hip flexion peak torque 60 degrees/second
20. Right hip flexion peak torque 160 degrees/second
21. Right hip flexion power 60 degrees/second
22. Right hip flexion power 160 degrees/second
23. Left hip flexion peak torque 60 degrees/second
24. Left hip flexion peak torque 160 degrees/second
25. Left hip flexion power 60 degrees/second
26. Left hip flexion power 160 degrees/second
27. Right hip extension peak torque 60 degrees/second
28. Right hip extension peak torque 160 degrees/second
29. Right hip extension power 60 degrees/second
30. Right hip extension power 160 degrees/second
31. Left hip extension peak torque 60 degrees/second
32. Left hip extension peak torque 160 degrees/second
33. Left hip extension power 60 degrees/second
34. Left hip extension power 160 degrees/second
35. Right knee flexion peak torque 60 degrees/second
36. Right knee flexion peak torque 180 degrees/second
37. Right knee flexion power 60 degrees/second
38. Right knee flexion power 180 degrees/second
39. Left knee flexion peak torque 60 degrees/second
40. Left knee flexion peak torque 180 degrees/second
41. Left knee flexion power 60 degrees/second
42. Left knee flexion power 180 degrees/second
43. Right knee extension peak torque 180 degrees/second
44. Right knee extension peak torque 180 degrees/second
45. Right knee extension power 60 degrees/second
46. Right knee extension power 180 degrees/second
47. Left knee extension peak torque 60 degrees/second
48. Left knee extension peak torque 180 degrees/second
49. Left knee extension power 60 degrees/second
50. Left knee extension power 180 degrees/second
51. Right ankle dorsiflexion peak torque 60 degrees/second
52. Right ankle dorsiflexion peak torque 180 degrees/second
53. Right ankle dorsiflexion power 60 degrees/second
54. Right ankle dorsiflexion power 180 degrees/second
55. Left ankle dorsiflexion peak torque 60 degrees/second
56. Left ankle dorsiflexion peak torque 180 degrees/second
57. Left ankle dorsiflexion power 60 degrees/second
58. Left ankle dorsiflexion power 180 degrees/second
59. Right ankle plantar flexion peak torque 60 degrees/second
60. Right ankle plantar flexion peak torque 180 degrees/second
61. Right ankle plantar flexion power 60 degrees/second
62. Right ankle plantar flexion power 180 degrees/second
63. Left ankle plantar flexion peak torque 60 degrees/second
64. Left ankle plantar flexion peak torque 180 degrees/second
65. Left ankle plantar flexion power 60 degrees/second
66. Left ankle plantar flexion power 180 degrees/second
Speed

Flexibility variables:

1. Right shoulder flexibility
2. Left shoulder flexibility
3. Right hip flexibility
4. Left hip flexibility
5. Right ankle flexibility
6. Left ankle flexibility

Coordinative ability variables:

1. Reaction ability
2. Kinesthetic differentiation ability

Anthropometric variables:

1. Weight
2. Height
3. Sitting height
4. Total arm length
5. Upper arm length
6. Forearm length
7. Total leg length
3. Thigh length
4. Lower leg length
5. Foot length
Limitations

1. Lack of proper and advanced tests and measurement procedures was considered as limitation of the study.
2. No motivational technique was used to motivate the subjects and the difference in the performance due to lack of motivation was considered as a limitation of this study.
3. The life style, dietary habits, and climatic conditions might have influenced the performance of the subjects were considered as the limitation of this study.

Hypotheses

On the basis of available research findings, experts’ opinion and scholar’s understanding of the problem, it was hypothesized that:

There will be positive correlation between anthropometric and motor performance variables to spike jump and block jump performance.

Definition and explanation of terms

Three stride approach spike jump

An approach runs of three strides used by the spiker to increase the horizontal momentum during the spike (Cox, 1982).

Block Jump

A specific technique of vertical jump employed by one or more front line players during the block to intercept the progress of a hard/soft ball or spiked ball (Cox, 1982).
Anthropometric measurements

Anthropometric measurements are dimensions of the structure of the human body taken at specific sites to give measures of length, girth and width (Mathews, 1978).

Flexibility

Flexibility is the ability of an individual to move the body and its parts through as wide a range of motions as possible without undue strain to the articulation and muscle attachments (Johnson and Nelson, 1982).

It concerns degree of movement and it limits the degree to which the body parts can bend or twist by means of flexion and extension of muscles. This degree of movement depends on the flexibility and extensibility of the muscles and ligaments surrounding the particular joint (Barrow and McGee, 1979).

Isokinetics

Exercise with an accommodating resistance and a fixed speed (Brown, 2000).

With an isokinetic machine an individual works at a fixed velocity against resistance that automatically accommodates to the force an individual is capable of producing at any point in the range of motion.

Torque

A force that produces or tend to produce a rotation about a point or axis, usually measured in units of Newton-meters (Nm) or foot-pounds. Often used as a synonym for moment, is the tendency or measure of tendency to produce motion, especially about a point or axis (Brown, 2000).
Peak torque

Peak torque represents the single highest point on the torque curve (Brown, 2000).

Power

Work per unit time; that is, power = f d, usually reported in units of watts (Brown, 2000).

Co-ordinative abilities

Co-ordinative abilities are relatively stabilized and generalized patterns of motor control and regulation process. These enable the sportsman to do a group of movements with better quality and effect (Singh, 1995).

Speed

Speed is the capacity of the individual to perform successive movement of same pattern at a fast rate (Barrow and McGee, 1979).

Significance of the Study

Since performance specificity has emerged as a new discipline of the present system of sports, it necessitates a high degree of perfection in the talent identification system. The performance divergence as the result of specialization demands players to have different performance pre-requisites, which may be very much different from the general performance standard. At the elite level, the successful performance not merely depends on one or two basic performance traits, it also relies on many more elements which individually as well as collectively contribute to the performance standard. Hence it is quite logical to analyze the two techniques of jumps with variations to find out the factors contributing specifically to each and also their interrelationships.
The study will make the following contributions:

1. The findings of the study will help to identify the factors contributing to spike jump and block jump.
2. The result of this study is likely to throw light on the motor abilities needed to develop and improve spike jump and block jump.
3. The study will help the coaches and trainers to develop an effective individualized training programme to improve spike jump and block jump.
4. The result of this study may help the players to choose their specialization in front row.
5. This study may motivate other scholars and volleyball lovers to take up in depth studies in this direction.