**Review of Literature**

The Researcher had undergone a vast survey of related literature. She had appraised various journals, books, periodicals etc. related with various aspects of this study. The important studies having specific relevance with the undertaken study are cited below.

*Hirata (1966)* studied 116 Olympic volleyball players who were found to be tall and lean. Their average height was 183.8cm and weight 79kg respectively. Less rating of endomorphic component than the controls, considerably greater length of the trunk, broad shoulders and hips, greater size of hand span, larger chest, upper arm, thigh and calf circumference than the control. All the above characteristics mechanically help for better performance.

*Lamp (1954)* conducted a study on Junior high school boys and girls and found positive correlations between the volleyball playing ability and age, height, weight and strength.

*Sodhi (1980)* collected data of different levels of volleyballers and found that with increase in the standard of the game the average stature of the players was greater. This means tall players have a natural advantage in performance. However, the volleyballers are not as tall as the basketballers on the whole.
Sodhi and Sidhu (1984) noted that the players in the Indian national volleyball team dominated other groups in all anthropometric measurements. They were lighter in proportion to stature with proportionately shorter trunks, longer lower extremities, smaller chest, and narrow hips. The rating of endomorphic and mesomorphic components was lower, but that of ectomorphic component was higher in their case. They had greater musculo-skeletal tissue in the thigh relative to the upper arms and possessed wider knees relative to the elbows than players of lower standards however; the amount of body fat was least in them.

The state level volleyballers, when matched with the controls, showed almost the typical body characteristics as those of the national team players, but with a smaller degree of pronouncement than the latter.

Sodhi et al. (1990) conducted a study on the north Indian junior volleyball players aged between 16 to 18 years. The results were based on the cross-sectional data of 90 volleyball players and 94 control subjects. The data were divided age-wise into three subgroups of each category. The results of the study revealed that the volleyballers in each age group were significantly taller and heavier than the controls. But amongst volleyballers the difference in height were found to be statistically non-significant between the three ages group. The possibilities of developing national and international level aspirants from amongst the players in the study were also discussed.
The volleyballers in each age group possessed considerably greater length of their trunk, broader shoulders and hips, wider humerus and femurs, greater size of hand span, larger chest, upper arm, thigh and calf circumference than the controls. The differences were statistically significant in most of the cases. The skin fold showed almost similar status except the biceps and sub-scapular skin folds showing significantly greater value than the controls in the 16 years age group. In somatotype the 16 years volleyballers were significantly more endomorphic than the controls of same age. But the other groups showed similar status. In mesomorphy the 16 and 18 years volleyballers were considerably better developed than the controls. On the other hand in ectomorphy the sporting children had lower score than the latter. On average, the volleyballers were found to be meso-ectomorph.

*Phul et. al, (1982)* determined the basic physical characteristics of male volleyball players and found that they were taller, heavier, had a higher body density and lean body weight and lower body fat. They also concluded that the volleyball players achieved greater absolute height in jump and reach and a greater jumping height above the standing reach. Considering as a percentage of the net height (2.43m for men and 2.24m for women measured from each court), the absolute jump and reach values were 130% and 124% of the respective net heights.
John et al., (1988) studied the physique of elite volleyball players of different countries and found that among these volleyball groups, the U.S.A. group was tallest, heaviest and largest in measures of upper and lower limb lengths. The Korean group was largest in stem height and calf girth.

Mokha and Sidhu (1988) took anthropometric measurements of Indian female volleyball players having International level of participation. They found that the volleyballers were taller and heavier than the controls. The taller stature of volleyball players was mainly due to the longer lower extremity because the mean values of the sitting height in both the groups were almost comparable. Upper extremities were also longer for volleyball players and they also possessed broader shoulders, wider knees and wrist.

In similar study Heimer, Misigoj and Medved (1988) reported that the performance in volleyball was largely influenced by anthropometric parameters, leg explosive strength and anaerobic capacity.

Sodhi et al. (1987) studied the somatotype and body composition of one hundred twenty two different level volleyball players. They found average values of somatotype components for national, state, university and district level players. Different group of volleyball players exhibited significantly lesser amount of percentage of body fat than the controls.
**Abel et. al, (1987)** compared basketball players and volleyball players in selected anthropometric parameters. They found that the basketball players were significantly taller and having larger humerus diameter then the volleyball players. Volleyball players were found to be significantly taller than the non-athletes. The somatotype distribution of the subjects showed that both basketball and volleyball players were significantly more ectomorphic than non-athletes.

**Shamim Parvez (2002)** carried out a study to ascertain the difference between physical and physiological variables of high and low performance basketball players and found that the high performance basketball players had greater height, weight, lower leg, thigh, upper arm and lower arm length. They had greater shoulder and hip width and greater calf and biceps muscle girth with greater diameter of humerus and femur biepic condyle. They are meso-ectomorph and their sitting height is greater than low performance basketball player. They had lesser sum of four-skin folds measurement than that of low performance basketball players.

High performance basketball player had better body proportionality in relation to mechanical advantage. They also had lesser heart rate and greater vital capacity. However there was no significant difference in the blood pressure of high and low performance basketball players.
Monyeki M. et al. (1988) designed a study to describe and compare the somatotype characteristics of first division college basketball players of South Africa with their counterparts in other parts of the world. College basketball players of Nigeria were reported to be mesomorphic, while Sam Diego state university players were reported to be ectomorphic. The rationale of the study was that regular participation brings somatotype similar to top basketball player in the world.

Sodhi (1980) studied the top-ranking national basketball players and found that with the increasing standard of the participants the average stature was greater. The top class teams in the world have a greater average height than the teams of lower standard. A significant correlation was seen between the stature and performance in the competition. The value of correlation was very high with the field basket scores. Thus greater the stature of a basketballer, the better will be his performance.

The Olympic basketball players are the tallest followed by the national team, the state level and district level players (Sodhi & Sidhu, 1984). The controls were shortest among all. In general there was a gradient of decreasing body viz from the national team players to states level players through the district level players and the controls. The first mentioned were found to have proportionally long upper and
lower extremities, shorter trunk, broader hips and more slender chest. The somatotype indicated that the rating of ectomorphic component was greater in the case of the state level players than in the case of other groups. However, it is interesting to note that the rating of mesomorphic component was not greater in these players. The Indian basketballer were, therefore, less muscular than their Olympic counterparts. The lack of ecto-mesomorphic physique among Indian may be a limiting factor for their better performance in the international competitions.

In body composition, the basketballer had less of body fat than the controls. The state level players seemed to be less fatty, with more strongly developed knees and a better-developed musculature in the limbs.

Garay et. al., (1974) observed that the Mexican Olympic basketballers were 189.1 cm tall and 79.7 Kg heavy. Many of their players were ectomorph or mesomorphs. One player had a rating of 1.5-2.5-5.6.

In this chapter, selection of subjects as per the objectives of our study, tools and techniques employed for collecting the relevant data and statistical techniques applied for its analysis are described in detail.
Selection of Subjects

Keeping in view the objectives of our study 50 subjects each from Inter-University and college level performance volleyball players of our country were selected.

Inter-University volleyball players; Were selected from;

- South zone women volleyball Inter-University held at Acharya Nagarjuna Univ., Guntur from 28 Oct - 31 Oct 2012
- All India inter zone volleyball held at BHU, Varanasi since 5 Nov - 10 Nov 2012.

Low performance volleyball players; Were selected from;


Reliability of Data

Reliability of data was ensured by establishing the reliability of anthropometrical instruments and tester’s competency.
**Instruments Reliability**

Anthropometrical kit was used for obtaining anthropometric measurements. Instruments were of standard quality; their accuracy was ensured by the manufacturer. International society for the advancements of Kinanthropometry (ISAK) approved techniques were used for obtaining anthropometrical data. The reliability was checked by test-retest method and average co-efficient was found to be 0.96.

**Statistical Procedure**

Reiterating the objective of the study we have to point out that we intend to investigate the anthropometrical differentials between Inter-University and college level women volleyball players. Thus, Z test is used to test the significance of difference between anthropometrical parameters of Inter-University and college level women volleyball players. Z test is based on normal probability distribution and is used for judging the significance of several statistical measures, particularly the mean. It is the most frequently used test in research and is generally used for judging the significance of difference between means of two independent samples, when sample size is more than 30 (C.R. Kothari, 1998).