Chapter III

Procedure
The review of relevant literature in the preceding chapter has given direction in explicitly explaining the objectives of the study and in selecting the appropriate methods to be adopted for carrying out this research.

In this chapter, the selection of subjects, tools and techniques employed for collecting the relevant data and statistical procedures, applied for the analyses of data are described.

**SELECTION OF SUBJECTS**

For the purpose of this study two groups of 70 subjects each of high and low performance basketball players were formed.

High performance basketball players were randomly selected from Indian camp, National tournaments, National camps, and All India University championship finalist.

Low performance basketball players were randomly selected from Zonal-inter-varsity tournaments, States, Districts and Inter-collegiate tournaments.

**CRITERION MEASURE**

The criterion measure for this study were –

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RELIABILITY OF DATA

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

INSTRUMENTS RELIABILITY

Anthropometric kit was used for obtaining anthropometrics measurements and Sphygmomanometer, Stethoscope and Spirometer were used for obtaining blood pressure and vital capacity respectively. 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.

TESTER COMPETENCY

As the study was the extension of investigator’s area of interest (he has prepared and presented several research papers in the related field), therefore,

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he was well versed in the techniques of taking anthropometrical and physiological measurements. The investigator had a number of practice sessions under the expert guidance of Dr. Brij Bhushan Singh, Sr. lecturer in the Dept. PH & SE, A.M.U., Aligarh. To ensure tester's competency the anthropometrical and physiological data of 10 students were correlated with those taken by Dr. Rajender Singh, Sr. lecturer, Dept. of PH & SE, A.M.U., Aligarh, under similar conditions. The average co-efficient of the measurement taken by the investigator and expert was found to be 0.95. Thus, investigator's competency was established.

**COLLECTION OF DATA**

The data in the form of criterion measure of study described above were collected in the following ways –

1. **Anthropometric parameters**

   The anthropometrical measurements of selected body parts were taken in the following way –

   **Weight:**

   The subjects were examined in clothing of known weight in order to record nude weight with the help of weighing machine.

   **Stature:**

   Stature was taken as the maximum distance from the point vertex on the head to the ground. Subject was made to stand erect with heels together and

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arms hanging naturally by the side and head in the Frankfort plane, along a wall on which was fixed a measuring tape.

**Sitting height:**

The subject was made to sit on the stool with his legs hanging down freely. The subject was asked to stretch his back as far as possible and to hold his head upright so that Frankfort plane becomes horizontal. Gentle upward pressure was applied to the mastoid processes. The muscles of the thigh and buttock were contracted in order to stretch him full. The horizontal bar of the anthropometer rod was brought down so that it touched the highest point on the head. The distance between anthropometer rod and the highest point of the stool was measured.

**Triceps skin fold:**

The mid acromiale-radiale line on the posterior surface of the right arm was marked and the skin fold about one centimeter above marked level was picked up and jaws of the calipers were applied to the fold and after waiting for 2 to 3 seconds the reading was taken. One more reading was taken in the same way and average of the two was the final score.

**Sub scapular skin fold:**

A point below the right scapula was marked. The skin fold about one centimeter below marked level was picked up and jaws of the caliper were applied to the fold and after waiting for 2 to 3 seconds the reading was taken.

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One more reading was taken by the same procedure and average of the two was the final score.

**Supra spinal skin fold:**

A point above the anterior superior iliac spine on the line to the anterior axillary’s boarder of right side was marked. The skin fold about 2 to 5 centimeter above marked level was picked up and jaws of the caliper were applied to the fold and after waiting for 2 to 3 seconds the reading was taken. One more reading was taken by the same procedure and average of the two was considered.

**Calf skin fold:**

The subject was made to sit on a chair with knees bent at right angles. Medial side of the right calf, slightly above the level of the maximum girth was marked. The skin fold above the marked level was picked up and jaws of the caliper were applied to the fold. After waiting for 2 to 3 seconds the reading was taken. One more reading was taken by the same procedure and average of the two was considered.

**Humerus bi-epicondyler diameter:**

The subject’s right arm was raised forward to the horizontal and the forearm flexed to right angle at elbow. The distance between medial and lateral
epicondyle of the humerus was measured with the help of Vernier caliper and the value was recorded.

**Femur bi-epicondyle diameter:**

The subject was made to sit and the right leg was flexed at the knee to form a right angle with thigh. The distance between medial and lateral epicondyle of the femur was measured with the help of Vernier caliper and the value was recorded.

**Biceps muscle girth:**

The subject was made to raise his right arm to the horizontal position in the sagittal plane with the fully supinated forearm flexed at the elbow to an angle of $45^\circ$. The subject was encouraged to ‘Make a muscle’ by fully tensing his biceps. The measurement was taken with the help of measuring tape wrapped at right angles to the long axis of the upper arm where the maximum girth was affected.

**Calf muscle girth:**

The subject was made to stand erect with body weight equally supported on both legs. The measuring tape was wrapped around the right lower leg and measurement was taken at right angles to the axis of lower leg where it was maximum.

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Shoulder width:

The measurement was taken of the distance between the most lateral points on the acromion process, when the subject was standing erect with the arms hanging loosely at the side. Sliding caliper was applied from behind the subject, so that branches of caliper were at an angle of 45\(^{0}\) from the horizontal plane.

Hips width:

The subject was made to stand erect with sliding caliper applied from behind the subject, so that the branches of sliding caliper were at the most lateral points on the superior border of the iliac crests.

Upper arm length:

The subject was made to stand erect with arms hanging down normally with the palm of right hand directed towards thigh. Inferior border of the acromion process and the external superior border of the head of radius was marked. The distance between these two points was measured with the help of measuring tape and the value was taken.

Forearm length:

The subject was made to stand with arms hanging down normally. Radiale and dactylion were marked on the right hand. The distance between these two points was measured with the help of measuring tape.

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Thigh length:

The subject was made to stand erect with weight equally distributed on both legs. Trochanterion and tibiale lateral of the right leg were marked. The distance between these two points was measured with the help of measuring tape.

Lower leg length:

The subject was made to stand erect with weight equally distributed on both legs. Tibiale of the right leg was marked. The distance between tibiale and floor was measured with the help of measuring tape.

2. Physiological parameters

The selected physiological parameters were taken in the following ways –

Heart Rate:

The morning resting heart rate of the subject was taken. The subject was made to sit in resting position and semi-pronates the forearm and slightly flex the wrist. Three fingertips were placed on the radial artery at the lateral border of the wrist and the pulse was counted for one minute with the help of stopwatch.

Blood pressure:

The morning blood pressure was taken. Subject was made to sit in resting position and the cuff of sphygmomanometer was wrapped around the
upper arm. The stethoscope was placed lightly over the bronchial artery in the Cubital fossa. The pressure was increased in the cuff to 30mmHg, above the level at which radial pulsation can no longer be felt. Then, the pressure was lowered in the cuff to 5mmHg, at a time until the first sound of beat was heard. This was the systolic blood pressure and was recorded. The pressure was lowered further in the cuff, until the sound became suddenly faint or inaudible. This was the diastolic pressure and was recorded.

Vital capacity:

Subject was made to sit in resting position and the mouth piece of Spirometer was put into the mouth between the lips. The subject was asked to breath normally. Then, he was asked to take deep breath followed by rapid and full expiration. The two values were taken and mean of the values was noted down.

3. Somatotype

The following Heath Carter (1984) method was applied to determine somatotype of subjects –

Endomorphy:

\[-0.7182+0.1451\times \sum SF-0.00068\times \sum SF^2+0.0000014\times \sum SF^3\]

[(Where SF= sum of triceps, subscapular and supraspinal skin folds multiplied by (170.18/height in centimeter)].

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Mesomorphy:

0.858 \times \text{humerus breadth} + 0.601 \times \text{Femur breadth} + 0.188 \times \text{corrected arm girth} + 0.161 \times \text{corrected calf girth} - \text{height} \times 0.131 + 4.5

(*Subtract the skin fold of triceps skin fold and calf skin fold from the arm girth and calf girth, respectively).

Ectomorphy:

One of these equations was used depending on the value of the calculated height weight ratio (HWR) of the subject,

\[
\text{HWR} = \frac{\text{Height in cm}}{\sqrt[3]{\text{Weight in Kg}}}
\]

➢ If HWR is greater than or equal to 40.75 then ectomorphy

= 0.732 \times \text{HWR} - 28.58.

➢ If HWR is less than 40.75 and greater than 38.25 then ectomorphy

= 0.463 \times \text{HWR} - 17.68.

➢ If HWR is equal to or less than 38.25 than ectomorphy = 0.1

Proportionality:

The following indices were used to determining various body segmental proportionalities –

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• Sitting height-Stature Index = \( \frac{\text{Sitting Height}}{\text{Stature}} \times 100 \)

• Ponderal Index = \( \frac{\text{Stature}}{3\sqrt{\text{Weight}}} \)

• Thigh length-Lower leg length Index = \( \frac{\text{Thigh Length}}{\text{Lower leg length}} \times 100 \)

• Upper arm length-Lower arm length Index = \( \frac{\text{Upper arm length}}{\text{Lower arm length}} \times 100 \)

• Hips width-Stature Index = \( \frac{\text{Hips width}}{\text{Stature}} \times 100 \)

• Shoulder width-Stature Index = \( \frac{\text{Shoulder width}}{\text{Stature}} \times 100 \)

**INSTRUMENTS**

The following instruments were used for collecting the data –

(a) Anthropometric kit.

- Vernier caliper
- Skin fold caliper
- Measuring tape
- Sliding caliper

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Weighing machine

Anthropometer

(b) Sphygmomanometer.

(c) Spirometer.

(d) Stop watch.

(e) Stethoscope.

STATISTICAL PROCEDURE

Reiterating the objective of the study we have to point out that we intend to investigate the anthropometrical and physiological differentials between high and low performance basketball players. For that, Z test was used to test the significance of differences between high and low performance basketball 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).

LEVEL OF SIGNIFICANCE

The significance of differences between high and low performance basketball players was tested at 0.05 level of significance.