CHAPTER 3

Methodology
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Review of related literature had given an appropriate guidance in adopting an objective method of assessing the difference in anthropometrical and psychological characteristics of long distance runners at different levels of competitions. In this chapter the selection of subjects, criteria, measures, tools, test and techniques used in collecting data and statistical method applied for its interpretation are described earlier.

SELECTION OF SUBJECTS (Sampling)

Sample of the study consisted of 400 athletes who participated at different levels of competitions. 227 All India Intervarsity Long Distance Runners, 131 National Long Distance Runners and 42 State Long Distance Runners were selected from various parts of India. The detailed list of places and number of samples collected for the study are listed below:

➢ 68th All India Inter-varsity, Athletics Championship held at Annamalai University (T.N), data of 102 Long Distance Runners, was collected from 13th to 17th Jan. 2007-2008.
69th All India Inter-varsity, Athletics Championship held at M.G.U.Kottayam (K.R), data of 125 Long Distance Runners, was collected from 20th to 24th Dec.2008-09.

Federation Cup held at Bhopal (M.P), data of 52 Long Distance Runners, was collected from 26th To 29th Feb. 2008.

All India SAI Inter Hostels Athletics Meet held at Saifai-Etawa (U.P), data of 18 Long Distance Runners, was collected from 19th to 21 Jan.2009.

57th All India Police Athletics Meet held at 35th Bn. P.A.C. Mahanagar Stadium Lucknow (U.P), data of 61 Long Distance Runners, was collected from 10th to 14th Feb.2009.

18th U.P State Annual Open Athletics Championship held at Madan Mohan Malvaiyev Sports Stadium Allahabad (U.P), data of 32 Long Distance Runners was collected from 10th to 11th April 2009.

Inter Zone SAI Hostel Athletics Meet held at Saifai-Etawa (U.P), data of 4 Long Distance Runners, was collected from 14th to 16th Jan.2009.
20th North Zone Junior Athletics Championship held at G.G.S.Sport College Lucknow (U.P), data of 6 Long Distance Runners was collected from 2nd to 3rd August 2008.

TOOLS AND EQUIPMENT’S

Researcher took the help of the following instruments to collect the relevant information of investigation. The list of the equipments used for anthropometrical measurements are:

1. Weighing machine
2. Stadiometer
3. Steel measuring tape
4. Anthropometric rod
5. Sliding caliper
6. Skin fold caliper
7. Vernier caliper
8. Chest Caliper

The instruments were of standard quality. The accuracy of the instruments was ensured by the manufacturers. International society for the advancement of Kinanthropometry’s (ISAK) approved techniques
were used for recording the various body measurements. The reliability was checked by test-retest methods and average co-efficient was found to be 0.96.

For the assessment of psychological variables researcher used the following tools:

**SCAT:** To assess the Anxiety of the subjects, the sports competition Anxiety Test (SCAT), developed by Marten (1977).

**SSCI:** To assess the Self-Confidence of the subjects, the sport Self-Confidence Inventory (SSCI), developed by Dr. Reena Kaul and Madalsa Mittal (2003).
ADMINISTRATION OF TEST AND COLLECTION OF DATA:

All the Anthropometrical measurements were taken on the right side of the individual. Standard technique as described by Weiner and Lourie (1969) was followed for the measurements. The necessary anatomical landmarks and the sites for skin folds were marked with a sketch pen. The body weight was recorded to the nearest of half a kilogram and all others measurements were recorded to the nearest of a centimeter and millimeter.

For measurement of psychological variables, the researcher immediately after the anthropometrical measurements distributed the psychological questionnaire and collected as well as arranged the same sequentially the moment players returned them.

An assistant, who was well-versed with the chosen anthropometrical measurement as well as psychological instruments accompanied the investigator to all places during the collection of data. Necessary instructions and demonstrations were given to the subjects before conducting the test.
(A) PHYSICAL VARIABLES:

(1) Weight:

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

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

(3) 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 muscle of the thigh and hips were contracted in order to stretch him full. The horizontal bar of the anthropometric rod was brought down so that it touched the highest point on the head. The distance between anthropometric rod and the highest point of the stool was measured.
(4) Upper arm length in cm:

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

(5) Lower arm length:

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

(6) Thigh length:

The subject was made to stand erect with weight equally distributed on both legs. Trochanterion and tibia lateral of the right leg were marked. The distance between these two points was measured with the help of a measuring tape and the value was taken.
(7) **Lower leg length:**

The subject was made to stand erect with weight equally distributed on both legs. Tibia of the right leg was marked. The distance between tibia and sphyrion tibiale was measured with the help of a measuring tape and the value was taken.

(8) **Foot length:**

It is the straight distance between the most posterior point of the heel (acropodian) and the tip of the longest toe (pterion). The subject was asked to stand in an erect position with feet slightly apart and equal weight on both the feet. The anthropometeric rod was used to measure this distance. The reading was recorded up to one-tenth of a centimeter.

(9) **Chest width:**

The measurement of the maximum distance of the thorax at the level of the most lateral aspect of the fourth ribs was taken with the help of a chest caliper.

(10) **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 branch of caliper was at an angle of $45^0$ from the horizontal plane.

(11) **Hip 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.

(12) **Humerus biepicondyle 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.

(13) **Femur biepicondyle diameter:**

The subject was made to sit on a stool 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.
(14) **Ankle Width:**

The subject was seated with foot gently touching the ground. Here ankle width means diameter between the most medial and lateral projecting points of the medial and lateral malleoli. The crossbars of the sliding caliper were applied bisecting the angle of foot (lower leg) with pressure to compress the subcutaneous tissue, measuring to nearest 0.5mm.

(15) **Wrist Width:**

With the help of the sliding caliper the diameter between the most medial and lateral points of the distal epiphyses of radius and ulna was recorded nearest to 0.5mm.

(16) **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 a measuring tape wrapped at right angles to the long axis of the upper arm where the maximum girth was affected.
(17) 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 maximal.

(18) Thigh 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 upper leg and measurement was taken of the right thigh perpendicular to the long axis of the femur at the mid trochanterion-tibiale lateral level.

(19) Biceps skin fold:

The skin fold was measured by raising a vertical fold at the marked mid acromial-radiale line on the anterior surface of the arm. The subject stood with the arms hanging down freely. Special care was taken not to grasp the underlying muscular tissues. The reading was recorded to one-tenth of a millimeter.
(20) **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 taken as the final score.

(21) **Supra iliac skin fold:**

A point was marked on a slightly diagonal fold on the crest of the ilium at the midaxillary level, the skin fold of about 2 to 5 centimeter above 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 as the final score.

(22) **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. One more reading was taken by the same procedure and average of the two was taken as the final score.
(23) **Calf skin fold:**

The subject was made to sit on chair with knees bend 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 with the same procedure and average of the two was considered as the final score.

(24) **Thigh skin fold:**

The subject was made to stand erect. Medial side of the right thigh, 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 with the same procedure and average of the two was considered as the final score.

(25) **Body Composition:** (anthropometric method)

According to Durnin and Womessle (1974)

Body density = $1.1631 - 0.6321 \log(biceps + triceps + subscapular + suprailliac)$
HWR = \( \frac{\text{Heighth in cm}}{\sqrt[3]{\text{Weight in Kg}}} \)

(For 18-25)

(26) **Proportionality in ratings:**

The following indices were used to determine various body proportions.

(i) Sitting height-Stature index = \( \frac{\text{Sitting height}}{\text{Stature}} \times 100 \)

(ii) Ponderal index = \( \frac{\text{Stature}}{3\sqrt[3]{\text{Weight}}} \)

(iii) Thigh length-Lower leg length index = \( \frac{\text{Thigh length}}{\text{Lower leg length}} \times 100 \)

(iv) Upper arm length-Lower arm length index = \( \frac{\text{Upper arm length}}{\text{Lower arm length}} \times 100 \)

(v) Hip breadth-Stature index = \( \frac{\text{Hip breadth}}{\text{Stature}} \times 100 \)

(vi) Shoulder breadth-Stature index = \( \frac{\text{Shoulder breadth}}{\text{Stature}} \times 100 \)
(B) PSYCHOLOGICAL VARIABLES

The detail of the psychological instruments used in the study is as below.

(1) Sport Competition Anxiety test:

Items 1, 4, 7, 10, and 13 are filler items used to help disguise the purpose of the test; cross them out, as they will not be used for scoring. Items 2, 3, 5, 8, 9, 12, 14, and 15 are scored in the following manner: hardly ever=1 pt., sometimes=2 pts, often=3 pts. For items 6 and 11, the scoring is reversed: hardly ever=3 pts, sometimes=2 pts, often=1 pt. Simply total the numbers for these items to determine your trait anxiety score, which ranges from a low of 10, to a high of 30.

Ten of the items asses' individual differences in the extent of competition anxiety present in the athletes.

(2) Sport Self-Confidence inventory:

The sport self confidence inventory (SSCI) (Kaul and Mittal, 2003) consisted of 70 items. In the initial phase of standardization, psychometric and item analysis was done after which 44 items were dropped and 26 items were retained. It is used to measure the self-confidence of a player under different conditions in various sport situations. The items in this scale are scored on a 4- point interval scale, Items 2, 5,11,16,19,27,30,37,43,45,53,56,59, are scored in the
following manner: (1 = Always, 2 = Often, 3 = Sometimes and 4 = Never). The negatively worded items 4, 21, 25, 31, 35, 36, 40, 41, 42, 49, 61, 63, 64 are scored in the reverse: (4 = Always, 3 = Often, 2 = Sometimes and 1 = Never). Cronbach alpha internal consistency of the scale (n=159) is 88.

Twenty-six of the items assess individual differences in the extent of self-confidence present in the athletes.

**STATISTICAL PROCEDURE:**

Reiterating the objectives of the study researcher intended to investigate the differences in anthropometrical and psychological parameters of long distance runners at different levels of competition. One way analysis of variance was used to test the hypotheses. If significant differences were observed. Then, Scheffé's test was used to find out the ascending or descending order of means.

**LEVEL OF SIGNIFICANCE**

The significant difference in anthropometrical and psychological parameters of long distance runners at different levels of competitions was tested at 0.05 levels.