Chapter 3

PROCEDURE
Chapter-III

Procedure

The purpose of this study was to determine Kinanthropometric, anaerobic and aerobic fitness trends among badminton players in relation to their performance.

Before collecting the data one has to be very careful in designing the study to achieve the objective and successful completion of the project. The planning of the study in terms the design of the study, the sampling and the tools used for collection of data have been explained in this chapter.

Design of the study

A status quo study has been designed to probe kinanthropometric, anaerobic and aerobic fitness trends among badminton players in relation to their performance belonging to the states of North Zone including Punjab, Haryana, Chandigarh, Delhi, Jammu and Kashmir and Rajasthan in relation to their level of performance.

Sample

A systematic random sampling device was used to select eighty-eight players from the states of North Zone having participated at least district level recognized badminton competitions. The age of the players ranged...
between eighteen to twenty four years. The break up of the players has been given below:

**Group A : National level/Inter-University players = 25**

A list of players who participated in the senior national and All India Interuniversity competition during 1999-2000 were prepared and twenty five players were randomly selected to act as subjects in this group.

**Group B : State level/University players = 29**

A list of players who participated in interzonal university and inter-district competition was prepared and 29 players were randomly selected to act as subjects in this group.

**Groups C : District level/Inter college players = 34**

A list of players who played inter college competition of the university and did not qualify for inter zonal competition as well as the players who participated at district level competition was prepared and 34 players were randomly selected from this list to act as subjects for the third group.

**Tools used for collection of data**

(A) **Kinanthropometric Variables**

1. Height.
2. Weight.
3. Length of arms.
4. Length of torso.
5. Length of legs.
7. Upper arm circumference (flex) (L&R).
8. Upper arm circumference (nor).
10. Thigh circumference.
11. Calf circumference (L&R).
13. Triceps skinfolds.
15. Suprailiac skinfolds.
17. Thigh skinfold.
18. Calf skinfold (L&R)

Body fat
- Body density - Body density was calculated as per the formula given by Durnin and Womersley (1974)
- Percentage body fat - Percentage body fat was calculated through the formula given by Siri (1956)

(B) Motor ability variables
1. Anaerobic fitness
   "Margaria Kalemen stairs ascending test".
2. Aerobic fitness.
   "Cooper's 12 minute run and walk test"
Tools used

Tools used were as follows:

1. Heights of the subjects was measured in centimeters using anthropometer rod.

2. Weight of the subjects was measured and corrected to the nearest kilogram using a standard portable weighing machine.

3. Arm length, leg length and torso length were measured in centimeters using standard anthropometric kit.

4. Chest circumference, upper arm circumference (flexed and normal), forearm circumference, thigh circumference and calf circumference were measured in centimeters using flexible tape.

5. Skinfold measurements were taken by using Harpenden Skinfold caliper of standard pressure of 10 gm/mm² for determining percentage body fat and body density.

6. For the assessment of anaerobic fitness trends of badminton players Margaria anaerobic power test (William D., MCardle, 1981) was applied.

7. For the assessment of aerobic fitness trends of badminton players. Cooper's aerobic test - 12 min. run and walk (M. Barrow, Harold and McGee, Rosemary, 1979) was applied.
RELIABILITY OF DATA AND TESTER COMPETENCY

The reliability of data was ensured through repeated test measures. Twenty subjects were put under test and retest by the same tester under same conditions to find out coefficient of correlation. The results are given below:

(A) **Kinanthropometric variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heights</td>
<td>.998</td>
</tr>
<tr>
<td>2. Weight</td>
<td>.995</td>
</tr>
<tr>
<td>3. Length of arms</td>
<td>.899</td>
</tr>
<tr>
<td>4. Length of torso</td>
<td>.896</td>
</tr>
<tr>
<td>5. Length of legs</td>
<td>.927</td>
</tr>
<tr>
<td>6. Chest circumference</td>
<td>.907</td>
</tr>
<tr>
<td>7. Upper arm circumference (flex) (L&amp;R)</td>
<td>.898</td>
</tr>
<tr>
<td>8. Upper arm circumference (nor)</td>
<td>.901</td>
</tr>
<tr>
<td>9. Forearm circumference</td>
<td>.920</td>
</tr>
<tr>
<td>10. Thigh circumference</td>
<td>.960</td>
</tr>
<tr>
<td>11. Calf circumference (L&amp;R)</td>
<td>.890</td>
</tr>
<tr>
<td>12. Biceps skinfolds</td>
<td>.900</td>
</tr>
<tr>
<td>13. Triceps skinfolds</td>
<td>.896</td>
</tr>
<tr>
<td>14. Forearm skinfolds (L&amp;R)</td>
<td>.920</td>
</tr>
<tr>
<td>15. Suprailliac skinfolds</td>
<td>.890</td>
</tr>
<tr>
<td>16. Subcapular skinfold</td>
<td>.880</td>
</tr>
<tr>
<td>17. Thigh skinfold</td>
<td>.900</td>
</tr>
<tr>
<td>18. Calf skinfold (L&amp;R)</td>
<td>.890</td>
</tr>
</tbody>
</table>
(B) **Motor ability variables**

1. Anaerobic fitness .95
   "Margaria Kalemen stairs ascending test"
2. Aerobic fitness .96
   "Cooper's 12 minute run and walk test"

### Statistical Procedure

Analysis of variance statistical procedure was applied to compare three groups listed below:

- **Group A**: National level/inter-university players,
- **Group B**: State level/university players,
- **Group C**: District level/inter-college players, in their kinanthropometric, anaerobic and aerobic fitness variables.

F-test was applied to test the hypothesis at 5% level of significance.

### Conduct of test and collection of data

All the anthropometric variables were assessed using the standard anthropometric kit (mentioned below).

### Physical Variables

#### Measurement of anthropometric variables

1. **Height**

**Equipment** - Anthropometer rod.
It is the vertical distance between vertex to the horizontal floor on which the subject stands. The subject was asked to stand erect with bare foot touching each other and also touching the wall with the toes about 30° apart. Arms hanging naturally by the side, the subject's head was kept in Frankfort. Horizontal plane and asked to stretch body upward (this is possible only when visual axis is parallel to the ground on which the subject stands). The anthropometer rod was held vertically in front of the subject in the mid-sagittal plane. The horizontal movable arm of the anthropometer was brought down to the point vertex.

2. Weight

**Equipment** - a portable weighing machine.

The body mass was taken in kilograms. The pointer was adjusted at zero and subject was asked to stand at the centre of the platform with equal pressure on both feet with a minimum possible clothing. The weight was taken upto the unit of 0.5 kilograms.

3. Length of arm

**Equipment** - Anthropometer rod.

The straight distance between the points acromion and the tip of the middle finger was measured with the anthropometer compass when the subject stood erect with his arms hanging down freely.
4. Length of torso

**Equipment** - Anthropometer rod.

It is the vertical distance between the tip of acromion and trochanterion. The subject was asked to stand erect with bare foot with the toes about 30° apart. Arms hanging naturally by the side, the subject's head was kept in Frankfort horizontal plane and asked to stretch body upward. The anthropometer rod was held vertically and the horizontal movable arm of the anthropometer was brought down to the point vertex.

**Recording** - The length was recorded up to 1 millimeter.

5. Length of legs

**Equipment** - Anthropometer rod.

It is the vertical distance between the tip of trochanterion to the horizontal floor on which the subject stands. The subject was asked to stand erect with bare foot touching each other with the toes about 30° apart. Arms hanging naturally by the side the subject's head was kept in Frankfort horizontal plane and asked to stretch body upward. The anthropometer rod was held vertically of the side of the subject. The horizontal movable arm of the anthropometer was brought down to the point vertex.

**Recording** - The length was recorded up to 1 millimeter.
6. Chest circumference

**Equipment** - Flexible steel tape.

It is the circumference at the chest at the level of nipples in the front and subscapular on the back. The subject was asked to stand relaxed. The steel tape was wrapped around the chest over the nipples and under the lower angle of scapular. The respiration remained normal. It was also observed that the skin contours were not disturbed by the pressure.

7. Upper arm circumference (flex) (L&R)

**Equipment** - Flexible steel tape

It is the circumference of the flexed upper arm at the level half way between the tip of acromion and radiale. The subject was asked to stand with flexed arms. After marking the mid-acromiale radiale distance. The flexible steel tape was wrapped and measured. It was observed that the skin contours were not disturbed by pressure.

8. Upper arm circumference (nor)

**Equipment** - Flexible steel tape

It is the circumference of the upper arm at the level half way between the top of acromion and radiale. The subject was asked to stand with arms hanging in normal standing position. After marking the mid-acromiale radiale
distance, the flexible steel tape was wrapped and measured. It was observed that the skin contours were not disturbed by pressure.

9. Forearm circumference

**Equipment** - Flexible steel tape

It is the maximal girth of the forearm when the hand is held palm up and relaxed. The flexible steel tape was wrapped and measured in the subjects pronounced forearm developed where the belly of the muscle is more distal than normal.

10. Thigh circumference

**Equipment** - Flexible steel tape

It is the circumference at a point half way between the landmarks trochanterion and femorale. The subject was make to stand with feet apart putting equal pressure on both the feet. The flexible steel tape was wrapped around with a cross handed technique. In this, the third digits are used to manipulate and fix the tape to assure the measure is made perpendicular to the long axis of the femur.

11. Calf circumference

**Equipment** - Flexible steel tape

It is the maximum circumference of the calf in the plane at right angles to the long axis. The subject was asked to stand with feet slightly keep apart and equal pressure on both the feet. This measure is obtained
by manipulation of the tape taking a series of girth measurements to assure
the largest value. This is achieved by a relaxing and tightening of the tape
with manipulation to various levels facilitated by the investigator’s third digits.

**Skinfolds**

All the skinfold measurements were taken with the help of a Harpenden skinfold caliper. Some of the skinfolds were taken exactly at the level from where the circumferences were taken. For every measurement a fold of skin and subcutaneous tissue was picked up firmly between thumb and forefinger at the left hand about one centimeter above the mark made for the purpose and pulled away from the underlying muscle. The edges of the plates of caliper were then applied one centimeter below the finger of the left hand and allowed to free the caliper edged to use full pressure before taking the thickness of the fold. The subject relaxed at the time when skinfold was taken.

**12. Biceps skinfold**

**Equipment** - Harpenden skinfold caliper of standard pressure of 10 gm/mm.

This skinfold was taken on the front of the arm at the level marked on the skin for the arm circumference and directly in line with the centre of the cubital fossa.

**13. Triceps skinfolds (L&R)**

**Equipment** - Harpenden skinfold caliper of standard pressure of 10 gm/mm.
This skinfold was taken on the back of the arm at the level marked on the skin for the arm circumference and directly in line with the point of the elbow at the same level at that for the biceps skinfold. The reading has been recorded with the help of Harpenden caliper.

14. Forearm skinfold

**Equipment** - Harpenden skinfold caliper.

This skinfold was measured from the most lateral side of the forearm at the same level from where the circumference has been measured by the Harpenden caliper.

15. Subscapular skinfold (L&R)

**Equipment** - Harpenden skinfold caliper

The subscapular skinfold was taken up just beneath the inferior angle of the scapula in a direction which was obliquely downward and outward at an angle of about 45° from the horizontal. The subject was asked to stand in the normal position.

16. Suprailiac skinfold

**Equipment** - Harpenden skinfold caliper.

It was taken one centimeter above the superior margin of iliac crest where this point is cut by an imaginary vertical line drawn from the axillary fossa. Fold was taken vertically and caliper was placed one centimeter below the fold. The reading was recorded down immediately by unit of 0.1 mm.
17. Thigh skinfold

**Equipment** - Harpenden skinfold caliper.

The subject was asked to sit on the chair. The leg was straight and relaxed. The skinfold was lifted on the anterior aspect of the thigh, from the level where circumference of the thigh was taken with the Harpenden caliper.

18. Calf skinfold

**Equipment** - A vertical skinfold was lifted on the medial side of the lower leg at the maximum girth of the calf with the subject seated on the chair with knee bent at 90°.

**(B) Measurement of motor ability variables**

1. Anaerobic fitness

"Margavlakalen stairs ascending test (Fig. a)"
Purpose

To measure the maximum anaerobic power or capacity of a badminton player.

Equipments

A flight of stairs, 2 switch mats (platform) electronic timer of 0.01 seconds sensitivity.

Procedure

The subject was given a preliminary warm up of stretching exercises of lower extremity muscles. The subject taking the test was asked to start run up from 6 meters distance from the first step. Subject has to run up to flight of stairs, 3 steps at a time, as fast as possible. Switch platform which starts and stops the electronic watch were placed on the 3rd and 9th steps. As the subject stepped on the first switch platform placed on the 3rd step, the electronic clock started recording and when the subject stepped on the switch platform placed on the 9th step the clock stopped and time was recorded in 1/100th of a second. Three trials were given to each subject.

Recording

The best out of three performances was recorded for scoring purpose. The time elapsed from 3rd step to 9th step was considered as score.
2. Aerobic fitness

12 minute run and walk test

Purpose

To measure the basic endurance of the subjects which has a good relation to the aerobic capacity of an individual.

Equipment

400 mts. cinder track, flags and stop watch.

Procedure

This test measured the basic endurance of the subjects, which has a good relation to the aerobic capacity of an individual. The test was conducted on a 400 meters standard cinder track. Flags were placed around the track at 40 yard intervals. The subjects were made to take the standing position closely behind the starting line. On your marks and clap signals were used for the start. The instructions were given to run close the inner border of the track maintaining an even pace. The running was allowed bare footed or using the warming up shoes. When 11 minutes elapsed, the instructor called out the time left to run. At the ends of 12 minutes, the instructor blowed a blast on his whistle. The distance recorded at the end of the 12 minutes was taken as score.