CHAPTER - III

PROCEDURE

In this chapter, the selection of subjects, selection of variables, criterion measures, collection of data, reliability of data, procedure for administration of the tests and statistical technique employed, have been described.

Selection of Subjects

Twenty-five badminton players of Maharashtra State were selected as subjects for the study. Out of them 10 were Internationals, 8 National level players and 7 State level players. All of them were actively involved in the domestic and/or international tournaments.

Selection of Variables

Visualising the nature of the modern game of badminton, the following Physical and Physiological variables were selected:

Physical Variables:

Anthropometric Variables:

1. Height
2. Weight
3. Arm length
4. Leg length
5. Trunk length
6. Hand girth
7. Thigh girth
8. Calf girth
9. Shoulder width
10. Hip width
11. \( \Delta q \)

**Motor Ability Variables:**
1. Speed
2. Explosive strength
3. Agility
4. Flexibility
5. Reaction time

**Physiological Variables:**
1. Resting heart rate
2. Cardio-vascular endurance
3. Resting Systolic/diastolic blood pressure
4. Body composition:
   - Total body weight
   - Lean body mass
   - Percentage of fat
5. Quantum of Sweat excretion after submaximal work
6. Blood haemoglobin concentration
Criterion Measures

For the scholar's study the following criterion measures were selected:

1) Height of the subjects was measured in centimeters using a standard Martin type Anthropometer, Mfg. by Sieber - Hegner, Switzerland.

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

3) Arm length, leg length, trunk length, shoulder width, hip width, hand girth, thigh girth and calf girth were measured in centimeters using standard anthropometric kit. (mentioned above).

4) Speed of the subjects was assessed by 50 metre dash recorded to the nearest 1/10 of a second, (Citizen stopwatch Japan made).

5) Explosive strength of the subjects was measured to the nearest cm by the sargent Jump.

6) Agility of the subjects was determined by the time taken by the subjects in the semi Agility Test and recorded to 1/10 of a second.

7) Flexibility of the subjects was assessed by the Dynamic Flexibility Test and recorded in the number of cycles covered in 20 seconds.

8) Reaction time of the subjects was assessed by Nelson hand Reaction Test in second.

9) Heart-rate of the subjects was measured in beats/minute.

10) Cardio-vascular endurance of the subjects was assessed by the total time taken in minutes for the work to exhaustion on Monark 818 brand bicycle ergometer (made in Sweden) with a fixed load.
11) Blood pressure of the subjects was measured in mm. Hg. by using sphygmomanometer and stethoscope (Diamond brand).

12) Skin fold measurements of the subjects using a standard Lange skin fold caliper (Mfg. Cambridge Science Industries, Inc. Cambridge, Maryland) were recorded for analysing the body composition (using Durwin and Rahman method).

13) Quantum of sweat excretion of the subjects was estimated by finding the difference of weight (with minimal possible cloths) before and after the submaximal work (After wipe off sweat).

14) Haemoglobin content of the subjects was measured in gram/100 ml. Using Sahli's Haemoglobinometer.

15) Playing ability of the subjects were assessed by a Panel of three judges (International Players) by rating of skills during match play and recorded in points out of a maximum of 100 score.

16) Age of the subjects was recorded in years.

Administration of Test

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

Physical Variables

**Anthropometric Variable**

**Height:**

Equipment and material: Anthropometer, smooth wall and one assistant.
In order to obtain "Height", the subjects were asked to stand erect, heels together and arms hanging by the side. The heels, buttocks, upper part of the back and of the head were in contact with a vertical wall. The subject was instructed to "look straight ahead", take a breath, and "stretch up as far as possible. Height of the subjects was measured from floor to the subject's vertex (the highest point on the skull) with the help of device known as an Anthropometer. Height of the subjects was recorded to the nearest 0.1 cm. With cm. Rounded up ¹ (Shown in figure 1)

**Weight:**

Equipment and Material: Standard Avery beam weighing machine.

Body weight of the subjects, wearing gym shorts only, was taken in the morning with the help of the standard beam-weighing machine as mentioned. Measurement was made to the nearest 0.1 kg ² (Shown in figure 2).

**Arm Length:**

The subjects with gym. Shorts were asked to stand erect with arms sideways. Arm length of the subjects was measured from acromion process to the tip of the third finger by the standard Anthropometric kit. Measurement was recorded to nearest centimeter ³ (Shown in figure 3).

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¹Hertzberg H.T.E, G.S. Daniels and E. Churchill; Anthropometry of Flying Personnel, WADC, USA, 1954,P.10.

² Ibid p.11.

Anthropometric Variables

Stretch stature technique

Fig. 1: Height
Anthropometric Variables

Fig. 2: Weight
Anthropometric Variables

Fig. 3: Arm Length
**Leg Length:**

The subjects with gym shorts were asked to stand erect with arms side-ways. Weight of the body was equally distributed on both feet. Length of the subjects' legs was measured from the end of spinal column to the floor by the Standard Anthropometric Kit.

Measurement was recorded to nearest centimeter\(^4\) (Shown in figure 4).

**Trunk Length:**

Trunk length of the subjects was measured from standing height minus leg length and recorded to nearest centimeter\(^5\) (Shown in figure 5).

**Hand Girth:**

The subjects with shorts were asked to stand erect with a relaxed, Pendant right arm. Relaxed arm girth is the perimeter distance at right angles to the long axis of the humerus at the mid acromial-radiale level. Measurement was to the nearest 0.1 cm. A tape in centimeter was used to measure\(^6\) (Shown in figure 6).

**Thigh Girth:**

The subjects with gym shorts were asked to stand erect with weight distributed equally on each foot. A series of perimeter measures of right thigh was obtained by manipulation of the tape. The maximal thigh girth was the largest measure obtained with the tape at right angles to the long axis of femoris. Measurement was

\(^{45}\) Ibid. p.180

\(^{6}\) W. Ross. *The O Scale System* p.42.
Anthropometric Variables

Fig. 4: Leg Length
Anthropometric Variables

Fig. 5: Trunk Length
Anthropometric Variables

Fig. 6: Hand Girth
to the nearest 0.1 centimeter. A tape in centimeter was used to measure 7 (Shown in figure 7).

Calf Girth:

The subjects with gym shorts were asked to stand erect with weight distributed equally on each foot. A series of perimeter measures of right calf was obtained by manipulation of the tape. The maximal calf girth was the largest measure obtained with the tape at right angles to the long axis of tibia. Measurement was to the nearest 0.1 cm 8 (Shown in figure 8).

Shoulder Width:

The subjects with gym shorts were asked to stand erect against the wall with arms handing sidewise and closed to the body. Shoulder length of the subjects was measured from right bulge of deltid muscle to it left lateral bulge by using an anthropometric length caliper to the nearest 0.1 centimeter 9(Shown in figure 9).


8 Ibid., p.166.

9 Ibid. p.166.
Anthropometric Variables

Fig. 7: Thigh Girth
Anthropometric Variables

Fig. 8: Calf Girth
Anthropometric Variables

Shoulder width

Fig. 9: Shoulder Width
Hip Width:

Subjects with gym shorts were asked to stand erect against the wall. The length caliper was pressed against the widest part of the hip at a greater trochanters. The measurement was read to the nearest to the 0.1 cm (Shown in figure 10).

Age: Age of the subjects was recorded in years on the basis of their birth certificate.

Motor Ability Variables:

Fifty-yard Dash.

Equipment: Two stop-watches and assistance of two persons were needed to measure the speed of the subjects.

In order to get the actual speed, two subjects were asked to run at the same time. Both started from a standing position. The commands, "Are you ready?" and "GO" were given. At the command to go, the starter dropped his arm and the time keeper at the finish line immediately pushed the button of the stop watch to start. The subjects ran as fast as possible across the finish line. The elapsed time from the starting signal until the until the rider cross the finish was recorded to the nearest tenth of a second (Shown in figure 11).

\[\text{Referee 19, p.172}\]

\[\text{Referee 19, p.251}\]
Anthropometric Variables

Fig. 10: Hip Width
Motor Ability Variables

A wooden plate of 4 feet by 2 feet 6 inches was kept with half inch intervals from 6 yards on it. The measurement was marked at every inch on it, white lines and black lines in the half-inch marks were of a yellow colour. This board was hung so that its lower edge could be

Fig. 11: Fifty-Yard Dash (Speed Test)
**Vertical Jump:**

Equipment and Material: A jump board mark off in half inches, chalk dust a smooth wall surface of 12 feet from the floor were needed.

A wooden board of 4 feet by 10 inches was marked with horizontal line at half-inch intervals, from 0 feet to 4 feet. The measurement was marked at every inch with white colour and the lines at the half-inch marks were of a yellow colour. This board was hung so that its lower edge could be adjusted from the floor according to the height of the subject and it was blocked away from the wall by 6 inches so that the jumper does not scrape himself against the wall.

The subject was asked to face the wall under the board, and with his feet on the floor, stretched one hand as high as possible up towards the board, so that his tip of the middle finger could touch the lower edge of the board. Then he was asked to stand sideways beside the board with chalk dust was placed on the middle finger and leap vertically to touch as high up the board was possible. The feet would remain in contact with the floor until the actual jump was made. This height was noted. The best of three jumps was recorded to the nearest half inch. In order to achieve accuracy in recording, the tester stood on a chair opposite the board 12 (Shown in figure 12).

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Motor Ability Variables

Fig. 12: Vertical Jump Test
**Semo-Agility Test:**

**Purpose:** To measure the general ability of the body in manoeuvring, forward, backward, and sideward.

**Equipment and materials:** Area 12 feet by 19 feet with adequate running space around was marked on the badminton court.

Four plastic cones, 9 inches by 9 inches base and 12 inches heights and a stopwatch were needed. The cones were placed squarely in each corner of the marked area.

The subjects were lined up outside the lane at A with his back to the badminton side line. The subjects waited for the signal “ready go”. The subjects side-stepped from A to B and passed outside the corner cone. They then back pedalled from B to D and passed to the inside of the corner cone. They then sprinted forward from D to A and passed outside the corner cone. They then sprinted forward from C to B and passed outside the corner cone. They then side stepped from B to the finish at A. The best of the two trials (recorded to the nearest 1/10 second) was recorded as the score. One practice trial to each subject was given before the test.\(^\text{13}\) (Shown in figure 13).

Motor Ability Variables

Fig. 13: Semo Agility Test
**Dynamic Flexibility:**

Equipment and materials: A stop watch and chalk stick was required for the test.

Dynamic flexibility is defined by Fleishman as the ability to make repeated, rapid flexing movements in which the resilience of the muscles in recovery from strain or distortion is critical.

The subjects were asked to stand with their back to a wall and far enough from it so that they could bend over without hitting it. Their feet were shoulder width apart. With chalk the tester marked an X on the wall directly behind the middle of the subject's back and another X on the floor between the subject's feet. A stopwatch was used to time the test.

On the signal, 'Go', the subjects were bent and touched the X between his feet with both hands and then rose twisted to the left and touched the X on the wall with both hands.

Prior to the test, three correct cycles were demonstrated emphasizing speed ¹⁴(Shown in figure 14).

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Motor Ability Variables

Fig. 14: Dynamic Flexibility Test
This was counted as one cycle. In subsequent cycles the subjects alternated the side to which they twisted and the tester recorded the number of cycles completed in 20 seconds.

**Reaction:**

Test equipment and materials: One scale of 30 cm, table and chair, or desk and chair.

To measure the speed of reaction with the hand in response to a visual stimulus.

The subject was asked to sit with his forearm and hand resting conformably on the table.

The tips of thumb and index finger were held in a ready to pinch position about 3 to 4 inches beyond the edge of the table. The upper edges of the thumb and index finger were in a horizontal position. The tester hold the sticktimer near the top, letting it had between the subjects thumb and index finger. The base line was even with the upper surface of the subjects thumb.

The subject was directed to look at the concentration zone, and was told to react by catching the stick (by Pinching the thumb and index finger together) when it was released.

The subject was told not to look at the tester's hand, nor was he allowed to move his hand up or down while attempting to catch the following stick. Twenty trials were given.

Each drop was preceded by preparatory command of “Ready”.
Scoring, when the subject caught the scale stick, the score was read just above the upper edge of the thumb. The five lowest and the five highest trials were discarded, and an average of the middle ten was recorded as the score. Score in centimeter was converted into time by using the formula:

\[ \text{Time} = \sqrt{\frac{2 \times \text{Distance the stick falls}}{\text{Acceleration due to gravity}}} \]

since it is based on the law of constant acceleration of free falling bodies.\(^{15}\) (Shown in figure 15).

**PHYSIOLOGICAL VARIABLES**

**Resting Heart Rate**

Equipment and material: A stopwatch and two chairs.

Procedure: Heart rate was recorded during resting condition.

The heart rates of the subjects were determined by the pulse count. Pulse was taken from radial artery of the wrist. On the palm side, directly in line with the base of thumb, the tips of the index and middle fingers were used to feel the pulse. Due care was taken to apply appropriate pressure on the artery, so that a reaction to pressure did not

Motor Ability Variables

Figure 1. Position of Hand and Fingers for the Nelson Hand Reaction Test

Figure 2. Ready Position with Thumb as Base Line for Nelson Hand Reaction Test

Figure 3. Example of Scoring the Nelson Hand Reaction Test

Fig. 15: Reaction Test
produce alteration in the beat. The stop watch was kept started coincidentally with a pulse beat. In counting pulse, the beat felt designated as zero and then pulse was counted for one minute. The subjects were instructed to remain silent and refrain from moving or talking since these might affect the pulse rate 16 (Shown in figure 16).

**Quantum of Sweat Excretion After Submaximal work**

For determining the amount of sweat loss, a standard Avery weighing machine was used. Before the start of the endurance test the subjects with minimum of clothes on their body were made to stand at the centre of the weighing machine. The weight was recorded to the nearest 0.05 kilogram (50 grams).

After the endurance test (details mentioned on pages 56 - 59 the subjects were again weighed. Before the subjects were weighed, they were asked to wipe off any sweat that remained on their body with a towel and also were allowed to change the minimum cloths they were wearing at the time of exercise so as to avoid any influence on the weighing, as the cloths worn had absorbed some amount of sweat. The difference between the weight at the pre-exercise resting condition and the weight obtained after the bout of exercise was recorded as sweat loss.

\[\text{16Lourance E. Morehouse, Laboratory Manual for Physiology of Exercise (St. Louis: The C.V. Nosby Company 1972), p.66}\]
**Physiological Variables**

In this section, we will discuss the importance of physiological variables in understanding the effects of exercise and physical activity on the body. The measurement of physiological variables provides valuable insights into the physiological responses to exercise and can help in the assessment of health and fitness levels.

An example of a physiological variable is heart rate, which is often measured during exercise as an indicator of cardiovascular health. Heart rate can be measured using a variety of methods, including heart rate monitors and Holter monitors.

**Fig. 16: Resting Heart Rate**

[Image of two individuals sitting and discussing]
**Cardio-vascular Endurance**

To test the cardio-vascular endurance, the investigator preferred to use the bicycle ergometer because that bicycling has proved to be a very suitable work form, since, among other things, at a given load (Submaximal), it demands about the same energy output, whether the subject is young or old, trained or out of condition, elite athlete or unfamiliar with sport. The bicycle ergometer was invented several decades ago and has been widely used in studies related to exercise physiology. This instrument provides an exact measurement of the performed work, and thus a graded and measurable load could be applied to the subject. The changes in circulation and respiration could also be measured exactly during and after the work, hence exact evaluation of physical work capacity and physiological condition of the subject is possible.

The investigator used the reputed Swedish make Monark 818 model bicycle ergometer.

In Monark bicycle ergometer, gearing and circumference of the wheel have been dimensioned in such a way that one complete turn on the pedals moves a point on the rim 6 meters. A metronome was used to set to make exactly 100 beats per minute with the help of a stopwatch. The subjects were asked to follow the metronome timing.
so that 50 complete pedal turns per minute were achieved and the track distance covered in that speed was 300 meters per minute.

The wheel of the ergometer was breaked mechanically by a belt running around the rim. Both ends of this belt were attached to a revolving drum to which a pendulum was fixed. The device thus acted as a pendulum scale, measuring the difference in force at the two ends of the belt.

The belt could be stretched with a lever which was adjusted with the hand wheel, and the deflection of the pendulum was read off on the scale, graduated in kiloponds (1 kilopond or KP is the force acting on the mass of 1 kg at normal acceleration of gravity). The breaking power (kp) set by adjustment of belt tension, multiplied by distance (m), gives the amount of work in kiloponds metres (kpm). (1 kp = 100 kmp, and 50 Rpm = 300 metres, total work done in one minute = 300 kpm/min). Since the distance was expressed metres/minute the rate of work was obtained in kilopond metre, per minute (kpm/min) 17 (Shown in figure 17).

Physiological Variables

Fig. 17: Cardio-Vascular Test
The setting of load was done by placing the bicycle ergometer on a firm ground with the subject mounted but not touching the pedals. The pendulum was adjusted to "O" on the scale accurately so as to set the precise load. The subjects were asked to pedal with a salk belt for two minutes as warming up and to attain the 50 pedal revolutions per minute to the beats of the metronome. Thereafter the belt was stretched with the aid of the hand wheel until the required load was obtained i.e., 3 kp (3 kp = 900 kpm/min). The investigator was able to fix this load after a pilot study with five subjects who were chosen at random.

The stop-watch or the work-time-watch started simultaneously as the work load was achieved at 3 kp. The subjects were asked to pedal till they were tired and/or were not in a position to maintain the required pedal revolutions (i.e. 50 Rpm) any further. The moment the subject stopped the work the time was noted to the nearest minute and the amount of work performed was recorded in kilo pond metres.

Before the start of the endurance test, the procedure of the test in detail was explained to the subjects and any doubts raised by some of them were cleared by the investigator. At the outset in explaining the test procedure the subjects were told about the significance and rationale of the test and were motivated to work to their best potentials.
On the days of the endurance test the subjects were asked to report at least 15 minutes before the beginning of the test so as to provide them sufficient exposure to the testing environmental condition. Due care was taken that the subjects were similar kind of dress (namely shorts and T-shirt) while working. One hour prior to the test the subjects were asked to drink sufficient amount of water (approximately between 300 ml to 500 ml depending on body size) to ensure that they were sufficiently hydrated.

**Resting Blood Pressure:**

Equipment and materials: For measuring blood pressure sphygmomanometer and stethoscope were used. The blood pressure reading was taken during resting conditions. The subjects were asked to lie down in the supine position. While taking the blood pressure the subject's left arm was completely bared to make sure that the clothing did not constrict the blood vessels. The cuff of the sphygmomanometer was wrapped around the left arm evenly with the lower edge approximately one inch above antecubital space. With the earphones of the stethoscope in the tester's ears, the bell of the stethoscope was placed on the brachial artery just above the hollow of the elbow. The stethoscope was free from contact with the cuff. Then the cuff was inflated until the artery was fully pressed to the extent that no pulse best could be heard. Pressure was then slowly
released as the investigator watched the dial. When the first sound of the pulse became audible the reading in millimeter of mercury (mm.Hg) instant was recorded as the systolic blood pressure. The pressure then was further released gradually as the sounds of the pulse changed in intensity and quality and at the point the sound disappeared. The index of diastolic pressure was noted in mm.Hg when the pulse sound completely ceased 18(Shown in figure 18).

**Haemoglobin Concentration**

Sahl's Method to determine hemoglobin in blood is based on converting it into acid haematin by treating the blood with 0.1 N HCl and then comparing the color with a standard coloured glass fixed in the Haemoglobinometer itself. According to this method 100 % is equal to 17.3 gm.

**Appratus:**

The instrument is called haemometer or hemoglobin meter. It consists of:

1) standard graduated tube

Physiological Variables

Fig. 18: Resting Blood Pressure
2) Pipette
3) Glass rod
4) Bottle containing HCl
5) Pricklar
6) A comparator case with fixed standard brown glass.

Procedure:

The graduated tube with N/10 HCl up to the mark 10% or 2 grams was filled. Passing stillete tested the patency of the capillary pipette. Fingers of the subjects were pricked with usual precaution. When a blood drop was formed, it was sucked up in the pipette up to the mark 20 cm. Excess blood in the pipette was wiped quickly. Tip of pipette was then put into HCl in the graduated tube blood was blown into graduated tube blood into HCl. The contents (Acid and blood) were mixed by shaking the tube well and was allowed the tube to stand for 10 minutes to allow the brown colour to develop. When the mixture was clear and brown, then one drop of distilled water was added at a time by a small pipette and mixed every time and the colour was compared with the
standard until it matched. The tube in comparator was placed in such a way that the scale was not seen while comparing. Diffused light was used for comparison\(^{19}\) (Shown in figure 19).

**Body Composition**

Skinfold measurements of the subjects using a skinfold caliper was recorded for analysing the body composition (using Dumin and Rahaman Method)

**Triceps Skinfold:**

The subjects was asked to stand arm hanging relaxed by the sites, Palm against legs. A vertical fold was raised on the posterior surface of the right arm with the measures thumb and index fingers. The calipers were applied 1 cm below the near edge of the grasping fingers. Measurement was recorded in milimetre \(^{20}\) (Shown in figure 20).


\(^{20}\) W.Ross, *The 0 Scale System*, p.34
Physiological Variables

Fig. 19: Haemoglobin Concentration Test
Physiological Variables

Fig. 20: Triceps Skinfold
Biceps Skinfold:

The subjects were asked to stand arms having relaxed by the sides, palms against legs. A vertical fold was raised on the anterior side of the right arm with the measures thumb and index fingers. The calipers were applied 1 cm below the near edge of the grasping fingers. Measurement was recorded in milimetre 21 (Shown in figure 21).

Subscapular Skinfold:

The subjects were asked to stand with shoulder erect and relaxed. The fold was raised by the measure's left thumb and index finger just below and to the right of the inferior angle of the right scapula. The grasp encompassed the double layer of skin and subcutaneous tissue in the natural fold which runs obliquely downwards at about a 45° degree angle. The calipers were applied at right angles to the fold 1 cm lateral to the grasping fingers. Measurement was recorded in milimetre 22 (Shown in figure 22).

\[ \text{21 Ibid. p.35} \]
\[ \text{22 Ibid. p.36} \]
Physiological Variables

Fig. 21: Biceps Skinfold
Physiological Variables

Fig. 22: Subscapular Skinfold
Suprailliac Skinfold:

Often identified as the suprailliac skinfold, the technically correct name 'supraspinale' specifies the landmark and avoids confusion with the iliac crest skinfold. The illo-spinale is the under most lip of anterior superior iliac spine. Having located the spinale, the measurer moved about 7 cm for adults up an imaginary point/level extending to the axilla (arm pit). This brought the measure's thumb approximately to the level of the ilium.

The grasp was made raising the natural fold which extended downward and inwards at the angle about 45° degrees from the horizontal. The calipers were applied at right angles to the fold 1 cm medially from the grasping finger. Measurement was recorded in millimetre 23 (Shown in figure 23).

Reliability of Data

The reliability of data was ensured by establishing the tester's competency, reliability of tests, subject and and instrument reliability.

23 Ibid.p.37
Physiological Variables

Fig. 23: Supralliac Skinfold
Tester's Competency

All the measurements were taken by the research scholar himself with the assistance of a few staff members of I.I.T., Mumbai, to ensure that the investigator was well-versed in the techniques of conducting the tests and to obtain the accurate measurements. The scholar had a number of practice sessions in the testing procedure under the guidance of Dr. R.N. Dey, Reader in Exercise Physiology of the Lakshmibai National Institute of Physical Education, Gwalior.

Reliability of Data and Reliability of Subjects

Reliability of the performance given by the subjects in selected physical and physiological variables was checked by the test re-test method. The re-tests were conducted with an interval of two days. To check the reliability of data, same subjects were used under similar conditions by the same tester and no motivational techniques were used nor any training was given. The co-efficient of reliability of the scores of two tests were computed and presented in Table 1.

Table 1

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<td>sub motivation work</td>
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<tr>
<td>Blood hemoglobin concentration</td>
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**Instrument Reliability**

All the instruments used in this study were obtained from standard firms, which cater to the needs of various research laboratories in India and abroad. All the instruments used were available in the research laboratory of Lakshmibai National Institute of Physical Education, Gwalior, and Human Performance Lab and Gymkhana of I.I.T. Bombay and their calibrations were accepted as accurate enough for the purpose of this study.

**Collection of Data**

The data pertaining to Physical and Physiological variables were collected in the Human Performance Lab and Gymkhana of I.I.T. Bombay. The data collected during the playing ability was assessed by the panel of three judges, rating of skills during the state championship, and other state Ranking Tournaments.
Statistical Analysis of Data

The relationship between dependent variable (playing ability) and independent variables (physical and physiological variables) was established by computing Pearson Product Moment Correlation (Zero Order) and the combined effect or contribution of physical and physiological to playing ability in badminton was obtained through Wherry Do. Little Method of multiple correlation. Badminton playing ability was predicted from physical and physiological by utilizing regression equation. The relative contribution of a single independent variable to dependent variable (playing ability) by eliminating of partialling out the effect of one or the other was found through partial correlation. Codes were given to the variables in the study to enable statistical analysis as well as to find out significant variables to playing ability.

Further, on way analysis of variance (ANOVA) was done to re-established the validity of significant predictors to playing ability.

The data were further examined by stepwise multiple regression to find out the most effective and powerful predictor to playing ability.

For testing hypothesis the level of significance was set at .05.