Chapter III

PROCEDURE

In this chapter selection of subjects, selection of variables, criterion measures, collection of data, administration of tests and statistical technique for the analysis of data has been described.

Selection of the Subjects

The subjects for this study were from the state of Delhi. A total of ninety subjects were selected. Thirty subjects were selected from each level i.e. Senior, Junior and Sub Junior.

Selection of variables

Based on literary evidence, correspondence with the expert and the scholar's own understanding the following variables were selected for this study.

**Coordinative abilities:**

(i) Reaction Ability

(ii) Orientation Ability

(iii) Differentiation Ability
(iv) Balance Ability
(v) Rhythmic Ability

**Physiological variables**

(i) Anaerobic Power
(ii) Vital Capacity
(iii) Resting Heart Rate
(iv) Resting Respiratory Rate
(v) Body Composition
   - Total Body Fat Percentage
   - Lean Body Weight
(vi) Breath Holding Capacity
   - Positive Breath Holding Capacity
   - Negative Breath Holding Capacity

**Criterion Measures**

1. The anaerobic capacity was measured through Sargent Jump-Lewis Nomogram was employed, and anaerobic power was expressed in Kg-m/sec.
2. Vital capacity was measured by Dry Spirometer. The amount of expired air that was read directly from the calibrated scale was the score of vital capacity and was recorded in litres.

3. Heart rate was measured in terms of number of pulse beats per minute.

4. Resting respiratory rate was measured by manual method over a period of one minute.

5. Fat percentage was measured by Slown Weir Nomogram Technique. In these technique two sites (Thigh and Subscapular) skin thickness was used.

6. Lean Body weight was calculated by subtracting the fat weight of the subjects from their total body weight.

7. Positive breath holding was measured by manual method and the score was recorded in seconds.

8. Negative breath holding was measured by manual method and the score was recorded in second.

9. Weight was recorded to nearest to half a kilogram.

10. To measure the reaction ability Ball Reaction Exercise Test was used. The score was the distance measured in
centimeters from the top of the planks to the point where the subjects stopped the ball. Only two trials were given and the best one was recorded as the score.

11. Orientation Ability of the subjects was measured by Numbered Medicine Ball Run Test. The time taken to complete the course was noted in seconds. Two trials were given to each subject and the best one was recorded as the score.

12. To assess the Differentiation Ability of the subjects Backward Medicine Ball Throw Test was applied. The score was recorded as (Medicine ball touching the mat – 1 point, Medicine ball touching the circle line – 2 points, Medicine ball touching inside the circle – 3 points, Medicine ball touching the 2 kg. Medicine ball – 4 points).

13. To determine the Balance ability of the subjects Long Nose Test was used. The time taken to complete the course was be the score. At the same time, the subject who failed to complete the task without losing balance was not given any further trial and no score was awarded.
14. To determine the Rhythm Ability of the subjects Sprint at the given Rhythm Test was used. The difference between the timing of the first and second attempts was taken as the score.

**Collection of Data**

Data were collected from the respective Centers / clubs of the subjects, when they were not busy and had enough time to spare for testing. Necessary instructions were given to the subject before the administration of each test. Confidentiality of response was guaranteed. The research scholar motivated the respondents by promising to send a separate abstract of conclusions of his study to each of the subject. The required data was collected during the course of three days in their centers/clubs. On the first day, the research scholar had a brief orientation and discussion with the badminton players. On the second day the scholar visited the centers/clubs and administered the test related to physiological variable. Lastly on the third day, the scholar administered the coordinative abilities tests and collected the required data.
Procedure for administration of Physiological Test

Anaerobic Power

Objective: To measure Anaerobic Power

Equipment required: Weighing machine, measuring tape and chalk

Procedure: The Anaerobic Power (Kg-m/sec) was calculated with the help of vertical jump by Sargent Jump Test. The Anaerobic Power was calculated by using the Lewis Nomogram. The score of the vertical jump was obtained in meters by measuring the difference between a subject Standing Reach and the height to which he could jump and touch. The body weight was recorded in kilograms.

Score: To obtain a score of Anaerobic Power, a straightedge was laid across the Lewis Nomogram, connecting the scores of the distance of jump and reach test and the body weight. The Point where the straightedge intersected the middle scale was the Anaerobic Power¹.

Fig. 1 Lewis Nomogram for measuring Anaerobic Power
Heart Rate

**Objective:** To measure the heart rate.

**Equipment:** Stop Watch.

**Description:** The heart rate was recorded before the practice session. Before recording the heart rate, the subjects were instructed to take rest for 30 mins. To record the heart rate, the pulse rate was recorded by palpation at the radial artery.

**Score:** The score was expressed in terms of number of pulse beats per minute.

Resting Respiratory Rate

**Objective:** To measure Respiratory Rate.

**Equipment required:** Stopwatch.

**Procedure:** The Resting Respiratory Rate of each subject was recorded in the morning session. Before recording the Resting Respiratory Rate, the subject was instructed to remain in supine lying position for five minutes. The tester then recorded the rate of respiration in unit counts per minute by carefully watching the
movements of the subject’s abdomen. Similarly, the respiration rate was counted during the game and at the termination of the game (three minute recovery).

Score: The total number of respiratory movements per minute was the final score.

Vital Capacity

Objective: To measure the Vital Capacity

Equipment: Dry Spirometer, Nose Clip.

Description: The spirometer was brought into zero position. The subject was asked to take maximum inspiration and after clipping the nose, the air was blown out as intensely as possible into the mouth piece.

Scoring: The amount of expired air was read directly from the calibrated scale and that was the score of vital capacity and was recorded in litres.²

Total Body Fat Percentage

Objective: To measure the Total Body Fat Percentage.

Equipment: Skinfold Caliper.

Description: For calculating total body fat percentage of the subjects, Slown Weir Nomogram Technique was used. In this technique two sites (Thigh and Subscapular) skin thickness was used.

Scoring: To obtain a score of total body fat percentage, a straightedge was laid across the Nomogram connecting the scores of thigh and subscapular skinfolds, The point where the straightedge intersects the middle scale, was the total body fat percentage\(^3\).

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\(^3\) Fox, Bowers and Foss, The Physiological Basis of Physical Education and Athletics, pp. 566.
Fig. 2 Sloan Weir Nomogram for measuring body fat percentage
Lean Body Weight (Fat Free Weight)


The lean body weight was calculated by subtracting the fat weight of the subjects from their total body weight\(^4\).

\[\text{Lean Body Weight} = \text{Total Body Weight} - \text{Fat Weight}\]

Positive Breath Holding Capacity

Objective: To measure Positive Breath Holding Capacity.

Equipment: Stop Watch and Nose Clip.

Description: To measure the positive breath holding capacity, the subjects were instructed to place the nose clip tightly. They were asked to inhale through the mouth to the maximum capacity. As soon as the subjects take a deep breath to the fullest capacity of their lungs and close the lips, the stop watch was started.

Scoring: As soon as the subjects open their lips to exhale, the stop watch was stopped and the time was recorded as the score of positive breath holding capacity.

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Negative Breath Holding Capacity

Objective: To measure Negative Breath Holding Capacity.

Equipment: Stop Watch and Nose Clip.

Description: To measure the negative breath holding capacity, the subjects were instructed to place nose clip tightly. They were asked to exhale through the mouth to the maximum capacity. As soon as the subjects exhale and close the lips, the watch was started.

Scoring: As soon as the subjects open their lips to inhale, the watch was stopped and the time was recorded as the score of negative breath holding capacity.

Administration of Coordinative Abilities Test

The necessary data was collected by administering co-coordinative abilities tests as suggested by Peter Hirtz5.

The necessary work was done before the start of the test. All the tests were administered and explained to the subjects by the scholar.

Ball Reaction Exercise Test

Objective: To measure the reaction ability.

Equipment:

(i) Two wooden planks, each of 4m. length.
(ii) One inflated Volleyball.
(iii) A supporting stand
(iv) Pencil, Papers and Clipboard

Description: Two wooden planks of 4 meter length were taken and each was kept inclined by a supporting stand having a height of one meter and twenty centimeters, so that it can enable a volleyball to roll freely from a height of 1.20 mt. The lower ends of the wooden planks was kept at a distance of 1.5 mt from the starting line; the outer side of one of the planks was graduated in centimeters.

A Volleyball was hold by the tester at the top of the plank. The subject was asked to stand behind the starting line, facing opposite the plank. On clapping, the subjects turned and ran towards the plank and stopped the ball which was dropped on the signal with
both the hands. Each subject was given a practice trial before actual commencement of the test.

**Instructions:**

1. The ball should be stopped with both the hands.

2. The ball should not be pushed upwards while stopping.

**Scoring:** The score was the distance measured in centimeters from the top of the planks to the point where the subject stopped the ball. Only two trials were given and the best one was recorded as the score.
Fig. 3 Ball Reaction Exercise Test
Numbered Medicine Ball Run Test

Objective: To determine Orientation Ability of the Subjects.

Equipment:

(i) Five medicine balls, each weighing 3 Kg.
(ii) One medicine ball weighing 4 Kg.
(iii) Stop Watch
(iv) Five metallic numbered plates
(v) Clapper
(vi) Pencil, Papers and Clipboard.

Description: All the medicine balls weighing 3 kg. were arranged on an even ground in a semi circle. The sixth medicine ball weighing 4 kg. was kept 3 m. away from these medicine balls. Behind all the medicine balls of 3 kg., metallic number plates of 1 square foot size was kept from 1 to 5. Before the start of the test, the subject was asked to stand behind the sixth medicine ball facing towards the opposite direction. On the signal, the subject turned and ran towards the ball, a number was called by the tester and the subject touched the medicine ball and ran back to touch the sixth medicine
ball, immediately another number was called, similarly the number was called three times by the tester and the subject performed accordingly. Before the actual test was administered, one practice trial was given to all the subjects.

**Scoring:** The time taken to complete the course was noted in seconds. Two trials were given to each subject and the best one was recorded as the score.
Fig. 4 Numbered Medicine Ball Run Test
Backward Medicine Ball Throw Test

Objective: To assess the Differentiation Ability of the Subjects.

Equipment:

(i) A gymnastic mat, size 3' x 6'
(ii) One medicine ball weighing 2 kg.
(iii) Five medicine balls weighing 1 kg. each
(iv) Pencil, papers and clipboard.

Description: A gymnastic mat was kept 2 meters away from the starting line. A circle of 40 cm. radius was drawn in the middle of the mat and a medicine ball of 2 kg. was kept at the centre of the circle. The subject was asked to stand behind the starting line facing the opposite direction. He was asked to throw five medicine balls (1 kg. each) over the head to hit the 2 kg. ball kept on the mat, one after another, using both the hands. One practice trial was given to all the subjects.

Instructions:

1. Only overhead throw was permitted.
2. The subject was not allowed to look back.
Scoring:

1. Medicine ball touching the mat – 1 point
2. Medicine ball touching the circle line – 2 points
3. Medicine ball touching inside the circle – 3 points
4. Medicine ball touching the 2 kg. Medicine ball – 4 points.

Points were decided considering the first pitch of the ball. The score of the individual was the total points scored in all the five throws.
Fig. 5 Backward Medicine Ball Throw Test
**Long Nose Test**

**Objective:** To determine the Balance ability of the subjects.

**Equipment:**

(i) Balancing Beam/ modified beam

(ii) One Medicine Ball weighing 2 kgs.

(iii) One Medicine Ball weighing 4 kgs.

(iv) Stop Watch

(v) Pencil, paper and clipboard.

**Description:** A balancing beam or its modified form was kept on the floor one and half meters away from the starting line. The subject was asked to stand behind the starting line with one kilogram medicine ball in his strong hand fully stretched forward and the other hand holding the opposite ear lobe. On clapping the subject moved over the balancing beam towards the 2 kg. medicine ball which was kept at the other end of the beam, push down the medicine ball with his foot and moved back to the starting line, without losing balance, over the beam.
**Instructions:**

1. The arm with which the ball is carried should be kept straight.

2. The medicine ball kept on the balancing beam should be rolled down with either foot.

**Scoring:** Only one chance was given to each subject. The time taken to complete the course was the score. At the same time, the subject who failed to complete the task without losing balance was not given any further trial and no score was awarded.
Fig. 6 Long Nose Test
Sprint at the Given Rhythm Test

Objective: To determine the Rhythm Ability of the subjects.

Equipment:

(i) Eleven gymnastic hoops, each 1 mt. in diameter.

(ii) One Stop Watch

(iii) One measuring tape.

Description: The subject has to run a distance of 30 mt. marked between two lines with maximum sprinting speed. The sprinting time of the subject was recorded by stop watch. In the second attempt the subject had to run at a particular rhythm with maximum speed through eleven hoops which was arranged systematically. Three hoops were kept in a sequence against each other at a distance of 5 m from the starting line. Similarly three hoops were kept at a distance of 5 m. from the finishing line. Five more hoops were kept in a sequence in the middle of the running distance. The subject had to run through those hoops, stepping each hoop. The scholar will explain the test along with one
demonstration and each subject was given one trial run.

**Scoring:** The difference between the timing of the first and second attempts was taken as the score.
To characterize badminton players by their coordinative abilities and physiological characteristics, the mean and standard deviation were used. To compare at different levels, one-way analysis of variance was applied at .05 level of significance.

**Fig. 7 Sprint at the Given Rhythm Test**
Statistical Techniques Employed for the Analysis of Data

To characterize Badminton players by their coordinative abilities and physiological characteristics, the mean and standard deviation was used. To compare at different levels, one way analysis of variance was applied at .05 level of significance.