In this chapter selection of subjects, selection of variables, criterion measures, reliability of data, description of tests, collection of data, detailed methodology and statistical technique used for analysis of data are presented.

Selection of Subjects

A total of 60 subjects in the age category 10-14 & 15-19 of different academies in Surat district have been selected. Subjects of the research group were divided into four groups (two control groups & two experimental groups). Two groups will be consisting of 15 players each of the beginner level. First group was comprise of players of age 10-14 years on which the training schedule was implied followed by second group which was of the same age category of the advanced player. Third group was of 15-19 years age category ofthe beginners followed by the fourth group which was having the advanced players of the same age category. The Training programme was administered on the experimental group four times in a week for a period of 12 weeks.

Criterion Measures

The scores obtained through various tests in physical variables and physiological variables was the criterion measures of the study.

Selection of Variables

A number of physical variables and physiological variables are important to achieve excellence in sports, but the most important variables were selected for the purpose of study. The chosen physical variables and physiological variables for the purpose of the study are presented below –

PHYSICAL VARIABLES

Sr. No.	Variables	Test	Units of Measurement
1.	Speed	20 mts. Dash	$1/100^{th}$ of a Second Stopwatch
2.	Explosive Power	Sargent jump test	In Feet or inches

3.	Balance	Modified Bass Test of DynamicBalance	Calculated in seconds
4.	Flexibility	Sit and Reach Test	In centimeters
5.	Lower Body Strength	Lunges	Number of lunges in 1 minute
6.	Back Strength	Kraus Webertest	Counted in numbers/ minutes

PHYSIOLOGICAL VARIABLES

Sr. No.	Variables	Test	Units of Measurement
1.	Heart Rate	Digital Heart Rate Monitor	Number of beats per minute
2.	Vital Capacity	Spirometer	Liters

Reliability of Data

Reliability of Data was quesered by tester's competency, reliability of subjects, reliability of instruments/ equipment's and reliability of test items. Description and administration of tests all the tests were measured by standard tests. Test was administered to the badminton players who were selected for the study. The researcher has elaborated the purpose of the test after making sure that the subject was clearly understood the procedure of the test. Scores obtained from each test were recorded for the analysis of data.

Description of Physical Variables

1. **Speed (20 meters dash)**

   Purpose - The purpose of this test was to measure the speed of subjects.

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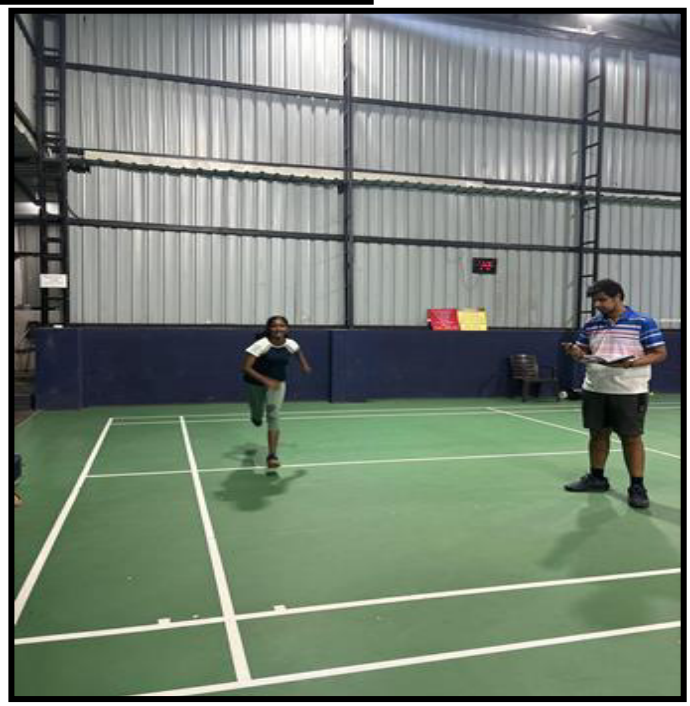
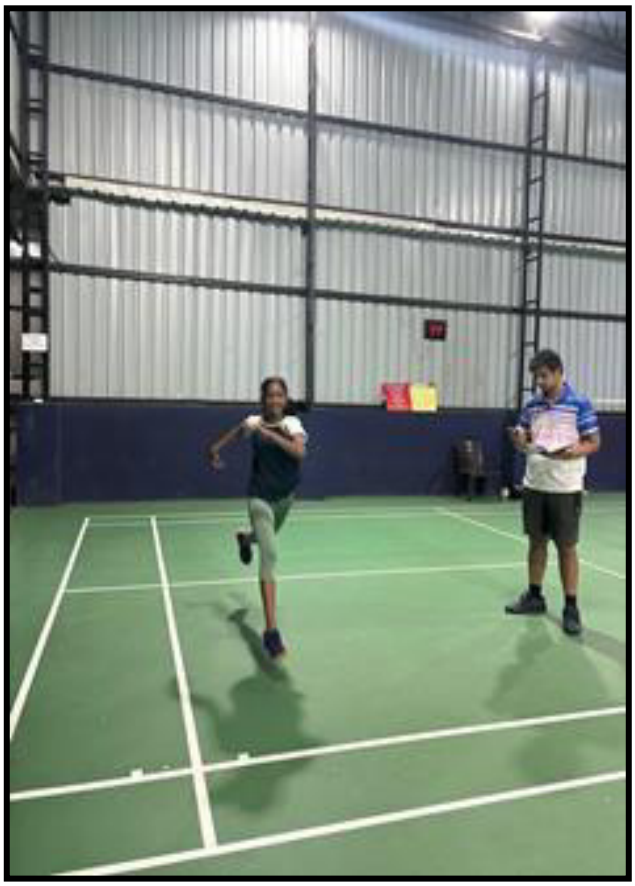
   Procedure - Prior to the test administration, a suitable running area with the distance of 20 meters and extension for stopping was marked. The subjects

were asked to take a standing start behind the starting point. The commands "Ready" and "Go" were given to start their running. At the same time stopwatch was turned on. The subject ran as fast as possible and when the subject crossing the finishing line, the stopwatch was stopped. No trials were given.

Scoring - The time taken to cover the distance was recorded to the nearest $1/10^{th}$ of the second.





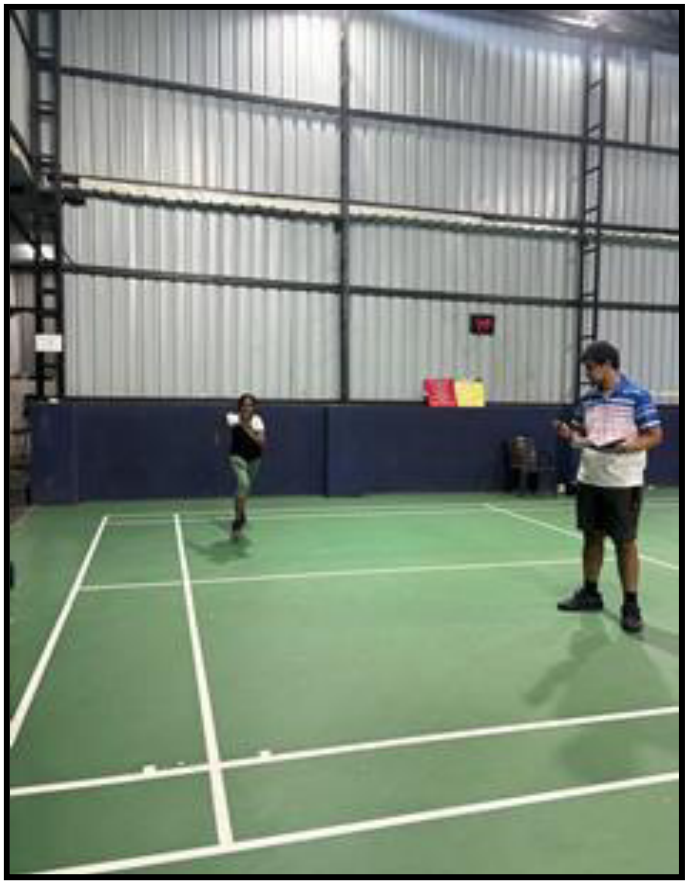


Photo1 : Speed 20 meters dash

2. Plosive Power (Vertical Jump)

Purpose - The purpose of this test was to measure explosive strength of subjects in vertical direction.

Equipment's - A plywood board as suggested by Sargent was used to obtain the data.

Procedure - To obtain data for vertical jump, Sargent jump was administered to the subjects. Before the execution of the vertical jump test, subjects were directed to practice for a few minutes. A plywood board (blackened 1 cm. Thick 1.50 mts. Long and 50 cm. Wide) with lines marked horizontally 1 cm. apart was used. This board was placed vertically, the zero point of the scale being at the reaching height of the shortest subject tested. The subject stood with his side toward the wall and reached as high as possible with heels on the floor and made a mark on the wall with chalked fingers. The subject then swung his arms downward and backward assuming a crouched position with the knees bent at about right angle. The subject then jumped as high as possible, swinging the arms upward, as the highest point of the jump was reached, and another mark was made above the initial one. Three trials were allowed with one-minute rest in between.

Scoring - The score was recorded to the nearest inches or feets, between the reachand jump mark. The best of the three trials was recorded as the test score.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Photos : 2 Vertical Jump

3. Balance Measurement

Purpose - The purpose of this test was to measure the dynamic balance of subjects.

Equipment's - Adequate floor space, sticky tape for marking floor, measuring tape, stopwatch.

Procedure - The subject begins by standing stationary on the right foot on the starting point square. The subject then hops to the first tape mark with the left foot and immediately holds a static position for five seconds. After this time, he then hops to the second tape mark with the right foot and holds a static position for another five seconds. This continues with alternate foot hopping and holding a static position for five seconds at each point until the course is completed. At each point, the sole of the foot must completely cover each tape mark so that it cannot be seen. A period of practice with the procedure and on the course should be allowed.

Scoring - The result is recorded as either a success or fail. A successful performance consists of hopping to each tape mark without touching the floor with the heel or any other part of the body, and holding a static position on each tape mark for five seconds without exposing the tape mark.

4. Flexibility

Purpose - The purpose of this test was to measure the flexibility of subjects.

Equipment's - Sit and reach box (or alternatively a ruler can be used, and a step or box).

Procedure - This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at least one-two seconds while the distance is recorded. Make sure there are no jerky movements. See also video demonstrations of the Sit and Reach Test.

Scoring: The score is recorded to the nearest centimeter or half inch as the distance reached by the hand. Some test versions use the level of the feet as the zero mark, while others have the zero mark 9 inches before the feet. There is also the modified sit and reach test which adjusts the zero mark depending on the arm and leg length of the subject. There are some norms for the sit and reach test and also examples of some actual athlete results.

Photos 3 : Flexibility

Lower Body Strength

Purpose - The purpose of this test was to measure the strength of lower body through lunges of subjects.

Equipment's - Adequate floor space, stopwatch.

Procedure - The subject is asked to begin lunges on command "Go". Number of correctly lunges performed by the subject in one minute will be counted by the tester.

Scoring - The correct number of lunges performed by the subject in one minute will be recorded as the score.

Photos 4 : Lower Body Strength

5. Back Strength (Kraus Weber Test)

Purpose: The purpose of this test was to assess the strength of the lower back muscles.

Equipment required: Flat surface, pillow, stopwatch, recording sheets.

Procedure: The subject lies in prone position i.e., face down on his stomach with a pillow under his lower abdomen and his hands behind his neck. The examiner holds his chest down (compared to the other Kraus Webber back strength test in which the feet are held down). The subject is asked to raise his feet, keeping his knees straight. The examiner counts to 10 seconds.

Scoring: This test is graded on a pass-fail basis. The test is passed if the subject holds the position for ten seconds.

Photos 5 : Back Strength

Description of Physiological Variables

1. **Heart Rate**

   Purpose: The purpose of this test was to measure the heart rate of the subjects.

   Equipment required: Digital heart rate monitor.

   Procedure: The subject sits in the normal position. With the help of Digital heart rate monitor heart rate of the subject has been measured as number of beats per minute.

   Scoring: Number of beats per minute of the subjects has been recorded as the score.

2. **Vital Capacity**

   Purpose: The purpose of this test was to measure vital capacity of the subjects.

   Equipment required: Dry Spirometer.

   Procedure: Vital capacity was measured in liters by using Dry spirometer. The spirometer will be brought in to zero position. The subject performed maximum inspiration and after closing the nose, the air will be blown intensely in the mouth piece of the spirometer. Then the amount of expired air will be read directly from the calibrated scale and that will be the score of vital capacity.

   Scoring: The vital capacity of the subjects will be recorded in liters.

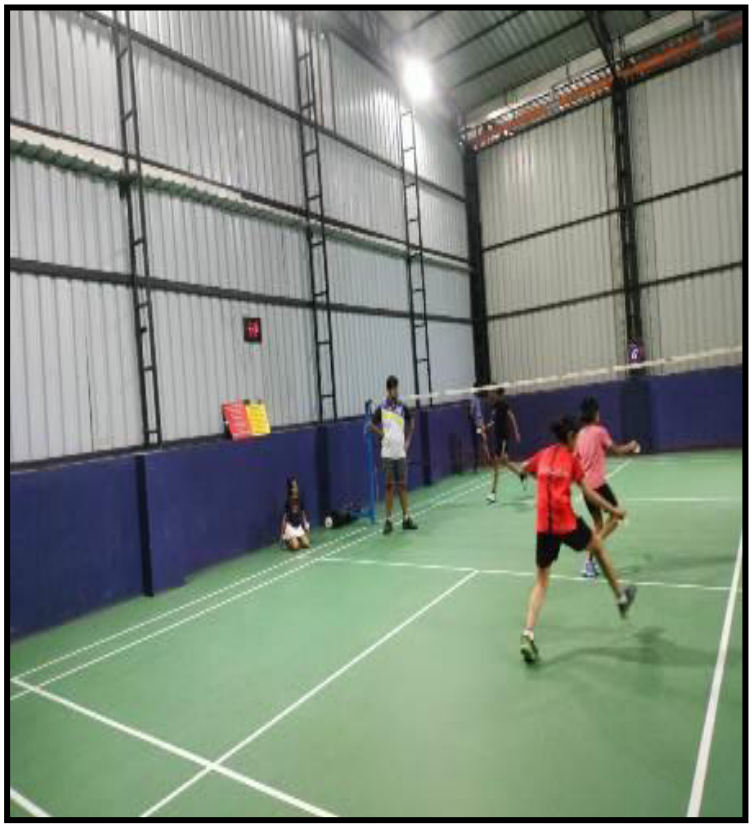
TRAINING PROGRAMME

Pre- test and Post-test randomized group design has been used for the purpose of the study. The training was divided into sub-parts and training on each variable was specific followed by the whole training together.

Training period 1 - 4 weeks (single corner)

Training period 4-8 weeks (2-4 corners)

Training period 8-10 weeks (multiple corners)



Photos 6 : Shadow Training

Table-3.1 Badminton shadow group weekly training program

Training period 1 - 4 weeks (single corner)

Days	1st	2nd	3rd	4th
Time	30-35 Min.	30-35 Min.	30-35 Min.	30-35 Min.
Intensity	50%	60%	70%	80%
No. of sets	10 sets	12 sets	15 sets	15 sets
Duration of eachsets	30 seconds	30seconds	30 seconds	45 seconds
Recovery	1 Min.	1 Min.	1 Min.	1 Min.

Training period 4-8 weeks (2-4 corners)

Days	1st	2nd	3rd	4th
Time	40-45 Min.	40-45Min.	40-45 Min.	40-45 Min.
Intensity	60%	70%	75%	80%
No. of sets	12 sets	12 sets	15 sets	15 sets
Duration of each sets	30 seconds	30 seconds	30 seconds	45 seconds
Recovery	45 seconds	45 seconds	45 seconds	45 seconds

Training period 8-10 weeks (multiple corners)

Days	1st	2nd	3rd	4th
Time	60-65 Min.	60-65Min.	60-65 Min.	60-65 Min.
Intensity	70%	75%	80%	85%
No. of sets	15 sets	15 sets	15 sets	15 sets
Duration of each sets	45 seconds	45 seconds	45 seconds	45 seconds
Recovery	45 seconds	45 seconds	45 seconds	45 seconds

Training period 10-12 weeks (Full court)

Days	1st	2nd	3rd	4th
Time	60-65 Min.	60-65Min.	60-65 Min.	60-65 Min.
Intensity	60%	70%	80%	90%
No. of sets	20 sets	20 sets	20 sets	20 sets
Duration of each sets	45 seconds	45 seconds	45 seconds	45 seconds
Recovery	30 seconds	30 seconds	30 seconds	30 seconds

This Programme consists of following off court exercisesdaily-

- Flexibility
- Back strength
- Lower Body Strength
- Balancing exercise
- Co-ordination exercise

Collection of Data

A total of 60 subjects in the age category 10-14 & 15-19 of different academies in Surat district have been selected. Subjects of the research group were divided into four groups (two control groups & two experimental groups). Two groups will be consisting of 15 players each of the beginner level. First group was comprise of players of age 10-14 years on which the training schedule was implied followed by second group which was

of the same age category of the advanced player. Third group was of 15-19 years age category ofthe beginners followed by the fourth group which was having the advanced players of the same age category. The Training programme was administered on the experimental group four times in a week for a period of 12 weeks.

Statistical Technique

The data collected from two groups before and after experimental period was statistically analyzed for observing significant improvement by using T- Test. In order to observe the effect of Shadow Training on selected Physical & physiological variables of beginners and advanced badminton players Analysis of co- variance (ANCOVA) was used. Statistical significance was accepted at 0.5 level.