Chapter-III  
METHODS AND PROCEDURE

In this chapter, the procedure adopted for the design of the study, selection of subjects, selection of variables, criterion measures, collection of data, reliability of data, procedure for administering the test, training protocol, training programme, administration of the test and statistical procedures that were required to analyze the data are presented.

**DESIGN OF THE STUDY**

Random Group Experimental Design was adopted for this study. Equal numbers of subjects were assigned randomly to four groups, of fifteen subjects each. The experimental treatments were also assigned randomly to the three groups and one group served as the control. The three experimental groups were administered three different types of training programmes for the development of fitness level and performance of female basketball players. Plyometric Training was given to Group-I, Resistance Training to Group-II, and combination of both (Plyometric and Resistance Training) to Group-III as mentioned in Table I, II & III. A proper warming-up period of 15-20 minutes duration was given before training sessions in Experimental groups on alternative days. The control group was not allowed to participate in any of the training programme except in their daily routine practice. Measurements of fitness variables and basketball performance variables were taken before and after an experimental training period of eight weeks. During data collection period, the subjects were not allowed to participate in any training competition.

The subjects were explained the purpose of the tests and way of executing the test by demonstration of the tests before the subjects and all efforts were made to ensure accuracy, uniformity and standardization in the administration of the tests at the fields.
**SELECTION OF SUBJECTS**

The present study was conducted on sixty (60) School National level female basketball players ranging between 16-18 years of age. The subjects were randomly selected and training was conducted at Government Senior Secondary Girls School, Mall Road, Amritsar (Punjab). The subjects were divided into two groups namely: Experimental Group (45 subjects in total) and Control Group (15 subjects). The Experimental group was further sub-divided into three groups of 15 subjects in each group. Experimental Group-I was given (Plyometric Training), Experimental Group-II (Resistance Training) and Experimental Group-III was given both training in combination (Plyometric and Resistance Training). All the subjects were local residents.

**SELECTION OF THE VARIABLES**

The research scholar examined the scientific literature pertaining to fitness and performance variables of athletes from different libraries, and also consulted experts in this area to select the appropriate fitness and performance variables. The Administrating feasibility in terms of availability of instruments, time factor from point of view of subjects and expertise in the collection of data were also given due consideration. By adopting the above criterion, the following variables were selected for the purpose of the study.

- Flexibility (Sit and Reach Test)
- Strength (Vertical Jump Test)
- Speed (50m dash Test)
Methods and Procedure

- Agility (Shuttle Run Test)
- Cardio-vascular Fitness (Cooper 12 minute Run-Walk Test)
- Performance (*Johnson Basketball Test, C. Meyers, 1974*)
  - a) Dribble Test
  - b) Field Goal Speed Test
  - c) Basketball Throw For Accuracy

CRITERION MEASURES

The criterion measures that were chosen for testing hypothesis are as follows:

1. Sit and Reach Test (Flexibility) was recorded in Inches.
2. Vertical Jump Test (Strength) was recorded in Inches.
3. 50m Dash (Speed) was recorded in 1/10th of Second.
4. Shuttle Run (Agility) was recorded in 1/10th of Second.
5. Cooper 12 minutes Run Walk (Cardiovascular Fitness) was recorded to the nearest 50 meter.
6. Johnson Basketball Test
   - a. Performance in Dribble Test: Total numbers of zones covered in 30 Seconds were recorded.
   - b. Performance in Field Goal Speed Test: The total number of successful baskets converted in 30 seconds was recorded.
   - c. Performance in Basketball Throw for Accuracy: The total score of hitting in rectangle were recorded.

COLLECTION OF DATA

Data on the selected variables was collected as per the method prescribed above, before training period pre-test and at the end of training period of eight weeks post-test. During this period, the subjects were not allowed to participate in any other training programme or competition.

RELIABILITY OF DATA

The reliability of data was measured by ensuring instruments reliability and testers competency.
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Reliability of Instrument

The instrument used for the study was procured from the department of Physical Education, Panjab University, Chandigarh, which is supplied by well known manufacturers catering to research laboratories and hence was considered accurate and reliable.

Testers Reliability

To ensure that the investigator is well versed with technique of conducting the tests, the investigator had a number of practice sessions in testing procedures under guidance of the expert. The investigator took all the measurement with the assistance of qualified testers, who were also well acquainted with the tests. To determine the reliability of tests, 10 subjects were selected at random and tester reliability was established by test-retest process whereby consistency of results were obtained by product moment correlation is presented in table 1.

<table>
<thead>
<tr>
<th>Fitness Variables</th>
<th>TEST</th>
<th>CO-EFFICIENT CORRELATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sit and Reach</td>
<td></td>
<td>.92</td>
</tr>
<tr>
<td>• Vertical Jump</td>
<td></td>
<td>.94</td>
</tr>
<tr>
<td>• 50m Dash</td>
<td></td>
<td>.88</td>
</tr>
<tr>
<td>• Shuttle Run</td>
<td></td>
<td>.87</td>
</tr>
<tr>
<td>• Cooper 12 Min Run/Walk</td>
<td></td>
<td>.90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance</th>
<th>TEST</th>
<th>CO-EFFICIENT CORRELATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dribble</td>
<td></td>
<td>.92</td>
</tr>
<tr>
<td>• Field Goal Speed Test</td>
<td></td>
<td>.94</td>
</tr>
<tr>
<td>• Throw for Accuracy</td>
<td></td>
<td>.88</td>
</tr>
</tbody>
</table>
PROCEDURE FOR ADMINISTERING THE TEST

Fitness Variables

SIT AND REACH TEST

Equipment required: sit and reach box or alternatively a ruler, placed on a step or box can be used.

Procedure: This test involved sitting on the floor with legs stretched out straight ahead. The soles of the feet were placed flat against the box. Both knees locked and pressed flat to the floor - the tester assisted the subject by holding knees down. With the palms facing downwards, and the hands on top of each other or side by side, the subject was instructed to lean forward along the measuring line/scale as far as possible with the hands remaining at the same level, not one reaching further forward than the other. After some practice, the subjects reached out and hold that position for at one-two seconds while the distance was recorded. Make sure there are no jerky movements.

Scoring: The score was recorded to the nearest centimeter or half inch as the distance reached by the hand. The best of three trials was recorded.

Fig 1: Illustration of Sit and Reach Test
VERTICAL JUMP TEST

**Equipment required:** measuring tape or marked wall, chalk for marking wall

**Procedure:** The athlete stands side on to a wall and reached up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips was marked or recorded. This is called the standing reach height. The athlete then stand away from the wall, and leaped vertically as high as possible using both arms and legs to assist in projecting the body upwards. The athlete then attempted to touch the wall at the highest point of the jump.

**Scoring:** The difference in distance between the standing reach height and the jump height was the score. The best of three attempts was recorded.

*Fig 2: Illustrations of Vertical Jump Test*
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50 METER DASH

Equipment required: A stopwatch, cones for marking, flat and clear surface of at least 70 meters and lime powder.

Procedure: The test involved running a single maximum sprint over 50 meters, with the time recorded. A thorough warm up was given, including some practice and accelerations. The subject started from a stationary standing position, with one foot in front of the other, the front foot was behind the starting line. Once the subject was ready and motionless, the starter gave the instructions "set" then "go." The tester provided hints for maximizing and the subjects were encouraged not to slow down before crossing the finish line.

Scoring: Two trials were allowed and the best time out of the two trials was recorded to the nearest 2 decimal place.

Fig 3: Illustrations of 50 Meter Dash
SHUTTLE RUN

**Equipment required**: Two wooden blocks, cones for marking, measurement tape, stopwatch, non-slippery surface, lime powder.

**Procedure**: This test required the person to run back and forth between two parallel lines as fast as possible. Two lines of cones were set up 30 feet apart, and two blocks of wood were placed or a similar object behind one of the lines. Starting at the line opposite the blocks, on the signal "Ready? Go!" the participant ran to the other line, picked up a block and returned to place it behind the starting line, then returned to pick up the second block, then ran with it back across the line. As soon as the second block was placed on the floor, the timer was stopped for recording time.

**Scoring**: Two trials were allowed with some rest in between. The time of better of the two trials was recorded to the nearest 10th of a second as the score.
COOPER 12 MINUTE RUN WALK

Purpose: to test aerobic fitness (the ability of the body to use oxygen to power it while running)

Equipment required: flat, oval or running track, marking cones, recording sheet and stop watch.

Procedure and scoring: Place markers at set intervals around the track to aid in measuring the complete distance. At the signal ready/go, the subject covered as much distance as possible in 12 minutes. If the track or running area is marked off every 50 meter, the tester can count the number of laps completed and additional incomplete lap distance covered in 12 minutes respectively. Although the tester has to encourage all the students to run the entire period of 12 minutes but interspersed walking was allowed and total distance covered exactly in 12 minutes was recorded.

Fig 5: Illustration of Coopers 12 Minutes Run Walk Test
PERFORMANCE TEST

Johnson Basketball Test Battery (C. Meyers, 1974)

It is probably the oldest but the most commonly used test and was constructed in 1934 by Johnson. The test batteries include the following test items:

a) Johnson Basketball Dribble Test: For conducting this test, four restraints were required that were kept at distance of 6(foot) from each other. A starting line was drawn at a distance of 12(foot) from first restraint. The subject was required to cover a maximum distance while dribbling around obstacles/restraints in 30 seconds. The subject was asked to begin the dribbling from one end of the starting line and required to dribble for 30 seconds in zig zag manner around turnings at each obstacle, and secured points as shown in picture below. Two trials were conducted and the best was recorded as score.

Starting line

![Diagram of Johnson Basketball Dribble Test](image)

**Fig 6: Illustrations of Johnson Basketball Dribble Test**
b) Johnson Field Goal Speed Test: The subject was made to score maximum number of successful baskets in 30 seconds receiving the rebounds by own as the score. This test item measured the ability of the player to make maximum successful baskets quickly under stress of time.

Fig 7: Illustration of Johnson Field Goal Speed Test

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c) Johnson Basketball Throw For Accuracy: A Restraining line was drawn at a distance of 40 (foot) from a wall. On this wall a rectangle was drawn measuring 60 by 40 (foot) at the outermost at 14 (inches) distance from the floor. Inside this rectangle was one more rectangle measuring 40(foot) by 25 (foot) and innermost smallest one with 20 by 10 (foot). The subject was to stand behind the restraining line and throw at the wall for ten times at least and their score was noted. The ball that hit the outermost rectangle scored minimum i.e. 1 point, hitting at centre rectangle scored 2 points and the hitting at the innermost rectangle scored maximum i.e. 3 points. The score was the total of all the ten hits.
**TRAINING PROTOCOL**

To have uniformity in training load for all the subjects, the volume and intensity was manipulated by closely monitoring the quality of movements of the subjects. At the end of eight weeks training, all the subjects were administered for fitness and performance tests.

**TRAINING PROGRAMME**

First to eight week training exercises planned for Experimental Group-1, 2 and 3 (twice a week) is given below in Table – 1, 2 & 3.

The control group was trained with own game related training only, without any other specific training programme for eight weeks. The Experimental Group-1 underwent Plyometric training, Experimental Group-2 underwent Resistance Training and Experimental Group-3 underwent combination of both (Plyometric and Resistance training). Total numbers of 16 sessions were engaged during training. The training session consisted of warm up including stretching exercises, co-ordination footwork with skipping prone and jumping drills as warm up for duration of 15-20 minutes. The total duration of training for all Experimental groups was two hours.

The exercises were followed in progression of speed, agility, endurance and explosive strength. After the training sessions, recreational activities were followed by cool down exercises for 15-20 minutes. The training programme was scheduled from 3:00-5:00pm per day for twice a week for all three Experimental Groups (1, 2 and 3), for six days i.e. Monday and Thursday for Group -1, Tuesday and Friday for Group-2 and Wednesday and Saturday for Group-3 a week .The post tests was conducted at the end of eight weeks respectively for all the groups.
### TABLE - 2

#### PLYOMETRIC TRAINING PROGRAMME

<table>
<thead>
<tr>
<th>Plyometric Training</th>
<th>First 4-Session</th>
<th>Second 4-Session</th>
<th>Third 4-Session</th>
<th>Fourth 4-Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth jump</td>
<td>‡3*6(40) 30</td>
<td>‡3*8(50) 30</td>
<td>‡4*7(60) 30</td>
<td>‡4*8(75) 30</td>
</tr>
<tr>
<td>Split squat jump</td>
<td>‡3*6(30)</td>
<td>‡3*8(30)</td>
<td>‡4*7(30)</td>
<td>‡4*8(30)</td>
</tr>
<tr>
<td>Rim jump</td>
<td>‡3*6(30)</td>
<td>‡3*8(30)</td>
<td>‡4*7(30)</td>
<td>‡4*8(30)</td>
</tr>
<tr>
<td>Box to box depth jump</td>
<td>‡2*6/4(40)30</td>
<td>‡3*6/5(50)30</td>
<td>‡4*5/5(60)30</td>
<td>‡4*6/6(75)30</td>
</tr>
<tr>
<td>Skipping</td>
<td>‡3*70 (-)90</td>
<td>‡3*80 (-)90</td>
<td>‡3*85(-) 80</td>
<td>‡3*85(-) 75</td>
</tr>
</tbody>
</table>

†Sets*reps at (box height (cm)) times rest between sets
□ Sets*reps/ at (box height (cm)) times rest between sets

### TABLE - 3

#### RESISTANCE TRAINING PROGRAMME

<table>
<thead>
<tr>
<th>Weight Training</th>
<th>First 4-Session</th>
<th>Second 4-Session</th>
<th>Third 4-Session</th>
<th>Fourth 4-Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit-Ups</td>
<td>‡3*30 (120)</td>
<td>‡3*40 (120)</td>
<td>‡3*40 (110)</td>
<td>‡3*45 (100)</td>
</tr>
<tr>
<td>Pull-Ups</td>
<td>‡3*10 (120)</td>
<td>‡3*12 (120)</td>
<td>‡3*14 (110)</td>
<td>‡3*15 (100)</td>
</tr>
<tr>
<td>Bench Press</td>
<td>‡3*10 (120)</td>
<td>‡3*12 (120)</td>
<td>‡3*15 (110)</td>
<td>‡3*18 (100)</td>
</tr>
<tr>
<td>Leg press</td>
<td>‡4*10 (40%) 60</td>
<td>‡4*10 (60%) 60</td>
<td>‡4*8 (80%) 50</td>
<td>‡4*6 (100%) 40</td>
</tr>
<tr>
<td>Squat</td>
<td>‡4*10 (40%) 60</td>
<td>‡4*10 (60%) 60</td>
<td>‡4*8 (80%) 50</td>
<td>‡4*6 (100%) 40</td>
</tr>
</tbody>
</table>

†Sets*reps (times rest between sets) in seconds / in bench press and squat resistance will be sub-maximal
‡ Sets*reps at (percentage of 1RM) times rest between sets.

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TABLE-4
COMBINED (PLYOMETRIC AND RESISTANCE) TRAINING PROGRAMME

<table>
<thead>
<tr>
<th>Complex Training</th>
<th>First 4-Session</th>
<th>Second 4-Session</th>
<th>Third 4-Session</th>
<th>Fourth 4-Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth jump</td>
<td>† 3*4(30) 30</td>
<td>† 3*6(40) 30</td>
<td>† 3*7(45) 30</td>
<td>† 4*6(55) 30</td>
</tr>
<tr>
<td>Split squat jump</td>
<td>† 3*4(30) 30</td>
<td>† 3*6(30) 30</td>
<td>† 3*7(30) 30</td>
<td>† 4*6(30) 30</td>
</tr>
<tr>
<td>Rim jump</td>
<td>† 3*4(30) 30</td>
<td>† 3*6(30) 30</td>
<td>† 3*7(30) 30</td>
<td>† 4*6(30) 30</td>
</tr>
<tr>
<td>Skipping</td>
<td>† 3*70 (-90) 30</td>
<td>† 3*80 (-90) 30</td>
<td>† 3*85 (-80) 30</td>
<td>† 3*85 (-75) 30</td>
</tr>
<tr>
<td>Sit-Ups</td>
<td>† 3*30 (120)</td>
<td>† 3*35 (120)</td>
<td>† 3*35 (110)</td>
<td>† 3*40 (100)</td>
</tr>
<tr>
<td>Pull-Ups</td>
<td>† 3*10 (120)</td>
<td>† 3*12 (120)</td>
<td>† 3*14 (110)</td>
<td>† 3*15 (100)</td>
</tr>
<tr>
<td>Leg press</td>
<td>† 4*8(30%) 60</td>
<td>† 4*8 (45%) 60</td>
<td>† 4*6 (60%) 50</td>
<td>† 3*6 (75%) 40</td>
</tr>
<tr>
<td>Squat</td>
<td>† 4*8 (30%) 60</td>
<td>† 4*8 (45%) 60</td>
<td>† 4*6 (60%) 50</td>
<td>† 3*6 (75%) 40</td>
</tr>
</tbody>
</table>

†Sets*reps at (box height (cm)) times rest between sets
‡Sets*reps (times rest between sets) in seconds (for Sit-Ups)
§Sets*reps at (percentage of 1RM) times rest between sets

ADMINISTRATION OF THE TEST

Before testing, the subjects were oriented the purpose of the study and the importance of the training programme. The technique of performing the training sessions was explained to the subjects by means of demonstration and instructions by the investigator in order to handle them and get their full cooperation so as to ensure reliable data. The training program designed for each group was demonstrated to the respective groups. This was done to ensure a good orientation and exposure. The investigator with the help of Coach and Assistants verified the timings & efficiency of subjects at the training sessions.
STATISTICAL PROCEDURE

The difference between the initial (pre-test) and final (post-test) scores in each of the criterion were tested for significance by applying ‘t’ test in order to find out the effects of the experimental variables on criterion measures. In order to find out the differential effects of the three treatment groups (Plyometric, Resistance and Combined Plyometric & Resistance) and one control group, Analysis of Covariance (ANCOVA) test was computed with the help of SPSS computer software. The LSD post-hoc test was applied in cases where ‘F’-ratio has shown significance to find out which of the differences of the paired means were significant. The level of significance chosen was .05.