Chapter III

METHODOLOGY
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METHODOLOGY

In this chapter selection of subjects and its reason, variables selection, design, pilot study, pilot study, criterion measures and tests selection, reliability of data, reliability of instruments, tester’s reliability, subject reliability, administration of tests, training programs, collection of data, statistical techniques and its justification have been described in detail.

3.1 SELECTION OF SUBJECTS AND ITS REASON

In this world, Hockey is a fabulous game and day by day the performances of Indian hockey team diminishing every year. At this age level 18 to 21 years any type of training can be adapted by the body. Since, the researcher himself a player in Hockey game; he felt that there is a need to organize research in order to determine the type of training method which is is better to improve the potential of the player. Moreover, very little research had been done on women hockey players, which motivated the investigator to take up the study.

The purpose of the study was to find out the “effect of resistance and plyometric training on selected physical, physiological and skill performance variables of female hockey players”. For this purpose forty five female hockey players were randomly selected from PKR College of Arts and Science for Women and Gobi Arts and Science College, Erode district, Tamilnadu, India and their age ranged from 18 to 21 years. The subjects were divided into three groups where n = 15 in each. Group I was treated with resistance training and group II with plyometric training, Group III was kept under control.

3.2 VARIABLES SELECTION

The investigator reviewed available scientific literature from journals, periodicals, magazines and research articles pertaining to the physical, physiological and skill performance variables taken into consideration of availability of instrument and relevance of variables of present study the following variables were selected.
3.2.1 DEPENDENT VARIABLES

Physical Variables
- Speed
- Agility
- Endurance
- Strength
- Flexibility

Physiological Variables
- Vital Capacity
- Blood Pressure
- Resting Pulse Rate

Skill Performance Variables
- Dribbling
- Hit
- Scoop

3.2.2 INDEPENDENT VARIABLES

- Resistance Training
- Plyometric Training

3.3 DESIGN

The study consists of a pre-test and post-test, coming under true randomized group design. Forty-five female hockey players from PKR College of Arts and Science for Women and Gobi Arts and Science College, Erode district, Tamilnadu, India were randomly selected and their age ranged from 18 to 21 years. The selected physical, physiological, and skill performance variables were tested twice initially and after the training programme whereby the pre and post test scores were collected. The groups were assigned as experimental group I and was treated with resistance training, experimental group II with plyometric training and group III as control group who were not exposed to any type of training other than their regular activities. The duration of training period was 12 weeks. The collected scores were analysed using paired ‘t’ test and ANCOVA to find out the significance among the mean differences.
If the obtained ‘F’ ratio for adjusted post test was significant, Scheffe’s post hoc test was used. For this present investigation 0.05 level of confidence was fixed.

3.4 PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subjects, in order to fix load. For the pilot study ten subjects were selected at random basis among the forty five female hockey players, and divided into two groups of five each, in which group I underwent resistance training and group II underwent plyometric training. Based on the response of the subjects in the pilot study, the training schedule for the experimental groups was constructed. While constructing the training programme the basic principles of training (progression, over load and specificity) were followed.

3.5 CRITERION MEASURES AND TESTS SELECTION

The present study was undertaken to find out the “effect of resistance and plyometric training on selected physical, physiological and skill performance variables of female hockey players”. As per the available literatures the following tests were used to collect the relevant data on selected physical, physiological and skill performance variables are presented in table I.

<table>
<thead>
<tr>
<th>Test Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.No</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
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<td>4</td>
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<td>6</td>
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<td>7</td>
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<td>8</td>
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<tr>
<td>9</td>
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<tr>
<td>10</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td>12</td>
</tr>
</tbody>
</table>
3.6 RELIABILITY OF DATA

The test-retest method was used to establish the reliability of data. For this purpose, ten subjects were tested twice after a day’s gap uniformly. The obtained scores from the ten subjects were correlated using Intra Class Correlation for the different variables. The table – II represents the co-efficient of correlation.

Table – II
Reliability Co-Efficient of Correlation of Test Retest Scores

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
<th>‘r’</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed</td>
<td>0.87*</td>
</tr>
<tr>
<td>2</td>
<td>Agility</td>
<td>0.89*</td>
</tr>
<tr>
<td>3</td>
<td>Endurance</td>
<td>0.92*</td>
</tr>
<tr>
<td>4</td>
<td>Strength</td>
<td>0.91*</td>
</tr>
<tr>
<td>5</td>
<td>Flexibility</td>
<td>0.88*</td>
</tr>
<tr>
<td>6</td>
<td>Vital Capacity</td>
<td>0.91*</td>
</tr>
<tr>
<td>7</td>
<td>Systolic Blood Pressure</td>
<td>0.88*</td>
</tr>
<tr>
<td>8</td>
<td>Diastolic Blood Pressure</td>
<td>0.86*</td>
</tr>
<tr>
<td>9</td>
<td>Resting Pulse Rate</td>
<td>0.87*</td>
</tr>
<tr>
<td>10</td>
<td>Dribbling</td>
<td>0.88*</td>
</tr>
<tr>
<td>11</td>
<td>Hit</td>
<td>0.90*</td>
</tr>
<tr>
<td>12</td>
<td>Scoop</td>
<td>0.91*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level
3.7 RELIABILITY OF INSTRUMENTS

The instrument such as leg dynamometer, sit and reach box, spirometer, sphygmomanometer, stethoscope, stop watch and measuring tape were reliable and accurate enough to carry out the test procedures successively.

3.8 TESTER’S RELIABILITY

The investigator was well versed in the teaching procedure and technique of conducting the test to ensure the tester’s reliability. Test-retest method was used to establish tester reliability. For this purpose ten subjects were tested on selected variables twice under identical conditions on different occasions by two investigators.

3.9 SUBJECTS RELIABILITY

In order to get uniform results from the test items the subjects were used under identical conditions for the same test by the same tester. The subjects reliability was established by test-retest method.

3.10 ORIENTATION TO THE SUBJECTS

Prior to the administration of tests the investigator explained the purpose and the significance of the study. The requirements of the testing procedure were explained to the subjects in detail, to avoid any confusion in their minds. All the subjects voluntarily came forward to co-operate in the testing procedures and put their best efforts in the process of the scientific investigation and in order to enhance their own performance. The subjects were very enthusiastic and co-operative throughout the research work.
3.11 ADMINISTRATION OF TEST ITEMS

3.12 PHYSICAL VARIABLES

3.12.1 Speed (50 Metres Run)

Purpose:

To measure the speed of the hockey players.

Equipments:

Stopwatch, whistle, score sheet and pen.

Procedure:

The subjects were asked to have short warm-up to avoid injuries. The students took start position from the starting line. The time elapsed from the ‘clap’ to the runner crossing the finishing line was taken as test score. The fractions were rounded to the next largest one tenth of a second. For this purpose electronic stopwatches were used. Two trials were conducted with sufficient rest in between and the best of two trials were recorded.

Scoring:

The time taken from the starters signal to the instant at which the subjects crossed the finishing line was measured as the score in $1/10^{th}$ of the second.

3.12.2 Agility (Shuttle Run)

Purpose:

To measure the agility of the hockey players.

Equipments:

Two lines parallel to each other with 30 yards apart are drawn on the floor. Two blocks of wood and stopwatch.

Procedure:

The subjects were asked to stand at the starting line. On the command of “Go” the subjects ran to another end and take one wooden block and return to the starting
line and keep the block on the starting line. The subjects were asked to repeat the same for the second wooden block continuously.

**Scoring:**

The score was recorded in tenth of seconds among the best of two trials.

### 3.12.3 Endurance (9 Mins run/walk)

**Purpose:**

To assess the endurance of the hockey players.

**Equipments:**

Stop watch, score sheet, whistle and pen.

**Procedure:**

The test was administered in a 400 meter track with markings at every five meters. The investigator and the testers acted as the lap scores. The subjects were asked to stand behind the starting line drawn at the finish of the 400 mts track. They were instructed to run as much as possible either by running or walking throughout the 9 minutes. The race was started with a whistle and finished at the end of the ninth minute. Announcement was given after end of each minute. At the end of the final minute the subjects were asked to stand where they are.

**Scoring:**

The distance covered by each subject for nine minutes was recorded to the nearest fifth meter.

### 3.12.4 Strength (Dynamometer)

**Purpose:**

To assess back and leg strength of the hockey players.

**Equipments:**

Dynamometer.
Procedure:

The subjects were asked to stand on the base of the dynamometer in a comfortable position. The subject holds the bar with both hands by palms facing toward the body. The knees are bent at approximately 110 degrees. From this position the subjects asked to pulls the bar as hard as possible without bending the back.

Scoring:

The score was recorded in kilograms.

3.12.5 Flexibility (Sit and Reach)

Purpose:

To measure the flexibility of the hockey players.

Equipments:

Sit and reach box.

Procedure:

The subjects were asked to extend their legs and the bottom of his feet flat against a board projecting from the wall. Then they were asked to stretch both hands forward as close as possible towards scale and hold it for three seconds. The investigator measured the distance (centimeters) between the board and fingertips.

Scoring:

Recorded the maximum distance reached by the subjects to the nearest 0.5 cm.

3.13 PHYSIOLOGICAL VARIABLES

3.13.1 Vital Capacity (Spirometer)

Purpose:

To assess the vital capacity of the hockey players.

Equipments:

The equipment used was a computerised RMS Spirometer Helios 401.

Procedure:

The ambient conditions were set and the instrument was calibrated by pumping a volume of 1 litre air. The subjects ID number, name, age, sex, height and
weight were feed into the system. Flow volume test was selected from the function menu. The subject was made to breath through mouth piece as the instructions displayed on the screen. The subjects were asked to use the nose clips in order to avoid air leakage and to tighten the lips over the mouth piece. As the subject breathed through the mouth piece they were asked to exhale fully with forceful exhalation.

3.13.2 Blood Pressure (Sphygmomanometer)

**Purpose:**
To measure the blood pressure (systolic and diastolic) of the hockey players.

**Equipments:**
Sphygmomanometer.

**Procedure:**
The method used to measure the systolic and diastolic blood pressure is relatively simple. The cuff was wrapped around the forearm above the elbow, with earphones of the stethoscope in the tester’s ears; the bell of the stethoscope was placed on the bronchial artery just above the hollow of the elbow. The cuff was pumped up until no pulse beat could be heard. The investigator recorded the millimetres of mercury by releasing the air slowly for the first and fifth count of sound heard through the stethoscope. The first and fifth sound of beat recorded as systolic and diastolic blood pressure respectively.

**Scoring:**
The blood pressure was measured in millimeters of mercury (mmHg).

3.13.3 Resting Pulse Rate (Stethoscope)

**Purpose:**
To measure the resting pulse rate of the hockey players.

**Equipment:**
Stethoscope and watch.

**Description:**
The heart beat of the individual was measured with the earphones of the stethoscope placed in the tester’s ears, the bell of the stethoscope was placed on the radial pulse, so that one could measure her own heart beat.
Scoring:

Pulse rate was measured for one minute.

3.14 SKILL PERFORMANCE VARIABLES

3.14.1 Dribbling

Purpose:

The purpose was to assess the dribbling ability of hockey players.

Equipments:

Hockey balls, hockey sticks, measuring tape, whistle, 5 flag post, stop watch and lime powder for marking purposes.

Marking:

Three flag post were placed in a straight line with the gap of 5 meters A, C and E respectively from each other. Five meters arc was drawn from point A & C, C & E and flag post was placed at the intersection points of B and D.

Description:

On the signal “Go” the players were asked to dribble the ball from the flag A to B, C, D and to E respectively and back to the starting line in the reverse manner and totally covers 40 meters.

Scoring:

The watch was operated on the signal “Go” and stopped when the player returned back to the starting line. Two trials were allowed and the best time was recorded in one tenth of a second.

3.14.2 Hitting

Purpose:

The purpose was to assess the hitting ability of hockey players.

Equipments:

Hockey ball, hockey sticks, 2 flag posts, goal post and lime powder.

Marking:

Shooting circle was marked. Inside the goal 2 flag posts were fixed at each end with one meter from goal line.
Description:

10 balls were placed in the top of the shooting circle. The subjects were asked to hit the stationary ball one by one alternatively to the corners of the goals marked on the left and right side of the goals.

Scoring

The total number of goals scored was recorded.

3.14.3 Scooping

Purpose:

The purpose was to assess the scooping ability of hockey players.

Equipments:

Hockey sticks, hockey balls, whistle, measuring tape ten cones and lime powder.

Marking:

The hockey field was marked from back line in meters with the help of cones.

Description:

The player scoops the ball in a stationary position with maximum effort to cover maximum distance. Five chances were allowed.

Scoring:

The longest distance covered scooping by the player out of 5 attempts was recorded.

3.15 TRAINING PROGRAMME

The experimental groups underwent the training programme in addition to their regular activities. Experimental groups namely resistance training and plyometric training underwent their respective experimental training on three alternate days per week for twelve weeks. The experimental training programmes were designed based on the resources collected from books, periodicals, e-materials and discussions with the experts. Each training session lasted for 50 minutes with 5 minutes warm up and 5 minutes warm down each.
Table – III
General Structure of Training Programs

<table>
<thead>
<tr>
<th>GROUPS WITH TRAINING PARTICULARS</th>
<th>TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>Resistance training</td>
</tr>
<tr>
<td>Group II</td>
<td>Plyometric training</td>
</tr>
<tr>
<td>Group III</td>
<td>Control group</td>
</tr>
<tr>
<td>Training Duration</td>
<td>Sixty minutes</td>
</tr>
<tr>
<td>Training Session per week</td>
<td>Three days</td>
</tr>
<tr>
<td>Total length of training</td>
<td>Twelve weeks</td>
</tr>
<tr>
<td>Training load progression</td>
<td>Every four weeks</td>
</tr>
</tbody>
</table>
Table – IV
Resistance Training Programme

<table>
<thead>
<tr>
<th>Week &amp; Session</th>
<th>Intensity (%)</th>
<th>Exercises</th>
<th>Repetition / Recovery</th>
<th>Sets / Recovery</th>
</tr>
</thead>
</table>
### Table – V

#### Plyometric Training Programme

<table>
<thead>
<tr>
<th>Week &amp; Session</th>
<th>Intensity</th>
<th>Exercises</th>
<th>Repetition / Recovery</th>
<th>Sets / Recovery</th>
</tr>
</thead>
</table>
| I to IV       | Low Intensity Exercises        | 1. Line Jumps  
2. Line Hops  
3. Squat Jumps  
4. Split Squat Jumps  
5. Box Jump Under 12”  
6. Lateral Cone Hops | 8-10/  
10-30 Seconds | 3 Sets /  
2-3 Min |
| V to VIII     | Moderate Intensity Exercises   | 1. Tuck Jumps  
2. Pike Jumps  
3. Box Jump 12” to 18”  
4. Alternate Leg Bound  
5. Double Leg Zig Zag Hop  
6. Single Leg Box Jump | 6-8/  
10-30 Seconds | 3 Sets /  
3 Min |
| IX to XII     | High Intensity Exercises       | 1. Double Leg Vertical Power Jump  
2. Single Leg Tuck Jump  
3. Box Jump Over 18”  
4. Depth Jump Landing  
5. Lateral Box Jump Above 18”  
6. Explosive Push ups | 4-6/  
10-30 Seconds | 3 Sets /  
3-4 Min |
3.16 COLLECTION OF DATA

The variables used in the present study were assessed from all the subjects before administering the respective treatments. It was assumed as pre-test. After completion of training they were tested again and assumed as post test.

3.17 STATISTICAL TECHNIQUES AND ITS JUSTIFICATION

The following statistical techniques, was adopted to treat the collected data. To find out the difference between pre and post test of each groups, paired ‘t’ test was used. Analysis of covariance was computed, where the final means were adjusted for differences in the initial means, and the adjusted means were tested for significance. When ever the adjusted mean was found to be significant, the Scheffe’s post-hoc test was administered to find out the paired mean difference. In all cases the level of significance was fixed at 0.05 level to test the hypothesis.
Research Flow Chart

SUBJECTS
Forty Five Female Hockey players
(18 to 21 years)

DESIGN
True Random Group Design

PRE-TEST

Physical Variables
1. Speed
2. Agility
3. Endurance
4. Strength
5. Flexibility

Physiological Variables
1. Vital Capacity
2. Blood Pressure
3. Resting Pulse Rate

Skill Performance Variables
1. Dribbling
2. Hit
3. Scoop

Group I
Experimental Group I
(n=15)

Resistance Training
(12 weeks)

Group II
Experimental Group II
(n=15)

Plyometric Training
(12 weeks)

Group III
Control Group
(n=15)

POST-TEST

Statistical Analysis (‘t’ test & ANCOVA)