CHAPTER – III
METHODOLOGY

In this chapter, procedures and methods applied in the selection of subjects, selection of variables, selection of tests, competency of the tester, reliability of the instruments, reliability, orientation to the subjects, validity of the questionnaires, procedure of scoring, pilot study, training programme, collection of data, administration of tests, experimental design and statistical technique were presented.

SELECTION OF SUBJECTS

The purpose of the study was to find out the effects of circuit training, skill training and the combined effects of circuit training and skill training on performance variables, physical variables and psychological variables. Sixty (N=60) school girls, higher secondary girls hockey players who were studying in various schools in Tamilnadu who have been participating in inter school Hockey tournaments during the year 2011-2012 were randomly selected as subjects. The age, height and weight of the subjects ranged from 15 to 18 years, 148 to 156 cms and 42 to 48 kg respectively, and the standard deviations were 0.12, 0.07, and 0.10 kilograms respectively.

Subjects selected were randomly divided into four groups of fifteen each (n=15). Group I underwent Circuit training, Group II underwent Skill training, Group III underwent Combined Circuit and skill training and Group IV acted as Control. The duration of the
training period was restricted to twelve weeks and the number of sessions per week was confined to three. Combined Circuit and skill training group underwent first six weeks of Circuit training and next six weeks of skill training. A written consent was also obtained from the subjects. However, they were free to withdraw their consent in case they felt any discomfort during the period of their participation. There were no such dropouts in this study.

**SELECTION OF VARIABLES**

**Dependent Variables**

Sports require us to be physically and mentally fit, with the capability of making split level decisions. Proper training helps achieve this, and without training all sportsmen and athletes would never be able to understand and tap into their original potentials. With sports training athletes and sportsmen understand that they have to go beyond just ensuring that they achieve their goals.

Most training is dependent on the sports played and in some sports training might even be periodized. Sports training require greuling efforts to be put in and pushing the body well beyond the limits of fatigue and negative instincts and anxiety. While training to be professional sportsman requires more than just bodily effort, often most professionals succumb to pressures exerted by their bodies itself. Sports training for professionals and wannabe’s alike are continuous and never stops, training is only secondary to actually playing the sport and winning the game. The difference between a winning athlete and a
losing one is often the amount of training received and techniques and strategies implemented.

**Dribbling**

In modern hockey, the man to man dual is decisive. During the game situation when there is no possibility of scoring or passing the ball to the team players, dribbling helps the player to find the appropriate opportunity for the next pass. Dribbling is an important aspect of individual tactics. The great dribblers have been creative artists. Good dribblers have the magical powers to attract the crowd.

Dribbling plays a vital role for an individual to possess the ball while the opponents try to tackle the ball from the dribbler. Dribbling differs from individual to individual. When a player wants to carry or propel the ball for a longer distance, the dribbling helps to do the same. Recent studies have shown that performance variable dribbling has got direct relationship with the hockey performance. Dribbling is highly helpful in the following ways:

(i) To advance to the target through the open space,
(ii) When there is no other teammate to receive the pass,
(iii) To maintain the ball possession and to hold longer time, and
(iv) To beat the opponents mainly in one versus one situation.

Taking into consideration of the above facts dribbling has been selected as one of the performance variables for this study.
**Hitting**

Hitting is one of the most important fundamental skills in hockey. The hitting plays a vital role in the modern hockey. The hit in, free hit, 16 yards free hit, long corner, and the penalty corner are mostly taken by the hockey players by hitting. To score the goal, to clear the ball for a longer distance from the dangerous zone for a long pass or diagonal pass and cross pass hitting is the prime skill to execute all these tactics. It is recognized that among the fundamentals the ability to hit the ball is needed for high level of performance. The game of hockey is nowadays becoming more attractive. Because of the above qualities hitting was chosen as one of the performance variables for this study.

**Trapping**

This is also one of the most important basic skill is in the game of hockey. A player insists this skill to his or the team’s advantage to execute the next move. The perfection of trapping not only shows the individual superiority of executing the skill but also to the successful team tactics. It also helps to defend from the attack to stop goal scoring by the opponents and receive passes from own teammate. Considering the above facts trapping was selected as one of the performance variable for this study.

**Speed**

An essential physical ingredient for successful performance in many activities is speed. Hockey is a game which involves running with
and without ball in various directions. Speedy players are always asserting to every team in match winning performances. Speed in hockey often refers to one’s ability to accelerate over a short distance. Penetration into the opponent territory with and without the ball can be achieved more easily with speed and an attack can be launched by speedy runs. So speed appears to be one of the most important factors in the modern hockey. Since speed is applicable to all playing positions it is relevant to analyze the speed of the subjects.

Considering the importance of speed I as the investigator selected speed as one of the physical variable in this study.

**Power**

Legs muscles, strength and power are important factors for a hockey player. Artificial surfaces require more power on the legs since the game of hockey requires more running. Playing in the artificial surface requires more power than playing in other playing surfaces like grass or gravel. In all the major competitions such as Olympics, World Cup, Asian games, Asia cup, Champion trophy and Common Wealth games, Hockey is played only in the artificial surface. The artificial surface is made with artificial grass and to play in the artificial surface more power is needed. Playing in the grass surface and gravel surface may not require power as in artificial surface.
Nowadays the inter university hockey competitions are conducted in the artificial surface. Sometimes due to non availability of the artificial surface, the competition was conducted in grass or gravel surface. High level of physical fitness is required for good performance in hockey. Fitness requirements will vary according to the players levels, playing position and according to the different playing surfaces. Special techniques imply not only the specific movements necessary for the sport concerned but all the related and general complementary movements such as running and jumping. When movements are correctly and economically executed, the standard of the performance can be greatly improved. All the anaerobic activities are related to leg power. Greater the leg power, better the anaerobic performance in the field of sports and games. Hence power plays a vital role in all the anaerobic activities. Because of the above reasons power was selected as a physical variable, for this study.

**Endurance**

Endurance is defined as the capacity to work under strain for a long period of time without undue fatigue. It is the ability to persist in strenuous activity. This definition may apply to the body as a whole to a particular body system or to a local area of the muscle system. Endurance is one of the basic components of general athletic ability and it is usually considered to be the most important component of physiological fitness. The game of hockey requires high level of endurance. After the introduction of artificial surface the game has
become faster compared to other playing surface like gravel and grass. The speed of the ball is more in the artificial surface than in the grass and gravel surfaces.

Every hockey player must adopt themselves to play the game according to the playing surfaces. Hockey is a game in which endurance is of prime importance. Hence endurance occupies an important place in the game of hockey. Muscular endurance is the ability to continue successive movements with heavy load at a maximum speed for a short period of time. Taking into consideration of the above facts endurance was selected as physical variable for this study.

**Anxiety**

Competition anxiety is the anxiety generated in a sport competition situation. It is a specific form of anxiety that occurs as a function of the competition situation.

**Aggression**

Aggression could have a positive influence on the performance outcome of an individual or a team. The aggressive behavior may harm the opposition either physically or psychologically thereby weakening their resources. Aggression may also improve the team’s performance outcome by improving the process and function of the team. Aggression can be classified as “Good and Bad”. The good aggression is the type of assertiveness or dominance or attitude of taking charges that
contribute to success. In competitive sports, on the other hand, Bad or negative aggression is considered as harmful type, frequently associated with contact sports where physical injury to the opponent may be the aim of the participant. Human aggression is the most complex and multifaceted behavior with many outlets and expression. In modern Hockey players need to play aggressive game. Because of the above facts aggression was selected as the variable for the investigation.

**Self-Confidence**

Self-confidence is an important factor in any performance. Self-confidence can be considered as a sense of oneself. Positive assurance of success in hockey game depends upon what and how things have developed before and after competition. To execute this aspect positively self-confidence is highly necessary. Confident player will win situations, which need high level of presence of mind and concentration while attempting to execute skills. The confident players are more effective and successful than others who lack in confidence. Due to the above facts Self-confidence was chosen as a variable for this study.

Keeping the above concepts in mind, I as the investigator have selected the following variables which were found appropriate and worthy of investigation.
Performance variables

(i) Dribbling
(ii) Hitting
(iii) Trapping

Physical variables

(i) Speed
(ii) Power
(iii) Endurance

Psychological variables

(i) Anxiety
(ii) Aggression
(iii) Self confidence

Independent Variables

The standard of sports is gaining momentum day by day. New records are coming into exist at national and international level. It is all because of technical as well as tactical training to compete with the advanced sports countries. It will only be possible if the athletes are equipped with advance training (Sharma, 2004).

Today sports training are mostly based upon the competitive motive. Various training programs have been incorporated to reach top performances and such training is Circuit training which is short bursts of resistance exercise using moderate weights and frequent
repetitions, followed quickly by another burst of exercise targeting a different muscle group. Because the exerciser switches in between muscle groups, no rest is needed in between the exercises. This gets the heart rate up, which usually doesn’t happen during resistance exercise. Sometimes, to tune up the heart rate further, aerobics are sprinkled between the resistant exercises. It is generally used to develop muscle strength and power. It also develops muscular endurance, elasticity and co-ordination.

Based on the above mentioned concepts the following independent variables have been taken for the present study.

1. Circuit training
2. Skill training
3. Combined Circuit and skill training

**SELECTION OF TESTS**

The present study was undertaken to find out the effects of circuit training, skill training and the combined effects of circuit training and skill training on performance variables, physical variables and psychological variables. As per the available literature, the following standardized tests were used to collect relevant data on the selected dependent variables that are presented in Table I.
# TABLE – I

## TESTS SELECTION

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Criterion Variables</th>
<th>Test Items</th>
<th>Unit of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dribbling</td>
<td>Standard Field Test</td>
<td>In Points</td>
</tr>
<tr>
<td>2.</td>
<td>Hitting</td>
<td>Standard Field Test</td>
<td>In Points</td>
</tr>
<tr>
<td>3.</td>
<td>Trapping</td>
<td>Standard Field Test</td>
<td>In Points</td>
</tr>
<tr>
<td>4.</td>
<td>Speed</td>
<td>50 Meters Run Test</td>
<td>In Seconds</td>
</tr>
<tr>
<td>5.</td>
<td>Power</td>
<td>Standing Broad Jump Test</td>
<td>In Meters</td>
</tr>
<tr>
<td>6.</td>
<td>Endurance</td>
<td>Cooper’s 12 Minutes Run/walk Test</td>
<td>In Meters</td>
</tr>
<tr>
<td>7.</td>
<td>Anxiety</td>
<td>SCAT Questionnaire</td>
<td>In Points</td>
</tr>
<tr>
<td>8.</td>
<td>Aggression</td>
<td>Smith’s Aggressive Questionnaire</td>
<td>In Points</td>
</tr>
<tr>
<td>9.</td>
<td>Self-confidence</td>
<td>Agnihotri’s Self Confidence Inventory(ASCI)</td>
<td>In Points</td>
</tr>
</tbody>
</table>
COMPETENCY OF THE TESTER

All the measurements in this study were taken by me as the investigator along with the assistance of Physical Directors working in various Schools in Thanjavur District, Tamilnadu, India. To ensure that the assistants of the investigator were well versed with the technique of conducting tests, they had a number of practice sessions in the correct testing procedure. The tester’s reliability was established by test and re-test methods. Testers Competency was assessed together with the reliability of the test. To determine the reliability of the test and testers competency I as the scholar recorded the performance of ten subjects selected at random on each of the selected variables twice under similar conditions. These were done by the test; re-test method on two consecutive days. The data’s thus collected by test, re-test were correlated using the Pearson’s product correlation.

RELIABILITY

INSTRUMENTS RELIABILITY

Clinical stopwatches, measuring tape and laboratory equipments used in this study were tested by appropriate testing agencies and test and re-test scores method.

TESTERS RELIABILITY

*Baumgartner and Jackson (1987)* opines that repeated measurement of the individuals on the same test for determining the reliability is a univariate and not a bivariate situation and it is the
distribution of single variable. Hence it is meaningful to use univariate statistics like intra-class correlation coefficient.

The following table presents the intra-class correlation coefficients of the data obtained by tests and re-tests.

**TABLE – II**

**INTRA CLASS CO-EFFICIENT OF CORRELATION ON SELECTED DEPENDENT VARIABLES**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Criterion Variables</th>
<th>‘R’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dribbling</td>
<td>0.92*</td>
</tr>
<tr>
<td>2.</td>
<td>Hitting</td>
<td>0.93*</td>
</tr>
<tr>
<td>3.</td>
<td>Trapping</td>
<td>0.91*</td>
</tr>
<tr>
<td>4.</td>
<td>Speed</td>
<td>0.94*</td>
</tr>
<tr>
<td>5.</td>
<td>Power</td>
<td>0.89*</td>
</tr>
<tr>
<td>6.</td>
<td>Endurance</td>
<td>0.87*</td>
</tr>
<tr>
<td>7.</td>
<td>Anxiety</td>
<td>0.91*</td>
</tr>
<tr>
<td>8.</td>
<td>Aggression</td>
<td>0.96*</td>
</tr>
<tr>
<td>9.</td>
<td>Self-confidence</td>
<td>0.82*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level of confidence.

(Table value required for significance at 0.01 level of confidence is 0.77)
SUBJECTS RELIABILITY

The above test and re-test coefficient values determined and confirmed the subject’s reliability and was quite adequate as the same subjects were used under the same condition by the same tester.

ORIENTATION TO THE SUBJECTS

I as the investigator clearly explained the purpose of the training programmes and their part in the present study to the subjects. For the collection of data, I have explained the procedure of testing on selected dependent variables and given instruction to the subjects about the procedure to be adopted by them for measuring. Five sessions were spent to familiarize the subjects with the techniques involved in undergoing Circuit Training, Skill Training and Combined Circuit and skill training. It helped them perform the exercises perfectly without injuries. The subjects of all the groups were sufficiently motivated to perform their assigned tasks during the testing periods.

VALIDITY OF THE QUESTIONNAIRES

Many researchers have used these questionnaires for research. The questionnaires used are Sports Competition Anxiety Test (SCAT) and Smith’s Aggressive Questionnaire. There can be no better evidence to prove the validity of the questionnaire than their universal use.
PROCEDURE OF SCORING

SPORTS COMPETITION ANXIETY TEST (SCAT)

The standardized sports competition anxiety test (SCAT) was used to measure the anxiety. The test consists of fifteen statements. It is based on Likert’s method and each statement has three responses after value.

‘Hardly ever’, ‘sometimes’ and ‘often’. The respondents make a cross mark (x) on any one of the responses that fitted them. The inventory in its original form was used in this investigation.

This inventory was scored with the help of a scoring key, which is given below. A separate scoring method was followed for positive and negative statements. The scores obtained for both positive and negative statements were added. A higher score indicates higher anxiety. Positive Statement-Questions are numbered such as 1, 2, 3, 4, 5, 7, 8, 9, 10, 12, 13, 14 and 15 and Negative Statement-Questions are 6 and 11.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Response</th>
<th>Scores for Positive Statements</th>
<th>Scores for Negative Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hardly ever</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Sometimes</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Often</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
**Scoring:**

Sports competition anxiety test (SCAT) questionnaire consists of fifteen questions. There was no right or wrong answer. A three point scale was used for scoring. Subjects were asked to mark one of the above cited words like ‘hardly ever’, ‘some times’, or ‘often’ before being measured. Performance improves with increasing levels of anxiety to an optimum point, any further increase in anxiety causes performance impairment. Sports Competition Anxiety Test (SCAT) Questionnaire is given in Appendix -I.

**AGGRESSION TEST**

Standardized Smith’s questionnaire for sporting aggression was used to scale the aggressiveness. The test consists of four questions with five levels of responses. The level changes from ‘strongly disagree’ to ‘strongly agree’. The respondents were made to encircle the approximate number, which suited their attitude.

The inventory was scored with the help of the scoring key given below. The range of scores was from 4 to 20. The higher the score, the more aggressive the player is.

<table>
<thead>
<tr>
<th>Response</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>1</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
</tr>
<tr>
<td>Undecided</td>
<td>3</td>
</tr>
<tr>
<td>Agree</td>
<td>4</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>5</td>
</tr>
</tbody>
</table>
**Scoring:**

The total points were recorded as the individual scores. The Aggression Questionnaire is given in Appendix-II.

**SELF CONFIDENCE TEST**

**Self Confidence:**

Self Confidence was assessed by Agnihotri’s Self Confidence Inventory (ASCI) developed by Dr. Agnihotry.

Agnihotri’s Self Confidence Inventory (ASCI) consists of 56 questions which includes items for the assessment of self confidence.

The author has given the following classification criteria:

<table>
<thead>
<tr>
<th>Raw Score</th>
<th>Explanation</th>
<th>Self Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 and below</td>
<td>Very high</td>
<td>Self Confidence</td>
</tr>
<tr>
<td>8-19</td>
<td>High</td>
<td>Self Confidence</td>
</tr>
<tr>
<td>20-32</td>
<td>Average</td>
<td>Self Confidence</td>
</tr>
<tr>
<td>33-44</td>
<td>Low</td>
<td>Self Confidence</td>
</tr>
<tr>
<td>45 and above</td>
<td>Very Low</td>
<td>Self Confidence</td>
</tr>
</tbody>
</table>

**Scoring:**

The inventory can be scored by hand. A score of one is awarded for a response indicative of lack of Self Confidence i.e. for making cross (X) to wrong response to items nos. 2, 7, 23, 31, 40, 41, 43, 44, 45, 53, 54, 55 and for making cross (X) to right response to the rest of the items. Thus each item has a maximum score of “1” and minimum of “0”
and response value of which extends from 0-56. Hence the lower the score, the higher would be the level of Self-Confidence and vice-versa (Agnihotry, 1987).

PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subjects to fix the load and also to design the training programme. For that purpose, twenty higher school girls were selected at random and they were given Circuit Training, Skill Training and Combined Circuit and skill training under the watchful eyes of the investigator. While constructing the training programmes the basic principles of sports training (progression of overload and specificity) were followed. During construction of the training programme, the individual differences were also considered.

TRAINING PROGRAMME

During the training period, the experimental groups underwent their respective training programmes. Group I underwent Circuit training, Group II underwent Skill training and Group III underwent Combined Circuit and skill training, for three days in a week for twelve weeks. The duration of training session in all three days was approximately forty five minutes to one hour which included warming up and limbering down. They were questioned about their health status throughout the training programme. None of them reported any injuries. However, muscle soreness appeared in the earlier period of the training programme and was reduced in due course.
Circuit training is a form of training in which a circuit is formed establishing several stations wherein the subjects have to perform the particular exercise allotted at each station.

**Circuit Training**

In the present study, I as the research scholar fixed 6 stations in which the exercises were performed in sequence by the subjects as shown in Figure-I. The duration of the exercise varied between 45 to 50 seconds with six exercises (Squat thrusts, Pushups, Squat Jumps, Skipping, Sit-ups and Back Extension) per circuit and the number of circuits varied between two and three for twelve weeks. The recovery time between circuits varied between five and four minutes.

**Table-III**

*Training Intensity for Circuit Training*

<table>
<thead>
<tr>
<th>Week</th>
<th>Duration of Exercises (in Seconds)</th>
<th>Number of Circuits</th>
<th>Recovery Time between Circuit (in Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>40</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>III-IV</td>
<td>40</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>V-VI</td>
<td>45</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>VII-VIII</td>
<td>45</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>IX-X</td>
<td>50</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>XI-XII</td>
<td>50</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
FIGURE: I

CIRCUIT TRAINING STATION
AND EXERCISES
Skill Training

In skill training, zigzag dribbling, stationary dribbling, Circle dribbling, hitting to partner, hitting against the goal area, hitting against wall, dribble the ball and stop, hit the ball to the partner and stop and hitting against the wall and stop only given. The duration of the skills varied between 45 to 50 seconds with nine exercises (zigzag dribbling, stationary dribbling, Circle dribbling, hitting to partner, hitting against the goal area, hitting against wall, dribble the ball and stop, hit the ball to the partner and stop and hitting against the wall and stop) for twelve weeks. The sequences of the skill training exercises are shown in Figure-II-IV
FIGURE: II
Dribbling Drills

- Zig-zag dribbling
- Stationary dribbling
- Circle dribbling

FIGURE-III
Hitting Drills

- Hitting to partner
- Hitting against the Goal area
- Hitting against the Wall
FIGURE - IV

STOPPING/TRAPPING DRILLS

- **Trapping**
  - Dribble the ball & Stop
  - Hit the ball to the partner & Stop
  - Hitting against the Wall & Stop
COLLECTION OF THE DATA

For the data on Dribbling, Hitting and Trapping were assessed by standard Hockey field test, Speed was assessed by 50 meters run test, Power was assessed by Standing Broad Jump, Endurance was assessed by Cooper’s 12 Minutes Run/walk Test, Anxiety was assessed by SCAT Questionnaire, Aggression was assessed by Smith’s Aggressive Questionnaire and Self Confidence was assessed by Agnihotri’s Self Confidence Inventory (ASCI). Pretest data were collected two days before the training programme and post test data were collected immediately after the twelve week training session. In all the cases, the data were collected on two consecutive days. On the first day morning psychological variables such as Anxiety, Aggression and Self confidence were measured and Dribbling, Hitting and Trapping were assessed on the evening session, whereas speed and power tests were conducted on the second day morning session and endurance test was taken on the evening session.

ADMINISTRATION OF THE TESTS

1. Dribbling Test
**Purpose**

To measure the Dribbling ability in field hockey

**Ground markings**

A line AB is drawn 25 yards long. The first point marked on the line is 5 yards from the starting point ‘A’ and the remaining four more points are marked on line AB of 4 yards at equal intervals. A one yard starting line ‘AA’ is marked on the right side of the point A. flags are so placed alternatively that odd numbers are on the right and even numbers are on the left starting with the flag No.1(one) on the right and flag No2 (Two) on the left and so on alternatively as shown in the diagram.

**Procedure**

The player rolls the ball up to the first flag where he can tap or dribble the ball to get round the flag. The player has to move on the path shown on the diagram. He has to follow the same route that he adopted while approaching the 6th flag as shown in the diagram. He has to dribble up and down. One has to move around the 6th and 12th flag till the time expires.

**Scoring**

0.5 points (1/2) are awarded for each of the flag crossed. The flag placed on the starting point is not counted while starting the best. This flag is counted when it is crossed within the allotted time on the way back. The maximum scores are 10 point added if a player is in between the two flags when the time expires.
The equipments used for taking performance tests were hockey sticks, standard ball, flag post, measuring tape, watch (1/100th) and chalk powder (Sodhi, et.al, 1995).

2. Hitting Test

![Diagram of hitting test setup]

**Purpose**

To assess the Hitting ability in field hockey

**Ground markings**

Six balls placed in pairs at 45, 90 and 135 on one foot line of a semi circle of five yards radius, whose straight line AB is drawn parallel and opposite to the goal line thirty yards, inside the ground. Two flags are placed on the goal line, one yard inside from each goal post.

**Procedure**

The players starting from mid point (c) of semi circle straight line have to take first ball placed at 135 degree and have to hit the ball
white in motion from the semi circle for a goal. He takes the next ball from 90 degree line and hit in the semi way. The third ball is taken from 45 degree spot and a similar hit is repeated till all the 6 balls are finally hit while keeping the same sequence within a span of 25 sec.

**Scoring**

Two points are awarded if the ball crosses the goal line in between the 2 flags. One point is awarded if the ball passes between the flag and goal post on either side. No point is awarded if the ball hits the goal post and rebounds off in or outside the ground. One point is given when the ball strikes the flag post or outside the ground. One point is given when the ball strikes the flag post or after hitting the goal post crosses over the goal line. The maximum marks that a subject can score are 12. *(Sodhi, et.al, 1995).*

3. **Trapping Test**

**Objective**

The purpose of trapping test to measure the subject’s trapping ability.

**Equipments**

Hockey sticks, hockey balls, measuring tape and lime powder.

**Description**

The subjects were asked to stand on the goal line and other subject should stand on the top of the shooting circle with 10 balls and
asked to hit into the goal post. The subject standing on the goal line was asked to stop the ball with the stick using any type of technique.

**Score**

Three chances were given to each subject in playing surface. In as much as three experts assessed the trapping ability of the subjects using five point rating scale. The mean score of the experts was the individuals score.

4. **Speed (50 meters run)**

**Purpose**

To assess Speed.

**Equipments Used**

Measuring tape, starting clapper and stopwatch.

**Procedure**

The standing start method was adopted for this purpose. The time from the ‘clap’ to the runner crossing the finish line was taken as the test score. The fractions were rounded to the next largest one tenth of a second. For this purpose digital electronic watch was used. Two trials were conducted with sufficient rest in between and the better of the two trials was recorded.

**Scoring**

Speed was recorded in 1/10\textsuperscript{th} second.
5. **Power (Standing Broad Jump)**

**Purpose**

To measure explosive power.

**Facilities and Equipment**

Tape measure and an outdoor jumping pit.

**Procedures**

The subject stood behind a take off line with his feet several inches apart. Before jumping the subject dipped at the knees and swung the arms backward and then jumped forward by simultaneously extending the knees and swinging the arms forward. Three trials were permitted. Measurement was taken from the nearest break mark to the take off line. One best trail was recorded.

**Scoring**

The score is the distance between the take-off line and the nearest point where any part of the body touches the floor. It is measured in metres.

6. **Cardio Respiratory Endurance**

*(Cooper's Twelve Minute Run/Walk Test)*

**Purpose**

The purpose of this test was to assess the cardio respiratory endurance of the subjects.
**Facilities and equipment**

The test was administered on the 400 meters track, A stop watch with calibration of 1/10 seconds, a whistle, score sheets and pencils were used to administer the test.

**Procedure**

Cooper’s Twelve-minute run test was administered with the help of qualified testers. For this test, a 400 meters track was prepared with marking at every tenth meter. I as the investigator and the testers served as the lap scorers. The subjects were asked to stand on the starting point. At a signal he must cover as much distance as possible by running in the 400 meters track. They were instructed to continue the run till the final whistle. The race was started with a whistle and at the end of the twelfth minute again the whistle was blown. The number of minutes left was announced to the subjects for every minute. At the twelfth minute a whistle was blown and the subjects stopped instantly and stood on that spot.

**Scoring**

The distance covered by each in twelve minutes was recorded to the nearest tenth meter. The distance covered by the subjects in meters was used as a measure of cardio respiratory endurance.

**EXPERIMENTAL DESIGN AND STATISTICAL TECHNIQUE**

The experimental design used in this study was random group design. The selected subjects were divided at random into four groups
of fifteen each (n=15). Group I underwent Circuit training, Group II underwent Skill training, Group III underwent Combined Circuit and skill training and Group IV acted as Control. All the subjects were tested prior to and immediately after the training period for all the selected variables.

The data collected from the three groups prior to and immediately after the training programme on the selected criterion variables were statistically analyzed with dependent ‘t’ test and Analysis of Covariance (ANCOVA). Whenever the ‘F’ ratio for adjusted post test means was found to be significant, Scheffe’s post hoc test was followed to determine which of the paired mean differences was significant. In all the cases .05 level of confidence was fixed to test the hypotheses.