Chapter III

METHODOLOGY

The procedures in handling various details of an experiment are extremely important for the success of any research. Research methodology refers to a systematic procedure by which the researcher starts from the initial identification of the problem to its final conclusions. In this chapter, the selection of variables, selection of test, selection of the subjects, orientation of testers, orientation of the subjects, collection of data, reliability of the data, pilot study, training programme, administration of tests, experimental design and statistical technique are explained and presented.

SELECTION OF THE SUBJECTS

The main motive of the study was to find out the effect of isolated and parallel core strength and mobility training on selected biomotor and psychomotor parameters of cricket players. Cricket players studying various courses in Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya University, Kanchipuram, Tamil Nadu, India, during the academic year 2013-2014 were selected as subjects to fulfill the purpose of the proposed problem and their age ranged from 20 to 25 years. Ensuring the quality in selection of samples, cricket playing ability was considered as criterion measure. The overall playing ability of selected samples was assessed by a team of three experts including the investigator using a 10 point rating scale. Based on the performance in the overall playing ability, of the 57
cricket players, 48 cricket players were selected excluding the players scored lower and upper quarter. Thus out of 57 cricket players, 48 players were randomly selected as subjects finally for this present analysis.

The selected subjects were randomly assigned four equal groups of 12 each. Experimental group-I was given the packages of mobility training, experimental group-II was given the packages of core strength training, experimental group-III was given the packages of parallel mobility training and core strength training and group IV acted as control group. Control group was restricted to participate in any specific training programme. The selected subjects underwent medical test by a certified physician and declared that they were physically and medically fit to undergo the necessary training programme. A consent form for the proposed research study was collected from the participants and the copy of a consent form is enclosed in the appendix -I. The mean and standard deviation values on age, height and weight of the experimental and control groups are presented in table-3.1.

Table- 3.1

<table>
<thead>
<tr>
<th>Group</th>
<th>Number</th>
<th>Age (years)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core strength training</td>
<td>12</td>
<td>22.36±3.17</td>
<td>172.36± 4.27</td>
<td>66.42± 5.18</td>
</tr>
<tr>
<td>Mobility training</td>
<td>12</td>
<td>24.18±2.96</td>
<td>169.84±3.59</td>
<td>68.39±4.86</td>
</tr>
<tr>
<td>Parallel Training</td>
<td>12</td>
<td>23.53±3.24</td>
<td>168.83±4.86</td>
<td>70.26±5.28</td>
</tr>
<tr>
<td>Control</td>
<td>12</td>
<td>22.65±2.93</td>
<td>171.45±3.63</td>
<td>67.84±6.03</td>
</tr>
</tbody>
</table>
SELECTION OF THE VARIABLES

The researcher had thoroughly analyzed the available literature and discussed with his guide and with various experts before selecting variables. The availability of resources for the purpose of reliability, analysis, outcome, feasibility and procedure were extensively taken care before finalizing the variables. The selected independent and dependent variables of this study are stated as below.

Dependent Variables

Cricket is an extremely demanding sport. At an elite level, cricket players are often required to perform at their limits of agility, speed, flexibility, strength and endurance. In addition to all, players must maintain a high state of concentration in order to meet the mental and tactical demands of dealing with their opponents. Therefore it becomes essential that everyone involved with the modern game needs to be familiar with the psychomotor and bio-motor which are the fitness requirements of the game. Core strength and mobility training are the most competent ways to improve bio-motor and psychomotor parameters. Examining the changes on selected bio-motor and psychomotor variables as a result of core strength, mobility and parallel trainings is a useful research objective. By considering the nature of these training the following bio-motor and psychomotor variables were selected.
Biomotor Abilities

The biomotor abilities selected for the present investigation are as follows.

1. Speed
2. Explosive power
3. Muscular strength
4. Flexibility

Psychomotor Variables

The psychomotor parameters selected for the present study are as follows.

1. Reaction time
2. Balance
3. Coordination
4. Kinesthetic sense

Independent Variables

In order to compete at peak levels, a successful cricket player needs core strength, good balance and speed running between the wickets in the field. Fast bowlers need very good speed and power in particular. In order to attain high levels of these attributes, one needs specific physical training. Careful planning is required for athletic training to create a calendar of workouts that progress from general to specific exercises. There are two types of athletic movement patterns namely dynamic and variable. Proper neuromuscular training is required to respond and react to loads placed on the body. A variety of methodologies and equipments have to be accomplished using training.
For athletes, core training is the most essential aspect of an exercise. It will help to improve neuromuscular control and try to reduce injuries when incorporated into a proper workout routine. The core is the basis for all functional movements in sports and is crucial for everything from cutting to throwing, to pivoting, etc. Its main purpose is to allow for balance and stability, transfer of energy, absorbing force. The transfer of force or energy makes the athlete to evolve the ability to generate extra power with numerous athletic activities such as a golf swing or a punch. Implementing proper technique and core training into a routine will enhance improved neuromuscular athletic movement patterns and this will help to maintain perfect stability and alignment of the spine and pelvis during an athletic activity. It will also help the athlete become highly efficient with the execution of movements. For improved sports performance, good stability, core strength and efficient dynamic neuromuscular control are very much required.

Trainers and coaches use mobility training to increase flexibility and possibly minimize the incidence of injury. It is the duty of the trainer or coach to select the best suited method for the sport and athletes. The above mentioned evidence favours the fact that mobility training is the best solution for performance enhancement. Muscle stretching combined with resistive exercises has been described as the best intervention to decrease or prevent loss of muscle mass, strength, mobility, balance and flexibility. These exercises have also been shown to improve the performance even when performed in isolation. However, it still has not been determined whether resistive exercise combined with stretching
exercise can lead to greater improvement in sports performance compared to resistive or stretching exercise alone.

In order to attain peak physical condition, athletes use combined training from a wide range of sports. If this training is used correctly, it can be the best and effective form of training, especially when combined with a suitable training program. Combined training has gained much popularity and it is the widely used training strategy. In order to improve athletic performance, anecdotal reports recommend training of this nature. Numerous studies have examined the concept of combined training despite the fact that lot of queries remain about the potential effectiveness and implementation of this kind of training. The results of recent studies give valuable input for guiding practitioners in the development and implementation of combined training programs. Based on the above concept, in this experimental study the following three experimental treatments were selected as independent variables, to assess the difference in its effectiveness.

1. Core strength training
2. Mobility training
3. Parallel core strength and mobility training

**RESEARCH DESIGN**

Random group design was used as research design with isolated and parallel core strength, mobility training as independent variables and selected biomotor and psychomotor parameters as dependent variables. The methodology adopted in the study is given in chart-I as research flow chart.
Chart – I

FLOW CHART DEPICTING THE METHODOLOGY ADOPTED IN THE STUDY

SUBJECTS
(48 Men Cricket Players - Age: 20 to 25 years)

Experimental Group (12 weeks)

Group – I
Core Strength Training (n=12)

Group – II
Mobility Training (n=12)

Group – III
Parallel Training (n=12)

Control Group – IV (n=12)

Pre and Post-Test Variables
(Biomotor and Psychomotor Parameters)

Biomotor abilities

Speed
Explosive Power
Muscular Strength
Flexibility

Psychomotor Variables

Reaction time
Balance
Coordination
Kinesthetic sense

STATISTICAL TECHNIQUE
Descriptive Statistics
Paired ‘t’ Test
Percentage of Changes
ANCOVA and Scheffé’s Post Hoc Test
CRITERION MEASURES

The investigator analyzed various literatures, has consulted the experts in physical education and selected the test items to collect data on the selected biomotor and psychomotor parameters, which were standardized and most suitable to this study and they are listed in table-3.2.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>List of Variables</th>
<th>Test type</th>
<th>Measurement Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed</td>
<td>50 meters run</td>
<td>Seconds</td>
</tr>
<tr>
<td>2</td>
<td>Explosive Power</td>
<td>Standing broad Jump</td>
<td>Centimeters</td>
</tr>
<tr>
<td>3</td>
<td>Muscle strength</td>
<td>Knee bent Sit-ups</td>
<td>Number</td>
</tr>
<tr>
<td>4</td>
<td>Flexibility</td>
<td>Sit and reach test</td>
<td>Centimeters</td>
</tr>
<tr>
<td>5</td>
<td>Reaction time</td>
<td>Reaction Time Ruler Test</td>
<td>Seconds</td>
</tr>
<tr>
<td>6</td>
<td>Balance</td>
<td>Stork Stand Test</td>
<td>Seconds</td>
</tr>
<tr>
<td>7</td>
<td>Coordination</td>
<td>Alternate Hand Wall Toss Test</td>
<td>Number</td>
</tr>
<tr>
<td>8</td>
<td>Kinesthetic sense</td>
<td>Shuttle Board Distance Perception Test</td>
<td>Points</td>
</tr>
</tbody>
</table>

RELIABILITY OF DATA

The reliability of the tests and data were assured by establishing the tester’s competency, instrument reliability and subject’s reliability.

TESTER’S COMPETENCY

The investigator collected data with the assistance of Physical Directors working in Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya University, Kanchipuram. The objectives of the research work and various testing methodologies were explained and demonstrated to the testers. A number of practice sessions were arranged by the investigator in order to familiarize the
correct testing procedure. The testers’ reliability was established by test and re-test method. The reliability of the test and the tester’s competency in taking measurements were accepted due to the result of very high correlation.

**RELIABILITY OF TESTS**

The tester’s competency for test administration was evolved with the reliability of tests. To determine the reliability of tests, test and retest method was followed. For this purpose twenty subjects were selected at random and used for experimentation in this study. All the chosen criterion variables were tested twice for the same subjects under identical conditions at the interval of five days. As suggested by Johnson and Nelson (1988) Univariate correlation (intra class correlation) was calculated separately for each criterion variables. The obtained coefficient of correlation is presented in table-3.3.

**Table –3.3**

**INTRACLASS CO-EFFICIENT OF CORRELATION ON SELECTED DEPENDENT VARIABLES**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Dependent Variables</th>
<th>‘r’ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed</td>
<td>0.89*</td>
</tr>
<tr>
<td>2</td>
<td>Explosive Power</td>
<td>0.93*</td>
</tr>
<tr>
<td>3</td>
<td>Muscular strength</td>
<td>0.90*</td>
</tr>
<tr>
<td>4</td>
<td>Flexibility</td>
<td>0.92*</td>
</tr>
<tr>
<td>5</td>
<td>Reaction time</td>
<td>0.84*</td>
</tr>
<tr>
<td>6</td>
<td>Balance</td>
<td>0.87</td>
</tr>
<tr>
<td>7</td>
<td>Coordination</td>
<td>0.91*</td>
</tr>
<tr>
<td>8</td>
<td>Kinesthetic sense</td>
<td>0.89*</td>
</tr>
</tbody>
</table>

*Highly significant at 0.05 level of confidence.
(Table value required for significance at 0.05 level of confidence with df 18 is 0.44)
Since the obtained ‘r’ values were much higher than the required value, the data were accepted as reliable in terms of instrument, tester and the subjects.

**SUBJECT’S RELIABILITY**

The test, re-test scores indicated the subject reliability as the same subjects were used under different conditions by the tester.

**RELIABILITY OF EQUIPMENTS**

The required equipments were availed from the department of Physical Education of Annamalai University. They were in good working condition. The instruments were purchased from the reliable and standardized companies. Their calibrations were tested and found to be accurate enough to serve the motive of the study.

**ORIENTATION TO TESTERS**

The objective of the study, the testing procedures, and the method of scoring were briefly explained and demonstrated to the testers who assisted the investigator. The data required for the research and the objectives of study were clearly explained to them. The investigator himself demonstrated the operation of the various equipments used in this study. It was also demonstrated to the assistants, the exact way of measuring the selected dependent variables. The testers were trained to conduct test and collect data without errors.
ORIENTATION TO THE SUBJECTS

The subjects were first explained about the procedure of the tests to be administered and then the investigator demonstrated each test item. Each subject was asked to take as many trials as they wanted to familiarize themselves with the test items.

PILOT STUDY

Before constructing the training schedule, a pilot study was performed to assess the capability of all the participants in order to fix the load. For this, 10 subjects were selected at random and divided into two groups of five each, in which group-I had undergone core strength training and group-II had undergone mobility training under the supervision of experts and the scholar. During this period the tester had realized the difficulties and familiarized them with the procedures. After the pilot study necessary alterations were made in consultation with the guide in the aspect of core strength training and mobility training exercises, intensities, sets and repetitions. The basic principles of sports training namely progression, over load and specificity were followed while constructing the training programmes.

TRAINING PROGRAM

Adequate warm up was given to the subjects prior to the experimental treatment. Attention was given to stretching, jogging, general mobility and striding especially about the joints involved in the planned core strength, mobility and
parallel training sessions. Cool down exercises were performed after each sessions. The subjects were clearly instructed not to start any specific training program during the 12-week period and to only perform their usual activities. The procedures and guidelines were presented orally and in written form before starting the analysis. An institutionally approved consent form was handed over to the subjects who agree to participate and they were asked to sign them. The experimental groups trained at the same time of day in the morning session, four days a week, throughout the study. All subjects were under direct supervision during training and were clearly instructed regarding how to perform each exercise.

The training regiment lasted for twelve weeks for four days per week for all the three experimental groups. Experimental group-I had undergone core strength training, group-II had mobility training and experimental group-III was subjected to parallel mobility and core strength training. Group-IV was the control group and they did not participate in any specialized training during the entire period of study.

**Core Strength Training**

The core strength training (*experimental group-I*) group performed six core-related exercises alternatively for twelve weeks with four days in a week (Monday, Tuesday Thursday and Friday). The following six Swiss ball exercises such as Swiss ball back extension, supine pelvic raises, Swiss ball dips, prone fly, supine side rolls and incline push-ups were fully instructed and demonstrated by a
specialist to ensure the understanding of the proper mechanics. The training load was progressively increased once in two weeks. The rest interval of two minutes between exercises and five minutes between sets was given.

**Mobility Training Programme**

The mobility training (experimental group-II) group performed six exercises four days in a week (Monday, Tuesday Thursday and Friday) for twelve weeks. The following six exercises such as front of trunk stretch, hip and thigh stretch, side bends, shoulder and triceps stretch, hamstring stretch and groin stretch were performed. The rest interval of two minutes between exercises and five minutes between sets was given.

**Parallel Mobility and Core Strength Training**

The subjects of experimental group-III performed the combination of core strength and mobility training in parallel four days (Monday, Tuesday Thursday and Friday) in a week for twelve weeks. The parallel training group subjects performed the same volume, intensity and frequency of training as isolated core strength and mobility training group however, they performed core strength training during every Monday and Thursday, and mobility training during every Tuesday and Friday in a week for 12 weeks.

**Control Group**

The control group was doing their usual training and they did not undergo any experimental training.
COLLECTION OF DATA

The data on the selected biomotor and psychomotor variables were collected prior to the commencement of experiment (pre test) and after twelve weeks of training period (post test). Both the pre and post tests were administered under identical conditions, with same apparatus, testing personal and testing procedures.

ADMINISTRATION OF THE TESTS

Standardized tests were employed to measure the selected physical and physiological parameters. The objectives, description and scoring of tests are explained below.

FIFTY METERS DASH

Purpose: To measure the speed of the participants.

Facilities and Equipments: Smooth surface, test course, scorecards, electronic stopwatch and a starting clapper.
**Procedure:** The participants were taken the starting positions behind the starting line. The test administrator (at the finish line) raised both arms sideways to indicate the set position. The ‘Go’ signal was given by rapidly lowering the arms to the side. The administrator had a stopwatch in his hand and started when the arms reach the side of the body. The participant ran as fast as possible across the finish line. The watch was stopped when the participant body (not head or arms) crossed the finish line. One trial was taken.

**Scoring:** The score was the time elapsed between the ‘Go’ signal and the moment the participants torso crossed the finish line. The time was recorded to the nearest one tenth of a second (Safrit, 1990).

**STANDING BROAD JUMP**

**Purpose:** The main aim of the test was to analyse the explosive power in horizontal distance.

**Equipment:** Measuring tape and Chunnam.

**Procedure:** A take off line was drawn on the ground. The subject took a position with toes just behind the take off line, feet slightly apart. Taking off from both feet simultaneously then jumps to the extent possible and landing on both feet. In jumping, the subject was crouched slightly and swunged the arms to aid the jump.

**Scoring:** The score was the distance to the nearest centimeter from take off line to the closest heel position. The best of the three trails was recorded (Jenson & Hirst, 1980).
BENT KNEE SIT-UPS

**Purpose:** Mainly to assess the muscular strength of the abdominal muscles.

**Equipments used:** Mat and stopwatch.

**Testing procedure:** The subject assumed supine lying position on the mat, knees bent to an angle less than 90 degrees and feet on the mat and heels were between 10 and 12 inches from the buttocks. The hands were clasped behind the neck and the elbows were placed flat on the mat. A partner held down the feet. On the signal ready ‘start’, the subject brought his head and elbows forward in a curl-up motion by contracting the abdominal muscles. The left elbow touched the right knee and vice versa alternatively. In return to starting position, the elbows touched the mat. These actions constitute one sit-up and it was repeated as many times as possible. On the word ‘stop’ after the expiry of one minute, the subjects stopped performing the sit ups.

Incomplete sit-ups such as (i) did not keep the feet flat on the mat (ii) did not keep the fingers clasped behind the neck, (iii) each time in return to starting position, failed to touch the elbows on the mat and (iv) resting between sit-ups were not counted.

**Scoring:** The number of sit-ups executed correctly in one minute was recorded as the individual score.

SIT AND REACH TEST

**Purpose:** Main objective of sit and reach test is to study and measure the anterior trunk flexion.
**Equipment:** The equipment to be used is Flexomeasure case with yardstick and tape.

**Procedure:** Flexomeasure case was set to face down by Lining up the 15-inch marks of the yardstick with a line on the floor and tape the ends of the stick to the floor. The subject was asked to sit down and line up his heels with the near edges of the 15inch mark and slide his seat back beyond the zero end of the yards stick. By keeping a partner stand we have to brace his toes against yard heels. An assistant is required on each side to hold his knees in a locked position as he prepares to stretch further. Keeping heels not more than 5 inches apart, slowly stretch forward, while pushing the Flexomeasure case as far down the stretch as possible with the fingertips of both the hands. Now readings were noted at the near edge of the Flexomeasure case.

**Scoring:** Individuals score is determined from the best of three trails (Johnson & Nelson, 1998).

**REACTION TIME RULER TEST**

**Purpose:** To measure attentiveness, reaction time, and hand-eye quickness of the subjects.

**Equipment:** Table, One meter long ruler or Yardstick, calculator and chair.

**Procedure:** The subject sites with his forearm and hand resting comfortably on the table in such a manner that their wrist extends over the side. The tips of the thump and index finger are held in already to pinch position about 3 or 4 inches in
a horizontal position. The tester holds the stick timers near the top, letting it hang between the index finger and subject’s thumb and the base line was even with the upper surface of the subject’s thumb. The subject was directed to look at the concentration zone and was told to react by catching the stick when it is released. The subject was instructed not look at the tester’s hand or allowed to move his hand up or down while attempting to catch the falling stick. Ten trails are given. Each drop was preceded by a preparatory command of ‘ready’.

**Scoring:** When the subject catches the ruler, the score just above the upper edge of the thumb was recorded. An average of the ten trails was recorded as the individual score. The distance score was then converted to time score by using the formula.

\[
\text{Time} = \sqrt{\frac{2d}{g}}
\]

where

\(d\) = the distance the ruler fell (meters)  
\(g\) = the acceleration due to gravity (9.8 m/s\(^2\)) and  
\(t\) = the time the ruler was falling (seconds)

**STORK STAND TEST**

**Objective:** To monitor the subject's ability to maintain a state of equilibrium (balance) in a static position.

**Equipment:** A Flat non-slip surface, stopwatch, an assistant, paper and pencil.
Procedure: The subjects were asked to stand comfortably on both feet with their hands on their hips. Then lifts the right leg and placed the sole of the right foot against the side of the left kneecap. When the assistant gave the command “GO”, the investigator starts the stopwatch and the subjects raises the heel of the left foot to stand on their toes. The subjects were asked to hold this position for as long as possible. The test was stopped when the subjects hand(s) come off the hips or the supporting foot swivels or moves (hops) in any direction or the non-supporting foot loses contact with the knee. The subjects were given three attempts, the investigator recorded the time of three attempts.

Scoring: The best time from the three attempts was recorded in seconds as individual score (Johnson & Nelson, 1979).

Alternate Hand Wall Toss Test

Purpose: To measure the hand-eye coordination of the subjects

Equipment: Tennis ball, smooth and solid wall, marking tape, stopwatch

Procedure: A line was marked 2 meters distance from the wall. The subject stands behind the line with a tennis ball and facing the wall. The ball was thrown against the wall using one hand in an underarm action and it was attempted to be caught with the opposite hand. Then the ball was thrown back against the wall and caught with the initial hand. The test was performed for a time period of 30 seconds. Each subject is subjected to three trails and the best was considered as individual score.
Scoring: The number of successful catches in 30 seconds was taken as individual score.

SHUTTLE BOARD DISTANCE PERCEPTION TEST

Objective: To measure the ability to perceive distance by concentrating on the effort involved in pushing the disc.

Equipment and Floor Marking: shuttle board cue sticks, discs, tape, blindfolds and measuring tape. The floor was marked as shown in figure-3.1. There are three phases of the test each from a different distance to the target (5, 10 and 15 feet from beginning of target scoring zones). The distance between each scoring zone was 6 inches.

Procedure: the subject was initially given four are five practice trials away from the target to get acquainted with the shuttle board pushing motion and the movement of the disc on the floor surface. Then the subjects taken to the target and positioned at the starting line 1 (5 feet from beginning of target zones) and told to sense the distance to the 10 point target zone. Then, the subjects blindfolded and were given ten trials. After each trial the subjects was allowed to saw where the disc came to rest. The blindfold was then repositioned, and executed the next trial. After ten trials at that distance they moved to starting line 2 and instructed to try to sense the distance to the 10 point zone. They again blindfolded, and 10 trials are given. The same procedure was repeated at starting line three.
**Scoring:** The zone in which the disc stops was recorded as the score for each trial. The total points from the three distances (thirty trials) were recorded as the individual score (Johnson & Nelson, 1979).

**STATISTICAL PROCEDURES**

Random group design was used in this study by involving 48 subjects. They were divided into four equal groups of twelve each randomly. All the four group subjects were selected from the same group. No effort was made to equate the groups prior to the commencement of the experimental treatment.

The data collected from the experimental and control groups on selected dependent variables was statistically analyzed by paired ‘t’ test to find out the significant differences if any between the pre and post test. Further, percentage of changes was calculated to find out the chances in selected dependent variables due to the impact of experimental treatment.

The data collected from four groups prior to and post experimentation on selected dependent variables were statistically analyzed in order to nullify the initial mean differences. To find out the significant differences if any, the analysis of covariance (ANCOVA) is performed. The pre test means of the selected dependent variables was used as a covariate. Since four groups were involved, whenever the obtained ‘F’ ratio value was found to be significant for adjusted post test means, if any. In all the cases the level of confidence was fixed at 0.05 level for significance.
Chapter – IV

Analysis of the Data and Results of the Study....©