Chapter - III

METHODOLOGY

In this chapter the selection of subjects, selection of variables, selection of tests, instruments reliability, reliability of the data, orientation to the subjects, competency of the tester, pilot study, training load, training programme, collection of the data, tests administration, experimental design and statistical procedures used have been explained.

SELECTION OF SUBJECTS

The purpose of the study is to find out the relative effects of isolated and combined aerobic and anaerobic interval training on selected speed and endurance parameters among Soccer players. To achieve this purpose, forty five women Soccer players who participated in the Bharathidasan University Intercollegiate Tournament of Department of Physical Education, Health Education and Sports, H.H.The
Rajah’s College, Pudukkottai, Tamil Nadu, India were selected as subjects. Their age ranged from 18 to 22 years. The selected subjects were divided into three equal groups of fifteen each, such as aerobic interval training group, anaerobic interval training group and combined aerobic-anaerobic interval training group. Group I underwent aerobic interval training programme, group II underwent anaerobic interval training programme and group III underwent combined aerobic-anaerobic interval training for twelve weeks – three days per week. Since the subjects were from Department of Physical Education, Health Education and Sports, they were found to be fit enough to undergo the interval training programme. The investigator received written consent from the subjects for participating in the experiment. The subjects were allowed to take rest whenever they feel discomfort. But they were not allowed to discontinue the training as a whole.
SELECTION OF VARIABLES

The game of Soccer now a day is being played in many types of surfaces namely grass, gravel and artificial surface. The players, coaches and the conditioning experts now understand that the physical variables are playing vital role to reach high level performance in the artificial surface. Playing in the artificial surface requires high level of physical efficiency, especially in speed, speed endurance, cardio respiratory endurance and muscular endurance.

When a sports or game training is introduced it is likely to improve physical and bio-motor abilities. The sports performance depends largely on physical fitness. Millions of young athletes are practicing games and sports regularly. Often these young athletes are disadvantaged through lack of sufficient physical fitness to execute movement. Choosing the right person for the right event can eliminate this problem. Keeping all these facts in mind, the researches has made an attempt to find out the effect of training on motor qualities.

Soccer has grown tremendously over the last few years, more people are playing the game than ever before. On all
levels from the pros to kinds the game has a lot to offer in mental, physical and physiological conditioning (Vogelsinger, 1985).

According to Bose and Banerjee (1987), Soccer seems one of the most physically and emotionally involved games as suggested by different sports professional personnel. The Soccer player requires good physique, efficient physical and physiological fitness and obviously excellent skills of the game.

**Speed**

An essential requirement for successful performance in Soccer activities is speed. In general, speed may be defined as the capacity of the individual to perform successive movements of the same pattern at a fast rate. It is influenced by several factors like stride length, stride frequency, reaction time, movement time etc.,

Speed of muscle contraction would appear to be an innate quality, but speed of movement used in sprints or running in any game such as Soccer can be improved through
training in the proper techniques and through continued practice in the co-ordination of movements.

Speed is the most important skill for all the Soccer players. Speed is one of the main requisites which enable the players for higher performance in certain motor tasks. Especially it is very essential for forward players, when they get solo balls that time speed is necessary for scoring the goal. Hence the following speed parameters namely Maximum speed, Stride length and Stride frequency have been selected as dependent variables.

**Endurance**

Endurance is considered to be the ability of the circulatory and respiratory system to supply oxygen to the cells of working tissue to sustain the oxidative energy demands of the body and to remove the waste materials of the metabolism. Most of the physiologists agree that gas transport, especially oxygen is the primary determinant of the endurance. Gas transport (O₂, CO₂ transport) depends on the cardiac output and the oxygen carrying capacity of the blood. The oxygen carrying capacity is increased by the increasing
hemoglobin contents and the number of red bloods cells (RBC) per unit of the blood and ability of heart and lungs for gaseous exchange. Thus one reason for developing endurance is to improve the circulation of the blood to the working muscles being exercised. Systematic packages of training will improve endurance through the development of the circulatory and respiratory system. Mainly Soccer is an endurance game because it is played for longer time. Those who get the very good endurance can give better performance in Soccer. Hence the following endurance parameters namely Cardio respiratory endurance, Muscular endurance and Speed endurance have been selected as dependent variables.

**Independent Variables**

The standard of sports is gaining momentum day by day. New records are coming into existence at national and international level. It is all because of technical as well as tactical training to complete with advance sports countries. It will only be possible if the athletes are given advance training in the field of physical education and sports. It is only possible with help of research of high caliber (*Sharma, 1997*).
Sports training is the basic form of an athlete’s training. It is the preparation systematically organised with the help of exercise which in fact is a pedagogically organised process of controlling the development of an athlete.

Today sports training are mostly based upon the competitive motive. Each nation is trying to achieve top level performance and to win laurels in international competitions. Today records are proved to be lower performance of tomorrow. This is because greater stress has been laid on the quality rather than quantity training.

Interval training is the most versatile of speed and endurance training which involves repeated efforts at a relatively faster pace, separated by measured intervals of incomplete recovery. The intensity of each bout of running should be such that the heart rate increases from normal to between 170 to 180 beats per minute. The bouts of loads are repeated when the heart rate comes down from the above value to about 120 beats per minute. The training load in this method is best maintained by repeatedly checking the heart rate (Uppal and Gautam, 2000).
Interval training involves fixed patterns of work and fixed patterns of rest. This is probably the most popular type of training used in sports for training the elite athletes or players. Interval training can improve both aerobic and anaerobic capacities and enables the athlete to exercise at the specific intensity necessary to train the relevant energy system for that activity. Interval fatigue is associated with a continuous sessions of equal intensity. Hence aerobic interval training, anaerobic interval training and combined aerobic - anaerobic training were selected as independent variables for this study.

**SELECTION OF TESTS**

The purpose of the study was to find out the relative effects of isolated and combined aerobic and anaerobic interval training on selected speed and endurance parameters namely maximum speed, stride length, stride frequency, speed endurance, muscular endurance and cardio respiratory endurance among women Soccer players. The researcher had discussed with the experts, physical education professionals and had reviewed the various literatures and selected the following test items, which were standardized, ideal and apt
test for measuring the selected criterion variables and it was presented in Table I.

### TABLE I

#### TESTS SELECTION

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Speed</td>
<td>50 mts Run</td>
</tr>
<tr>
<td>2.</td>
<td>Stride Length</td>
<td>50 mts Run</td>
</tr>
<tr>
<td>3.</td>
<td>Stride Frequency</td>
<td>50 mts Run</td>
</tr>
<tr>
<td>4.</td>
<td>Speed Endurance</td>
<td>150 mts Run</td>
</tr>
<tr>
<td>5.</td>
<td>Muscular Endurance</td>
<td>Bent Knee Sit-ups</td>
</tr>
<tr>
<td>6.</td>
<td>Cardio Respiratory Endurance</td>
<td>Cooper’s 12 min Run / Walk</td>
</tr>
</tbody>
</table>

### INSTRUMENTS RELIABILITY

Instruments used for this research have been tested and approved by experts and physical education professionals. All the instruments were in good condition and they were purchased from a reputed company. The calibration were
tested and found to be accurate enough to serve the purpose of the study.

**RELIABILITY OF THE DATA**

To establish the reliability of the data, ten subjects were selected at random. The test-retest method was adopted to ensure the reliability of the data. All the selected criterion variables in the present investigation were tested twice for the subjects by the same tester under similar conditions. The obtained data on maximum speed, stride length, stride frequency, speed endurance, muscular endurance and cardio respiratory endurance were subjected to intra class correlation to find out the reliability of the data as suggested by *(Johnson and Nelson, 1988)* and they are presented in Table II.
TABLE II
INTRA CLASS CORRELATION CO-EFFICIENT ON SELECTED CRITERION VARIABLES

<table>
<thead>
<tr>
<th>S.No</th>
<th>Tests</th>
<th>“R” Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>50mts run</td>
<td>0.89*</td>
</tr>
<tr>
<td>2.</td>
<td>150 mts Run</td>
<td>0.92*</td>
</tr>
<tr>
<td>3.</td>
<td>Bent Knee Sit ups</td>
<td>0.89*</td>
</tr>
<tr>
<td>4.</td>
<td>Copper’s 12 min run / walk</td>
<td>0.87*</td>
</tr>
</tbody>
</table>

*Significant at .05 level of confidence.
(The table value required for significance at .05 level of confidence with df 9 was 0.767)

ORIENTATION TO THE SUBJECTS

The investigator explained the purpose of the training programs to the subjects participating in the study. For the collection of data, the investigator explained the procedure of the 50 mts run, 150 mts run, bent knee sit ups and cooper’s 12 min run/walk tests for measuring maximum speed, stride length, stride frequency, speed endurance, muscular endurance and cardio respiratory endurance respectively.
COMPETENCY OF TESTER

The investigator was assisted by his co scholars. To ensure that the investigator and his co scholars were well versed with the techniques of conducting the tests. The investigator and his co scholars had a number of practice session to learn the correct testing procedures under the guidance of an expert after considerable practice.

PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subjects in order to fix the load. For this, ten subjects were selected at random and divided into two groups of five each, in which group I underwent aerobic interval training and group II underwent anaerobic interval training under the watchful eyes of experts and the researcher. Based on the results of the pilot study, the initial load of the subjects for aerobic interval training group, anaerobic interval training group and combined aerobic - anaerobic interval training group were fixed. The initial load for all experimental groups were more or less similar.
TRAINING LOAD

Sports training is a pedagogical process based on scientific principles, aimed at preparing sportsmen for higher performances in sports competitions. Sports training consists of activities and movement which generally lead to high fatigue. Fatigue is the direct product of load caused by physical activities or exercises. Fatigue is essential for starting the adaptation processes in the organism which ultimately leads to increase in performance capacity. Load, therefore, is of central importance in sports training. Without load through physical exercises performance cannot be improved, stabilized and maintained. Stagnation of load is stagnation of performance (Singh, 1991).

Based on the direction given by Jack Wilmore and David Costill (1988), the training programmes were fixed for aerobic interval training, anaerobic interval training and combined aerobic – anaerobic interval training groups. While constructing the training programmes the basic principles of training (specificity and progression of overload) were followed.
TRAINING PROGRAMME

During the training period, the experimental groups underwent their respective training programmes three days per week (alternate days) over twelve weeks in addition to the regular programme of Soccer training. Group I underwent aerobic interval training, group II underwent anaerobic interval training and group III underwent combined aerobic - anaerobic interval training programmes. Every day the work lasted for 45 to 60 minutes approximately including warming up and warming down periods. The training programmes carried out on a 400 mts track during the morning hours. The subjects underwent the respective programmes as per the schedules under the supervision of the investigator. Attendance was recorded and calculated for all the training groups separately for dividing the total numbers of training session by the number of sessions present. All the subjects involved in the training programmes were questioned about their health status throughout the training period. None of them reported any injuries like sprain, strain, muscle cramp etc., However muscle soreness was reported in the early weeks but it subsided later.
COLLECTION OF THE DATA

The data on speed, stride length, stride frequency, speed endurance, cardio respiratory endurance and muscular endurance were collected by administering 50 mts run, 150mts run, bent knee sit ups and cooper’s 12 min run/walk test respectively. Pre test and post test data were collected at prior to and immediately after the training period. All the variables were tested in two consecutive days.

TESTS ADMINISTRATION

The administration of the tests and method of collecting data were explained here.

SPEED

(50 METRES RUN)

Purpose

To measure the speed of the subjects.

Facilities and Equipments

An area on track with a starting line, a 50 metres (straight) running course, a finish line, electronic stopwatch and a starting clapper.
**Procedure**

After a short warm-up period, the students took standing start position behind the starting line. To obtain better result, two subjects ran at the same time. 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 better of the two trials were recorded.

**Scoring**

The time taken between the starters signal and the instant at which the subjects crossed the finishing line was measured as the score in \( \frac{1}{10} \text{th} \) of the second \( (\text{Seagrave, 1996}) \).

**STRIDE LENGTH**

(50 METRES RUN)

**Purpose**

The purpose of this test was to measure the stride length of the subjects.
Facilities and Equipment

Test course on the track, a standard measuring tape, saw dust and starting clapper were used.

Procedure

While the subjects were allowed to run fast about 50 metres to measure speed, the measurement of the length of stride was taken in the test course, which consists of an acceleration zone of 20 metres and the test zone of 30 metres (between 20\textsuperscript{th} to 50\textsuperscript{th} metre). The athlete uses the acceleration zone to gain maximum speed through the 30 metres test course. A light coating of sawdust was spread over the test zone that highlighted the footprints. Stride length was the distance from the tip of the rear toe to the tip of the front toe was recorded to the nearest centimeter. To avoid the bilateral discrepancies two successive strides are measured to the nearest centimeter.

Scoring

The average of two successive strides of the subject was recorded in centimeter as the individual score (Seagrave, 1996).
**STRIDE FREQUENCY**

*(50 METRES RUN)*

**Purpose**

The purpose of this test was to measure the stride frequency of the subjects.

**Facilities and Equipment**

Electronic stopwatch, test course and starting clapper were used.

**Procedure**

While the subjects were allowed to run fast about 50 metres to measure speed, the measurement of the stride frequency was taken in the test zone of 30 metres (between 20th to 50th metre). The time elapsed for five right/left foot contacts of the subjects after the initial supporting phase in the test zone. Thus, recording the time taken for ten strides.

**Scoring**

Dividing the number of strides (10) taken by the time recorded given the number of strides ran in one-second *(Seagrave, 1996).*
**150 metres run**

**Purpose**

To measure the speed endurance of the subjects.

**Facilities and Equipments**

An area on track with a starting line, a 150 metres running course, a finish line, electronic stopwatch and a starting clapper.

**Procedure**

After a short warm-up period, the subjects took standing start position behind the starting line. To obtain better result, two subjects ran at the same time. 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. Two trials were conducted with sufficient rest in between and the better of the two trials were recorded.

**Scoring**

The time taken to run the 150 metres distance was measured in one-tenth of a second *(Seagrave, 1996).*
Bent Knee Sit-ups

Purpose

To measure the muscular endurance.

Equipments

Mats, stop watch and whistle.

Procedure

The subjects lied flat on the back with knees bent and the feet on the floor with the heels not more than 30 cms. from the buttocks. The knee angle should not be less than 90 degrees. The fingers were interlocked and placed behind the neck with elbows touching the mat. The feet were held securely by a partner. The subject then curled up to a sitting positions and touched his knees with the elbows. The exercise was repeated as many times as possible in one minute.

Scoring

One point was scored for each correct sit-up. The score was the maximum number of sit-ups completed in one minute (Uppal, 1992).
Cooper’s 12 Minutes Run/Walk

**Purpose**

The purpose of this test was to assess the cardio-respiratory endurance of the subjects.

**Equipments**

The test was administered in 400 meters track. A stopwatch, whistle, score sheets and pencils were used to administer the test.

**Procedure**

Cooper’s twelve minute run / walk test was administered with the help of qualified testers. For this test, 400 meters track was prepared with marking at every tenth meter. The investigator and the testers served as the lap scorers. The subjects were asked to stand on the starting arc drawn at the finish line of the 400 meters track and they were given instructions to cover as much distance as possible by running/walking. They were instructed to continue the run / walk 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 every minute. At the twelth minute a long whistle was blown and the subjects stopped instantly and stood on that spot. The lap scorers must rush to the spot and take the reading in nearest tenth meter.

**Scoring**

The distance covered by each subjects in twelve minutes were recorded to the nearest tenth meter. The distance covered by the subjects was used as a measure of cardio-respiratory endurance (*Clarke and Clarke, 1976*).

**EXPERIMENTAL DESIGN AND STATISTICAL PROCEDURES**

The experimental design used in this study was similar to random group design involving forty five women subjects who were divided at random into three groups of fifteen each. This study consisted of three independent variables such as aerobic interval training, anaerobic interval training and combined aerobic- anaerobic interval training. All the subjects were tested at prior to and after the training on speed, stride length, stride frequency, speed endurance, muscular endurance and cardio respiratory endurance. The data collected from the three groups on selected criterion
variables were analysed with dependent t-test to find out the significant improvement if any, due to the influence of the selected training means. The concept of magnitude of improvement (MI) was also used to find out the percentage of improvement of each criterion variable due to the influence of independent variables.

Further the concept of analysis of covariance (ANCOVA) was also used to find out the significant difference if any, among the experimental groups after the training programmes. Since three groups were compared whenever the obtained F-ratio for the adjusted post test was found to be significant, the scheffe’s test was used as a post hoc test to study the paired mean differences. The level of significance was fixed at .05 level of confidence to test the hypotheses.