Chapter – III

Methodology

In this chapter, the procedures and the methods adopted in the selection of subjects, experimental variables, experimental design, pilot study, selection of tests, reliability of the instruments, competency of the tester, orientation to the subjects, training programme, administration of tests, collection of data, experimental procedure, and statistical techniques are presented.

SELECTION OF SUBJECTS

The purpose of the study was designed to find out the acute effects of Continuous running and Intermittent training programmes on selected Bio-motor, Bio-chemical and athletic performance factors of professional college men athletes. Forty five men students, who participated in Anna University Zone-XIII inter collegiate athletic meets during the year 2012-2013, were selected randomly as subjects. The age, height and weight of the subjects ranged from 18 to 21 years, 167 to 171 cms and 64 to 71 kg respectively.
SELECTION OF EXPERIMENTAL VARIABLES

Based on the relevant literature reviewed and in accordance with the views of professional experts in Physical Education, the following Bio-motor, Bio-chemical, and athletic performance factors were selected:

**Independent Variables:**

- Continuous Running
- Intermittent Training

**Dependent Variables:**

**Bio-Motor Factors**

- Speed
- Agility
- Cardio respiratory endurance

**Bio-Chemical Factors**

- High Density Lipoproteins Cholesterol (HDL)
- Low Density Lipoproteins Cholesterol (LDL)
- Very Low Density Lipoproteins (VLDL)

**Athletic Performance**

- 100 Meters Run
- 800 Meters Run
- 1500 Meters Run
**EXPERIMENTAL DESIGN**

The experimental design used in this study was random group design. The subjects were divided at random into three groups of fifteen each (n=15). Group-I underwent Continuous Running, Group-II underwent Intermittent Training, and Group-III acted as Control. All the subjects were tested prior to and immediately after the training for all the selected variables.

**PILOT STUDY**

A pilot study was conducted for the purpose of finalizing and deciding upon the intensity and duration of the various packages of Continuous Running and Intermittent training programmes. The pilot study was conducted with fifteen subjects to find out the suitability of varied packages of Continuous running and Intermittent training and to find out the difficulties and short comings of the study. While constructing the training programmes the basic principles of sports training (progression of overload and specificity) were followed. During the construction of the training programme, the individual differences were also being considered. Further it helped to ensure the accurate measurement of selected Bio-motor, Bio-chemical, and athletic performance factors among professional college men students.
As per the directions given by Karvonen (2011), the maximum heart rate (MHR) and intensity level of the subjects were found out using the following formula:

1. \[ \text{MHR} = 220 - \text{age} \]

2. \[ \text{Target Heart Rate} = \text{MHR} - \text{Resting Heart Rate} \times \% \text{ of Intensity} + \text{Resting Heart Rate} \]

The initial load of the subjects was fixed by considering the above criteria. As has already been stated, while designing the training programme the basic principles of progression of load and specificity were taken into consideration. During the construction of the training programme, the individual differences were also being considered.

**SELECTION OF TESTS**

The following tests (Table - I.) were administered to measure the selected Bio-motor, Bio-chemical, and athletic performance factors. The tests were administered on the subjects before and after the training programme:
Table – I
Selection of Tests

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Criterion Variables</th>
<th>Test Items</th>
<th>Unit of Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Speed</td>
<td>50 Meters Run</td>
<td>In Second</td>
</tr>
<tr>
<td>2.</td>
<td>Agility</td>
<td>Shuttle Run</td>
<td>In Seconds</td>
</tr>
<tr>
<td>3.</td>
<td>Cardio Respiratory Endurance</td>
<td>Cooper’s 12 Minutes Run/Walk Test</td>
<td>In Meters</td>
</tr>
<tr>
<td>4.</td>
<td>High Density Lipoproteins (HDL)</td>
<td>Blood samples test</td>
<td>In mg/dL</td>
</tr>
<tr>
<td></td>
<td>Low Density Lipoproteins (LDL)</td>
<td>Blood samples test</td>
<td>In mg/dL</td>
</tr>
<tr>
<td></td>
<td>Very Low Density Lipoproteins (VLDL)</td>
<td>Blood samples test</td>
<td>In mg/dL</td>
</tr>
<tr>
<td>5.</td>
<td>100 Meters Run</td>
<td>100 Metres Run Test</td>
<td>In Seconds</td>
</tr>
<tr>
<td>6.</td>
<td>800 Meters Run</td>
<td>800 Metres Run Test</td>
<td>In Seconds</td>
</tr>
<tr>
<td>7.</td>
<td>1500 Meters Run</td>
<td>1500 Metres Run Test</td>
<td>In Seconds</td>
</tr>
</tbody>
</table>

RELIABILITY OF THE INSTRUMENTS

Instruments Reliability

Instruments such as stop watches, measuring steel tape, and laboratory instruments were used for this study. All instruments were in good working condition. Their calibrations were tested and found to be accurate enough to serve the purpose of the study.

Subject Reliability

The intra class correlation value of the above test and retest also indicated subject reliability as the same subjects were used under similar conditions by the same tester.
COMPETENCY OF THE TESTER

The investigator learned the procedures and methods to handle and operate the instruments to administer the test. Bio-motor factor and Athletic performance factors measurements were taken by the investigator himself using stop watches and steel tape. Services of qualified assistants were used for taking other measurements. Bio-chemical factors were assessed by Qualified Medical Laboratory Technicians employed in Kavery Medical Laboratory centre in Tiruchirappalli, Tamilnadu, India.

Bumgartner and Jackson (1991) have obtained that the repeated measurement of the individual on the same test was a univariate, not a bivariate situation. It is distribution of a single variable. Hence it makes sense and fits enough to use univariate statistics, like the Intra – class correlation co-efficient.
Table – II

Intra Class Correlation for Establishing Test –Retest Reliability

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Criterion Variables</th>
<th>‘R’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Speed</td>
<td>0.81*</td>
</tr>
<tr>
<td>2.</td>
<td>Agility</td>
<td>0.79*</td>
</tr>
<tr>
<td>3.</td>
<td>Cardio Respiratory Endurance</td>
<td>0.81*</td>
</tr>
<tr>
<td>4.</td>
<td>High Density Lipoproteins (HDL)</td>
<td>0.88*</td>
</tr>
<tr>
<td>5.</td>
<td>Low Density Lipoproteins (LDL)</td>
<td>0.79*</td>
</tr>
<tr>
<td>6.</td>
<td>Very Low Density Lipoproteins (VLDL)</td>
<td>0.92*</td>
</tr>
<tr>
<td>7.</td>
<td>100 Meters Run</td>
<td>0.86*</td>
</tr>
<tr>
<td>8.</td>
<td>800 Meters Run</td>
<td>0.79*</td>
</tr>
<tr>
<td>9.</td>
<td>1500 Meters Run</td>
<td>0.91*</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)

ORIENTATION TO THE SUBJECTS

Prior to the administration of tests, the investigator held a meeting with the subjects. The purpose, the significance of this study and the requirements of the testing procedure were explained to them in detail, so that there was no ambiguity in their minds, regarding the efforts required of them. All the subjects voluntarily came forward to co-operate in the testing
procedures and the training and to put in their best efforts in the interest of the scientific investigation and in order to know their own performance. The subjects were very enthusiastic and co-operative throughout the study.

**TRAINING PROGRAMME**

The control group was not exposed to any specific training. However; they were participating in their regular Physical activities. The experimental groups-I and II were subjected to twelve weeks of Continuous running and Intermittent training respectively. Then training was given for three days per week (alternative days). Every training session lasted for 40 to 60 minutes. The training programme was scheduled for the morning between 6.00 am and 7.00 am.

The subjects underwent their respective programme under strict supervision prior to and during every session. Subjects underwent a 10 minute warm-up and cooling-down exercises which included jogging, stretching, striding and push-ups. All the subjects involved in the training were questioned about their health condition throughout the training period. None of them reported any injuries. However, muscle soreness was reported in the early weeks, but it subsided later.
Attendance was calculated for the training groups by dividing the total member of training sessions by the number of sessions attended. It was 97% for group-I (Continuous Running) and 96% group-II (Intermittent training).

The training programmes offered to the experimental groups are presented in Tables III & V:

**Table-III**

**Continuous Running Programme**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Week</th>
<th>Duration of Work out</th>
<th>MHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>800 Meters Run</td>
<td>60%</td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>1000 Meters Run</td>
<td>60%</td>
</tr>
<tr>
<td>I</td>
<td>3</td>
<td>1200 Meters Run</td>
<td>60%</td>
</tr>
<tr>
<td>I</td>
<td>4</td>
<td>1400 Meters Run</td>
<td>60%</td>
</tr>
<tr>
<td>II</td>
<td>5</td>
<td>1600 Meters Run</td>
<td>70%</td>
</tr>
<tr>
<td>II</td>
<td>6</td>
<td>1800 Meters Run</td>
<td>70%</td>
</tr>
<tr>
<td>II</td>
<td>7</td>
<td>2000 Meters Run</td>
<td>70%</td>
</tr>
<tr>
<td>II</td>
<td>8</td>
<td>2200 Meters Run</td>
<td>70%</td>
</tr>
<tr>
<td>III</td>
<td>9</td>
<td>2400 Meters Run</td>
<td>80%</td>
</tr>
<tr>
<td>III</td>
<td>10</td>
<td>2600 Meters Run</td>
<td>80%</td>
</tr>
<tr>
<td>III</td>
<td>11</td>
<td>2800 Meters Run</td>
<td>80%</td>
</tr>
<tr>
<td>III</td>
<td>12</td>
<td>3000 Meters Run</td>
<td>80%</td>
</tr>
</tbody>
</table>

- A Phase consists of four weeks
- MHR = Maximum Heart Rate
**Table-IV**

**Intermittent Training Programme**

<table>
<thead>
<tr>
<th>Work out</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm up at 5 mph pace</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Jog at 6 mph pace</td>
<td>1 minute</td>
</tr>
<tr>
<td>Jog at 5.5 mph pace</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Jog at 6.2 mph pace</td>
<td>1 minute</td>
</tr>
<tr>
<td>Jog at 5.3 mph pace</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Jog at 6 mph pace</td>
<td>1 minute</td>
</tr>
<tr>
<td>Jog at 5.5 mph pace</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Jog at 6.2 mph pace</td>
<td>1 minute</td>
</tr>
<tr>
<td>Jog at 5.3 mph pace</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Jog at 6 mph pace</td>
<td>1 minute</td>
</tr>
<tr>
<td>Jog at 5.5 mph pace</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Jog at 6.2 mph pace</td>
<td>1 minute</td>
</tr>
<tr>
<td>Jog at 5.3 mph pace</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Jog at 6 mph pace</td>
<td>1 minute</td>
</tr>
<tr>
<td>Jog at 5.5 mph pace</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Jog at 6.2 mph pace</td>
<td>1 minute</td>
</tr>
<tr>
<td>Jog at 5.3 mph pace</td>
<td>2 minutes</td>
</tr>
<tr>
<td>Cool down</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

**Total Workout time:** **44 minutes**

- Maximum Heart rate = 60±15%
- Total workout Time was increased by 5% every week.
ADMINISTRATION OF THE TESTS

BIO-MOTOR FACTORS

1. Speed (50 Yards Run)

Purpose

To measure the speed of the subjects

Equipment

An area on track with a starting line and a finishing line separated by a distance of 50 yards, two stop watches

Procedure

After a short warm-up period, the subjects take a position behind the starting line. Best results are obtained when two students run at the same time for competition. The starter uses the command. “On your marks” “set” and “go” along with a clapper and a signal to the timer by a downward sweep of the arms. The students run across the finish line. Only one trial is permitted.

Scoring

The score is the elapsed time to the nearest tenth 1/10th of a second between the starting signal and the instant the subject crosses the finish line.
2. Agility (10 Yards Shuttle Run)

Purpose:

To measure agility of the subjects

Equipments:

Stop Watch, Measuring tape, lime powder, flag post, rope, paper and pen.

Description:

A distance of ten yards is marked by two parallel lines. The subject stands behind the starting line. On getting starting signal “Go” he runs fast, towards the other line and touches it with one hand and runs back to the starting line. After touching it, he repeats the shuttle run.

Scoring:

The time taken by the performer to complete the course of 4x10 yards to the nearest 1/10th of a second is recorded as score in the test.
3. 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**

A 400 meter track, a stop watch with calibration of 1/10th of a second, a whistle, score sheets, and pencils.

**Procedure**

Cooper's Twelve-minute run/walk test was administered with the help of qualified testers. For this test, a 400 meter 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 line and were given instructions to cover as much distance as possible by running. 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 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 was used as a measure of cardio respiratory endurance.

**BIO-CHEMICAL FACTORS**

4. **High Density Lipoprotein Cholesterol**

**Method**

HDL- Cholesterol was estimated by applying enzymatic colorimetric method, as recommended by Burstein et.al, (1970) and Lopes *et al.*, (1977). Erba Smart lab auto analyzer was used for this purpose.

**Test Principle.**

Chylomicrons, VLDL(Very Low-Density Lipoproteins) and LDL (Low Density Lipoproteins) are precipitated, by adding Phosphotungstic acid and magnesium ions to the sample, Centrifugation leaves only the HDL in the supernatant, their cholesterol content is determined enzymatically by cholesterol oxidize paraaminophenazone method.

**Reagents**

Phosphotungstic acid – 0.44m mol/1

Magnesium Chloride --- 20 m mol/1
**Procedure**

To 200 mg/l of sample, 500 ml of precipitating reagent is added, mixed and kept for 10 minutes at room temperature. The tubes are centrifuged at 4000 rpm for 10 minutes and 100 mg/dl of clear supernatant is removed within two hours for cholesterol estimation by cholesterol oxidase—paraaminophenazine method with 1000 mg/dl of the reagent. Serum HDL cholesterol is expressed as mg/dl.

**5. Low Density Lipoprotein Cholesterol (LDL)**

LDL-Cholesterol is calculated from Total Cholesterol Triglycerides and HDL Cholesterol levels, by using the following equation recommended by Friedewald, Levy and Fredrickson(1972) equation.

\[ \text{LDL-C} = \text{TC-TG} / 5 - \text{HDL-C} \]

LDL-C is expressed as mg/dl.

**6. Very Low Density Lipoprotein (VLDL)**

VLDL-C is calculated from TG using the formula

\[ \text{VLDL-C} = \text{TG} / 5 \]

VLDL-C is expressed as mg/dl.
ATHLETIC PERFORMANCE FACTORS

7. 100 Meters Run

Purpose

To assess 100 meters running performance of the subjects

Equipments Used

Measuring tape, Starting clapper, and Stopwatch

Procedure

The crouch start method of maximum effort sprint over 100 mts is adopted for this purpose. The time from the ‘clap’ to the runner crossing the finish line is taken as the test score. The fractions are rounded up to the next largest one tenth of a second. For this purpose digital electronic watch is used.

Scoring

Time taken in the course of 100 meters run performance from starting to finish is noted in seconds.
8. **800 Meters Run**

**Purpose**

To assess 800 meters running performance of the subjects

**Equipments Used**

Measuring tape, Starting clapper, and Stopwatch

**Procedure**

The standing start method of maximum effort sprint over 800 mts is adopted for this purpose. The time from the ‘clap’ to the runner crossing the finish line is taken as the test score. The fractions are rounded up to the next largest one tenth of a second. For this purpose digital electronic watch is used.

**Scoring**

Time taken in the course of 800 meters run performance from starting to finish was taken in seconds.
9.1500 Meters Run Performance

Purpose

To assess 1500 meters running performance of the subjects.

Equipments Used

Measuring tape, Starting clapper, and Stopwatch

Procedure

The standing method of maximum effort sprint over 1500 mts is adopted for this purpose. The time from the ‘clap’ to the runner crossing the finish line is taken as the test score. The fractions are rounded up to the next largest one tenth of a second. For this purpose digital electronic watch is used.

Scoring

Time taken in the course of 1500 meters run performance from starting to finish is taken in seconds.

COLLECTION OF THE DATA

Continuous running and intermittent training were given as per the training schedule of twelve weeks. The pre and post test data on the selected criterion variables were collected by administering the test as per the standardized procedures before and after the twelve weeks of the training programme.
EXPERIMENTAL PROCEDURE

To facilitate the study, forty five (N=45) healthy, untrained college men students who were studying in various affiliated Colleges of Anna University Zone-XIII and who were participating in inter-collegiate athletic meets during the year 2012-2013 were selected as subjects at random and their age was between eighteen and twenty one years. They were divided into three equal groups namely experimental group-I (Continuous running) group-II (Intermittent training) and group-III( Control Group) that did not involve in any training. The pre-test was taken from the subjects before administering the continuous running and intermittent training. The subjects were involved in their respective packages for a period of twelve weeks under the personal supervision of the research scholar. At the end of the twelfth week, the post – test was taken.

STATISTICAL TECHNIQUE

The data obtained from the control and the experimental groups before and after the experimental period 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, the Scheffe’s Post hoc test was applied to determine the paired mean differences. The level of confidence was fixed at 0.05 level for all the cases.