CHAPTER III

METHODOLOGY

This chapter gives a detailed description about the procedures adopted for selection of subjects, selection of experimental variables, pilot study, experiment design, procedure, training programme, criterion measures and reliability of the data, administration of tests, collection and statistical treatment of data involved in the study.

3.1 SUBJECTS SELECTION

The research was designed to discover the isolated and combined impact of continuous run, alternative pace run and fartlek training on motor fitness, physiological, hematological variables and lactic acid on the Alagappa university college athletes. For this purpose, fifty athletes from the college were chosen randomly as subjects for the study and their age ranged between seventeen and twenty five years.

3.2 EXPERIMENTAL VARIABLES SELECTION

In accordance with the relevant literature reviewed and the views of professional experts in Physical Education, the following dependent variables of motor fitness namely aerobic endurance, speed endurance, muscular endurance, physiological variables namely vital capacity, breath holding time, resting pulse rate and hematological variables namely hemoglobin, red blood corpuscles, especially lactic acid were chosen. The independent variables of the experimental groups such as group A, B, C, D and E namely Continuous Run, Alternative Pace Run, Fartlek Training, Combined Training and Control Training.
A) DEPENDENT VARIABLES

a. Motor Ability Variables
   - Aerobic Endurance
   - Speed Endurance
   - Muscular Endurance

b. Physiological Variables
   - Vital Capacity
   - Breath Holding Time
   - Resting Pulse Rate

c. Hematological Variables
   - Haemoglobin
   - Red Blood Corpuscles

d. Lactic Acid

(B) INDEPENDENT VARIABLES OF THE EXPERIMENTAL GROUPS

Group A : Continuous Run
Group B : Alternative Pace Run
Group C : Fartlek Training
Group D : Combined Training
Group E : Control Group

3.3 PILOT STUDY

A pilot study was undertaken to analyze and choose the intensity and duration of the different endurance training programme. The Pilot study was conducted with ten subjects to know the suitability of different endurance training and to find out the difficulties and short comings of the Study. Furtherer, it helped to ensure the accurate motor fitness, physiological, hematological variables, lactic acid among male athletes.
3.4 SELECTION OF TESTS

The study attempted primarily to evaluate the effect of different endurance trainings, Continuous Run, Alternative Pace Run, Fartlek training and combined training on selected motor fitness, physiological, hematological variables such as aerobic endurance, speed endurance, muscular endurance, vital capacity, breath holding time, resting pulse rate, hemoglobin, red blood corpuscles, lactic acid among male athletes. According to literature review, the tests listed below were conducted for the collection of the data based on chosen dependent variables that were showed in table-1.

**TABLE – 1 Test Selection of Variables**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>TEST SELECTION</th>
<th>VARIABLES TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aerobic Endurance</td>
<td>Cooper 12minrun/walk</td>
</tr>
<tr>
<td>2</td>
<td>Speed Endurance</td>
<td>300Mts</td>
</tr>
<tr>
<td>3</td>
<td>Muscular Endurance</td>
<td>Sit – Ups (Bent knees/ 1 mint.)</td>
</tr>
<tr>
<td>4</td>
<td>Vital Capacity</td>
<td>Spirometer</td>
</tr>
<tr>
<td>5</td>
<td>Resting pulse rate</td>
<td>Palpation Method (Radial artery of the wrist)</td>
</tr>
<tr>
<td>6</td>
<td>Breath Holding Time</td>
<td>Noise Hole Method</td>
</tr>
<tr>
<td>7</td>
<td>Haemoglobin</td>
<td>Blood Sampling Analysis</td>
</tr>
<tr>
<td>8</td>
<td>Red Blood Corpuscles</td>
<td>Blood Sampling Analysis</td>
</tr>
<tr>
<td>9</td>
<td>Lactic Acid</td>
<td>Blood Sampling Analysis</td>
</tr>
</tbody>
</table>

3.5 INSTRUMENTS RELIABILITY

The instruments and equipment used in the study for collection of data were procured by standard companies. The working condition and the reliability of the standardized instruments were ensured.
3.6 SUBJECTS RELIABILITY

The method of test-retest was used for evaluating the reliability of the subjects. Similar tester and conditions on the individual chosen variables were used to examine the fifty athletes selected from the Alagappa University Colleges, Tamil Nadu. The intra class correlation measure the reliability of the subjects with the scores test and retest on each individual criterion variable.

3.7 RELIABILITY OF THE DATA

Test and retest process determined the reliability of the data by using each of the five groups consisting 10 athletes as subjects. The subjects under similar tester and conditions were brought to twice of the tests on chosen criterion variables. The correlation of the intra class co-efficient for determining the reliability of the collected data and the table-2 lists the results.

<table>
<thead>
<tr>
<th>S.NO</th>
<th>VARIABLES</th>
<th>‘R’ VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aerobic Endurance</td>
<td>0.88*</td>
</tr>
<tr>
<td>2</td>
<td>Speed Endurance</td>
<td>0.92*</td>
</tr>
<tr>
<td>3</td>
<td>Muscular Endurance</td>
<td>0.94*</td>
</tr>
<tr>
<td>4</td>
<td>Vital Capacity</td>
<td>0.90*</td>
</tr>
<tr>
<td>5</td>
<td>Resting pulse Rate</td>
<td>0.94*</td>
</tr>
<tr>
<td>6</td>
<td>Breath Holding Time</td>
<td>0.87*</td>
</tr>
<tr>
<td>7</td>
<td>Haemoglobin</td>
<td>0.96*</td>
</tr>
<tr>
<td>8</td>
<td>Red Blood Corpuscles</td>
<td>0.95*</td>
</tr>
<tr>
<td>9</td>
<td>Lactic Acid</td>
<td>0.98*</td>
</tr>
</tbody>
</table>

3.8 COMPETENCY OF THE TESTER

The researcher developed an ability of making an appropriate choice and handling of the procedures, methods and instruments for the administration of the tests. Standard equipment assisted in the measurement and evaluation procedures of the study. Services of qualified assistants were used for taking other motor fitness, physiological, hematological variables and lactic acid.
3.9 COLLECTION OF THE DATA

Continuous run, alternative pace run, fartlek training and combined groups were given training as per the schedule of thrice a week for twelve weeks. The data of the pre and posttest on the chosen variables were collected by administering the test as per the standardized procedures in prior and after twelve weeks of the training programme.

3.10 EXPERIMENTAL DESIGN AND PROCEDURES

The study involved a single dimensional design with five groups assigned with different endurance trainings. To facilitate the study, a random selection of fifty male athletes whose age ranged from 17 to 25 years from Alagappa University inter colleges athletes was done. Equal division of the four experimental groups such as continuous run, alternative pace run, fartlek training, combined training and one control group without special training was done. The pre-test was taken from the subjects at prior to the administration of the different endurance trainings. The subjects were involved with their respective training sessions which lasted thrice a week for about twelve weeks under the personal supervision of the research scholar. At the end of twelfth week, the post – test was taken on selected criterion variables.

3.11 CRITERION MEASURES

From the literatures and with the consultation of professional experts, the selected dependent variables were measured with the following as the criterion measures for this study for testing the hypothesis. The criterion measures adopted for the studies measuring the motor fitness, physiological, hematological variables and lactic acid are given below.

3.12 TEST ADMINISTRATION OF MOTOR FITNESS VARIABLES

COOPER’S 12 MINUTES RUN OR WALK TEST

Purpose:

The study intended to evaluate the cardio respiratory endurance.
**Equipment:**

A stopwatch, whistle, distance mark and 400mts were used for testing the group.

**Procedure:**

The role of assigning each runner to a spotter is very productive. The number of laps that could be covered by the athletes in a period of 12 minutes by walking or running from the starting line in the lead of the starting signal is calculated. The spotters keep up a check of each lap, and during the stop signal, they promptly hurried to the spots of the sprinters.

**Scoring:**

The product of the quantified time of laps and its distance with the addition of each segments in quarters, eighths, 10-yard interval etc., in an incomplete lap and the quantified yards covered between a specific segments.

**SPEED ENDURANCE 300 METERS RUN**

**Purpose:**

The test aimed to evaluate the speed endurance of a person running for a given distance.

**Equipment:**

Stop watch, whistle, finishing stand, paper, pencils.

**Procedure:**

After a short period of warm up exercises, the chosen subjects were instructed to take position behind the beginning line. The stop watch was begun at the go signal. The distance covered by the runners was measured in meters from the starting line. The time of an assigned runner was stopped at the finish line with a count of one trial.

**Scoring:**

The score was measured by the lapse period to the closest tenth of a second between the beginning and the moment of crossing the end line.
**SIT-UPS (BENT KNEES)**

**Purpose:**

The study aimed to evaluate the muscular endurance of the abdomen.

**Equipment:**

A stop clock, a mat/ dry turf/ dirt-free floor

**Procedure:**

The subject laid down on the back with bent knees at an angle under 90, rested feet involving heels not exceeding twelve crawls from the buttocks.

The subject placed the hand with the fingers fastening around the back of the neck, the elbows in a square on the surface, the feet that were held by a partner to establish the feet in contact with the floor. At that point the subject tightened the muscles of the abdomen, and the head and elbows were brought to the knees. After the whole activity that constituted one sit up, the beginning position was brought back with the elbows on the surface before sitting. Before the execution of the test, the tester demonstrated the above process. At the starting signal of the timer, the subject executed the whole process with intense attempts. The tester checked the quantity of sit ups performed and following 60 seconds of which the subjects stopped.

**Scoring:**

The score represented the quantity of accurate sit-ups in 60 seconds where one fair trial was permitted.

3.13 TEST ADMINISTRATION OF PHYSIOLOGICAL VARIABLES

**Vital Capacity**

**Purpose:**

To assess the function of the lung.

**Equipment:**

Spirometer
**Procedure:**

The function of the lung is typically measured using the forced vital capacity and expired volume in 1 second with an expiration at the maximum level. The subjects are instructed to breathe in the lungs fully, close the mouth tightly and breathe their lungs quickly. Generally the best among the trials is recorded.

**Scoring:**

There must be an immediate derivation of vital capacity and volume of expiration that were forced and flow rate values of expiration in primary, secondary and peak level from spirometer. The best of three similar readings were chosen for obtaining the values.

**BREATH HOLDING TIME**

**Purpose**

The objective of the investigation was to estimate the capability of the subjects in holding the breath for an extended period of time.

**Equipment:**

A stop watch with calibration of 1/10 seconds, score sheet and a pencil.

**Procedure:**

The subject remained calm and breathed in profoundly after which she held her breath for a time span conceivable to her. The subject’s index finger acted as the signal for the beginning and ending of the time. The subject held the nose using the thumb and centre finger to avoid the removal of air through the nostrils, and also avoided the removal of air by closing the mouth during the record of the breath holding time.

**Scoring:**

The breath holding time i.e., the duration of the breath held by the subject until its release was recorded with the help of stopwatch to the closest 0.1 as breath holding time.
RESTING PULSE RATE

Purpose:

The test aimed to evaluate the rate of resting pulse of the subject.

Equipment:

Stop clock, paper, and pencil.

Procedure:

The pulse of the subject on the radial artery in the fore arm was checked by placing the index and middle fingers. The pulse of the subject each minute for 3 minutes in the morning at rest before the training was recorded. The pulse rate can be measured with a 10 seconds count multiplied by six or a 15 seconds count multiplied by four or a 30 seconds count with the doubling of the figure. As the It helped the subject to keep up the optimal zone during the training session.

Normal Results:

The normal rate of resting pulse for an adult is from 60 to 100 beats a minute. It varies based on the age and physical condition of an individual.

3.14 TEST ADMINISTRATION OF HEMATOLOGICAL VARIABLES

HAEMOGLOBIN CONTENT

Purpose:

To find out the level of hemoglobin in blood

Equipment:

Hemoglobin tube, Diluted hydrochloric acid, pipette, Distilled water, a table.

Procedure:

Place n/10 Hcl acid into the hemoglobin tube in the lowest mark (0.10, 20). Add one drop of blood to the 20 cubic m. Marks into the hemoglobin pipette and
transfer in to the acid tube. Capillary blood to venous blood may be used. Rinse the pipette 2 or 3 times. Mix well and allow standing for 5 minutes the solution is diluted drop by drop by distilled water. Each time mix the solution with stirring rod unit it matches stained tube by observing is not made within 2 minute. After mixing in the blood with the n/10 Hcl acid 2% should be debuted from the result obtained.

Normal Results:

Normal values vary in accordance with age and sex. The value of hemoglobin in women is generally lower than men.

1. for Men ranges from 14.0 - 18.0 g/dl
2. for Women ranges from 12.0 - 16.0 g/dl.

RED BLOOD CORPUSCLES COUNT

Purpose:

To find out the number of red blood cells in the blood.

Apparatus:

Hemocytometer and coverslip, RBC pipette, Hayem’s fluid.

Procedure for Red Blood Corpuscles Counting

1. The Haemocytometer was cleaned and focused under high power of a microscope and the rulings were observed. A clean coverslip was placed over the chambers.

2. A clean dry RBC pipette was taken and blood was drawn to 0.5 marks. The tip of the pipette was wiped.

3. Hayem’s fluid was drawn into the pipette up to101 mark carefully avoiding air bubbles.

4. The contents of the pipette were gently mixed taking care to avoid haemolysis.

5. First few drops that come out if the pipette were discarded to avoid pure Hayem’s fluid. Then a small drop of the mixture from pipette slip was under the cover slip
by applying the same at the edge of the cover slip. Now the mixture was held in the NEUBEUR counting chamber.

6. Five minutes was allowed for the cells to settle on the Haemocytometer and then the number to cells in 1 square millimeter area was counted.

7. During routine tests only cells in the first five squares out of 25 squares were counted.

**Normal Results**

The red blood corpuscle is the count of number of red blood cells contained in blood in one cubic millimeter. The values of normal red blood cells at different ages are as follows.

1. for Male ranging from 4.6 to 6.0 million
2. for Female ranging from 4.2 to 5.0 million

**LACTIC ACID**

**Purpose**

The test aims to find out the level of lactic acid in blood.

**Equipment**

Scalpels or lancets (small sized), ice, storage container, alcohol wipes, equipment to analyze blood and disposal unit of sharps and contaminated items.

**Procedure**

Small samples pinpricked often of venous blood can be drawn from any clean area with the help of a dry tissue for the removal of sweat followed by alcohol swab and pierce of the skin using lancet. There would be a possible oozing of good blood out of the wound that in turn was collected in the capillary tubes or various devices for investigation. In the event of the blood not streamed out openly, delicate pressure or re-pricking over the site was done.
Analysis

Lactate is a kind of salt formed from the production of lactic acid by the anaerobic exercises. Hence there is an interchangeable usage of the terms such as lactate and lactic acid. An automatic determination of lactic acid in the blood is done. Lactate concentration in the blood is a combination of the production, release and removal of lactate into the blood. The measurements of blood lactate help in the process of observation of changes in anaerobic power and responses to various workload sets.

3.15 TRAINING PROGRAMME

The experimental groups I, II, III, IV and the control group V were subjected to twelve week of continuous run (Group I), alternative pace run (Group II), fartlek training (Group III), combined training (Group IV) and control (Group V) on three alternative days a week. Each of the training programmes extended from 60 to 90 minutes with a schedule in the morning from 6.00 am to 8.00 am. The control group underwent usual regular exercises and was devoid any specific training. The subjects underwent their respective programme under strict supervision prior to and during every session. They experienced a 10 minutes warm up and cool-down exercises which included jogging, stretching, striding and push-ups. A regular self-analysis of the stature of the subject was done during the whole training session and none reported of injuries whereas muscle soreness that occurred in the earlier weeks lowered down in the later period. The training is scheduled as given in Appendix1-6.

3.16 STATISTICAL TECHNIQUES

The design of the experiment and the random group involved fifty as subjects who were divided into five groups containing ten each. This study was based on the chosen criterion variables such as motor fitness, physiological, hematological variables and lactic acid namely aerobic endurance, speed endurance, muscular endurance, vital capacity, breath holding time, respiratory rate, hemoglobin, red blood corpuscles. The five selected group underwent continuous run, alternative pace run, and fartlek method, combined method and controlled training respectively. The study mainly aimed at finding out the effects of different endurance trainings among the subjects on selected criterion variables. The data was obtained from the four experimental groups and the control group at the beginning and after the conduct of the test. The procured data was
statistically examined for significant difference using the method of analysis of covariance i.e., ANCOVA. Due to the involvement of the five various groups and at the significance of the F ratio for the adjusted post mean, the post hoc test utilized the Scheffe’s test to measure the difference of the paired means.