CHAPTER – III

METHODOLOGY

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

SELECTION OF SUBJECTS

The purpose of the study was to find out the Effect of Varied Volumes of Interval Training on Selected Motor Ability Components, Physiological and Psychological Variables of University Men Athletes. For this purpose, forty five Inter Collegiate Athletes of Bharathidasan University, Tiruchirappalli,
Tamilnadu, India, who participated in the Bharathidasan University inter collegiate Athletic Meet held in the year 2005-2006 were selected as subjects at random. The age, height and weight of the subjects ranged from 18 to 21 years, 163 to 171 cms and 54 to 66 kg respectively, and the means were 19.3 years, 167 centimeters and 57 kilograms respectively.

The subjects successfully completed the minimum strength requirement test recommended by Voight and Draovitch\textsuperscript{72}, which consist of static stability and dynamic movement testing for thirty seconds. The selected subjects were randomly assigned to three groups of fifteen each. Group I underwent Low Volume Interval Training, Group II underwent High Volume Interval Training, Group III acted as Control. They underwent the respective training programme for duration of twelve weeks at the rate of three days a week. A written consent was 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.

\textsuperscript{72} Micheal L. Voight and Peter Draovitch, “Plyometrics”, as cited in Mark Albert., \textit{Eccentric Muscle Training in Sports and Orthopaedics}, (New York: Churchill Livingstone, 1991), Ch.V.
SELECTION OF VARIABLES

Dependent Variables

Training involves constructing an exercise programme to develop an athlete for a particular event. This increasing skill and energy capacities are equal in consideration.73

‘Training’ is applied now–a–days for any organized formation purposefully aimed at the rapid increase in the physical, psychological, mental and technico–motor performance capacity of men.

Speed may be developed, but is in large part dependent upon a person’s genetic ability. Requirements for running speed are stride length; stride frequency, reaction time, acceleration, strength, power, endurance, flexibility and running form. Of all these components, stride length, stride frequency and speed endurance are most important and may contribute most to speed.

Agility, a motor fitness variable chosen for the study, may be explained as the physical ability which enables an individual to rapidly change body position and direction in a precise manner. Agility is an important component of motor fitness test and variable performance in shuttle run reveals the agility of an individual.\textsuperscript{74}

Winning performances require good technique, proper conditioning, and a strong competitive spirit. However, the ability to generate explosive, powerful effort on demand clearly separates elite athletes from the rest of the pack. Generating exceptional athletic power is only possible through a complete power-training program designed specifically with the athlete encage and his sport in mind.

Explosive power is a characteristic of the superior athlete. Speed and force are combined in athletic performance of high standards of excellence. The standing broad jump is most commonly used to measure leg power.

High level of performance of a crew in rowing might be dependent upon the physiological make up and it was recognized that physiological proficiency was needed for high level performance.

The resting pulse rate or heart rate varies greatly among different people and in the same person under different situations. The American heart rate association accepts as normal a range from 50 to 100 beats per minute. Some endurance athletes with very strong and efficient hearts have rates as low as 45 beats per minute. Women have heart rates 5-10 beats faster than men. This is primarily due to their size. Good cardio respiratory condition would be indicated by a pulse rate of 60 for women and 50 for men.

Respiration (breathing) supplies the body with the oxygen needed by the body and removes carbon dioxide, a waste product. Respiration has two phases: inhalation (bringing fresh air into the lungs) and exhalation (expelling air from the lungs). When the muscles of the rib cage and the diaphragm muscle contract, the chest expands (rib cage is pulled up and out, the bottom of the chest cavity lowers). When the chest expands, air rushes into the lungs. When the chest muscles and diaphragm muscle relax, the
chest cavity returns to its normal (smaller) size and some of the air in the lungs is forced out. Usually, an adult will inhale and exhale about 500 milliliters (about one pint) each time he breathes. Not all of the air is exhaled. After normal exhalation, around 2300 milliliters (ml) of air remain.

Breathing is usually performed automatically (without conscious thought) by the respiratory control center located in the brain. Serious head injuries can interfere with the control center and make mouth-to-mouth resuscitation or other measures necessary. Determining the effectiveness of the casualty's efforts to breathe (rate and depth) and other characteristics can be of great help in evaluating a casualty's condition.

Respiration is also affected by the amount of carbon dioxide in the blood. An increase in carbon dioxide causes an increase in respiration rate. The respiratory rate is also affected by extremes in body temperature and by emotions such as anger, fear, and anxiety.
Cardio Respiratory efficiency is an important quality to be developed in sportsmen. Man needs to participate in physical activities in order to achieve growth, development and maintain good health. It is the natural and inborn quality of a child to participate in such activities as running, throwing, jumping etc.

Cardiovascular endurance is the ability to perform whole body activities for extended periods of time. The cardio respiratory system provides a means by which oxygen is supplied to the various tissues of the body. Without oxygen, the cells within the human body cannot possibly function and ultimately death will occur. Thus the cardio respiratory system is the basic life support system of the body.\textsuperscript{75}

Anxiety is manifested in a variety of ways, sometimes the individual experiences it as merely a sense of harmless dread, without being able to identify why or of what he is fearful. Psychiatrists call this, “Free Floating Anxiety” to indicate that it is not attached to any specific object.\textsuperscript{76}

\textsuperscript{75} Prentice and Bucher, \textit{Fitness for College and Live} (2\textsuperscript{nd} ed), (New Delhi: West Book Depot, 1985), p.47.

\textsuperscript{76} E.B.Neil \textit{Psychology Today and Tomorrow} (New York: Hoper and Brothers, 1987) p. 134
Human aggression is a problem in society as well as in sport. Aggression is any form of behaviour directed to the goal of harming or injuring another being. The key element in this definition is the notion of intent to harm. We have identified two types of aggression and in hostile aggression, the aggressor’s reinforcement, gives suffering to the victim.

Since Motor Ability Components, Physiological and Psychological related variables play an important role in almost all games and sports, the following dependent variables were selected for this study.

1. Speed
2. Agility
3. Explosive Power
4. Resting Pulse Rate
5. Respiratory Rate
6. Cardio Respiratory Endurance
7. Anxiety
8. Aggression
**Independent Variables**

All athletic programs should incorporate the fundamental factors of training, namely physical, technical, tactical, psychological and theoretical training. They are an essential part of any training program regardless of the athlete’s age, individual potential, training level, or training phase. The relative emphasis placed on each factor varies, however, according to these features and the characteristics of the sport or event.

The interval programs of today have become highly sophisticated methods of structured training for athletic performance enhancement. Physiologists and trainers have designed interval programs that are specifically suited to individual athletes. These sessions include precisely measured intervals that match the athlete's sport, event and current level of conditioning. Often the appropriate intensity and duration of the intervals is determined by the results of anaerobic threshold testing (AT) that includes measuring the blood-lactate of an athlete during intense exercise.
Interval training works both the aerobic and the anaerobic system. During the high intensity effort, the anaerobic system uses the energy stored in the muscles (glycogen) for short bursts of activity. Anaerobic metabolism works without oxygen. The by-product is lactic acid, which is related to the burning sensation felt in the muscles during high intensity efforts. During the high intensity interval, lactic acid builds and the athlete enters oxygen debt. During the recovery phase the heart and lungs work together to "pay back" this oxygen debt and break down the lactic acid. It is in this phase that the aerobic system is in control, using oxygen to convert stored carbohydrates into energy.

This repetitive form of training leads to the adaptation response. The body begins to build new capillaries, and is better able to take in and deliver oxygen to the working muscles. Muscles develop a higher tolerance to the build-up of lactate, and the heart muscle is strengthened. These changes result in improved performance particularly within the cardiovascular system. Interval training also helps prevent the injuries often associated with repetitive endurance exercise, and they allow you to increase your training intensity without overtraining or burn-
out. In this way, adding intervals to your workout routine is a good way to cross-train.

Success in competitive sports and games can be attributed to many factors, training being one of the most important factors. Different training methods have been commonly used to improve physical fitness and related standards of performance of athletes. The training methods include interval training, circuit training, weight training, attitude training, resistance training, continuous training, alternate pace running, slow continuous running and Fartlek training.

Interval method is perhaps the most versatile method for improving endurance of various types. In interval method, the exercise is done at relatively higher intensity with intervals of incomplete recovery. Interval method is based on the principle that work should be done with sufficient speed and duration so that the heart rate goes up to 180 beats per minute. After this there should be a recovery period and when the heart rate comes down to 120-130 beats per minute the work should be started again. The training load can be controlled by repeatedly checking the heart rate.
The training effect of exercise depends upon the amount of stress imposed upon the relevant part of the body. There are variations, in the resting heart rate of different individuals. The percentage of heart rate reserve that is used in the exercise gives a better indication of intensity.

Intensity is the rate of doing work. In other words it is the pace at which physical activity is done. For example in sports (running) jumping and (throwing) running and swimming, the speeds are the intensity and in jumps and throws distance and height cleared are the intensities.

Different activities may be carried out with different intensities which may have different effects in organisms. Most exercise physiologists agree that the physiological and biochemical changes associated with training occur at about 70 percent of the individual’s maximal aerobic capacity whereas intensity less than 60 percent are not of efficient.
For cardiovascular conditioning to take place the intensity should exceed approximately 50 to 60 percent of functional capacity. This usually translates to a heart rate training range of 70 to 85 percent maximum heart rate.

To obtain the optimal effects, one should train at a level of intensity vigorous enough to raise one’s heart rate. The increased heart rate indicates that the body needs oxygen in greater amounts.

Most exercise physiologists agree that the physiological and biochemical changes associated with training occur at about 70 percent of the individual maximal aerobic capacity.

The proper intensity of training can be determined by simple trial and error. If the exercise bout results in a heart rate that is below the training heart rate, one could increase the speed or intensity of the next bout. If the heart rate is above the training heart rate one has to decrease the intensity of the next level. One of the great advantages of this type of program is that it allows exercise in many varied and different conditions with minimal danger. The heart rate will accurately reflect the stress level on the
body and allow the adult to exercise safely in the heat or altitude. The speed of the activity may decrease safely but the training effect will be safe. The principle works in another way too. As the cardiovascular system becomes more efficient, work will become easier and the tempo of the activity will necessarily increase to maintain the Running heart rate. Training by heart has advantages over training by time and distance.

Sport training aims are to improve sports performance. Therefore the nature and structure of sports performance determines to a great extent, the means and methods of training as well as the total planning, organization, implementation and assessment of training. The Knowledge about the nature and structure of sports performance must be considered as the first and perhaps the most important step towards the successful preparation of sportsmen for higher performance. The process of identification and development of sports talent also has to be based on this knowledge.
Based on the above mentioned concepts of interval training the following independent variables have been designed.

1. Low Volume Interval Training
2. High Volume Interval Training

**SELECTION OF TESTS**

The present study was undertaken to find out the Effect of Varied Volumes of Interval Training on Selected Motor Ability Components, Physiological and Psychological Variables of University Men Athletes. As per the available literature, the following standardized tests were used to collect relevant data on the selected dependent variables and they 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>Speed</td>
<td>50 Meters Run</td>
<td>1/10&lt;sup&gt;th&lt;/sup&gt; of a second</td>
</tr>
<tr>
<td>2.</td>
<td>Agility</td>
<td>Shuttle Run</td>
<td>1/10&lt;sup&gt;th&lt;/sup&gt; of a second</td>
</tr>
<tr>
<td>3.</td>
<td>Explosive Power</td>
<td>Standing Broad Jump</td>
<td>In Centimeters</td>
</tr>
<tr>
<td>4.</td>
<td>Resting Pulse Rate</td>
<td>Biomonitor</td>
<td>In Numbers</td>
</tr>
<tr>
<td>5.</td>
<td>Respiratory Rate</td>
<td>Expirograph</td>
<td>In Numbers</td>
</tr>
<tr>
<td>6.</td>
<td>Cardio Respiratory Endurance</td>
<td>Cooper's 12 Minute Run</td>
<td>In Meters</td>
</tr>
<tr>
<td>7.</td>
<td>Anxiety</td>
<td>SCAT Questionnaire</td>
<td>In Numbers</td>
</tr>
<tr>
<td>8.</td>
<td>Aggression</td>
<td>Smith’s Aggressive Questionnaire</td>
<td>In Numbers</td>
</tr>
</tbody>
</table>

COMPETENCY OF THE TESTER

All the measurements in this study were taken by the investigator with the assistance of Physical Directors working in various colleges in Bharathidasan University area in Thiruchirappalli 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.

**RELIABILITY OF THE INSTRUMENTS**

The clinical stopwatches, measuring tape, Sargent jump board, Biomonitor, and Expirograph used in this study were availed from Department of Physical Education, Bharathidasan University, Tiruchirappalli, Tamilnadu, in India. These instruments had been purchased from reliable and standard companies and were considered accurate enough for the purpose of the study.

**RELIABILITY OF THE DATA**

Test and retest method was followed in order to establish the reliability of data by using ten subjects at random. All the dependent variables selected in the present study were tested twice for the subjects by the same personnel under similar conditions. The intra-class co-efficient of correlation was used to find out the reliability of the data as suggested by *Johnson* and *Nelson* and the results are presented in Table II.

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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>Speed</td>
<td>0.91*</td>
</tr>
<tr>
<td>2.</td>
<td>Agility</td>
<td>0.89*</td>
</tr>
<tr>
<td>3.</td>
<td>Explosive Power</td>
<td>0.94*</td>
</tr>
<tr>
<td>4.</td>
<td>Resting Pulse Rate</td>
<td>0.89*</td>
</tr>
<tr>
<td>5.</td>
<td>Respiratory Rate</td>
<td>0.97*</td>
</tr>
<tr>
<td>6.</td>
<td>Cardio Respiratory Endurance</td>
<td>0.95*</td>
</tr>
<tr>
<td>7.</td>
<td>Anxiety</td>
<td>0.89*</td>
</tr>
<tr>
<td>8.</td>
<td>Aggression</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)

Since the obtained ‘r’ values were much higher than the required value, the data were accepted as reliable in terms of instruments, testers and subjects.
ORIENTATION TO THE SUBJECTS

The investigator explained the purpose of the training programme and their part in the study to the subjects. For the collection of data, the investigator explained the procedure of testing on selected dependent variables and gave instruction about the procedure to be adopted by them for measuring. Five sessions were spent to familiarize the subjects with the techniques involved in undergoing Low Volume Interval Training and High Volume Interval Training. It helped them to perform the Interval Training 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 universe 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 scores were recorded as the individual scores. The Aggression Questionnaire is given in Appendix-II.

**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, ten men subjects were selected at random and they were given different kinds of volume of Interval Training under the watchful eyes of the investigator. During the pilot study, the subjects underwent Low Volume Interval Training and High Volume Interval Training. Finally, limited exercises, which were closely related to developing the dependent variables were identified and designed as the training programme. The initial loads on the subjects were fixed based on the results of the
pilot study and the directions indicated Dan Wathen and William B. Allerheibigen. The respective volume and programme were fixed for Interval Training. While constructing the training programmes the basic principles of sports training (progression of overload and specificity) were followed. During construction of the training programme, individual differences were also considered.

**TRAINING PROGRAMME**

During the training period, the experimental groups underwent their respective training programmes. Group-I underwent Low Volume Interval Training, Group-II underwent High Volume Interval Training, for three days a week for twelve weeks.

The duration of the training session on all the days was between one hour to one and half hours approximately which included warming up and limbering down. All the subjects involved in this study were carefully monitored throughout the

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training programme and kept away from injuries. 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.

The percentages of volume for Low and High Interval Training are presented in Table III.

**TABLE – III**

**PERCENTAGE OF VOLUME FOR LOW AND HIGH VOLUME INTERVAL TRAINING GROUPS**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Groups</th>
<th>Components</th>
<th>Phase I</th>
<th>Phase II</th>
<th>Phase III</th>
<th>Phase IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Low Volume Interval Training Group</td>
<td>Sets</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repetition</td>
<td>10 to 12</td>
<td>14 to 18</td>
<td>10 to 12</td>
<td>10 to 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intensity</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
</tr>
<tr>
<td>2.</td>
<td>High Volume Interval Training Group</td>
<td>Sets</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repetition</td>
<td>10 to 12</td>
<td>14 to 18</td>
<td>10 to 12</td>
<td>10 to 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intensity</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
</tr>
</tbody>
</table>

* A Phase consists of Three weeks duration.
COLLECTION OF DATA

The data on Speed were collected by administrating 50 Meters Run, those on Agility were collected by administering Shuttle Run, Explosive Power was measured by administering Sargent Jump test, Resting Pulse Rate was assessed by Biomonitor, Respiratory Rate was measured by Expirograph. Data on Cardio respiratory Endurance was measured by Cooper’s 12 Minutes Run/walk test, those on Anxiety was measured by SCAT Questionnaire and those on Aggression were collected by administering the Smith Aggressive Questionnaire. 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 Speed, Agility, Explosive Power and Resting Pulse Rate tests were measured, whereas Respiratory Rate, Cardio Respiratory Endurance, Anxiety and Aggression tests were conducted on the second day.
ADMINISTRATION OF THE TESTS

1) 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 second.
2. Agility (10 Yards Shuttle Run)

Purpose:

To measure agility.

Equipments:

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

Description:

Ten yards distance is marked by the two parallel lines. The subjects stand behind the starting line. On getting starting signal “Go” he runs faster, goes nearer to the other line and touches it with the one hand turns and comes back to starting line touches it with hands turns and repeats it for a total of two times.

Scoring:

The time taken by the performer to complete the course of 4x10 yards to the nearest 1/10th of the seconds is recorded as score in the test.
3) **Explosive Power (Vertical Jump Test)**

**Purpose**

To measure explosive power in vertical direction.

**Equipment used**

A plywood board as suggested by Sargent was used to obtain the data.

**Procedure**

To obtain data for vertical jump, Sargent jump was administered to the subjects. Before the execution of the test, all the subjects were instructed by the tester regarding the test performance. They were taught how to perform the test perfectly by the investigator. Before the execution of the vertical jump test, subjects were directed to practice for a few minutes.

A plywood board (blackened 1 cm. Thick 1.50 mts. Long and 50 cm. Wide) with lines marked horizontally 1 cm apart was used. This board was placed vertically, the zero point of the scale being at the reaching height of the shortest subject tested. The subject stood with his side toward the wall and reached as high as possible with heels on the floor and made a mark on the wall with chalked fingers. The subject then swung his arms downward and backward assuming a crouched position with the knees bent at
about right angle. The subject then jumped as high as possible, swinging the arms upward, as the highest point of the jump was reached, and another mark was made above the initial one. Three trails were allowed with one-minute rest in between.

**Scoring**

The score was recorded to the nearest centimeter, between the reach and jump mark. The best of the three trials was recorded as the test score\(^79\).

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4) **Resting Pulse Rate**

(Radial Pulse Method)

**Purpose**

To record the resting pulse rate per minute

**Equipment**

Stop watch and chair were used.

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\(^79\) Dudley A. Sargent., “Physical Test of a Man”, *American Physical Education Review*, 26, (April 1921), 188.
Procedure

The pulse rates of all the subjects were recorded in a sitting position in the morning session between 6.00 am to 7.00 am. Before taking the pulse rate the subjects were asked to sit in a chair and relax for 15 min. To record the pulse rate, the three finger tips were placed on the left radial artery at the wrist so that the pulse was clear.

Scoring

The numbers of pulses were recorded for 15 seconds and then multiplied by four to recorded rate for a full minute.

6. Respiratory Rate

(Expirograph)

Objective

To measure the subject's frequency of respiration per minute.

Equipment

The apparatus ‘expirograph’ was used to measure the respiratory rate of the subjects.
Procedure

Respiratory rate was assessed by using the apparatus expirograph. When the subject became used to the room temperature and attained normal breathing Kymograph was switched on at a speed of 60mm / minute. Then the subject was asked to breathe normally for one minute. Now the recorder pen was moving up and down with marking on the graph. It was allowed to move up to 60 millimeters. There were a number of sharp edges on the graph sheet indicating the number of breaths in one minute. This reading was recorded as the respiratory rate of the subjects.

Scores

The investigator stood nearby, observed and recorded the readings.

7. 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. 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 TECHNIQUES

The experimental design used in this study was random group design. The selected subjects were divided at random into three groups of fifteen each (n=15). Group I underwent Low Volume Interval Training, Group II underwent High Volume Interval Training, and Group III 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 four 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 test was followed, as a post hoc test to determine which of the paired mean differences was significant. In all the cases .05 level of confidence was fixed as a level of confidence to test the hypotheses.