Chapter III

PROCEDURE

In this chapter the selection of the subjects, reliability of the data, criterion measures, collection of the data, description of the test, experimental design, selection and administration of the aerobic exercise programme and statistical model used for analysing the data are presented.

Selection of Subjects

Eighty middle aged females of Vikaspuri, New Delhi were selected randomly by using the table of random numbers. The age of the subjects ranged from forty to forty five years. It was ensured from the medical examination records of the subjects that all of them were medically fit for going through the experimental requirements of the project.

The requirement of the project were explained to all the subjects and all of them agreed voluntarily to undergo testing and training programmes. The procedures of testing blood samples and the harmless nature of taking
such samples under strict conditions of hygiene and sterility was explained to them so the subjects would not have any reservations in this matter.

The subjects were randomly assigned to two groups (one experimental, one control), each consisting of forty subjects.

**Reliability of Data**

The reliability of data was measured by ensuring instrument reliability and tester competency.

**Instrument Reliability**

The instruments used in this study were procured from Anthropology Department, University of Delhi, Sports Authority of India, New Delhi and Indira Gandhi Institute of Physical Education and Sports Sciences, New Delhi, which were supplied by well known manufacturers catering to research laboratories and hence were considered accurate and reliable.

**Tester Reliability**

To ensure that the investigator was well versed with the technique of conducting the tests, the investigator had a number of practice sessions in testing
procedures, under the guidance of the expert. All the measurements were taken by the investigator with the assistance of qualified testers, who were also well acquainted with the tests.

Tester reliability was established by test re-test process whereby consistencies of results were obtained by product moment correlation. The data collected from a randomly selected sample of five subjects in test re-test was correlated and the co-efficient of correlation thus obtained is presented in Table 1.

Since very high correlations from .85 to .99 were obtained for the variables, the competency of the tester to administer the tests was accepted.
TABLE 1

TESTER COMPETENCY FOR TEST RE-TEST IN PHYSICAL AND PHYSIOLOGICAL VARIABLES

<table>
<thead>
<tr>
<th>Variables</th>
<th>Co-efficient of Correlation</th>
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<td>Body Weight</td>
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<tr>
<td>Flexibility (Sit and Reach)</td>
<td>.94</td>
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<tr>
<td>Flexibility (Shoulder and Wrist Elevation)</td>
<td>.94</td>
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<tr>
<td>Grip Strength</td>
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<td>Leg Strength</td>
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<td>Back Strength</td>
<td>.94</td>
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<td>Supra-iliac</td>
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<td>Resting Blood Pressure</td>
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<td>Air Flow Rate</td>
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<td>Cholesterol</td>
<td>.99</td>
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<tr>
<td>Haemoglobin</td>
<td>.94</td>
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</table>
Criterion Measures

The criterion measures chosen to test the hypothesis were:

1. Distance covered in metres in Cooper's 12 minute run/walk test to the nearest fifty metres.

2. Sit and Reach test recorded to the nearest half of an inch with the help of yardstick and tape.

3. Shoulder and Wrist Elevation recorded to the nearest half of centimetres with the help of steel tape.

4. Grip Strength (Right and Left Hand) measured to the nearest half a kilogram with the help of grip dynamometer.

5. Leg Strength measured to the nearest half kilogram with the help of leg dynamometer.

6. Back Strength measured to the nearest half a kilogram with the help of back dynamometer.

7. Weight of the subjects recorded nearest to half a kilogram with a standard weighing machine.

8. Percentage of body fat obtained by taking skinfold measurements at four selected sites namely biceps, triceps, subscapular and supra-iliac and the total
value of the four sites compared to ready reckoner prepared by Durnin and Womersley\textsuperscript{1} to obtain the percentage of fat.

9. Weight of fat calculated by the following formula:

\[
\text{Fat Weight} = \frac{\text{Body Weight} \times \text{Percentage of Body Fat}}{100}
\]

and recorded in kilograms.

10. Lean body mass obtained by subtracting weight of fat from total body weight and was recorded in kilograms.

11. Resting heart rate recorded in beats per minute.

12. Resting blood pressure recorded in mm. of Hg with the help of sphygmomanometer and stethoscope.

13. Air flow rate recorded in millilitres with a air flow meter.

14. Vital capacity recorded in litres with a spirometer.

15. Cholesterol tested using the standard CHOD-PAP method and recorded in mg/dl.

16. Haemoglobin level estimated and recorded in grams/100 ml.

Collection of Data

The necessary data was collected by administering the tests for the chosen variables prior to the training, after the fourth week, eighth week and twelfth week of the training period. All the tests were administered in the track and laboratory of Indira Gandhi Institute of Physical Education and Sports Sciences, New Delhi.

Before the administration of the tests the subjects were briefed on the objectives and requirements of the various variables that were to be tested. All were given a chance to practice and to get familiar with the desired test. The apparatus and the procedure was explained prior to the administration of tests.

Experimental Design

Random group design was used for the experimental study because it was considered the most appropriate. The subjects numbering 80 were equally divided into two groups (one experimental and one control). Each group consisted of 40 subjects. The experimental group was given an aerobic exercise programme for a period of twelve weeks, excluding the period utilized for pre-test and post-tests.
The control group did not participate in any activity during the experimental period. The training for the experimental groups were given thrice a week i.e. on Mondays, Wednesdays and Fridays.

**Administration of Tests**

**Weight**

The weight of the subjects was taken using a standard weighing scale with minimum clothings and recorded to half a kilogram.

**Cardio-vascular Fitness**

*(12 min. run/walk)*

The subjects were asked to run/walk as many laps as possible around a marked course within 12 minutes. The score was determined by multiplying the number of complete laps times the distance of each lap, plus the number of segments of an incomplete lap, plus the number of yards stepped off between a particular segment.²

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Flexibility (Modified Sit and Reach Test)

**Instruments:**

Flexometer case or yardstick and tape.

**Directions:**

The tester lined up the 15-inch mark of a yard stick with the line on the floor and taped the stick to the floor. The subject sat down and lined up her heels with the near edge of the 15 inch mark and slid her seat back beyond the 0 end of the yardstick. With the knees locked and heels not more than 5 inches apart, the subject stretched forward and touched the finger tips of both hands as many inches down the stick as possible.

The best of the three trials measured to the nearest quarter of an inch was the test score.  

**Flexibility (Shoulder-and-Wrist Elevation)**

**Instruments:**

Ruler, yardstick and adhesive tape.

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3 Ibid., p.78.
Direction:

A couple of small strips of adhesive tape was rolled to one side of a ruler and the subject assumed a prone position so that the body was straight and the arms extended with fists pressing against the base of a smooth surfaced wall. The subject raised the arm (keeping chin against the mat and struck the ruler (horizontally) as high up the wall as possible. The chin remained in contact with the mat throughout the lift. A yardstick was taken and measurement taken to the top center level of the ruler. The subjects arm length was measured from the acromion process (top of the shoulder joint) to the middle finger tip.  

The best of the subjects three lifts was subtracted from arm length and the remainder was recorded as the score in centimeter.

Grip Strength (Right Hand & Left Hand)

Instruments:

Grip Dynamometer.

\[4^{\text{Ibid., p. 83.}}\]
The subject stood erect without any support, holding the grip dynamometer in hand. The elbow was slightly flexed and hand described the sweeping downward movement as the subject squeezed the dynamometer. The subject was instructed not to touch or take support from any object during the test administration. Reading to the nearest half a kilogram was recorded as the score. The readings were taken for both right hand and left hand respectively.

Leg Strength

Instrument:

The subject stood by flexing both the knees, the handle of the dynamometer was placed on the thigh at the hip joint fold. The handle was supported by the hands crossing over the handle and was not allowed to move or slip from the thigh. The subject was then asked to extend the knees by keeping the legs straight. The measurement was recorded to the nearest kilogram from the indicators needle of the dynamometer.
Back Strength

Instrument:

Back Dynamometer.

Direction:

The back strength was determined by using a back dynamometer. The subject stood by keeping the knees straight and bending from the back, the handle of the dynamometer was placed at thigh level and ends of the handle was tied with a belt which was crossed over the back. The bell was supported by the hands not allowing to move down from the back. Then the subject extended the back to a erect position, and the readings were recorded to the nearest of kilograms from the indicator needle.

Body Composition

Body Fat

The Lange's skinfold caliper was used to assess the body fat. The instrument consisted of accurately calibrated dial which indicated in millimetres the thickness of the skinfold when the jaws were open, holding the skinfold.
To eliminate the possible error, the reading was made between three to four seconds, when essentially all compressions had taken place. If this precaution were not taken then the skinfold would gradually have decreased, the tissue being squeezed out from the jaws of the calipers.

The right side of the body was used to determine the percentage of fat. The thickness of the skin and subcutaneous fat were grasped between the thumb and index finger and measurement was taken to the nearest millimetre from four different specific sites using the calipers.\(^5\)

**Biceps Skinfold**

With the subject standing erect with arm held loose, a fold of skin was picked up on the anterior of the midpoint of biceps and fold was held vertical, reading to the nearest half millimeter was recorded.

**Triceps Skinfold**

The skinfold thickness was taken over the triceps muscle at a point half way between the tip of the shoulder

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and the tip of the elbow. The point was located with forearm flexed to 90 degrees and while taking the measurement the skin was lifted parallel to the long axis of the arm and the reading was taken to the nearest half millimeter.

**Subscapular Skinfold**

The skinfold thickness was taken at the tip of the scapula with the subjects in relaxed standing position. The fold was lifted in the diagonal plane at about 45 degrees from vertical and horizontal planes and the reading was taken to the nearest half millimeter.

**Supra-Iliac Skinfold**

The skinfold thickness was taken above the anterior superior iliac crest on diagonal line going downward and inward and the reading was recorded to the nearest of half millimeter.

The sum of the skinfold thickness of all four sites of the body was converted into percentage body fat with the help of standard table suggested by Durnin and Womersley. From each subject, body weight and the weight of the fat she possessed was calculated by using the following formula:
Fat Weight: $\frac{\text{Body Weight} \times \text{Percentage of Value of Fat}}{100}$

**Lean Body Weight**

The total body weight minus the weight of body's fat gave the lean body weight.

The weight of the fat was deducted from each subject's total body weight and recorded in kgs.\(^6\)

**Resting Heart Rate**

**Apparatus:**

Stethoscope.

**Procedure:**

The resting heart rate was determined by pulse count. Pulse was taken from the radial artery of the wrist, on the palm side, directly in line with the base of the thumb. The tips of the index and middle fingers were used to feel the pulse. Due care was taken to apply appropriate pressure on the artery, so that a reaction to pressure did not produce an alteration in the beat. The

stop watch was started coinciding with the pulse beat. In counting pulse, the beat felt was designated as zero and then pulse was counted for one minute. The subjects were given instructions to remain silent and refrain from moving or talking since these would effect the pulse rate.7

Resting Blood Pressure

Apparatus:

Sphygmomanometer (dial type), stethoscope.

Procedure:

The subjects were given five minutes of rest prior to the recording of the blood pressure. It was ensured that each subject was placed in a comfortable position. While taking the blood pressure the subjects left arm was completely bared to make sure that the clothing did not construct the blood vessels. The blood pressure was recorded, with the subject in a sitting position, her forearm was supported on the handle of the chair. The cuff was wrapped around the arm, evenly with the lower edge approximately one inch above the antecubital space.

The lower end of the brachial artery in the cubital space, just medial to the tendon of biceps was located. The diaphragm of the stethoscope was placed over this region and kept in a position with the fingers and thumb of a hand, ensuring that it does not rub against the cuff or the tubes. The cuff was slowly inflated and the pressure was raised to about 30 mm above the systolic level. The cuff pressure was gradually lowered until the first sound was heard, usually as a clear sharp tap. The reading at this point was recorded as the systolic pressure.

The mercury column was further lowered, at the same time listening to the sounds carefully. As deflation progressed the character of the sound was found to change, varying through murmurs to banging and loud, then suddenly becoming 'muffled' (dull and faint, as if coming from a distance) and finally disappearing. The manometer reading at this instant the sound became muffled marked the diastolic pressure. The reading at which the sounds disappeared completely was noted, after which the cuff was quickly deflated to zero pressure.
Air Flow Rate

Instrument:

Air flow meter.

Direction:

The air flow rate of each subject was measured using the air flow meter. The instrument had a detachable mouth piece connected to a drum with a graduated dial with readings ranging from 0-100. Inside the dial is an indicator which revolves when air blown into the drum. Indicator when it comes to rest at some point along the graduated dial, the reading on the dial shows the air flow rate in ml./min. For further using it, the indicator is brought back to zero by rotating the dial.

The subject had the nose clip on. After maximal inspiration the subject expired out the air to the maximum possible by blowing out into the mouth piece with a hard blow. The air which was expelled out caused the inside indicator to move along the graduated dial. The value, where the indicator came to rest, was recorded as the air flow rate of the subject in ml./minute.
Vital Capacity

Instrument:

Wet Spirometer.

Direction:

The instrument consists of two metal containers, one inverted over the other. The inverted container is made air tight by sealing in column of water. A drum or a rotating chart is attached to the spirometer.

The subject after a maximum possible inhalation, exhaled slowly and steadily with the mouth piece of the spirometer till the air within the control was expelled.

The up and down movements of the bell, which represents the volume of air breathed, recorded on the rotating chart. The reading on the chart was recorded in litres.

Cholesterol

For the estimation of the cholesterol, a standard test using the CHOD-PAP method was administered. The blood samples (fasting) of the subjects were drawn in the morning. 3 ml of blood was drawn and poured into a plain vial and it was incubated at 37% for 10 minutes. After the serum was separated, with the help of the reagents provided in the Enzokit and the computerised photometer, the readings were directly read on the photometer.
Test for cholesterol were conducted for the experimental subjects prior to the training programme, after fourth, eighth and twelfth week. For the control group, the test was conducted prior to the training programme and after the twelfth week.

Haemoglobin

Apparatus:

Sahli's Haemoglobinometer, comparator, haemoglobin tube (Sahli's Adams Tube), haemoglobin pipette, a thin glass-rod stirrer.

Reagents:

N/10 HCL (0.1N-HCL) solution, distilled water, pricking needle, cotton swabs, alcohol.

Procedure:

Sahli's acid haematin method was used to determine the amount of haemoglobin in the blood.

The haemoglobin tube was studied and the graduations noted. A clean and dry tube was filled with N/19 HCL solution upto the mark 3 gm (or 20 per cent) and was put aside. The subjects finger was pricked with a
sterile needle and the first one or two drops of blood was wiped away with a cotton swab. When a good-sized drop formed at the puncture site, the tip of the pipette was dipped in it and the blood was drawn up to the 20 cm mark by gently sucking on the plastic mouth piece fitted to the rubber tube. The tip of the pipette was wiped with cotton so that no blood was left sticking to its outside. The blood was expelled into the Sahli's tube containing the HCL solution. A small amount of acid was sucked into the pipette and expelled again into the tube, making sure that no solution remained on or in the pipette. The tube was then allowed to stand in the comparator for about ten minutes for maximum development of colour. Distilled water was added drop by drop to the mixture. On every drop added to mixture, it was stirred to ensure through mixing. The colour of the mixture was then matched against the colour standard of the haemometer removing the stirrer. After the colour of the mixture matched with that of the standard, the tube was taken out of the comparator and stirrer removed from the tube. The reading on the haemoglobin scale on the tube was read at the level of the lower meniscus of the solution avoiding parallel error. The scale was provided in grams of haemoglobin per 100 ml of blood.
Selection and Administration of The Training Programme

After reviewing the literature pertaining to aerobic exercise programme (walking) and its contribution to the development of selected physical and physiological parameters the research scholar selected the Cooper's walking programme for the age group of 40-49 years and prepared the programme with the help of experts (Table 2). The training programme was carried by the subjects under the supervision of the investigator with the assistance of other experts in the specialised field.

Aerobic exercise programme (walking) was administered to the experimental group with the purpose of improving the selected physical and physiological parameters. The subjects performed the workouts on Mondays, Wednesdays and Fridays. The experimental group had a warming up session prior to the training programme.

After the completion of 6 weeks of walking programme, the subjects were tested on Cooper's 12 min. run/walk test. On the basis of their performance, the subjects were placed in the Fitness Category I, walking

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programme given by Cooper.

The experimental group were tested for the various selected physical and physiological parameters prior to the training programme, after the fourth, eighth and twelfth week after the cessation of the training programme respectively.

The control group was tested prior to the training programme (pre test) and after the cessation of the training programme (post test).
<table>
<thead>
<tr>
<th>Week</th>
<th>Distance (metres)</th>
<th>Time (min.)</th>
<th>Frequency/Week</th>
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Statistical Procedure Employed

To compare the mean differences between the experimental and control group, 't' test was employed with respect to each of the selected physical and physiological parameters.

To determine the difference between the results obtained at different stages of training of the experimental group, analysis of variance (F test) was computed for each of the selected physical and physiological variable.

The level of significance chosen was .05.