**METHODOLOGY**

In this chapter Research Methodology, Selection of subjects, Reliability of Data, Training Programme, Duration, Selection variables, Administration and Photos are presented.

**RESEARCH PROCESS**

This study based on observation method. 60 students, who are in the age group of 17-20 years, were chosen from Osmania University Sports Student, Hyderabad as a sample 60 subjects are divided into 3 groups, namely A, B and C. For C group no training was given and called as controlled group and for B group 20 minutes and for A group 30 minutes aqua aerobic training was given and observed the physical, physiological changes among the selected groups. However, to study physiological changes through aerobic training 14 Physiological Variables were chosen, namely : 1) Glucose 2) Glycogen 3) Lactic acid level 4) Lactic dehydrogenase 5) Pyruvic acid 6) Creatin 7) Creatinrne 8) Creatin Phosphokinase 9) Amylase 10) Phosphorus/Phosphate 11) Alkaline Phosphatase 12) Acid phosphatase 13) Amino transferase ASAT and ALTP. Similarly to study the physical changes 5 Physical variables were chosen namely ; 1) Age 2) Height 3) Weight 4) Cardio Vascular endurance 5) Body fat. For selecting the sample convenience sample techniques have been used. To study the impact of above said variables 't' test, 'F' test ANOVA and correlation were calculated at 0.05 and 0.01 level of significance based on pre training and post training on experimental basis of 20 minutes and 30 minutes training in 12 weeks. The results are interpreted.

This study is confined to Osmania University Sports Student, it does not cover any other institutes. Even though the results are more useful to take up aerobic training programme among the 17-20 years Osmania University at the national level also. However, the selecting sample are presented below.

<table>
<thead>
<tr>
<th>Group</th>
<th>Category</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Experimental Group</td>
<td>16</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>Experimental Group</td>
<td>16</td>
<td>4</td>
<td>20</td>
</tr>
</tbody>
</table>
SELECTION OF THE SUBJECTS

60 subjects of Osmania University Sports Student, Hyderabad were selected at randomly. These 60 subjects were divided into three groups, consisting of two experimental and one control group with 20 subjects in each group. The subjects selected were medically fit for the present study.

The requirements and the procedure of the present study were explained to all the subjects and they have agreed to undergo testing and training activity voluntarily. Taking care of hygiene and sterility conditions collected the blood samples.

RELIABILITY OF DATA

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

Instrument Reliability: To measure cardiovascular endurance 12 minutes run was administered since this is a valid measure for the subjects who are in the age group of 17-20 years. The samples used in this study were procured from Osmania University Sports Student, Hyderabad and analyzed at Ultra Diagnostic Centre, Secunderabad, which were supplied by well known manufacturers catering to research laboratories and hence the results 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 experts. The investigator took all the required measurements with the assistance of qualified testers, who were well acquainted with the testing procedure. Data was collected on the chosen variables by test, retest method on the sample was 6 subject each groups conducted and data was connected again (Test)

TRAINING PROGRAMME

The following types of training methods were prescribed.

1. Slow continuous method

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>16</th>
<th>4</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td></td>
<td>48</td>
<td>12</td>
<td>60</td>
</tr>
</tbody>
</table>
2. Fast continuous method and
3. Fartlek method.

I. SLOW CONTINUOUS METHOD

In this variation the sportsman exercises at a certain speed without any pause for very long duration. Long cross-country runs are typical examples of slow continuous method. In this method the speed or pace of exercise is determined according to heart rate. For trained sportspersons the heart rate during the exercise should be from 140-160 beats per minutes. The volume in terms of total duration should not be less than 30 minutes, at a certain speed method any break for 30 and 20 minutes duration.

Effects of slow continuous method increase in muscle glycogen and liver glycogen, capillarisation, quantity of oxydative enzymes, and increase in the number and size of mitochondria.

II. FAST CONTINUOUS METHOD

In this variation the work is done at fast but unchanging pace for long durations without any break. Heart rate is normally between 160-180 beats per minute. The total duration should be not less than twenty minutes. Because of the higher intensity the fast continuous method is more strenuous and exhaustive.

Fast pace method is very effective for improving the VO2 max. There is highly significant increase in number and size of mitochondria and quantity of oxidative enzymes. Fast method however has less effect on capillarisation, muscle glycogen and movement economy etcetera. It is a strong stimulation for structural changes in the heart and lungs.

III. FARTLEK METHOD

Fartlek is Swedish word meaning 'Speed Play'. In stride sense it is a variation of variable pace methods. In Fartlek the change of pace or speed is not pre-planned. The sportsman changes the speed on his own during the activity according to the terrain, surrounding and his feelings. Therefore, this method requires more self-discipline in order to be effective. Like variable pace method is Fartlek also the heart rate fluctuates between 140-180 beats/minute. The total volume
and duration are also similar to variable pace method, The physiological and training effects are also, therefore, the same.

**DURATION**

The details of duration of training methods, number of days and type of training methods of experimental groups of A & B are given below.

<table>
<thead>
<tr>
<th>Group</th>
<th>Type of Group</th>
<th>Duration of exercise in minutes</th>
<th>No. of days in a week</th>
<th>Actual days</th>
<th>Specific training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Experimental</td>
<td>30 mts</td>
<td>Thrice</td>
<td>Tuesday, Thursday, Saturday</td>
<td>Slow continuous method, Fast Continuous method, Fartlek method</td>
</tr>
<tr>
<td>B</td>
<td>Experimental</td>
<td>20 mts</td>
<td>Thrice</td>
<td>Tuesday, Thursday, Saturday</td>
<td>Slow continuous method, Fast Continuous method, Fartlek method</td>
</tr>
</tbody>
</table>

The training programme was confined to two experimental groups. One group was 30 minutes and another group was 20 minutes.

**SELECTION OF VARIABLES**

*Physiological Variables:*

1) Glucose  
2) Glycogen  
3) Lactic acid level  
4) Lactic dehydrogenase  
5) Pyruvic acid  
6) Creatin  
7) Creatinine  
8) Creatin Phosphokinase  
9) Amylase  
10) Phosphorus/ Phosphate  
11) Alkaline Phosphatase  
12) Acid phosphatase  
13) Arnino transferase ASAT and ALTP

*Physical variables:*

1) Age  
2) Height  
3) Weight  
4) Cardio Vascular endurance  
5) Body fat
TEST ADMINISTRATION

I) Physical Variables

i) Age
The period of time.
Date of birth, it measures chronological age

ii) Height
The height is measured by a standard height measuring stand.

Procedure
The height of subject should be measured without shoes. It has been suggested that standing with the back against a support helps the subject to stretch to his full height. The chin is tucked in slightly and the head is held erect. The object used to form a right angle to the backboard is pressed firmly in to the subjects head. Care should be taken so that the upper surface is horizontal and not tilted and also that this pressure does not cause the subject to slump or alter his position, finally, the subject bends his knees slightly when he steps away so as not to disturb the angle before the height is recorded.

iii) Weight
Generally speaking, scales based on the lever system are more reliable than the spring scales. Both types, however, require periodic inspection and rather delicate handling.

Equipment
Weighing machine.

Procedure
The subject to be weighed should be wearing a minimum amount of clothing. The subjects should be weighed at the same time of day and to the same degree of accuracy usually the nearest half pound.

iv) Cardiovascular Measurement
12-Minute Run Test

To measure cardiovascular endurance

Equipment

Flags are placed around the track at 40 yard distance.

Procedure

The subject is instructed to run on 400 mts track for 12 minutes. The subjects will be informed the time left at the completion of 11 minute. The tester will be noting down the number of laps and the distance covered in 12 minutes

v) Body Fat

The Lange's skin fold caliper was used to measure the body fat. The instrument consisted of accurately calibrated dial, which indicates the thickness of skin in millimeters.

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 the index finger and the measurement was taken to the nearest millimeter from four different specific sites using the calipers.

a) Biceps Skin fold

With the subject standing erect with arm held loose, a fold of skin was picked up on the anterior of the mid-part of the biceps and fold was held vertically, reading to the nearest millimeter was recorded.

b) Triceps Skin fold

The skin fold thickness was taken at the triceps muscle at a point halfway between the tip of the shoulder 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 millimeter.

c) Sub scapular Skin fold
The skin fold 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 millimeter.

**d) Supra iliac Skin fold**

The skin fold thickness was taken above the anterior superior iliac top on diagonal line going downward and inward and the reading was recorded to the nearest of millimeter.

The sum of the skin fold thickness of all four sites of the subject was converted into percentage body fat with the help of standard table suggested by Durrin and Womersley. From each subject, body weight and the weight of the fat they possessed were calculated by using the following formula.

\[
\text{Fat weight} = \text{Body weight} \times \frac{\text{Percentage of value of fat}}{100}
\]

**II) Physiological Variables**

The subjects were randomly selected three groups (one control group and two experimental groups) each consisting of six subjects - three girls and three boys.

**Alkaline Phosphatase (ALP) Kit: (kind & king's method) Principle**

Serum ALP hydrolyses disodium phenyl phosphate into phenol and disodium hydrogen phosphate into phenol and disodium hydrogen phosphate at pH 10.0. The phenol so formed reacts with 4-Aminoantipyrine in alkaline medium in presence of oxidizing agent Potassium ferricyanide to form a red coloured complex whose absorbance is proportional to the enzyme activity.

\[
\text{Disodium phenyl phosphate} + \text{H}_2\text{O} \xrightarrow{\text{ALP}} \text{Phenol} + \text{Disodium hydrogen phosphate} \\
pH 10.0
\]

\[
\text{Phenol} + 4\text{ Aminoantipyrine} \xrightarrow{\text{Alkaline medicum}} \text{Potassium ferricyanide} \xrightarrow{\text{Red coloured complex}}
\]
**Procedure**

Pipette into the test tubes labelled Blank (B), Standard (S), Control (C) and Test (T) as follows:

<table>
<thead>
<tr>
<th></th>
<th>(B)</th>
<th>(S)</th>
<th>(C)</th>
<th>(T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Buffered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substrate</td>
<td>1.0ml</td>
<td>1.0ml</td>
<td>1.0ml</td>
<td>1.0ml</td>
</tr>
<tr>
<td>Deionized Water</td>
<td>3.1 ml</td>
<td>3.0ml</td>
<td>3.0ml</td>
<td>3.0ml</td>
</tr>
<tr>
<td>Incubate for 3 minutes at 3°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum</td>
<td></td>
<td></td>
<td></td>
<td>0.1 ml</td>
</tr>
<tr>
<td>Phenol Standard (3)</td>
<td></td>
<td>0.1 mol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incubate for 15 minutes at 37°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour Reagent (2)</td>
<td>2.0ml</td>
<td>2.0 ml</td>
<td>2.0ml</td>
<td>2.0ml</td>
</tr>
<tr>
<td>Serum</td>
<td></td>
<td></td>
<td></td>
<td>0.1 ml</td>
</tr>
</tbody>
</table>

Mix well after each addition of reagent and measure ascorbic for Blank (B) Standard (S), Control (C), and Test (T), against deionised water on photo colorimeter using a green filter or on spectrophotometer at 510 nm.

**SCOT (AST) KIT (Reitman and Frankel's Method)**

**Principle**: SGOT catalyses transfer of amino group from L-aspartate to a-ketoglutarate with formation of oxaloacetate and glutamate. The oxaloacetate so formed, is allowed to react with 2.4 DNPH to form 2,4-dinitrophenyl hydrazone derivative, which is brown coloured in alkaline medium. The absorbance of this hydrazone derivative is correlated to SGOT activity by plotting a calibration curve using pyruvate standard.

\[
\text{SGOT} \\
\text{L-aspartate} + \text{a-ketoglutarate} \rightarrow \text{Oxalacetate} + \text{L-glutamate}
\]

\[
pH 7.4
\]
Alkaline

Oxaloacetate + 2,4-DNPH  $\rightarrow$ 2,4-dinitrophenyl hydrazone

Medium (Brown coloured)