Chapter III

PROCEDURE

In this chapter the selection of the subjects, experimental design, reliability of data, criterion measures, training program, collection of data and statistical technique for the analysis of data have been prescribed.

One hundred male students studying in 11th and 12th classes of Bhupindra Khalsa Senior Secondary School, Moga, District Faridkot were selected as subjects for this investigation. These subjects were selected at random out of 200 students. The age of these subjects ranged from 17 to 20 Years. Before the commencement of the scientific investigation, the investigator checked the health record of these students maintained by the school and also at his own level with the help of a qualified Doctor of a local private clinic conducted a few medical tests to ensure that all the subjects were medically fit to undergo the type of training program they were subjected to. After scrutiny of the health records and medical reports prepared by the Doctor after a general check up, it was revealed that all the subjects had fairly well developed physique and were free from any chronic disease.

Prior to the commencement of this experiment a
meeting of all the selected subjects was held in which the Principal and some of the faculty members of the school were present. The purpose of this study along with the various testing procedures and training programs was briefed to them in detail so that there was no ambiguity in their minds regarding the efforts required by them and the hard work they would have to put in. All the subjects were convinced and agreed to cooperate wholeheartedly in the experiment which was explained to them. The Principal and teachers also asked them to put in their best efforts in the interest of scientific investigation and to enhance their own performance and achievement standard. However, no motivational techniques were used to enhance their performance.

Experimental Design

Random group design were adopted for this study. One hundred subjects were divided at random into four equal groups of 25 subjects each i.e. in total four groups were formed which were named as Group CT-2, Group CT-4, Group WT-2 and Group WT-4. Four experimental treatments were also assigned to these four groups at random (one each) i.e.

1. Circuit training twice a week named as Group CT-2
2. Circuit training four fold a week named as Group
3. Weight training twice a week named as Group WT-2 and
4. Weight training four fold a week named as Group WT-4

All the four groups participated in the planned training program for a period of 10 weeks. However, they kept participating in the required Physical Education classes of the school curriculum.

Reliability of Data

The reliability of the data were ensured by establishing the instrument reliability, tester competency, reliability of test and subjects reliability.

Instrument Reliability

Electronic stop-watches, weighing machine, and weight training equipments used in this study were obtained from the reputed supplier of standard firms which cater to the needs of various research laboratories in India and abroad. All the instruments used were available in the Department of Physical Education, Guru Nanak College, Moga and Bhupindra Khalsa Senior Secondary School, Moga. The
calibration of these instruments was certified by the suppliers.

Tester Competency and Reliability of Test

To ensure that the researcher was well versed in the techniques of conducting the test, the researcher had practice sessions under the guidance of Dr. J.S. Gill, Department of Physical Education & Sports, Punjab Engineering College, Chandigarh at Bhupendra Khalsa Senior Secondary School, Moga, District Faridkot (Punjab). All the measurements were taken by the researcher with the help of his colleagues and some of the teachers of Physical Education of the local colleges who were also trained and acquainted with the test and the testing procedures.

The tester competency was also evaluated together with the reliability of test. Reliability of test was established by test re-test method whereby consistency of results was obtained by product moment co-relation. The data was collected from randomly selected 10 subjects through test re-test. The test re-test scores for each variable were than co-related and coefficients thus obtained have been presented in Table 1.

It is evident from Table 1 that the data pertaining to different tests were quite reliable and the table further indicated that the testers reliability was
significantly high (reliability co-efficient ranging from .956 to .992), which ensured the competency of the researcher to administer the tests.

**TABLE 1**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Test</th>
<th>Reliability co-efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Vertical Jump</td>
<td>.990</td>
</tr>
<tr>
<td>2.</td>
<td>Cricket ball throw</td>
<td>.967</td>
</tr>
<tr>
<td>3.</td>
<td>Standing broad jump</td>
<td>.959</td>
</tr>
<tr>
<td>4.</td>
<td>Pull up</td>
<td>.962</td>
</tr>
<tr>
<td>5.</td>
<td>Sit up</td>
<td>.985</td>
</tr>
<tr>
<td>6.</td>
<td>Push up</td>
<td>.992</td>
</tr>
<tr>
<td>7.</td>
<td>Bench press</td>
<td>.956</td>
</tr>
<tr>
<td>8.</td>
<td>Leg press</td>
<td>.976</td>
</tr>
<tr>
<td>9.</td>
<td>Standing press</td>
<td>.982</td>
</tr>
</tbody>
</table>

*Significant at .05 level.

Subjects Reliability

The test re-test co-efficient and correlation also established the subjects reliability, because the same subjects were used and under similar conditions by the same tester and no motivational techniques were used.
Criterion Measure

The criterion measures for testing the Hypothesis were:

Maximum strength

Maximum strength of the subjects was measured in maximum weight lifted in Kg. by using the following test:

1. Beach press in kg.
2. Leg press in kg.

Power

The power (explosive strength) of the subjects was measured by using the following test:

1. Vertical jump test in inches.
2. Cricket Ball throw test in mtrs.
3. Standing broad jump in inches.
Strength endurance

Strength endurance of the subjects was measured by using the following test:

1. Pull ups (in nos.)
2. Sit ups (in nos.)
3. Push ups (in nos.)

Training Program

Circuit Training and Weight Training Program was administered to all the experimental groups, namely Group CT-2, Group CT-4, Group WT-2 and Group WT-4 which mainly provide for the three strength characteristics, mainly maximum strength, power (explosive strength) and strength endurance. This Program was planned and prepared by the investigator in consultation with experts in the field of training methods and exercise physiology. The training schedule, set of exercises, included in the Program after conducting pilot study to establish the progression of load and intensity have been presented in Table 2.
TABLE 2
SCHEDULE IN WEIGHT TRAINING

<table>
<thead>
<tr>
<th>Exercises</th>
<th>Week</th>
<th>Intensity (%)</th>
<th>Repetition (No.)</th>
<th>Recovery (Min.)</th>
<th>Set No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bench press, 1 &amp; 2</td>
<td>1 &amp; 2</td>
<td>70-80</td>
<td>4-8</td>
<td>2-5</td>
<td>3</td>
</tr>
<tr>
<td>Standing press, 3 &amp; 4</td>
<td>3 &amp; 4</td>
<td>80-90</td>
<td>4-8</td>
<td>2-5</td>
<td>3</td>
</tr>
<tr>
<td>Leg press, 5 &amp; 6</td>
<td>5 &amp; 6</td>
<td>70-80</td>
<td>4-8</td>
<td>2-5</td>
<td>3</td>
</tr>
<tr>
<td>Dead press, Press behind the neck, 7 &amp; 8</td>
<td>7 &amp; 8</td>
<td>80-90</td>
<td>4-8</td>
<td>2-5</td>
<td>3</td>
</tr>
<tr>
<td>Sit up with weights and arm curls</td>
<td>9 &amp; 10</td>
<td>70-80</td>
<td>4-8</td>
<td>2-5</td>
<td>3</td>
</tr>
</tbody>
</table>

The above weight training Program was administered to Group WT-2 and Group WT-4 with help of qualified teacher of physical education of the local college and Bhupindra Khalsa Senior Secondary School Moga, between 2 PM to 4 PM. on each day of training. Group WT-2 was given this Program twice a week whereas Group WT-4 was given this Program four day week. Bi weekly progression was executed in this Program.

Circuit Training

A pilot study was conducted on ten subjects taken at random to establish the number of exercises and the total circuit time, so that the pulse rate of the subjects be raised 150-170. The physiological effects of exercise and training depends a great deal on the specificity of training McCafferty and Morvath (1977) have concluded that training
effects would depend upon specific type of exercises, intensity and duration of training Program. Based on pilot study eight exercises were selected. These exercises were Medicine Ball, Sit ups, Bench stepping, Pull ups, Running on the spot, Push ups, Tuck Jumps and Dumbles.

These exercises were arranged in an order based on progressive sequence which constituted a circuit. The influence time for exercise stimulus was fixed at eight minutes. The duration of each exercise was one minute. Rest pause of 30 second was given between one exercise and to change over to the next exercise. Therefore the total time of the circuit was fixed at 11 minutes 30 seconds to raise the pulse rate to 150-170 and to continue the exercise for about five minutes for its physiological effects (Cooper, 1970). After each round of circuit a total rest phase of five minutes was provided to bring the pulse rate to 110 to 120 beats per minute (Matveyev, 1980).

This circuit Training Program was administered to Group CT-2 and Group CT-4 with the help of qualified teacher of physical education, between 2 PM to 4 PM on each day of training. Group CT-2 performed this program twice a week whereas Group CT-4 four fold a week.

After every two weeks of adaptation period the number of circuits was increased from two to three, three to four and four to the maximum of five at the conclusion of the experiment. This was based on the findings of Harre
The model of the circuit employed in this study has been shown in Figure 3.1.

Before starting each day's training all experimental groups were given the necessary warming up which included jogging, running, stretching exercises and exercises with light weights.

Collection of Data

The necessary data were collected by administering the tests for measuring power (explosive strength), strength endurance and maximum strength following standard procedures of test administration on the subject selected for this study before start of training and after experimental period of ten weeks. All the tests were administered in complex hall and play grounds of Bhupindra Khalsa Senior Secondary School, Moga, District Faridkot, Punjab.

Before administration of the test, the subjects were given a chance to practice the prescribed test so that they became familiar with the test and knew exactly what was to be done. The use of apparatus was explained to them prior to the administration of test and demonstration of the test was given by investigator himself. To ensure uniformity in the testing condition the subjects were tested between 2 PM to 4 PM by the same tester and competent assistants under the supervision of the researcher.
Fig. 3.1 THE MODEL OF THE CIRCUIT TRAINING STATIONS
ADMINISTRATION OF TEST

Power (Explosive Strength)

The power (explosive strength) of subjects were measured by means of Vertical Jump Test, Cricket Ball Throw Test and Standing Broad Jump Test.

Vertical jump test

In this test the wall was marked in inches. The subject stood away from the wall for avoiding any type of injuries or disturbances while executing the jump (Figure 3.2).

For getting the standing reach the subject was instructed to stand close to the wall and to extend both the hands as high as possible. The measurement was recorded on a paper. He was then instructed to execute three jumps from a crouched position making a marks each time on the wall. The highest mark was again recorded and the difference was recorded as score in inches.

Cricket ball throw test

This was typically an outdoor test requiring an open field approximately 100 metres long. A restraining line
FIG. 3.2 VERTICAL JUMP

POSITION-1

POSITION-II
was marked on the ground and the subject was required to throw the cricket ball as far as he could from standing position. He was asked to take comfortable position behind the restraining line (Figure 3.3). He was not allowed to shift the position of his feet during the throw.

The subject was given three chances and the best among them was his score. If he lifted his rear foot while throwing, the throw was not measured, but was counted as one of the three throws allowed to him. All throws were made over head. Best throw among the three allowed to the subject was his score. The distance measured was recorded in metres.

Standing broad jump test

A take-off line was drawn near one edge of a jumping pit. The subject was asked to take his position with toes just touching the take-off line, feet slightly apart (Figure 3.4). Taking off from the both feet simultaneously, he jumped to cover maximum possible horizontal distance, landing on both feet, while jumping, he crouched slightly and swung the arms to aid the jump. Three trials were given to him, the best of three being credited as his score. The jumping pit was filled with fine river sand and frequently leveled with long wooden block.

The horizontal distance between the take-off line and the nearer break made in landing was measured. The
FIG. 3.3 CRICKET BALL THROW
FIG. 3.4 STANDING BROAD JUMP
distance measured correct to an inches was recorded as the score for explosive power of leg muscle.

Strength Endurance

The strength endurance was measured by means of pull up, sit up and push up tests.

Pull up

Each subject performed as many pull ups as he could possibly do in the manner described below from a horizontal bar of enough height so that the feet of the tallest boy did not touch the floor when performing the test (Figure 3.5).

In taking the pull up test, the subject hung from the bar by his hands with inward hand grip and chinned himself as many times as he could. In executing the movement, he pulled himself up until his chin was even with his hands then lowered himself until his arm were straight. He was not permitted to kick, jerk, or use a hip motion.

The number of completed pull ups to the nearest whole number was recorded as a score in shoulder girdle strength.
FIG. 3.5 PULL UP
Sit up

Each subject was asked to do as many sit ups as he could perform in a minute in described below.

The pupil assumed a supine lying position, knees bent at an angle less than 90 degree and hands clasped behind the neck (Figure 3.6). To perform the sit ups, the pupil brought his head and elbows towards knees. In returning to the supine position, the elbow touched the floor each time.

The number of completed sit ups to the nearest whole number was recorded as a score for strength of abdominal muscles.

Push up

The subject was asked to take dip position on the floor. From this position, on signal 'start' the subject pushed the whole body downward thus bringing down the entire body weight on his hands (Figure 3.7). He then lifted the body up and returned to the starting position. This was scored as one. This procedure was continued to the maximum till the subject got tired completely. Swinging of the body or stopping in between was not allowed. Push was considered complete when the arms were fully extended at the elbows while taking the body upwards. Bending of the elbows was not countered as a complete push up and did not account for scoring.
The total number of completed push ups without any break were recorded as score of the individual.

Maximum Strength

The maximum strength of the subject was measured by means of Bench press, leg press and standing press.

Bench press

1-RM method was used to determine the dynamic strength of arm and shoulder. The subject lied supine on a bench keeping the feet on the floor. The hands were at the side and just above the chest (Figure 3.8). The weights in the form of barbell had been given in the hands of subjects with the help of two helpers. He was then instructed to lift the barbell in upward direction at right angle until the arms were fully stretched reached in elbow extended position. By giving two or three trials the maximum weight was recorded to the nearest half of kilogram which the subject was able to lift 1-RM (Repetition maximum).

Leg press

1-RM method was used to determine the dynamic strength of leg muscles particularly thighs. The subject was
FIG. 3.8 BENCH PRESS
asked to take lying in supine position under the leg press machine and placed his feet together against crosspiece, then the weight was lowered as far as possible, bringing his knees towards his shoulder (Figure 3.9). He was then instructed to press the weight upward until the legs fully extended. By allowing two or three trials the maximum weight was recorded to the nearest half kilogram which the subject was able to press with his legs in 1-RM (Repetition maximum).

Standing press

1-RM method was used to determine the dynamic strength of should and arms. The subject was asked to take standing position with feet at shoulder width and the barbell was lowered behind the neck of the subject with the help of two helpers (Figure 3.10). The subject was then instructed to lift the barbell in upward directions to overhead position at right angle to the ground until the arms were fully extended. By giving two or three trials the maximum weight was recorded to the nearest half a kilogram which the subject was able to lift in 1-RM (Repetition maximum).
FIG. 3.9  LEG PRESS
FIG. 3.10 STANDING PRESS
To reveal the significance of differences, if any, between the pre-test and post-test means all the groups, 't' test was applied. Data were further analyzed by carrying out analysis of co-variance (ANCOVA) for all the groups with respect to the mean gains in each of the chosen variables, to find out the differential effects of varied schedules in weight training and circuit training on strength characteristics. To find out significance of differences between paired means and adjusted paired means, the Scheffes post hoc test was applied where 'F' values were found significant. For testing the Hypothesis .05 level of significance was chosen. All the statistical computation of this investigation were got done through VAX-8350 system of Computer Science and Application Department of Panjab University, Chandigarh.