CHAPTER-III
METHODS AND MATERIALS
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In this chapter, the selection of subjects, selection of variables, selection of tests, reliability of instruments, competency of tester, reliability of data, orientation of subjects, yogic training, collection of the data, administering the tests, experimental design and the statistical procedure used have been explained.

SELECTION OF SUBJECTS

Twenty college women who were studying Bachelor degree course at Queens Mary's College, Chennai, were randomly chosen from those who did not participate in any programme of physical education in the college. They were further randomly classified into two groups of ten each to form a control Group 'B' and experimental Group 'B'.

Another twenty college women students, who were studying Bachelor degree course at Queen's Mary's College, Chennai, were randomly chosen from those who participated in physical education programme in the college. They were further randomly classified into two groups of ten each to form a control Group 'A' and
experimental Group 'A'. In order to be qualified as a subject, each student gave a written informed consent and a certified qualified physician examined the subjects and declared that they were medically fit to participate in the yogic program.

The age, height and weight of the selected subjects ranged from 17 to 22 years, 145 to 170 centimeters and 43 to 65 kilograms respectively and the means were 20 years 7 months, 158 centimeters and 54 kilograms respectively. The experimental groups underwent yogic training program for 12 weeks and the subjects in control groups were not engaged in any activity during this yogic training period.

SELECTION OF VARIABLES

Cardiorespiratory endurance is directly or indirectly of high importance in all sports and games and also health. Cardiorespiratory endurance activities have been found to be of high value for maintenance of good organic health for increasing the general resistance against infection for cure and treatment of various diseases and metabolic disorders. Since cardiorespiratory endurance plays an important part in almost all sports and games and also health, it has been selected as one of the physical variables. Many men and
women, for instance, appear very trim but they get tired easily while carrying out their every day activities. To overcome this, they must have sound muscular endurance. Hence muscular endurance was selected as a variable. Flexibility is essential in carrying out many daily activities and can help to prevent muscle strain and orthopedic problems. Hence flexibility was selected as one of the physical variables.

Many studies have proved that regular yogic practice can make influential changes in many physiological parameters. Keeping in mind the opinion of the experts, availability of equipments, acceptability of the subjects and the time to be devoted, the following physiological parameters namely resting heart rate, respiratory rate and breath holding time were selected as variables.

Anxiety and self concept were selected as psychological variables for this study. The reason behind selecting anxiety and self concept as variables is very simple as they play a vital role in personality make up of an individual.
## SELECTION OF TESTS

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<thead>
<tr>
<th>Physical Variables</th>
<th>Test</th>
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<td>1. Cardiorespiratory Endurance</td>
<td>Cooper's 12 minutes run/walk</td>
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<td>2. Muscular Endurance</td>
<td>Bent Knee sit ups</td>
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<td>3. Flexibility</td>
<td>Sit and reach</td>
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<th>Physiological Variables</th>
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<td>1. Resting heart rate</td>
<td>Heart rate monitor of Biomonitor</td>
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<table>
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<tr>
<th>Psychological Variables</th>
<th>Test</th>
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<tr>
<td>1. Trait Anxiety</td>
<td>Spielberger, Gorsuch and Lushene Trait Anxiety Questionnaire</td>
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<td>2. Self Concept</td>
<td>Mukta Rani Rastogi Questionnaire</td>
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</table>
RELIABILITY OF INSTRUMENTS

Instruments such as Biomonitor, Expirograph and stop watches were used for the study. All the instruments were in good condition and workable, purchased in a reputed company. The calibrations were tested and found to be accurate enough to serve the purpose of the study.

COMPETENCY OF THE TESTER

The operation of the Biomonitor and Expirograph was taught by an experienced expert and the investigator learnt the procedure and methods to handle and operate the instruments to administer the tests. Measurements were taken by the investigator herself by using these two pieces of equipment. All other measurements were taken using the services of the qualified assistants working in various colleges in Madras.

RELIABILITY OF DATA

Reliability was established by test and retest process. Ten subjects of each from five participants and non participants in sports from Queen Mary's College, Chennai were tested on selected dependent variables. The intra class (Univariate Correlation)
reliability coefficients obtained for test and retest data are presented in table below.

**TABLE 1**

**INTRA CLASS RELIABILITY COEFFICIENTS OF SELECTED DEPENDENT VARIABLES**

<table>
<thead>
<tr>
<th>Test</th>
<th>'R'</th>
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<tr>
<td>1. Cooper's 12 minutes run/walk</td>
<td>0.92*</td>
</tr>
<tr>
<td>2. Bent Knee Sit-ups</td>
<td>0.91*</td>
</tr>
<tr>
<td>3. Sit and Reach</td>
<td>0.96*</td>
</tr>
<tr>
<td>4. Resting Heart Rate</td>
<td>0.97*</td>
</tr>
<tr>
<td>5. Respiratory Rate</td>
<td>0.95*</td>
</tr>
<tr>
<td>6. Breath Holding Time</td>
<td>0.92*</td>
</tr>
</tbody>
</table>

*Significant at 0.01 level of confidence. The table value required for significance at 0.01 level of confidence is 0.77.

The questionnaire technique was used to collect psychological data. Both questionnaires were standardized and reliable.

**ORIENTATION OF THE SUBJECTS**

The investigator explained to the subjects participating in the study, the purpose of the yogic
training and their part in the study. For the collection of data, the investigator explained the procedure of the Cooper's twelve minutes run/walk test for cardiorespiratory endurance, bent knee sit ups for muscular strength/endurance and sit and reach for flexibility and also instructed the subjects about the procedure to be adopted by them for measuring the physiological variables such as resting heart rate, respiratory rate and breath holding time. To measure psychological variables, Spielberger's trait Anxiety Questionnaire and Mukta Rani Rastogi Self Concept scale were administered to the subjects, where the contents of the questionnaire were explained to the subjects.

Eventhough the control groups did not undergo any training, they were given a thorough knowledge about the test items followed in this study.

**Yogic Training Programme**

During the training period, the experimental groups underwent yogic practice for five continuous days a week for twelve weeks. Training included 60 minutes Asana in different postures and pranayama for 15 minutes on each day as recommended by Central Advisory Board of Physical Education and Recreation (1956). The subjects underwent their yogic training in the morning sessions
from 6.15 A.M. to 8.00 A.M. under the supervision of the investigator. All the subjects were asked to come for training on an empty stomach. Subjects in control groups were instructed not to participate in any physical exercises/training programme during the experimental period.

The yogic practices were carried out at the premises of Queen's Mary College, Chennai. All the subjects involved in the yogic training were questioned about their stature throughout the experimental period. None of them reported any discomfort and hence there were no dropouts.

Attendance was recorded and calculated for both the experimental groups separately by dividing total number of training sessions by the number of sessions present. It was approximately 95% for participants and 94% for non participants in sports.

COLLECTION OF THE DATA

Pre-test data were collected two days before the training programme. Post test data were collected two days after the yogic training programme. In all the cases, the data were collected on two days in the morning and evening sessions.
TEST ADMINISTRATION
Cardiorespiratory Endurance
12 Minute run/walk

Purpose

To determine the level of cardiorespiratory endurance during a 12 minute run/walk.

Equipment

A standard track, stop watch, whistle, lime powder and colour flags.

Procedure

Lines were marked at every ten metres with lime powder and flags placed at every fifty metres. Subjects were paired and one among them acted as a scorer while the other ran and vice versa. During a 12 minute period the subject attempted to cover as much distance as possible by either running or walking. When eleven minutes elapsed, the instructor called out the time left to run. Whistle was blown at the end of 12th minute. Immediately after hearing the whistle, the runner stopped running and stood where she was.
Scoring

The scorer gave the runner the number of completed laps plus the number of lines crossed on the last lap (Clarke, 1976).

Muscular Endurance

Bent - Knee Sit-ups

Purpose

To measure abdominal muscle endurance

Procedure

1. The subjects lay flat on the back, crossed the arms across the chest by resting the hands on the shoulders. Knees were bent to 90 degrees with the feet flat and 18 inches from the buttocks.

2. The number of sit-ups completed in 1 minute were counted (Prentice, 1994).

Flexibility

Sit and Reach Test

Purpose

The purpose was to measure the flexibility of the trunk and the hips.
Procedure

1. Subjects sat on the floor with the legs fully extended and the feet flat against a bench turned on its side.

2. While a partner holds the knees straight, they bent forward and extended the arms and hands as far as possible.

3. The distance was measured from the fingertips to the edge of the bench. If the fingers do not reach the edge, the distance is expressed as a negative score, and if they reach beyond the edge, it is expressed as a positive score (Miller and Allen, 1989).

Physiological Variables

Resting Heart Rate

Objective

The objective was to record the Resting heart beats of each subject per minute.

Equipment

Heart rate monitor of the Biomonitor was used to measure the Resting heart rate.
Procedure

The Resting heart rate of the subjects was monitored through the Heart rate monitor of the Biomonitor. It monitored the Resting heart rate using the method of finger Plythesmography with the help of an opto-electronic transducer on finger.

The resting heart rate of each subject was recorded in the morning time between 6.00 and 6.30. Fifteen minutes before taking the heart rate, the subject was asked to sit and rest herself comfortably in a chair. The investigator fixed an Opto sensor unit to the thumb of the subjects using Velcro- straps. It was fixed in such a way that the light on the Opto-sensor unit was at the distal end of the finger tip and the LDR was nearer to the finger tip. The Velcro strap on the LDR side was fastened firmly while the strip on the lamp side was loosely fastened.

The PCG/Pulse ON-OFF switch of the Biomonitor was kept in the pulse position. Then the Heart rate monitor was switched on by pressing the pulse push button switch. After about 30 seconds the pulse LED indicator flashed and the beeps started and stabilised. After that the flashes and beeps occurred rhythmically with respect to the subject's pulse. The heart rate per
minute was indicated by the three digital meter. After a minute the digital meter showed the subject's Heart rate (Author's Guide, 1984).

Respiratory Rate

Objective

The objective was to measure the subject's number of breaths 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 familiar with the room temperature and attained normal breathing Kymograph was switched on at a speed of 60 mm/minute. Then the subject was asked to have the breath normally for one minute. Now the recorder pen was moving up and down with marking on the graph. It was allowed to move upto 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. The investigator
stood nearby, observed and recorded the readings. (Author's Guide, 1982).

Breath Holding Time

Objective

The objective was to measure the ability of the subjects to hold the breath for longer time.

Equipment

A stop watch with calibration of 1/10 seconds, score sheet and a pencil were used to administer the test.

Procedure

The subject stood at ease and inhaled deeply after which she held his breath for a length of time possible to her. The index finger of the respondent served as an indicator for the investigator to know the start and end of the recording time. The thumb and center finger were used to hold the nose to avoid letting the air through the nostrils. The subjects were requested not to let the air out by opening the mouth while recording the Breath holding time.

The time of holding the breath till the subject let the air out was clocked by using the stop watch to
the nearest one tenth of a second was recorded as Breath holding time (Astrand and Rodahl, 1977).

Psychological Variables

Trait Anxiety

Trait Anxiety questionnaire formulated by Spielberger et.al. was responded by all the subjects in the control and experimental groups before and after the application of yogic training for a period of 12 weeks.

The questionnaire used in the study is presented in Appendix-1.

Self Concept

Self concept scale formulated by Dr.Mrs.Mukta Rani Rastogi was responded by all the subjects in the control and experimental groups prior to and after the application of yogic training for a period of 12 weeks.

The questionnaire used in the study is shown in Appendix-2.

EXPERIMENTAL DESIGN AND STATISTICAL PROCEDURE

Random group design, involving forty women students divided into four groups of ten each, was used in this study.
Twenty college women students selected at random from those participating in the physical education programme were divided into two groups of ten each with one group assigned as control group 'A' and the other as experimental group 'A'. In the same way, twenty subjects selected at random from college women who did not participate in any physical education programme in the college were divided into two groups of ten each with one group assigned as control group 'B' and the other as experimental group 'B'.

All the subjects were tested prior and after yogic training programme and cessation on cardiorespiratory endurance, Bent knee sit ups, sit and reach, resting pulse rate, respiratory rate and breath holding time. The study was aimed at mainly in finding out the effects of yogic training on selected variables.

The data collected from the four groups were statistically examined for significant difference, if any, applying the analysis of covariance (ANCOVA).

No attempt was made to equate the groups in any manner. Hence, to make adjustments for difference in the initial means and test the adjusted post test means for significant difference, the analysis of covariance was used.
Since four groups were involved whenever the 'F' ratio was found to be significant for adjusted post means, Scheffe's test was followed as a post hoc test to determine which of the paired mean difference was significant.