Chapter III
Materials and Method

The present study has been conducted for investigating the means of SuryaNamaskar with Omkar chanting and Assistive yoga with Pranayam both for the functional fitness benefit of secondary school teachers. Further, this study may contribute to develop awareness about functional fitness especially for secondary school teacher population to enrich health. However, the methodology, in details, followed for the experiment has been presented in this chapter.

3.1 Research Design
This is an experimental study that considered two experimental interventions having two experimental groups and one control group. The groups were, divided into three groups conveniently. The methodology followed here was Nonequivalent-Control-Group Design.

3.1.1 Quasi Experimental Design.
Quasi Experimental Design research design in which the Experimenter tries to fit the design to real-work settings while still controlling as many of the threats to internal validity as possible. (Best, J.W. & Khan, J.V., 2009)

3.1.2 Nonequivalent-Control-Group Design.
A design using a nonequivalent control group is frequently used in real world settings where groups cannot be randomly formed. (Thomas, and Nelson, 2005)
The design can be depicted as follows:

Module I: \( O_1 -- X_1 -- O_2 -- O_3 \)
Module II: \( O_4 -- X_2 -- O_5 -- O_6 \)
Control Groups: \( O_7 -- C -- O_8 -- O_9 \)

Where:
\( O_1, O_4, O_7 = \) Pre Test; \( X_1 = \) Module I; \( X_2 = \) Module II; \( C = \) No treatment;
\( O_2, O_5, O_8 = \) Post Test; \( O_3, O_6, O_9 = \) Follow up
3.2 Subjects

• Population
The total population of this study comprised of eighty four female teachers in Guru Nanak secondary school G.T.B.Nagar, Sion.

• Sample
Sixty (N=60) Secondary school female teachers, age group ranging from 30 to 50 years, were pooled as convenient sample. The criteria for inclusion and exclusion of the subjects were as follows:

- The teachers who were regular permanent employees were included in the experiment.
- The subjects could remain present till the experimental trials finished were incorporated in this study.
- The subjects irrespective of any community, willing to participate in this study, were incorporated.
- The teachers suffering from known serious health problems were excluded.
- Moreover, teachers having incapacitating physical illness as ruled out by clinical investigation were excluded prior to the study.

The subjects fulfilling the above criteria were selected conveniently on the basis of age, status of fitness and socio-economic class and were assigned to different groups for the experiment.

3.3 Variables

The variables, as identified on the basis of various research reports, incorporated testing and their assessment procedures were as follows:

Standard norms and fitness procedures were applied by professionally qualified trainers and sports director to assess fitness condition of the subjects participating in the experiment.

3.3.1 Independent Variables:

The independent variables for the experiment were as follows:

Module-I: SuryaNamaskar and Omkar Chanting
Module-I: The Twelve Postures of Surya Namaskar
Pranamasana, Bhujangasana, Hastuttanasana, Parvatasana,
Padahastasana, Ashwasanchalanasana, Ashwasanchalanasana, Padahastasana,
Parvatasana, Hastuttanasana, Ashtanganamaskara, Pranamasana.

Module-I: Omkar Chanting
It consists of 3 syllables: A, U, M, which is sounded progressively from throat to lips.

Module-II = Assistive Yoga and Pranayama

Module-II: Assistive yoga
Shoulder Retraction with Rope Jacket, Bharadvajasana, AdhomukhaSvanasana,
Padangusthasana, Supta Virasana

Module-II: Pranayama
The researcher had prominence on Anuloma Viloma Pranayama in this experiment.

3.3.2 Dependent Variables
The dependent variables for the experiment were:

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Term</th>
<th>Definition</th>
<th>Test/unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aerobic Endurance</td>
<td>Aerobic Endurance is the ability to perform repetitive, moderate to high intensity movement for a prolonged period of time.</td>
<td>12 min. Run/Walk Recorded in Minutes and Seconds</td>
</tr>
<tr>
<td>2</td>
<td>Agility</td>
<td>The ability to change direction, without loss of speed and/or accuracy.</td>
<td>T-test, Recorded in Minutes and Seconds</td>
</tr>
<tr>
<td>3</td>
<td>Flexibility</td>
<td>Flexibility is the range of motion around a joint.</td>
<td>Sit and Reach Test, Measured in cm</td>
</tr>
<tr>
<td>4</td>
<td>Static Balance</td>
<td>Balance at rest. A condition in which a tyre and wheel assembly has equal weight around the wheel’s axis of rotation.</td>
<td>Stork stand Recorded in Seconds</td>
</tr>
<tr>
<td>5</td>
<td>Muscular Strength</td>
<td>Muscular Strength is the ability of muscles to exert maximal force for one repetition.</td>
<td>Modified Push-up Counted in numbers.</td>
</tr>
</tbody>
</table>
The variables, cited above, were assessed by considering standard methods at the time of pre-test, post-test and follow-up tests.

### 3.3.3 Confounding Variables

- **Lifestyle and Diet**
  Researcher had no control over food habits, health and daily living style of the subjects involved in the study.

- **Psychological Makeup**
  Researcher had no control on psychological aspect of the subjects.

- **Daily Schedule**
  Researcher had no control on the daily schedule at home and at school and also their extracurricular activities of subjects.

- **Environment**
  Researcher had no control over environment variables like extraneous factors such as mental fatigue, weather conditions and other external disturbances.

### 3.4 Threats to Internal Validity

**History:** No such event occurred during the experiments, as there was no historical events that would affect the treatment.

**Maturation:** This internal threat does not arise as the time span of the treatment was short and maturation could not take place in the participants.

**Testing:** Since tests were conducted only thrice. Care was taken that the effect of one test on subsequent administration of the same test would not crop up.

**Selection bias:** Care was taken to avoid all selection bias while forming groups and selecting subjects.

### 3.4.1 Threats to External Validity

**Reactive or interactive effect** of testing for a pre and post test was taken care of. Experimental design was studying efficacy of the independent variable, designed
especially for the characteristics of the group. Hence, there was no interaction of selection bias in the experimental treatment;

3.5 Ethical Considerations
Informed consent of all the participants prior to the experiment was taken with standard format. As there were medium intensity of training stimuli, which were constructed on the basis of scientific principles of SuryaNamaskar and Omkar chanting and Assistive Yoga and Pranayam, there was no problem for the participants. Both the modules are considered to be harmless and use non-invasive techniques. Moreover, as the period of actual training was for 8 weeks, the consequences of the same were not detrimental in any way.

3.6 Design of the Experiment
The researcher is herself an experienced (15 yrs) Secondary school teacher, and has been closely associated with the lifestyle of secondary school teachers in Mumbai an urban city. Researcher noticed that the quality of life was hampered due to lack of physical fitness and functional fitness literacy. Regarding the same, it has been her belief that for teachers to being efficient at work and at home it would be necessary to improve their functional fitness. Review of literature helped the researcher to design a viable solution and develop a customized program for the experiment.

Step-I
Before entering into actual procedure, administrative permission was taken from the Principal. The subjects were then asked to fill in the consent form with all their details. Keeping in mind the subjects age, gender and fitness level two Modules were designed and titled Module I and Module II. A control group was also formed as per the design requirements.
Module I comprised of SuryaNamaskar and Omkar chanting.
Module II comprised of Assistive Yoga and Pranayam.
Control group. (No treatment were given)

Step-II Development of Intervention
The design of the Modules were validated by five experts, they were renowned people in the areas of functional fitness, assistive yoga, suryanamaskar, pranayam and omkar
chanting. The researcher approached fitness expert Ms. Madhuri Ruia and Ms. Venu Hirani for their inputs in the Functional Fitness program with respect to the frequency and intensity of training and the methods to be used for evaluation in Module-I. Dr. Vishwajeet Chavan helped in the construction of assistive yogasanas in Module II. Dr. Datar helped in designing the Surya Namaskar program, and Prof. Damodikar from Nikam Guruji Sanstha provided inputs in Pranayam (Alternate Nostril Anulom Vilom) and Omkar chanting. The researcher finalized the design with the help of the experts.

**Step-III**

Pilot study was conducted to try out the modules and to make any changes if required, as the subjects were very new to the exercise regimen. The researcher conducted this pilot study for establishing the Reliability by the test retest method; this was done by using the correlation co-efficient, which was found to be between .80 to .95.

For this pilot study 10 teachers from the same age group from a different school in Mumbai city were selected. Similar to the training intervention, the pilot study was conducted with a pre test, one week of training and the post test. It was observed that most of the subjects were able to perform training of selected variables and the selected test.

**Step-IV**

Functional fitness of all the subjects belonging to control and experimental groups were tested prior to the experiment by using standard tests. The scores of fitness components were recorded carefully. The fitness components, the test items and their respective units are given in table no 3.2 below.

<table>
<thead>
<tr>
<th>Fitness Components</th>
<th>Test Item</th>
<th>Unit recorded in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic endurance</td>
<td>12 min. Run/Walk</td>
<td>Minutes and Seconds</td>
</tr>
<tr>
<td>Agility</td>
<td>T-test</td>
<td>Minutes and Seconds</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Sit and Reach Test</td>
<td>Cm</td>
</tr>
<tr>
<td>Balance</td>
<td>Stork stand</td>
<td>Seconds</td>
</tr>
<tr>
<td>Muscular Strength</td>
<td>Modified Push-ups</td>
<td>Numbers</td>
</tr>
</tbody>
</table>
Step-V (Treatment)
After the Pre test the actual experiment was conducted, the subjects of both the experimental groups received their respective training, as stated above, for 45 minutes daily. The subjects of the control group were kept busy with their regular activities for 45 minutes daily. Thus, all the subjects were involved for a period of 45 minutes daily except on Sundays. Prayer was conducted daily prior to warm up. The subjects were non sports persons, keeping this in mind the subjects were given very light warm up which included slow jogging for five minutes, and five minutes of basic stretching exercises and the subjects were given general relaxation poses for cooling down. The duration of this experimentation was eight weeks.

The details of the treatment are as follows:
The progressive loading principle was used in both the Modules. The treatment in each Module consisted of 1. Warming up 2. Treatment 3. Rest 4. Cooling Down.

- **Warming Up**- Total time allotted for warming up was kept the same. Warming up consisted of whole body stretching exercises which involved the major muscles and joints of the body. This helped increase the mobility of the joints. They started with the neck and went on to the toe. As the weeks progressed, the final position in the stretch was held for a longer period of time.

- **Treatment**- Module I consisted of SuryaNamaskar each of 12 counts with proper breathing technique. Emphasis was laid on the finer aspects of execution of every position especially the breathing technique. As the weeks progressed the number was increased from 6 to 14 and the total time required for completing one SuryaNamaskar reduced from 2min to 1min. Besides, the ease and blending of movement was emphasized as time progressed. Since the subjects where new to treatment a rest period was incorporated which was 1min in the first week and was subsequently reduced to 30secs in the last week. Kindly refer to table no 3.4

- **Omkar Chanting** was rendered 8 times in the first week and was increased to 20 times in the last week. As time progressed more emphasis was laid on reciting each syllable A - U-M. In the first week Omkar was chanted normally. In the later weeks the syllable U-M were emphasized and in the final week more emphasis was given to the length of M Kara.
• **Module II**- This module comprised of the following: the assistive asanas were performed so as to increase the mobility and strength of the major muscles and joints of the body. This included using props like the rope, the chair and bolsters which helped the subjects to attain and hold the final position. The range of movement (ROM) of the joint was the main aim of these asanas. The progression started with performing one set of five asanas which extended to three sets of five Asanas each. The progression was achieved by increasing the final holding position for a longer period of time, from 10 sec to 30 secs. Emphasis was laid on every position. (As described later) This was followed by the Pranayama where the total number of repetitions was increased from 8 to 18 by the end of the eighth week. The warm up and cooling down exercises was same in both the Modules.

• **Cooling Down** consisted of performing the Shavasan, and Nishpadasan for the subjects to return to normalcy and relaxation.

The details of the treatment given in Module I is presented below in table 3.3.

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Warm Up</th>
<th>SuryaNamaskar</th>
<th>Omkar Chanting</th>
<th>Cool Down</th>
<th>Total Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Min Reps</td>
<td>Min Reps</td>
<td>Min</td>
<td>Min</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>06</td>
<td>15</td>
<td>08</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>08</td>
<td>18</td>
<td>08</td>
<td>12</td>
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<tr>
<td>3</td>
<td>10</td>
<td>08</td>
<td>14</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>12</td>
<td>15</td>
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<tr>
<td>5</td>
<td>10</td>
<td>12</td>
<td>15</td>
<td>14</td>
<td>14</td>
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<tr>
<td>6</td>
<td>10</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>14</td>
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<tr>
<td>7</td>
<td>10</td>
<td>14</td>
<td>15</td>
<td>20</td>
<td>15</td>
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<tr>
<td>8</td>
<td>10</td>
<td>14</td>
<td>15</td>
<td>24</td>
<td>15</td>
</tr>
</tbody>
</table>

The table 3.3 shows the details of training program of Module I (SuryaNamaskar and Omkar Chanting). The total training program was divided into warm-up, SuryaNamaskar, Omkar Chanting and Cooling Down. One session was of 45 minutes
to. Progression loading principle was used and changes were made every week. The duration details of SuryaNamaskar and Omkar Chanting are given in table 3.4 and table 3.5.

- **Treatment program for SuryaNamaskar**

  **Table 3.4**

  Eight Week Treatment Progression for SuryaNamaskar

<table>
<thead>
<tr>
<th>Weeks No</th>
<th>Repetitions</th>
<th>Training Mins</th>
<th>Rest Time Mins/Secs</th>
<th>Total Duration In Mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>06</td>
<td>02</td>
<td>01</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>08</td>
<td>02</td>
<td>30sec.</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>08</td>
<td>1.5</td>
<td>30sec.</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>01</td>
<td>30sec.</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>01</td>
<td>30sec.</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>01</td>
<td>30sec.</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td>01</td>
<td>30sec.</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>14</td>
<td>01</td>
<td>30sec.</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 3.4 gives the details of repetitions of SuryaNamaskar and time required to complete the repetitions. After each repetition rest was given to subjects. In week 1 rest was 1 min. after each SuryaNamaskar. In week 2 rest was 30 seconds after two SuryaNamaskar. In week 3 rest was same as week 2. In Week 4 rest was 30 seconds after each SuryaNamaskar. In week 5 rest was 30 seconds after two SuryaNamaskar. In week 6 rest was 30 seconds after four SuryaNamaskar. In week 7 rest was 30 seconds after seven SuryaNamaskar. In week 8 rest was 1 min only after seven SuryaNamaskar.

The training Program for Omkar Chanting is discussed in detail below in table 3.5
Table 3.5

<table>
<thead>
<tr>
<th>Weeks No</th>
<th>Repetitions</th>
<th>Training Mins</th>
<th>Rest Time Mins/Secs</th>
<th>Total Duration Mins</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08</td>
<td>01</td>
<td>01</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>08</td>
<td>01</td>
<td>30 sec.</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>01</td>
<td>30 sec.</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>01</td>
<td>30 sec.</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>30sec</td>
<td>30 sec.</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
<td>30sec</td>
<td>30 sec.</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td>30sec</td>
<td>30 sec.</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>20</td>
<td>30sec</td>
<td>30 sec.</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 3.5 gives the details of repetitions of Omkar chanting and time required to complete the repetitions. After each repetitions rest was given to subjects. The total duration of the training of Omkar chanting is variable. After each repetitions rest was given to subjects. In Week 1 rest was 1 Minute after each Omkar Chanting, till 8th repetition. In Week 2 rest was 30 seconds after each Omkar Chanting. In Week 3 rest was 30 seconds after each Omkar Chanting. In Week 4 rest was 30 seconds after two Omkar Chanting. In Week 5 rest was 30 seconds after each Omkar Chanting. In Week 6 rest was 30 seconds after two Omkar Chanting. In Week 7 rest was 30 seconds after each Omkar Chanting. In Week 8 rest was 30 seconds only after three Omkar Chanting.

- Training Program of Module II for 8 Weeks
Table 3.6
Treatment Program of Module II (Assistive Yoga and Pranayama)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>02 set</td>
<td>15</td>
<td>08</td>
<td>05</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>04 set</td>
<td>18</td>
<td>08</td>
<td>05</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>04 set</td>
<td>16</td>
<td>10</td>
<td>06</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>04 set</td>
<td>16</td>
<td>12</td>
<td>06</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>04 set</td>
<td>17</td>
<td>14</td>
<td>04</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>04 set</td>
<td>18</td>
<td>18</td>
<td>03.30</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>03 set</td>
<td>18</td>
<td>18</td>
<td>05</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>03 set</td>
<td>19.30</td>
<td>18</td>
<td>04.30</td>
</tr>
</tbody>
</table>

The table 3.6 shows the details of training program of Module II (Assistive yoga and pranayama). The total training program was divided into warm-up, Assistive yoga and pranayama and Cooling Down. One session was of 45 minutes. Progression loading principle was used and changes were made every week. The duration details of Assistive yoga and pranayama is given in table 3.7 and table 3.8

Table 3.7
Eight Week Progression Treatment Program for Assistive Yoga

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Repetitions No</th>
<th>Time Min.</th>
<th>Rest Min./Sec.</th>
<th>Duration Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>02</td>
<td>05</td>
<td>2.30sec.</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>04</td>
<td>03</td>
<td>2Min</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>04</td>
<td>03</td>
<td>01</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>04</td>
<td>03</td>
<td>01</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>04</td>
<td>04</td>
<td>30sec.</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>04</td>
<td>04</td>
<td>30sec.</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>03</td>
<td>05</td>
<td>30sec</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>03</td>
<td>05</td>
<td>30sec.</td>
<td>19.30</td>
</tr>
</tbody>
</table>
Table 3.7 gives the details of repetitions in Assistive yoga treatment and time required to complete the repetitions. One set consisted of five assistive yogasanas. In week 1 rest given was 2:30 minutes after completion of one set. In week 2 rest was 2 minutes after completion of one set. In week 3 rest was 1 minute after completion of one set. In week 4 rest was 1 minute after completion of one set. In week 5 rest was 30 seconds after completion of two sets. In Week 6 rest was 30 seconds after completion of one set. In week 7 rest was 1 minute after completion of one set. In week 8 rest was 30 seconds after completion of one set.

Table 3.8

Eight Week Progression Treatment Program for Pranayama

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Repetitions</th>
<th>Time Min.</th>
<th>Rest Min./Sec.</th>
<th>Duration Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08</td>
<td>01</td>
<td>01</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>08</td>
<td>01</td>
<td>30 sec.</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>01</td>
<td>30 sec.</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>01</td>
<td>30 sec.</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>30 sec.</td>
<td>30 sec.</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
<td>30 sec.</td>
<td>30 sec.</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
<td>30 sec.</td>
<td>30 sec.</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>30 sec.</td>
<td>30 sec.</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 3.8 gives the details of repetitions of pranayama and time required to complete the repetitions. After each repetition rest was given to subjects. In week 1 rest was 1 minute after each Pramayama, till 8th repetition. In week 2 rest was 30 seconds after each Pramayama. In week 3 rest was 30 seconds after each Pramayama. In week 4 rest was 30 seconds after two Pramayama. In week 5 rest was 30 seconds after each Pramayama. In week 6 rest was 30 seconds after two Pramayama. In week 7 rest was 30 seconds after each Pramayama. In week 8 rest was 30 seconds only after nine Pramayama.
Step-VI (Post Test)
After completion of the eight weeks of treatment, as stated above, all the subjects of both the control and experimental groups were directed for post-testing. The testing procedures were same as mentioned in the pre-test.

Step-VII (Follow-Up)
Follow-Up program started for next 8 weeks after completion of post testing program. In this program, the subjects of all the groups (both control and experimental) did not practice what they already learnt in Step-II. After completion of 8 weeks, all the subjects of both the control and experimental groups were instructed for Follow-Up Test. Here the testing procedures were the same as mentioned in the pre and post-test. Experimentation was for 16 weeks.

3.7 Tackling Possible Problems during Experiment
Problems of assigning no equated groups for experiment may appear due to convenient sampling. Such problems were tackled considering the analysis of preliminary reports, age group etc. In fact, the baseline characteristics of different experimental and control groups were subjected to statistical analysis for significant difference.

The team of professionally qualified helping investigators was appointed and prior to the experiment and they were trained according to the objectives of the study. Reliability in data collection of different variables and training of different groups by different trainers was established by testing and re-testing procedures prior to the experiment.

Since, drop outs could create problems leading to insufficient number of data that may ruin the significance and precision of an experimental research the required follow up was taken. In this case, the addresses, telephone numbers, fax number, e-mail addresses of all the participant subjects as well as their close friends were noted in the beginning. Team of helping investigators and trainers established a personal rapport with the participating subjects to overcome such problems. The investigator convinced the subjects who refused to continue with the follow-up trials and continued the experiment with them. Absenteeism was minimum, less than five subjects were absent.
3.8 Test Administration

• Procedure of the study

The subjects were assembled together and a detailed explanation of the research project was given with the help of mass media. There were some queries, which were answered and the consent forms were filled in. The subjects were then divided into groups and termed group I and Group II and a third group was formed and titled Control Group.

The two Groups were given treatment for 8 continuous weeks. One group was treated by the researcher herself along with an assistant, while the other group was treated by an expert in assistive yoga. Module-I (SuryaNamaskar and Omkar Chanting) was looked after by the researcher, while Module II was handled by the expert.

Testing was done thrice during the experiment, in the pre-test, post test (after 8 weeks) and for the follow up study (8 weeks). The procedure adopted for this testing was similar and all the groups were tested on the same day. There were 5 tests in all and the sequence followed was similar in all the three evaluations. The subjects were divided into four groups one each for the T-test for Agility, Modified Pushups, Flexibility and Balance. The groups were rotated at all the stations, after which the common test for Aerobic Endurance 12min Run Walk test was conducted for all the subjects at one go. Adequate rest was given between the Tests and the scores were communicated to each one.

• Functional Fitness

Functional Testing in Human Performance, which was developed in 2009, as well as Test and Measurement in sports and physical education was considered for this study. Michael P. Reiman, University of Wichita state, Robert C.Manske, University of Wichita state, and Dr. Devinder K. Kansal, University of Delhi established the reliability of the Functional Fitness test, which includes five tests that measure components of functional fitness in relation to a positive health state. The validity and reliability of each test has been demonstrated to be adequate, as has the overall validity of the test items. The description of the tests is given below:
• **12 Min. Run and Walk (Aerobic Endurance)**

**Purpose:** The objective of the test was to measure cardio respiratory or aerobic endurance. The 12 Min. run and walk is a good indicator of the ability of the circulatory and respiratory systems to supply oxygen to functioning muscles.

**Equipment:** Stop Watch, Evaluation Sheet, Pencil, 400mts track

**Validity:** A validity coefficient of .90 was reported when maximum oxygen consumption was used as the criterion.

**Reliability:** When the test-retest method was used, a coefficient of .95 was reported.

**Procedure:** 12Min.Run and Walk, Subjects were instructed to run and walk in the fast and slow possible time. The subjects were asked to take their position just behind the starting line. The starter gave the command “Ready” and “Go”, the timekeepers started their watches and the subject covered as much distance as possible in 12 minutes. The tester counted the number of laps completed and additional completed lap distance covered in 12 minutes respectively. Although the tester had to encourage all the subjects to run the entire period of 12 minutes but interspersed walking was allowed and total distance covered exactly in 12 minutes was recorded correctly. Walking was permitted, but the objective is to cover the distance in the shortest possible time.

**Scoring:** The performance completed lap distance covered in 12 minutes run was scored to the nearest second.

• **T-Test (Agility)**

**Purpose:** To test multidirectional speed, agility, and body control.

**Equipment:** Flat nonslip surface, four cones, stop watch, measuring tape.

**Validity:** A validity coefficient of .72 was reported when T test was used as the test criterion.

**Reliability:** When the test-retest method was used, a coefficient of .93 was reported.

**Procedure:** (Seminick 1990; Fry et al.1991) The subject was instructed to sprint 10yd (9.1m) forward, touching the right hand to the base of the center cone (cone B) the subject then side shuffled to the left 5yd (4.6 m); the left hand touches the base of cone C. The subject was to shuffle to the right 10yd; the right hand touches the base of cone D. The subject was again to run to side, shuffle left to the center cone; the left
hand touches the base of cone B. The subject was finally asked to backpedal past the starting cone, and the watch was stopped. Two trials were performed and the best time is recorded to the nearest tenth of a second. The subject was asked to rest for 1 to 2 min between the two trials. Refer to fig. 3.1

**Disqualification criteria:** Subject does not touch the base of a cone, crosses feet when shuffling, or fails to face the front at all times.

**Scoring:** The total time taken for completing the test was recorded.

![Figure 3.1: T-Test (Agility)](image)

- **Sit and Reach (Flexibility)**

  **Purpose:** The objective of this test is to reach a specified distance on all sides. It measures flexibility of the lower back and hamstrings.

  **Equipment:** The test apparatus consists of a measuring tape, tailor tape, chalk.

  **Validity:** .83 was reported when Sit and Reach test was used as the test criterion.

  **Reliability:** When the test-retest method was used, a coefficient of .90 was reported.

  **Procedure:** Sit and Reach test was administered to assess the flexibility of low back and posterior thighs. The subjects were instructed to sit with the legs extended fully till 39 cm. dividing 30 cm line from 39 cm. With the arms extended forward, one hand on top of the other with palms down, the subjects were instructed to bend forward from the waist. Fingers are extended forward as far as possible to touch the tailor tape. The score was the distance in centimeters that passed the edge of the 39
cm against which the feet were positioned or the distance short of reaching. Three trials were given with the best score recorded to the nearest centimeter.

**Scoring:** Three trials were given with the best score recorded to the nearest centimeter. The test administrator remained close to the tape and noted the most distant line touched by the fingertips of both hands. If the hands reached unevenly, the test was administered again. The tester placed one hand on the subject’s knees to ensure that they remain extended.

- **Stork Stand Test (Static balance)**

There are numerous tests of measuring static balance, but the more common, simple and practical test of static balance conducted by researcher is described below:

**Stork stand test:** This test is used to measure the static balance on the ball of the foot. This test is suitable for both sexes aged 10 years and above.

**Equipment:** A stopwatch.

**Validity:** Face validity.

**Reliability:** When the test-retest method was used, a coefficient of .85 was reported.

**Test Administration:** The performer was asked to stand on the foot of the dominant leg and asked to place the ball of the other foot on the inside of the supporting knee. The subject was asked to place the hands on the respective sides of the waist. The subjects were informed that they would have to stand on the ball of the foot by raising their heel from the floor on the signal ‘Start’. The tester then announces, ready, steady, Start! On the signal ‘Start’, the subject raises the heel from the floor to maintain the balance as long as possible without moving the ball of the foot from its initial position, and the tester starts the stopwatch. The performer is also encouraged to maintain balance with their best efforts and not to let the heel touch the floor for the longest duration. As soon as the subject loses the balance, either by touching heel to the floor or by the movement of the foot from initial position, the tester stops the stopwatch.

**Scoring:** The score was given by the time in seconds for the duration of the maintenance on the ball of foot as described above in the test administration.
• Modified Push-ups (Muscular Strength)

**Modified pushups**: This test is used to measure Muscular Strength of upper body. This test is suitable for women.

**Equipment**: Yoga mat or towel, stopwatch or clock with second hand.

**Validity**: Face validity was used as the content validity.

**Reliability**: When the test-retest method was used, a coefficient of .93 was reported.

**Starting Position of pushups**: Modified pushups put less of a load on ones muscles than a standard pushup. The modified version uses subject’s knees as the pivot point instead of subject toes. The modified pushup offers a lower risk of muscle strain for men or women of any age who want to build upper body strength.

**Test Administration**: A yoga mat or a towel is placed on the floor to protect subject’s knees. The subject’s hands are placed on the floor, slightly in front of subject shoulders, fingers pointing forward. The subject is asked to lift up feet and cross the ankles. Keeping subjects abdominal muscles contracted she is lowered toward the floor until subjects chest was three inches from the ground; the subject is pushed back up to the starting position. The subject repeats as many times as she can do in 60 seconds. The, subject begins by getting down on hands and knees with hands just outside shoulder width and slightly forward of shoulders. Subject’s knees are kept directly aligned with hips. The subject is asked to Inhale: she bends the elbows and lowers chest to 90 degrees at the elbows and Exhales: She pushes up so that her arms are straight, making sure that her elbows are not completely locked.

3.9 Reliability

Data Reliability of data depends upon the reliability of tests, reliability of tools and tester’s competency.

**Reliability of Tests**

Although the reliability and validity coefficients of each test item have been presented above, the same for the overall tests have been presented here. Before the actual data collection on large sample, 10 subjects were tested twice within a week interval on the different test items as selected in this study. The test-retest reliability coefficient ranged from 0.84 to 0.95.
Reliability of Tools
The tools used in testing variables are standardized. All the instruments used were taken from the Research center and they were tested before their use and found reliable and trustworthy.

Testers’ Competency
All the measurements were taken by the researcher along with the assistance of some other professionally qualified Physical Education teachers, Fitness Trainers, and Yoga Experts. Before going for the data collection, the scholar had a number of practice sessions along with assistants under the guidance of Dr Nayana Nimkar who is the guiding teacher of this piece of research. Since the investigator collected on the data from different groups by administering different tools, however prior to conducting the actual test, ten subjects were chosen randomly and tests were taken on them by the research scholar and the assistants under identical conditions in which they had to participate. This established tester’s competency.

3.10 Training Interventions (Independent Variables)
3.10.1 SuryaNamaskar
SuryaNamaskar is one of the finest combinations of body movements. Traditionally, comprising of 12 body positions, where six positions are repeated first with right and then left leg, each of which corresponds to one of the 12 signs of the zodiac. One complete round of SuryaNamaskara consists of these 12 positions performed in succession. The dynamic exercise is not traditionally regarded as part of Yoga practices but it is such a good method of loosening up all the joints and muscles in the body, as well as massaging all the internal organs. It is an excellent exercise to do in the mornings after taking a bath and before doing any other yogic techniques. If one feels tired at any time of the day, this exercise will restore lost vitality, both physically and mentally. SuryaNamaskar is a form of exercise by itself and helps build stamina and strength, provided it is done regularly and in the correct way. (Suryanamaskar, 2012)
• The steps involved are:-

1. **Pranamasana:** Subjects stand with feet together and hands joined in front of the chest in the traditional namaskar position.

2. **Hastauttanasana:** Subjects inhale and stretch hands up straight, above their head. Stretch neck and look upwards. Bend slightly backwards to make an arch of the upper body.

3. **Padahastasana:** Subjects exhale and bend from the waist to touch fingers to the floor. After regular practice, subjects will be able to touch their forehead to the knees and rest the palms flat on the ground.

4. **Ashwasanchalanasana:** Now subjects were resting both hands firmly on the ground, inhale and take the right leg behind and stretch it out on the floor, lunge down. Bend the left knee and keep the foot in line with hands. Stretch subject’s neck up and gaze skywards. [In the next round, start with stretching subjects left leg behind first].

5. **Parvatasana:** While exhaling, subjects straighten the left leg out such that both feet were together and subjects back was straight, not curved. It was sure that subjects gaze was on the floor and elbows were not bent.

6. **Ashtanganamaskara:** Slowly brings subjects knees to rest on the floor, then chest, followed by the forehead. Do not rest the hips on the floor. This might be difficult initially but with practice, subjects will master the art.

7. **Bhujangasana:** In a smooth movement, raise subjects head and upper body, resting subject’s palms on the ground. Subjects gaze should be straight ahead. Be cautious not to hold subjects breathe while in this pose.

8. **Parvatasana:** From here, get into an inverted V-position keeping subject knees and elbows straight; rest the soles and palms flat in the ground and allow the head to hang down freely.

9. **Ashwasanchalanasana:** Fold the right leg from the knee and bring it close to the chest, resting it near the hands. When doing this, the left leg should be stretched out behind.

10. **Padahastasana:** Brings the left leg in front, rest it next to the right foot and rest subjects hands on the ground.
11. **Hastuttanasana:** Inhale deeply and get back to the standing position. Standing with subjects feet together, stretch out subject’s hands above the head, keeping the elbows straight. Bend subject’s spine backwards.

12. **Pranamasana:** Join the palms of both hands together in front of the chest in the namaskar position. Spend a few moments absorbing the energy of the sun and prepared subjects mind for the next round. Relax and stretch subject hands out by side. This completes one round of SuryaNamaskar. The one mentioned above is the traditional method and suits to secondary school teachers and their fitness levels. (Sarswati, S.S.,2003)

### 3.10.2 Mantra Recitation (Omkar Chanting)

In Hindu mythology there is a strong belief that by chanting different Mantras works as remedial measures to dissolve the malefic effects of planets’ energies. For every planet different mantras are framed in Shastras.

The OM (AUM) is a widely recognized mantra and has a variety of meanings; one of its most significant uses is for Meditation. Three sounds of AUM ("A", "U" and "M") symbolize specific states of consciousness. After these three parts of the OM mantra, there is a silence. The A is deep and comes from the throat. It is pronounced without any part of the tongue or palate in contact. The U sound comes from the middle of the sounding board, the palate. In Sanskrit, the A and U join together becomes O. So Om represents the source of all light, love and wisdom.

Subjects were asked to retire in a quiet place, where they sit down in a comfortable posture, they close their eyes and completely relax the muscles and nerves. They are asked to concentrate on the space between their eyebrows and silence the conscious mind. They breathe into the heart centre up to the crown while breathing in. On the exhaling they take the energy of breathe throughout the body, grounding it through the feet into the earth. This is done for five to ten minutes. They begin to repeat "Om" while relating to their inner consciousness and relating to the infinite.

### 3.10.3 Assistive Yoga (Restorative Aasana)

Regular practice of the classical yoga asanas can be quite helpful in creating a healthy immune system and the proper environment for its functioning. The following assistive asanas were taken by B. K. S. iyengar therapy of yoga. They were extremely effective in producing the relaxation response and in counteracting the negative
effects of the stress response on the immune system. These asanas were useful for their calming, nurturing effects and especially valuable when subject is too sick or weak to perform the more vigorous, classical poses. (Pizer, A.2012)

The assistive asanas differ from free-standing yoga poses which were held in proper alignment by muscular action. In these modifications of classical poses, the muscles remain quiet; the shape and alignment of the pose was determined by props. If relaxation is to be attained, therefore, subject had proper support and alignment. Subjects had given plenty of time to experimentation. Although a particular set of props may feel okay, was sure that props were exactly right by increasing or decreasing their dimensions until the pose was totally comfortable. Teachers were strongly advised to practice these postures on their own or with other teachers for several days before giving them prop to use becomes more refined, gradually increase the time, to a maximum of 5 to 10 minutes per posture. For the most profound results, the assistive asanas was practiced in the following sequence. Maintain the feeling of deep relaxation when moving from one pose to the next. Each pose should begin at a deeper level of relaxation than the preceding one. To facilitate quiet transitions, assemble props for all the poses before beginning. Using a timer with a pleasant bell would alleviate the necessity of watching the clock. Assistive yogasanas conducted in the treatment are as follows:-

- **Shoulder Retraction with Rope Jacket**

  **Technique:** The lumbar spine is supported by a rope. The height of the rope should be sufficient to create good chest expansion. The chest should look puffed out. If the chest appears flat or collapsed, try rolling the shoulders back. If the elbows are uncomfortable, support them. This is especially helpful for those who hyperextend when the legs are relaxed. If the lower back is uncomfortable, the lumbar support for adequate thickness is used. This supported modification as the shoulder expands is the most powerful of the restorative poses. The rope support should be firm and sufficiently high to create good chest expansion - puffed out, especially for people with back pain. To come out of this pose, be relaxed and roll off the props. Rest there for a minute, enjoying the feelings of deep and nurturing relaxation for 15 to 20 secs.

  **Benefits:** Relaxation to spine. Removes stiffness in the lower back, and relieves backache, by helping to align the pelvic area.
• **Bharadvajasana on a chair**

**Technique:** Sit sideways on the chair with the right side of subjects’ body against the chair back. Sit erect and exhale. Hold the outer sides of the chair back. Widen subjects’ elbows. Push the right side of the chair back away from body, exerting pressure, while pulling the left side towards subject. Exhale as subject rotate, but do not hold breath. Look over subjects’ right shoulder. Hold the pose for 20-30 seconds. Repeat the pose on the other side.

**Benefits:** Makes the spinal muscles supple, Relieves arthritis of the lower back, Reduces stiffness in the neck and shoulders, Alleviates rheumatism of the knees, Exercises the abdominal muscles, Improves digestion.

• **Adhomukha Svanasana**

**Technique:** Stand in tad asana facing against a wall and tie rope’ about 1m (3.5ft) away from it. Kneel on all fours in Table position. Curl subjects toes under. Shoulder-width apart, separating feet to a distance of 45cm (18in).kneel, and place palms on floor. Lift hips, high and back, with extended arms, keeping palms flat on the floor. Press palms down on the floor and walk subjects feet back, until they are 1.2m (4ft) away from hands, that subject feet are in line with hands and the same distance apart. Raise both heels, stretch legs, then lower subjects’ heels to the floor, Stretch subjects arms fully. Consciously stretch each leg from heels to buttock and from the front of the ankle to the top of the thigh. Then subjects head hangs down, look at navel, and breathe. Raise subject buttock, stretch chest, and push sternum towards hand. Exhale, and then rest subject arms fully. Stretch subject spine and expand chest. Keep throat soft and elongated. Relax eyes and keep brain passive.

**Benefits:** Relieves headaches and hypertension. Helps to rest and rejuvenate the heart. Reduces the “heavy-headed” feeling associated with menopause. Calms the mind, relieves stress, strengthens the arms & shoulders, stretches the shoulders, hamstrings, calves & hands, and relieves headache, back pain and fatigue.

• **Supta Padangusthasana**

**Technique:** Place a mat against a wall. Sit in dandasana facing the wall, keeping a yoga belt beside subject. The soles of subject feet should touch the wall comfortably,
with subjects’ toes pointing upward. Press both palms down on the mat. Lower back onto the mat, supporting subjects’ torso on palms until head rests on the mat. Bend subjects’ right knee, and bring it to her chest. Keep left sole pressed against the wall. Loop the belt around the sole of subjects’ right foot. Hold one end of the belt in each hand. Sure that subject holds the yoga belt as close to her foot as possible. This opens subjects’ chest, and keeps subjects breathing regular and even. Keep subject extended leg pressed down on the mat.

Benefits: Removes stiffness in the lower back, and relieves backache, by helping to align the pelvic area. Helps to treat osteoarthritis of the hip and the knees by stretching the hamstring and calf muscles and strengthening the knees. Stretches the hips joint and tones the lower spine. Relieves sciatic pain; Helps to relieve menstrual discomfort such as cramps, heavy bleeding, or pain during menstruation.

- Suptavirasana

Technique; The modification of Sputa Virasana for use as a restorative asana requires sufficient propping to support the trunk comfortably, while keeping the knees in contact with the floor and the thighs parallel. Even flexible yogis should take advantage of the deep relaxation the props afford in this pose. Sitting on a wooden block and increasing the height of the props supporting the back helps those who are less flexible to get comfortable. The bolster is supporting the lumbar spine Proper head and neck support is crucial for relaxation. A folded towel is used to support the head and neck so that a normal cervical curve is maintained. Avoid neck padding so thick that it causes throat compression. On the other hand, insufficient padding may result in hyperextension of the neck in persons with limited shoulder flexibility. Supta Virasana is best performed on a firm, non-compressible mat. One should not feel pain where the knees and tops of the feet come into contact with the floor. Knee joint pain or lower back discomfort calls for an increase in the height of the trunk and/or buttock supports. If the elbows do not reach the floor, put folded towels under the forearms for support. To come out of the pose, move the trunk into an upright position, using the hands to support the back. Then, still kneeling, separate the knees and lean the trunk forward. Rest the forehead on the floor or on a bolster. Lengthen, relax, and release the back.
Kneel in virasana and place a bolster behind, the short end touching buttocks. Place a rolled blanket on the far end. Make sure that the inner sides of subjects’ feet touch her hips. Keep subjects’ back straight. Place back straight. Place finger on the floor beside toes.

Press palms on the floor bend both elbows, and lean back towards the bolster. Place elbow and forearms, one at a time, on the floor. Gradually lower back onto the bolster. To avoid strain in the pelvic area or the thighs, ensure that knees remain firmly on the floor.

Once subject lower their back onto the bolster, rest the back of head on the rolled blanket. Keep subjects chest fully expanded. Press shoulder blades down on the bolster to lift chest. Extend with toes and ankles towards the bolster. Push feet closer to hips with hands. Extend the pelvis, and press thighs close together.

Move arms out to the sides, with the palms facing upward. Extend neck, but keep throat relaxed. Drop eyelids down gently. Experience the relaxation of the thighs and the abdomen, and the lift of the chest. Feel the continuous stretch from the cervical spine to the tailbone. Initially, stay in the pose for 30seconds. With practice, increase the duration to 1-5 minutes.

**Benefits:** Helps to prevent arterial blockages by gently massaging and strengthening the heart and increasing coronary blood flow. Increases the elasticity of lung tissue; Enhances resistance to infection. Relieves indigestion; acidity and flatulence. Corrects a prolapsed uterus, and tones the pelvic organs. Reduces inflammation in the knees, and relieves gout and rheumatic pain. Relieves pain in the legs and feet and rests them, alleviating the effects of long hour of standing.

### 3.10.4. Breathing Exercise (Pranayama)

Pranayam (also spelled Pranayama) is an ancient practice concerned with breath control. Anuloma Viloma is also called the Alternate Nostril Breathing Technique. In this Breathing Technique, inhale through one nostril, retain the breath, and exhale through the other nostril in a ratio of 2:8:4. The left nostril is the path of the Nadi called Ida and the right nostril is the path of the Nadi called Pingala. If one is really healthy, one will breathe predominantly through the Ida nostril about one hour and fifty minutes, then through the Pingala nostril. But in many people, this natural rhythm is disturbed. Anuloma Viloma restores, equalizes and balances the flow of Prana in the body.
One round of Anuloma Viloma is made up of six steps. Start by practicing three rounds and build up slowly to twenty rounds, extending the count within the given ratio. (Chris, H., 2010)

- **Pranayama - Alternate Nostril (Anuloma Viloma)**

In Anuloma Viloma, researcher adopted the Vishnu Mudra. Subjects’ right hand is used to close subject nostrils. Tuck index and middle finger into subjects’ nose. Place the thumb by subject right nostril and subject ring and little fingers by left. One round of Anuloma Viloma (Alternate Nostril Breathing) with closed eyes.

**Technique** focusing subject’s attention on their breathing, close the right nostril with the right thumb. Simply press the thumb against nostril to block it. Inhale through the left nostril, closing the right with the thumb, to the count of four, slowly through the left nostril. Fill subjects lungs with air. First, feel the diaphragm move down, allowing the lungs to expand and forcing the abdomen out; then feel subjects’ chest expand with their collar bones rising last. Hold the breath, closing both nostrils, to the count of sixteen. Remove subjects thumb from their right nostril. Keep subjects, right hand by their nose and lungs full of air. Exhale through the right nostril, closing the left with the ring and little fingers, to the count of eight. Use subjects’ ring and middle finger to close their left nostril. Most people find it easier to continue using the same hand to block either nostril, but subjects were welcome to switch hands depending on which nostril they were blocking. Subjects can also switch if their arm gets tired. Exhale slowly and completely with the right nostril. Feel the collar bones dropping, chest deflating, and abdomen shrinking as the lungs collapse. When subjects have finished exhaling, kept subjects left nostril closed. Inhale through the right nostril, keeping the left nostril closed with the ring and little fingers, to the count of four. Inhale through the right nostril. Fill subjects’ lungs. Hold the breath, closing both nostrils, to the count of sixteen. Exhale through the left nostril, keeping the right closed with the thumb, to the count of eight. Close the right nostril and open the left. Breathe out slowly through the left nostril. This process is one round of Anulom Vilom Pranayam, continue for 15 minutes. Subject takes a rest after doing exercise as in the training program.
3.11 Facilities Utilized

Instruments
Chandrasekhar Agashe College of Physical Education, Pune has all the necessary instruments and the department has provided all the instruments for successful completion of the project.

3.12 Statistical Analysis
Raw data were processed using descriptive statistics. The Mean and Standard Deviation were computed and all other descriptive measures were used to establish the normality of the data. Further, analysis was done using inferential statistics by computing the F Ratio in the Repeated Measure ANOVA technique to establish the significant difference between the groups and to test the hypothesis. This was followed by LSD Post Hoc test to study the significant difference between the two treatments given in the experiment.

The collected data would be analyzed by employing appropriate statistics. The data was presented in tables systematically. The step-wise results along with scientific as well as logical interpretations will be presented in chapter four. Further, the results are discussed and justified with sound reasoning to draw out definite conclusions in chapter five.
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