CHAPTER III

PLAN AND PROCEDURE
CHAPTER 3
Plan and Procedure

3.1 Methodology
This Chapter describes in detail of the procedures adopted for selection of subjects, Experiment variables, Experiment design, Procedure, Training Programme, Criterion measures, reliability of data, test administration, collection of data and statistical treatment of data involved in the study.

3.2 Selection of Subjects
The study was designed to find out the effect of plyometric and traditional training on performance of long distance athletes. For this purpose, Sixty cross country men and women students participated in the Inter-Zonal cross country tournaments held at R. B. Madhakholkar college, Chandgad were selected as subjects at purposive sampling and their age was between Eighteen and Twenty Nine years. It was ensured from the health examination records of the subjects that all of them were medically fit. The requirements of the project were briefed to ensure maximum co-operation from the subjects and to get positive response from them for the successful completion of the investigation.

A thorough orientation of the requirement of experimental procedure, testing as well as training schedule were explained to them. They were encouraged to cooperate in the study and to work hard to their utmost limit of capacity.

3.3 Selection of Experimental Variables
A feasibility analysis as to which of the important variables could be taken up for investigation, considering the
availability of equipment, acceptability to the subjects and appropriate time required to undertake the study, as well as to keep the entire study united and integrated was made in consultation with experts. Lastly, the selection of variables was finalized after a discussion between the research scholar and his guide.

Keeping the above criteria in mind the following variables were selected:

I. Dependent Variables
   1. Speed
   2. Leg explosive power
   3. Muscular endurance
   4. Resting pulse rate
   5. Vo2 Max
   6. Aerobic fitness and leg muscles endurance.

II. Independent Variables:
   2. Group II (Traditional Training Group).

3.4 Selection of Test

The present study was undertaken primarily the effect of plyometric and traditional training on performance of long distance athletes such as Speed, Endurance and Running economy; physiological variables such as Resting pulse rate, Vo2 Max, Aerobic fitness and leg muscles endurance among long distance athletes, as per the available literatures, the
following test were used to collect relevant data on the selected dependent variables and they were presented in the table 3.1

Table 3-1 Selection Of The Test

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed</td>
<td>50 meter dash</td>
</tr>
<tr>
<td>2</td>
<td>Leg explosive power</td>
<td>standing broad jump</td>
</tr>
<tr>
<td>3</td>
<td>Muscular endurance</td>
<td>Sit-ups</td>
</tr>
<tr>
<td>4</td>
<td>Resting pulse rate</td>
<td>Bio monitor</td>
</tr>
<tr>
<td>5</td>
<td>( \text{Vo}_2 ) Max</td>
<td>Queen's College Bench step up test</td>
</tr>
<tr>
<td>6</td>
<td>Aerobic fitness and leg muscles endurance.</td>
<td>5000 er run.</td>
</tr>
</tbody>
</table>

3.5 Reliability of the Instruments

3.5.1 Instruments Reliability

Instruments such as bio-monitor, stop watches, measuring steel tape, cone, plyometric box, medicine ball, take of board, were used for this study. All instruments were in good working condition. Their calibrations were tested and found to be accurate enough to serve the purpose of the study.

3.5.2 Subject Reliability

The intra class correlation value of the above test and retest also indicated subject reliability as the same subjects were used under similar conditions by the same tester.

3.6 Competency of the Tester

The investigator learned the procedures and methods to handle and operate the instruments to administer the test. Measurements were taken by the investigator himself using bio-monitor, stop watches and steel tape. Services of qualified assistants were used for taking other measurements.
The tester's competency was evaluated together with the reliability of the tests. To determine the reliability of tests, the performance of ten subjects selected at random on the selected variables were recorded twice under identical conditions by the scholar with an interval of one day in between.

Pearson's Product Moment Correlation was computed for assessing the reliability of the six variables and their values are shown in table 3.2 below.

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Variables</th>
<th>Reliability co-efficient</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Speed</td>
<td>.980*</td>
</tr>
<tr>
<td>2</td>
<td>Leg explosive power</td>
<td>.974*</td>
</tr>
<tr>
<td>3</td>
<td>Muscular endurance</td>
<td>.990*</td>
</tr>
<tr>
<td>4</td>
<td>Resting pulse rate</td>
<td>.872*</td>
</tr>
<tr>
<td>5</td>
<td>Vo2 Max</td>
<td>.975*</td>
</tr>
<tr>
<td>6</td>
<td>Aerobic fitness and leg muscles endurance</td>
<td>.968*</td>
</tr>
</tbody>
</table>

*Significant at 0.05 level of confidence

From the test-retest co-efficient of correlation (Table3.2) it was obvious that the tester's reliability was significantly high in establishing the competency of the scholar to administer the test. The coefficient of correlation also indicated the reliability of the tests selected, as very high correlation were obtained when tests were repeated.

3.7 Collection of Data

The plyometric training were given as per the training schedule of Six weeks. The pre-test, the test after second week, the test after fourth week and post test data on the selected criterion variables were collected, the traditional
training was done by the athletes on the same ground as they were doing before under the observation the pre-test, the test after second week, the test after fourth week and post test data on the selected criterion variables were also collected by administering the test as per the standardized procedures before, between and after the Six weeks of the training programme.

3.8 Experimental Design and Procedure

The study involved a single dimensional design with two groups assigned Group I with plyometric training and Group II with Traditional Training. To facilitate the study, 60 students from Inter-Zonal cross country tournaments held at R. B. Madhakholkar college, Chandgad were selected as subjects at purposive sampling and their age was between Eighteen and Twenty Nine years. They were divided into two equal groups namely experimental Group A. (Plyometric training) Group B. (Traditional training) .The pre-test was taken from the subjects before administering the plyometric training. The subjects were involved with their plyometric training and Traditional training for a period of Six weeks under the personal supervision of the research scholar. The prior, end of second week, again the test was taken on the fourth week and the post – test was taken.

3.9 Criterion Measures

By glancing the literature and in consultation with the professional experts, the following variables were selected as the criterion measures in this study for testing the hypothesis. The criterion measures adopted for the studies measuring the
motor ability components and physiological variables are given below.

**Speed**
Speed was measured by using 50 meter dash test. The measurement was recorded 1/100 of the seconds.

**Leg Explosive Power**
For measuring Leg Explosive Power, standing broad jump test was used and the unit of measurement was in meters.

**Muscular Endurance**
For measuring Muscular Endurance, sit-ups test was used and the unit of measurement was in counts.

**Resting Pulse Rate**
For measuring Resting Pulse Rate, Bio-monitor was used and the unit of measurement was in beats per minute.

**Vo2 Max**
For measuring Vo2 Max, was tested by using queen's college step test and the unit of measurement was recorded in ml/kg/min.

**Aerobic Fitness and Leg Muscles Endurance**
For measuring Aerobic Fitness and Leg Muscles Endurance was tested by using 5000 meter run and The measurement was recorded 1/10 of the seconds.

### 3.10 Administration of Tests

#### 3.10.1 Speed (50 meter Run)
**Purpose**
To measure the speed of the subjects.
Equipment

An area on track with a starting line and Finishing line with a distance of 50 meter, two stop watches.

Procedure

After a short warm-up period, the subjects take a position behind the starting line. Best results are obtained when two students run at the same time for competition. The starter used the command. "On your marks" and "go" along with a clapper and a signal to the timer by a downward sweep of the arms. The students run across the finish line. Only in trial is permitted.

Scoring

The score is the elapsed time to the nearest tenth 1/100 second between the starting signal and the instant the subject crosses the finish line.

3.10.2 Leg Explosive Power (Standing Broad Jump)

Purpose

To measure Leg Explosive Power of the Subject.

Equipment

Measuring Tape – Outdoor – Broad Jump Pit

Procedure

The subject was asked to stand with feet apart and toes just behind the take-off line. Prior to jumping, the arms are swing backward and the knees bent. The jump is done by extending the knees and swinging the arms forward simultaneously. Measurement is taken from the take-off line to the heel or part of the body that touches the floor nearest the take-off line. Three trials were permitted in succession. Best performance was taken in to account.
Scoring
The distance of all jumps were measured to the nearest and the best one was recorded in meters and centimetres.

3.10.3 Muscular Endurance (Sit – Ups Test)
Purpose
To measure muscular endurance.

Equipment
Stop watch and Mat

Procedure
The subjects perform the test with bent knees, feet at about 18 inches from the buttocks, and the hands touching the side of the head. A partner holds the subject’s feet as the exercise is performed. The subject touches the elbow to the alternate knee with each sit-up. The subject performs as many sit-ups in 1 minute as possible.

Scoring
One point was scored for each correct sit ups. The score was the maximum number of sit ups completed in one minute.

3.10.4 Resting Pulse Rate (Bio-Monitor Test)
Purpose
To record the resting pulse rate of each subject per minute.

Equipment
A stop watch and bio monitor was used to measure the resting pulse rate

Procedure
The resting pulse rate of the subjects was monitored by the pulse monitor. The resting pulse rate for all the subjects
were recorded in a sitting position, in the morning session between 8:30 a.m. to 9:00 a.m. The subjects were asked to sit down on the bench and relax for 15 minutes prior to the test.

**Scoring**

The number of pulse beats per minute was recorded as the scores.

### 3.10.5 \( V_{O_2\text{ Max}} \) (Queen's College Step Test)

**Purpose**

The purpose of the test was to find out the maximum oxygen consumption of the subjects.

**Equipment**

Stop watch, 18 inches high bench and metronome.

**Procedure**

After hearing the commend start from the investigator, the subjects stepped up and down on a bench of 18 inches high. All the time subjects stepped upon the bench with their body erect. The stepping process was performed in counts as follows.

- Left foot was placed on the Bench
- Right foot was placed on the Bench
- Left foot was placed on the floor
- Right foot was placed on the floor

The subjects were allowed to lead off with the same foot each time or to change the foot as she desired but the four counts was maintained. As the metronomes were not available the counting was done as “up” up and down, “down”. The subjects their step-ups when they heard the command “Stop” from the investigator.
The stepping exercise continued for three minutes in which each minute the subjects covered twenty-five steps – ups and at the completion of stepping the students remained standing. To predict the maximal oxygen uptake (Vo\textsubscript{2} Max) by the step test formula was used.

For Male \( V\text{O}_2\text{max} (\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}) = 111.33 \times (0.42 \times \text{HR}) \)

Women: \( V\text{O}_2\text{max} (\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}) = 65.81 \times (0.1847 \times \text{HR}) \)

**Scoring**

The Vo\textsubscript{2} Max measured in kg/mts/seconds

### 3.10.6 Aerobic fitness and leg muscles endurance.(5000 meters Run)

**Purpose**

The purpose of the test was to measures aerobic fitness and leg muscles endurance.

**Equipment**

A 400 meter track with a starting line and Finishing line, stop watches

After a short warm-up period, the subjects take a position behind the starting line. Best results are obtained when group of 10 students run at the same time for competition. The starter used the command. “On your marks” and “go” along with a clapper and a signal to the timer by a down ward sweep of the arms. The aim of this test is to complete a 5 kilometre course in the shortest possible time. Athletes begin running at their own pace, completing the 5km route as fast as possible without stopping.

**Scoring**
The score is the elapsed time to the nearest tenth $1/10$ second between the starting signal and the instant the subject crosses the finish line.

**3.11 Training Programme**

They were participating in their regular Physical activities. The experimental group A were subjected to first two week of Low Intensity, Third and Fourth Medium Intensity and Fifth and sixth High Intensity of Plyometric training respectively. Then training was given for three days per week (alternative days). Every training session lasted for 40 to 60 minutes. The training program was scheduled for the evening between 5.00 pm and 6.00 pm. The subjects underwent their respective programme under strict supervision prior to and during every session. Subjects underwent a 10 minutes warm up and warm -down exercises which included jogging, stretching, striding . All the subjects involved in the training were questioned about their stature throughout the training period. None of them reported any injuries. However, muscle soreness was reported in the early weeks, but it subsided later. Attendance was calculated for the plyometric training group by dividing total member of training sessions by the number of session presented It was 97% for group I for 96%.

Intensity is the effort involved in performing a given task. In plyometric, intensity is controlled by the type of exercise performed. Plyometric ranges from simple tasks to highly complex and stressful exercise. The Intensity of plyometric exercise can be increased by adding light weight in certain cases, by raising the platform height for depth jumps or simply by aiming at covering a greater distance in longitudinal jumps.
Plyometric Exercise for training groups were designed based on the classification made by the experts.

3.12 Administration and Organization of Training Programme

The investigator conducted the plyometric training programme at the Shivraj College Ground. The investigator could personally supervise and ensure proper execution of the plyometric training with the help of trained coaches.

3.13 Warming-up and Warming-down

Hardayal Singh (1991) has recommended that the physical preparation for the training session is achieved through optimum warm up of the six exercises in a definite manner for the purpose of warming of the physical and physiological systems of the organism. It leads to a) increase in muscle and body temperature, b) Raising the functional level of the heart and lungs, c) loosening of muscles, ligaments and joints, d) Facilitation of motor co-ordination, e) increase in readiness for training activity. General warm-up aims at general preparedness for the training activity. It consists of jogging and stretching exercises.

Table 3-3 Training Plan of session for Six Weeks

<table>
<thead>
<tr>
<th>S.NO</th>
<th>DETAILS</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of weeks</td>
<td>6 Weeks</td>
</tr>
<tr>
<td>2</td>
<td>Number of sessions per Week</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Duration of Each session</td>
<td>1 hour</td>
</tr>
<tr>
<td>4</td>
<td>Total number of foot contact</td>
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<tr>
<td>5</td>
<td>Rest interval between Repetition</td>
<td>3 to 5 minutes</td>
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<tr>
<td>6</td>
<td>Rest Interval between Exercises</td>
<td>2 to 3 minutes</td>
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<tr>
<td>7</td>
<td>warm up and warm down</td>
<td>20 minutes</td>
</tr>
<tr>
<td>Training Week</td>
<td>Training Volume (foot contacts)</td>
<td>Plyometric Drill</td>
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<td>---------------</td>
<td>--------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Week 1</td>
<td>100</td>
<td>Spot-Hopping</td>
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<tr>
<td></td>
<td></td>
<td>Vertical Jumps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Split Squat Jump</td>
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<tr>
<td></td>
<td></td>
<td>Tuck Jumps</td>
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<tr>
<td></td>
<td></td>
<td>Two-Foot Ankle Hop</td>
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<tr>
<td></td>
<td></td>
<td>Pike Jump</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bounding</td>
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<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td>Split Squat Jump</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Two-Foot Ankle Hop</td>
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<td></td>
<td></td>
<td>Pike Jump</td>
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<tr>
<td></td>
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<td>Bounding</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Split Squat Jump</td>
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<tr>
<td>Week 3</td>
<td>160</td>
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<tr>
<td></td>
<td></td>
<td>Vertical Jumps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Split Squat Jump</td>
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<tr>
<td></td>
<td></td>
<td>Tuck Jumps</td>
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</tr>
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<td>Week 5</td>
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<td>Count</td>
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<td>--------</td>
<td>------------------------</td>
<td>---------</td>
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<td>180</td>
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<td>3 X 12</td>
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<tr>
<td></td>
<td>Vertical Jumps</td>
<td>3 X 12</td>
</tr>
<tr>
<td></td>
<td>Split Squat Jump</td>
<td>3 X 12</td>
</tr>
<tr>
<td></td>
<td>Tuck Jumps</td>
<td>3 X 12</td>
</tr>
<tr>
<td></td>
<td>Two-Foot Ankle Hop</td>
<td>3 X 12</td>
</tr>
<tr>
<td></td>
<td>Pike Jump</td>
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</tr>
<tr>
<td></td>
<td>Bounding</td>
<td>3 X 12</td>
</tr>
<tr>
<td></td>
<td>Squat Jumps</td>
<td>3 X 12</td>
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<table>
<thead>
<tr>
<th>Week 6</th>
<th>Exercise</th>
<th>Count</th>
<th>Intensity</th>
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<tbody>
<tr>
<td>120</td>
<td>Spot-Hopping</td>
<td>3 X 12</td>
<td>Medium</td>
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<tr>
<td></td>
<td>Vertical Jumps</td>
<td>3 X 12</td>
<td>Medium</td>
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<tr>
<td></td>
<td>Split Squat Jump</td>
<td>3 X 12</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Tuck Jumps</td>
<td>3 X 12</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Two-Foot Ankle Hop</td>
<td>3 X 12</td>
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<td>Pike Jump</td>
<td>3 X 12</td>
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<td></td>
<td>Bounding</td>
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<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Squat Jumps</td>
<td>3 X 12</td>
<td>Medium</td>
</tr>
</tbody>
</table>

### 3.14 Plyometric Exercises

#### 3.14.1 Spot-Hopping

**Intensity level:** As per schedule

**Starting position:** Stand with slight flexion in ankles, knees, and hips

**Direction of jump:** Horizontal
**Arm action:** Double arm action

**Starting action:** Stand with feet shoulder-width apart and the body in a vertical position.

**Action:** Using only the ankles for momentum, hop continuously in one place. Extend the ankles to their maximum range on each vertical hop

**Volume:** Short response

### 3.14.2 Vertical Jump

![Jumping and Standing](image)

Figure 3-2 Vertical Jump

**Intensity level:** As per schedule

**Starting position:** Stand with the feet shoulder width apart.

**Direction of jump:** Vertical

**Arm action:** Double arm action

**Starting action:** Perform a rapid countermovement and jump as high as possible
**Ascent:** Thrust arms upward vigorously and reach as high as possible with one or two hands.

**Descent:** When the feet hit the ground, jump again immediately without a stutter step.

**Volume:** The jump is often performed against a wall or a free-standing device that measures jump height, with the athlete touching as high as possible.

### 3.14.3 Split Squat Jump

**Intensity level:** As per Schedule

**Starting position:** Assume a stance with one leg extended forward and the other oriented behind the midline of the body as in a lunge position. The forward leg should be almost fully extended.

**Direction of jump:** vertical

**Arm action:** None, or double arm action.

**Starting action:** Start with a countermovement of approximately in (1-25cm).
Ascent: Explosively jump off the front leg, using the calves (plantar flexion) of the back leg.

Descent: When landing, maintain the lunge position (same leg forward) and immediately repeat the jump.

3.14.4 Tuck Jump

![Image of Tuck Jump]

Intensity level: As per schedule

Starting position: Assume a comfortable upright stance with feet shoulder-width apart

Direction of jump: Vertical

Arm action: Double arm action

Starting action: Begin with a rapid countermovement

Ascent: Immediately explode upward. Pull the knees high to the chest and quickly grasp the knees with the hands and release

Descent: Upon landing, perform the next jump after minimal contact time on the ground.
Volume: Concentrate on flexing and pulling the knees upward in this drill.

3.14.5 Two-Foot Ankle Hop

Intensity level: As per Schedule

Starting position: Stand with slight flexion in ankles, knees, and hips

Direction of jump: Horizontal

Arm action: Double arm action

Starting action: Stand with feet shoulder-width apart and the body in a vertical position.

Action: Using only the ankles for momentum, hop continuously in one place. Extend the ankles to their maximum range on each vertical hop

Volume: Short response
3.14.6 Pike Jump

Intensity level: As per Schedule.

Starting position: Assume a comfortable upright stance with feet shoulder-width apart.

Direction of jump: Vertical

Arm action: Double arm action

Starting action: Begin with a rapid countermovement as in performing a vertical jump.

Ascent: Immediately explode upward. Keeping the legs straight, try to lift them to a position parallel to the floor and touch the toes (Pike position) with the hands.

Descent: Upon landing, immediately repeat this sequence, concentration on lifting the straight legs upward.

Volume: Perform the repetitions at the same semi rapid rate, emphasizing minimum contact time on the ground.
3.14.7 Bounding

Intensity level: As per Schedule.

Starting position: Assume a comfortable upright stance with Diagonal shoulder-apart.

Direction of jump: Horizontal

Arm action: Double arm action

Starting action: Begin with a rapid countermovement as in performing a vertical jump.

Ascent: Immediately explode upward. Keeping the legs as in lunge, try to lift them to a position parallel to the floor.

Descent: Upon landing, immediately repeat this sequence, concentration on lifting the straight legs upward.

Volume: Perform the repetitions at the same semi rapid rate, emphasizing minimum contact time on the ground.
3.14.8 Squat Jump

Intensity level: As per schedule

Starting position: Half-squat position (thigh parallel with the ground) with feet shoulder-width apart. Interlock fingers and place hands behind head.

Direction of jump: Vertical

Arm action: None

Starting action: Start movement by explosively jumping to maximum height.

Descent: Upon landing immediately go into half-squat position and without pause, repeat exercise.

Volume: The squat jump utilizes a deeper countermovement as compared to other jumps, so the amortization phase is the longest of all drills listed.
3.15 Statistical Techniques

In this study, analysis descriptive statics, paired \( t \) test and Independent sample \( t \) test with two tailed statistical techniques was used to find out the selected Variables among long distance Runner. Levene’s Test for Equality of Variances was used to see that group variances are equal and not equal. The test significance level is .05 level for all test.