CHAPTER V

SUMMARY, CONCLUSION &
RECOMMENDATIONS
CHAPTER 5
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Plyometric exercises come from the Greek word plyometric which means “more length.” This length refers to the body’s muscle for enhanced performance and powerful movements. Plyometrics exercises include the movements which aim to strengthen tissues by loading up the muscle and thereafter contracting it in rapid progression. It makes use of strength, flexibility and innervations of the muscles and tissues which will allow the practitioner to run faster, jump higher, hit harder or throw farther among many others. Plyometric exercises help in achieving the increase in the contraction rate or strength of muscles which leads to a successful and enhanced performance in sports activities.

Lundin and Berg (1991) described the process of plyometrics as: A muscle forcibly stretched before a contraction uses the stretch reflex to activate the muscle to shorten vigorously, and the elastic nature of the muscle fibers allows the muscle to store energy during negative work, that will be released during the shortening contraction.

Plyometric training is an effective mode of training as it enhances motor learning and neuromuscular efficiency promoting the excitability, sensitivity, and reactivity of the neuromuscular system to increase the rate of force production (power), motor-unit recruitment, fine frequency (rate coding), and synchronization.

The neuromuscular system must react quickly and efficiently following an eccentric muscle action to produce a
concentric contraction and impart the necessary force (or acceleration) in the appropriate direction. Therefore, specific functional exercises that emphasize a rapid change in direction must be utilized to prepare each athlete for the functional demands of a specific activity.

Plyometric training provides the opportunity to train specific movement patterns in a bio-mechanically correct manner at a more functionally appropriate speed. This provides functional strengthening of the muscle, tendon, and ligaments specific to the demands of everyday activities and sports. The ultimate goal of plyometric training is to improve the reaction time of the muscle action spectrum (eccentric deceleration, isometric stabilization, and concentric acceleration).

5.2 Restatement of the Problem

The present study undertaken may be stated as follows;

"Effect of Plyometric and Traditional Training on Performance of Long Distance Athletes"

5.3 Definitions of the Terms Used

The various terms and phrases used in the statement of the problem are operationally defined for the sake of clarity and also for limiting the scope as follows:
Plyometric Training

Conceptual Definition

Eccentric contraction followed immediately by a concentric contraction i.e., the exercise is based on the rapid lengthening of a muscle (forced stretch) just prior to a contraction. The voluntary impulse must be timed to coincide with involuntary impulse to achieve most powerful contraction to gain maximum height of jumps.

Operational definition

For the present study the Plyometric training means The ability of muscles and tendons to store and release elastic energy have been considered to be more important factors than previously thought to achieve a higher level of performance.

Traditional Training

Conceptual Definition

Traditional Training varies greatly with geography and by historical period. Traditional Training is to transmit to a next generation those skills, facts, and standards of Sports that athlete deem to be necessary for the next generation's sports success. As beneficiaries of this, which educational reformists John Dewey described as being "imposed from above and from outside", the students are expected to docilely and obediently receive and believe these fixed answers. (wikepida.com)

Operational definition

For the present study the Traditional Training means the senior athletes passes skills to his junior fellow.
Sport performance

Conceptual Definition

Sport performance is the unity of execution and result of a sports action or a complex sequence of actions measured or evaluated according to socially determined and agreed norms.

Operational definition

For the present study the Sport performance means the result of the skill it may be Distance or time.

Long Distance Running

Conceptual Definition

Long-distance running, or endurance running, is a form of continuous running over distances of at least five kilometers. Physiologically, it is largely aerobic in nature and requires stamina.

Operational definition

For the present study the Long distance is the running that covers the 5 kilometer, 10 kilometer, half marathon and marathon events.

Endurance

Conceptual Definition

The ability of the heart, blood, blood vessels and lungs (delivery system) to take in and transport an adequate of oxygen to the working muscles, and the ability of slow twitch muscle tissue to sustain rhythmic movement for an extended period of time.
Operational definition

For the present study the Cardiovascular Endurance the ability of an individual to run for longer period.

5.4 Variables

In the experimental research method, the investigator manipulates variables (independent variable) under controlled or natural field conditions by assigning the purposely sample and experimental method to examine the experimental and control group, whether changed occur in a second variable (dependent variable). The investigator considered two major types of variables, viz., independent and dependent variables in the present study.

1. Independent Variable

- Group I (Plyometric Training Group).
- Group II (Traditional Training Group).

2. Dependent Variable

- Speed
- Leg explosive power
- Muscular endurance
- Resting pulse rate
- Vo2 Max
- Aerobic fitness and leg muscles endurance

5.5 Objectives of the Study

The following objectives are framed for the present study.
**Major objectives**

The main objective of the study was to establish if a plyometric training program will improve the performance of long distance running.

**Minor objective**

4. To determine if plyometric training improves the speed, explosive power, muscular endurance, resting pulse rate, and Vo2 Max of long distance running.

5. To determine if plyometric training improves the endurance of long distance athlete during a 5000 meter run time trial.

6. To determine if Traditional training improves the endurance of long distance athlete during a 5000 meter run time trial.

**5.6 Research Hypothesis of the Study**

Following are the research hypotheses are used in the present study.

**H0:** There would be no significant difference in the performance of long distance running due to the effect of Plyometric training.

**H0:** There would be no significant difference in the performance of long distance athlete due to the effect of Traditional training.

**H0:** There would be no significant difference in the performance of long distance athlete due to the effect of Plyometric training and Traditional training.
Alternative Hypothesis: There would be significant difference in the performance of long distance athlete due to the effect of Plyometric training and Traditional training

5.7 5.8 Method Used in the Study

The investigator consulted with his guide and felt that the Experimental research survey method could be the most appropriate. The study involved a single dimensional design with two groups assigned Group I with plyometric training and Group II with 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.

5.8 Population and Sample

A population is any group of individuals that has one or more characteristics in common and that are of interest to the researcher.

The population of the study was all long distance runner of InterZonal cross country tournaments held at R. B. Madhakholkar College, Chandgad.

The most important factor in determining the general ability of research result in the selection of sample used in collecting the research data sampling is a miniature picture or the cross sectional of the entire group from which can be applied to the entire population. The important types of sampling or random sampling, area sampling, cluster
sampling and incidental sampling. In this study, purposeful sampling was used which often used in qualitative research studies the participants are often selected because they are typical or particularly interesting. Purposeful sampling allows the researcher to select those participants who will provide the richest information, those who are the most interesting; and those who manifest the characteristics of most interest to the researcher.

![Diagram](image.png)

The sample for the study was drawn through the purposive technique as the study was Experimental design in nature. 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 three years. All the selected subjects followed regional language as the medium of instruction.

5.9 Tools Used

To get the data on the variables selected for the study, the following tools were used in the study are given below:

1. Plyometric Training Programme
2. Tests of variables

5.10 Selection of the Approach/Techniques for the Study

With the consultation of guide, subject experts and the physical education teachers, the plyometric exercise where finalized then training plan is carried out.

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.

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 three 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.

5.11 Statistical Techniques Used

The collected data were tabulated for the purpose of analyses for testing the hypotheses set up in the present study, the data were calculated with paired ‘t’ test, the independent ‘t’ test, descriptive Statistics like mean median mode minimum maximum and S.D. were used.

5.12 Findings of the Study

Plyometric training can be successfully integrated with long distance running. Endurance performance ability or the ability to travel a long distance in the shortest time possible depends on several factors, like VO2max, Maintained submaximal velocity in long-distance running events, however, may also require optimal neuromuscular characteristics related to voluntary and reflex neural activation, muscle force and elasticity, running mechanics, and anaerobic characteristics. In fact, this study have shown that anaerobic aerobic characteristics can differentiate well-trained long distance runners according to their running performance. Whereas a traditional running results mainly shown less improvement.

Before the training period, experimental and Traditional Group did not differ in terms of any variable measured. Based on programed plan, every experimental subject complied
completely with the prescribed plyometric training program. Every subject complied with the instruction to maintain the same program of running that he or she followed immediately before the study. The purpose of the study was to find out the effect of plyometric and traditional training on performance of long distance athletes.

The possible effect of plyometric training on long distance running was analyzed statistically using Speed, Leg explosive power, Muscular endurance, Resting pulse rate, Vo2 Max and Aerobic fitness and leg muscles endurance variables. In general, the plyometric training caused improved long distance running. It improved in experimental subjects when compared with traditional group subjects.

The main finding of the present study was that the plyometric exercises and traditional training group induce significant increases in Speed, Leg explosive power, Muscular endurance; Resting pulse rate, Vo2 Max and Aerobic fitness and leg muscles endurance. Performance after 6 weeks of plyometric training in long-distance runners. These results suggest that to optimize running endurance performance adaptations long-distance runners, a plyometric training program should be added to their regular running training program.

1. The performance of (Speed) 50 meter dash goes on increasing in plyometric training from the experimental period (pretest), after two weeks of training (T1), after four weeks of training (T2) and after six weeks of the training period (posttest) respectively. The average difference means are 0.084 sec, 0.155sec, 0.268 sec and 0.507 sec
respectively. Whereas the average difference means of traditional training are 0.060sec, 0.028 sec, 0.045sec and 0.133 sec which are significant improvement in their respective group but there is no significant difference in the posttest performance of speed its p value of significance at two tailed is p=.071, the performance of plyometric group improved from 7.93sec to 7.42 sec and traditional from 7.91sec to 7.78 sec, the mean difference of pretest to posttest plyometric group is 0.51 sec and that of traditional is 0.13 sec.

2. The performance of (Leg explosive power) standing broad jump goes on increasing in plyometric training from the experimental period (pretest), after two weeks of training (T1), after four weeks of training (T2) and after six weeks of the training period (posttest) respectively. The average difference means are 6.83cm, 6.53cm, 7.17cm and 20cm respectively. Whereas the average difference means of traditional training are 6.90cm, 2.13cm, 4.00cm and 13.03cm which are significant improvement in their respective group. There is no significant difference in the posttest performance of Leg explosive power its p value of significance at two tailed is p=.387, the performance of plyometric group improved from 200.57 to 221.10 cm and traditional from 200.17 to 213.2 cm, the mean difference of pretest to posttest plyometric group is 20.53 cm and that of traditional is 13.00 cm.

3. The performance of (Muscular endurance) sit-ups goes on increasing in plyometric training from the experimental period (pretest), after two weeks of training (T1), after four
weeks of training (T2) and after six weeks of the training period (posttest) respectively. The average difference means are 0.90, 1.50, 5.53 and 7.93 respectively. Whereas the average difference means of traditional training are 1, 0.83, 1.13 and 2.97 which are significant improvement in their respective group. There is significant difference in the post test performance of Muscular endurance its p value of significance at two tailed is p=.000, the performance of plyometric group improved from 28 to 36 counts and traditional from 29 to 32, the mean difference of pretest to posttest plyometric group is 8 and that of traditional is 3 counts.

4. The performance of (Resting Pulse Rate) sit-ups goes on increasing in plyometric training from the experimental period (pretest), after two weeks of training (T1), after four weeks of training (T2) and after six weeks of the training period (posttest) respectively. The average difference means are 1, 1, 3 and 5 counts respectively. Whereas the average difference means of traditional training are 1, 1, 1and 3 which are significant improvement in their respective group. There is significant difference in the post test performance of Resting Pulse Rate its p value of significance at two tailed is p=.000, the performance of plyometric group improved from 71 to 65 counts and traditional from 71 to 67, the mean difference of pretest to posttest plyometric group is 6 and that of traditional is 4 counts.

5. The performance of (Vo2Max) Queen's College Step Test goes on increasing in plyometric training from the experimental period (pretest), after two weeks of training
(T1), after four weeks of training (T2) and after six weeks of the training period (posttest) respectively. The average difference means are -1.46, -1.46, -2.92 and -5.84 (ml.kg-1.min-1) respectively. Whereas the average difference means of traditional training are 0.1, 1.49, 1.49 and 3.1 ml.kg-1.min-1 which are significant improvement in their respective group. There is significant difference in the post test performance of Queen's College Step Test and p value of significance at two tailed is p=.042, the performance of plyometric group improved from 40.95 to 47.74 ml.kg-1.min-1 and traditional from 42.05 to 45.15 ml.kg-1.min-1, the mean difference of pretest to posttest plyometric group is 6.49 ml.kg-1.min-1 and that of traditional is 3.10 ml.kg-1.min-1.

6. The performance of (Aerobic Fitness and Leg Muscles Endurance) 5000 meter run goes on increasing in plyometric training from the experimental period (pretest), after two weeks of training (T1), after four weeks of training (T2) and after six weeks of the training period (posttest) respectively. The average difference means are 1.31, 22.64, 25.86 and 1:07.2 min respectively. Whereas the average difference means of traditional training are -1.31, 22.64, 25.86 and 47.19 min which are significant improvement in their respective group. There is significant difference in the post test performance of 5000 meter run and its p value of significance at two tailed is p=.045, the performance of plyometric group improved from 18:18 to 17:09 min and traditional from 18:30 to 18:08 min, the mean difference of pretest to posttest plyometric group is 1:09 min and that of traditional is 0:22 min.
5.13 Discussion and Conclusions

The main purpose of the study was to find out the effect of plyometric and traditional training on performance of long distance athletes. To achieve this purpose of the study, 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 ranged between 18 to 23 years. The selected subjects were divided in to two equal groups of thirty subjects each. Group I underwent plyometric training, Group II underwent traditional for three days per week for six weeks. Traditional Group acted as control that did not participate in any special training programme apart from their regular activities as they were doing before. The following motor ability components and physiological variables namely speed, leg explosive power and muscular endurance, resting pulse rate, vo2 max and Aerobic fitness and leg muscles endurance were selected as dependent variables. All the subjects of two groups were tested on selected dependent variables at for all the two groups before the experimental period (pretest), after two weeks of training (T1), after four weeks of training (T2) and after six weeks of the training period (posttest) immediately after the training programme. The analysis of paired ‘t’ test and independent ‘t’ test was used to analyze the significant difference, if any among the groups. Since, two groups were compared, the significance level (sign) of Levene’s Test for Equality of Variances was seen, the significance level is greater than .05, and so we can assume that group variances are equal and used the first row of t test results. The p= .05, the level of confidence was fixed as the
level of significance obtained by the analysis of independent ‘t’ test, which was considered as an appropriate.

From the analysis of the data, the following conclusions were drawn.

1. There was a significant difference among plyometric training, that the performance of long distance runners due to plyometric training had significant positive changes on Speed, Leg explosive power, Muscular endurance, Resting pulse rate, Vo2 Max and Aerobic fitness and leg muscles endurance.

2. There was a significant differences among traditional training in the performance in the selected variables Speed, Leg explosive power, Muscular endurance, Resting pulse rate, Vo2 Max and Aerobic fitness and leg muscles endurance.

3. There was a significant improvement in the performance of plyometric group goes on increasing from the experimental period (pretest), after two weeks of training (T1), after four weeks of training (T2) and after six weeks of the training period (posttest).

4. There was also significant improvement in the performance of traditional goes on increasing from the pretest, after two weeks of training (T1), after four weeks of training (T2) and after six weeks (posttest).

5. Among the groups, plyometric training group significantly improved the selected dependent variables namely muscular endurance, resting pulse rate, VO2max and Aerobic fitness and leg muscles endurance than that of traditional training.
5.14 Implications of the Study

The findings of the present study have the following implications on the present context on long distance runner.

1. The plyometric training will improve the sports performance achievement among the long distance runner.
2. Plyometric training should be used in a training plan of the long distance runner.
3. Plyometric training should be used in effectively to develop the running economy.
4. Plyometric training should be used in to develop the physical fitness.
5. Plyometric training should be used in to avoid the injures.
6. Some of the innovative programme of Plyometric training be adopted at the all level of sports.

5.15 Suggestions for Further Study

An attempt is made in this study to investigate the study was to find out the effect of plyometric and traditional training on performance of long distance athletes. Even in this study, the plyometric training programme has been used to improve the long distance performance. It is hoped that the present study will encourage, stimulate and provoke further researchers in the area of sports. Based on the present study, the researcher felt the need for undertaking the following studies in this field.
The following are the suggestions for further research.

1. In the present study, it was concluded that plyometric training had much influence on all the criterion variables. Hence, it is recommended to the coaches, trainers, and the physical educators to adopt this practice to improve selected motor ability components and physiological variables.

2. The same study may be conducted using large sample of national participated long distance runner.

3. The same study may be conducted for the students studying in residential schools.

4. The duration of the training period may be increased up to 8 – 12 weeks to examine the training effect.

5. The similar study may be carried out by selecting international, national or state level players as subjects.

6. The similar study may be conducted by selecting only women students as subjects.

7. The similar study may be conducted with large number of samples.

8. A study may be conducted at primary level.

9. A study may like this may be conducted by using higher order statistical techniques.

10. A comparative study of plyometric training and other training may be undertaken.

11. A study may be conducted for the better performance in sports purpose in school level.

12. The researcher can study the various aspects of plyometric training.

13. The study may be conducted by using various technological aspects.
14. The same study may be done by knowing detraining and retraining effects.
15. The same study may be conducted on other major games.
16. A similar study may be conducted by taking other variables, like Bio-chemical and anthropometrical variables.
17. The plyometric training programme can be followed by the coaches for developing the agility, explosive power, reaction time and abdominal strength endurance variables for other game players.