5.1. SUMMARY

Plyometrics (also known as "plyos") is a type of exercise training designed to produce fast and powerful movements, and improve the functions of the nervous system, generally for the purpose of improving the performance in sports. Plyometric movements, in which a muscle is loaded and then contracted in rapid sequence, use the strength, elasticity and innervations of muscle and surrounding tissues to jump higher, run faster, throw farther, or hit harder, depending on the desired training goal. Plyometrics is used to increase the speed or force of muscular contractions, providing explosiveness for a variety of sport-specific activities. Plyometrics has been shown across the literature to be beneficial to a variety of athletes. Benefits range from injury prevention, power development and sprint performance.

Plyometric training involves practicing plyometric movements to toughen tissues and train nerve cells to stimulate a specific pattern of muscle contraction. So the muscle generates a strong contraction as possible in the shortest amount of time. A plyometric contraction involves a rapid muscle lengthening movement (eccentric phase), followed by a short resting phase (amortization phase), then an explosive muscle shortening movement.
(concentric phase), which enables muscles to work together to perform a particular motion. Plyometric training engages the myotatic reflex, which is the automatic contraction of muscles when their stretch sensory receptors are stimulated.

“Soccer is a game which calls for strenuous, continuous thrilling action and therefore, appeals to the youth worldwide. The skills involved in the game are simple, natural and yet are highly stimulating and satisfying any one, who participates in the game”. Football as it is popularly called in India is a game where the foot is used much more than any part of the body. Bernard Shaw’s comment underlines this reality that “Footballers think with their feet”.

The game soccer is both an art and science. There is a distinction, which gives a speciality to soccer, compared to that of other games. It is the natural behavior of human beings to use their hands and arms for doing almost all activities. In all other games, hands are dominantly used. But in soccer, the use of hands has been restricted which is only used for throw in (exception is given only to Goal Keeper, that too inside the penalty area) and all other parts of the body are allowed to play, especially the foot.

It involves techniques of running, passing, kicking, tackling, blocking, heading, juggling and dribbling. All these activities have to be performed at a great speed. Though these individual skills are very important, it should not be forgotten that it is a team game and the players have to work together in offence.
or defense. A player must therefore, develop his skill and should understand his contribution according to the situation demands in the team play. Therefore, working in a competitive situation can develop the skills though individual practice is necessary. The game of soccer contains physical challenges.

Repeated use of plyometric exercises will gradually increase the efficiency of the neuromuscular connections between brain and muscle. However, a fine balance must be used if one wishes to build strength and power through plyometrics. It is often recommended that plyometric repetitions were not higher than 75-100 repetitions. The training with plyometric exercises more than three or four times per week can cause muscular degeneration, if proper nutrition and rest are not taken into account.

Plyometrics have been shown to have benefits for reducing lower-extremity injuries in team sports while combined with other neuromuscular training (i.e. strength training, balance training, and stretching). Plyometric exercises involve an increased risk of injury due to the large forces generated during the training and performance, and should only be performed by well-conditioned individuals who are under supervision. Good levels of physical strength, flexibility, and proprioception should be achieved before the commencement of plyometric training.

Kicking is a fundamental and versatile technique used for passing, shooting and clearing. An important skill in the game of soccer is the ability to kick the
ball forcefully and accurately. An important aspect of the soccer kick is the interplay between the various muscle groups active in the skill. Passing is the life of soccer. The renowned soccer players are noted for their outstanding ability to pass. To pass the ball to an apt player at the right time is one of the most important qualities of a soccer player.

Trapping the ball can be defined as the art of receiving or taking position of a moving ball, in other words bringing the ball under complete control. Dribbling is propelling the ball from one place to another without losing the control. But according to the situations the way of dribbling will differ. Even though dribbling is one of the most valuable fundamental technique in soccer, when it is done too often and for a longer time, it can completely distort a team’s offense or defense pattern. Therefore, it is very important to remember that dribbling is never justified, if there is an unguarded teammate waiting for a pass. A safe pass is always better than unnecessary dribble. Accuracy in shooting at goal becomes obvious during the training and it is entirely different in competition.

Physical fitness plays an important role in all sports and games. All the living individuals must possess physical fitness. At present the concept of physical fitness can be divided into two distinct categories; health related physical fitness and performance related physical fitness. Health related physical fitness components are strength, muscular endurance, cardio respiratory endurance,
body composition, flexibility and free from obesity. Performance related physical fitness includes those components important to play sports well, such as speed, strength, endurance, agility, explosive power, co-ordination, balance, etc.

Many research studies have been carried out only on the individual effect of plyometric training. Hence, the investigator has made an attempt to study the effects of varied intensities of plyometric training on motor fitness components and soccer techniques of junior players.

To fulfill the purpose of the study one hundred and twenty junior soccer players were randomly selected from Government Boys Higher Secondary School Manjeri, Hidayathul Muslimin Yatheemkhana Higher Secondary School Manjeri, M S P Higher Secondary School Malappuram and Govt. Higher Secondary School Pookottur of Malappuram District in Kerala State. The selected subjects were divided into four equal groups consisting of thirty each. No attempt was made to equate the groups. Experimental group I (n=30) underwent low intensity plyometric training (LIPT), experimental group II (n=30) underwent medium intensity plyometric training (MIPT), experimental group III (n=30) underwent high intensity plyometric training (HIPT) for a period of 12 weeks. Group IV acted as the control group (CG) (n=30) and the subjects in the control group were not engaged in any training programme other than their regular work. The subjects
were free to withdraw their consent in case of discomfort during the period of their participation, but there was no dropout during the study.

The influence of varied intensities of plyometric training was assessed on motor fitness components and soccer techniques. The following dependent variables were assessed by using standard tests.

1. **Motor fitness components**

   Speed was measured by 50 mts dash and the unit of measurement was in seconds.

   Agility was measured by 4×10 mts shuttle run and the unit of measurement was in seconds.

   Flexibility was measured by Sit and reach test and the unit of measurement was in centimeters.

   Leg Strength was measured by Leg dynamometer and the unit of measurement was in kilograms.

   Cardio respiratory endurance was measured by Cooper’s 12 minutes run and walk test and the unit of measurement was in meters.

2. **Soccer Techniques**

   Dribbling was measured by Sir Bobby Charlton Soccer School of Australia Test for dribbling and the unit of measurement was in seconds.
Passing was measured by Sir Bobby Charlton Soccer School of Australia Test for passing and the unit of measurement was in points.

Kicking was measured by Sir Bobby Charlton Soccer School of Australia Test for Kicking and the unit of measurement was in points.

Trapping was measured by Sir Bobby Charlton Soccer School of Australia Test for trapping and the unit of measurement was in points.

Shooting was measured by Sir Bobby Charlton Soccer School of Australia Test for shooting and the unit of measurement was in points.

After the initial measurements the subjects were divided into four equal groups; the low intensity plyometric training group (n=30); the medium intensity plyometric training group (n=30); the high intensity plyometric training group (n=30) and the control group (n=30). The control group did not undergo any training. The other three training groups trained for 12 weeks, three days per week. Before the initiation of the training periods, the subjects of all the groups were instructed about proper execution of all the exercises to be used during the training period. Subjects agreeing to participate signed an institutionally approved consent form.

In each training session the training was imparted for a period of 45 to 60 minutes, which included 5 minutes warming up and 5 minutes relaxation procedure after the training programme for three days per week for a period of
12 weeks. The American College of Sports Medicine recognizes that the adult should engage in moderate intensity physical activity for at least 30 minutes or more, on five or more days of the week, to obtain basic health benefits.

The pre and post test data on all the variables were tested for significance by applying ‘t’ test. Analysis of co variance (ANCOVA) was used to compare the effects of low intensity, medium intensity and high intensity plyometric training on the selected motor fitness components and soccer techniques of the junior players. Whenever, the obtained ‘F’ ratio was found to be significant for adjusted post - test means, Scheffe’s post hoc test was used to determine which of the paired mean difference was significant. The level of significance for the investigation was fixed at 0.05 level of confidence

5.2. CONCLUSIONS

The following conclusions were drawn from the results of the study:

1. Within the limitations and on the basis of the findings, it was very clear that twelve weeks of low intensity, medium intensity and high intensity plyometric training produced significant changes over motor fitness components of speed, agility, flexibility, leg strength and cardio respiratory endurance of the junior soccer players.
2. Results on individual effects confirm positively and significantly the effect of low intensity, medium intensity and high intensity plyometric training on dribbling, passing, kicking, trapping and shooting in soccer in addition to their traditional physical training.

3. Further, it was concluded that all the three plyometric protocols (low intensity, medium intensity and high intensity) adopted for the study are capable of improving speed, agility, flexibility, leg strength and cardio respiratory endurance, dribbling, passing, kicking, trapping and shooting in soccer significantly.

4. The medium intensity of plyometric training for a period of twelve weeks was found to be the most appropriate protocol to produce significant changes over motor fitness components and techniques in soccer.

5. When low intensity training was compared with high intensity training, the LIPT was found to be the suitable training to produce significant changes in motor fitness components and the soccer techniques.

5.3. RECOMMENDATIONS

The following recommendations have been made based on the results of the present study.

1. It is recommended that coaches, trainers and athletes interested in developing motor fitness and skills should adopt these types of plyometric exercises in training.
2. The medium intensity of plyometric training is the appropriate training to produce significant changes in motor fitness components and soccer techniques of the junior players.

3. Systematic plyometric training programme can be chalked out for the improvement of soccer techniques of the players of different age and achievement levels.

4. Plyometric training can be included as a regular part of training programme of an athlete of various sports and games.

5. Similar study may also be conducted for junior girls.

6. Studies of similar nature may also be conducted by changing the dependent variables.

7. Fitness experts, health consultants and conditioning experts can use plyometric exercises for preparing various training programmes.

8. Plyometric training to be included in the training programmes of various sports and games where a large variety of techniques and movements are to be involved done.

9. It is recommended that a similar study can be conducted on a wide range sample and for a longer duration.

10. It is also recommended that a similar study can also be conducted for the assessment of improvement of technique for various sports and games.