



# EFFECTIVENESS OF LOWER LIMB PLYOMETRIC EXERCISES ON ABDOMINAL ENDURANCE AND KICKING PERFORMANCE IN RECREATIONAL FOOTBALL PLAYERS: A QUASI- EXPERIMENTAL STUDY IN RECREATIONAL FOOTBALL PLAYERS.

<sup>1</sup>Sonam Nidhi, <sup>2</sup>V.K Jayasheelan

<sup>1</sup>Assistant Professor, <sup>2</sup> Assistant Professor

<sup>1</sup>Department of Physiotherapy,

<sup>1</sup>Teerthanker Mahaveer University, Moradabad, India

## Abstract

**BACKGROUND:** The aim of the study was to find out the effect of plyometric exercises on muscular endurance and kicking performance of football players.

**METHOD:** 30 recreational football players were chosen for this study (aged 19-26 years old) and randomly assigned into control (N=15) and experiment group (N=15) for six weeks. The experiment group was engaged in supervised plyometric training programmed for 4 weeks for 3 days in a week on alternate days. Subjects in the control group were excluded from plyometric training. The experiment group subjects participated in two tests; 1) Bent Knee sits up test and 2) McDonald Soccer test pre- and post-training.

**RESULTS:** The collected data was analyzed using descriptive statistics and paired t-test as t-value is calculated as 3.2944 for Bent Knee Sit up Test and 7.8474 for McDonald Soccer Test, which is found significant at 0.05 level of confidence. A significant difference is observed in mean values among calculated and tabulated "t-value" of experimental group on Bent Knee Sit Up Test and McDonald Soccer Test of football players via administering the plyometric exercises for 4 weeks.

**CONCLUSION:** The findings of the study conclude those four weeks of plyometric exercise effectively increases muscular endurance and kicking performance in football players. Clinical implications: The current study suggests that plyometric exercise could be a potential tool in improving muscle endurance and kicking performance in college football players. Additionally, sports-specific exercise will be beneficial for coaches and recreational athletes who are willing to improve muscle endurance, kicking performance and lower limb functional performance.

**KEY WORDS:** Plyometric exercises program-muscular endurance test-kicking performance-bent knee sit up test-McDonald soccer test.

## INTRODUCTION

Football is the most popular ball game in the world with large numbers of participants and spectators. Because of its simple principal rules and essential equipment, football sport can be played almost anywhere like official football fields (pitches), gymnastics, school playgrounds, streets, parks, or beaches.<sup>[1]</sup>

Football is a game which calls for strenuous vigorous and continuous thrilling actions. There is still limited scientific information available concerning the physique and performance qualities of elite Indian footballers and therefore appeals to youth world over.

Football involves phases like kicks, passes, dodging runs, fast runs, and cooperation cum co-ordination of each player with others while playing. To become a good player, strength, speed, stamina, skill, and strategy are essential.

In the prevention of football injury, some important aspects concern also about the law of the game, their observance and especially the spirit of fair play - a broader view and the involvement of other target groups would be desirable to make football a healthier game. Plyometric, also known as "Jump Training" or "Plyos", are exercises in which muscles exert maximum force in short intervals of time, with the goal of increasing power (Speed-strength). Dynamic movements and higher forces on the bones and muscles are produced by plyometric exercise. In the past, youth were discouraged from engaging in plyometric training because it was seen to be dangerous, and participation in plyometric programs required a minimum degree of strength.<sup>[2]</sup> Plyometric workouts start with a quick muscular stretch, followed by a quick muscle contraction. The stretch-shortening cycle trains the nervous system to respond to it more quickly.<sup>[2]</sup>

PT exercise for lower limbs includes hopping, drop jumping from a raised box or platform and immediately after an "amortization" period of ground contact. Plyometric exercises consist in three phases, first an eccentric phase in which there is a rapid muscle lengthening movement, a second amortization phase as a short resting period and a last third phase known as concentric phase where athlete engages in an explosive muscle shortening movement. Endurance is defined by the maintenance of working capacity and the degree of resistance of the structure against fatigue and against the influence of unfavorable environmental conditions. Additionally, the pace of recovery after a tiresome activity and competition is also a parameter.<sup>[3]</sup>

The bent knee sits up test is used to increase abdominal strength and it is commonly used for strengthening and testing the rectus abdominal and measuring overall abdominal muscle endurance. Maintaining abdominal muscles endurance in athletes is very important for the core stability and back support required for long durational performance.<sup>[4]</sup> This is the reason why the ability to control the position and motion of the trunk over the pelvic muscle to allow optimum production, transfer and control of force and motion to the terminal segment in integrated athletic activities, and therefore it enhances the sports skill and performance.<sup>[5]</sup>

Plyometrics are primarily used by athletes, especially martial artists, sprinters, and high jumpers, to improve performance, and are used in the fitness field to a much lesser degree. To achieve sporting success, in addition to a good vertical jumping performance and the ability to repeat vertical jumps effectively, football players must also be able to effectively change their direction of movement several times in a short period. Plyometric training consists of such movement activities, which enable efficient changes of direction and multiple jumps.<sup>[6]</sup>

When a footballer kicks or passes the ball, different parts of the foot are used for different purposes like the instep for power, the inside foot for accuracy, the outside of the foot for swerve or disguise.<sup>[7]</sup> McDonald soccer skill test, involves a player kicking a ball against a wall as many times as possible in 30 seconds. This test is designed to measure general soccer ability though mainly trapping and passing skills and is appropriate for most levels.<sup>[8]</sup>

A plyometric compression exercise includes initial and a quick muscle strengthening development trained by a short resting stage called as (amortization stage) at that point an unstable muscle shortening development (called as concentric stage), which empowers muscles to cooperate in doing the specific movements.<sup>[9]</sup>

## METHODS

### Experimental Approach to the Problem

- Study design- Quasi experimental.
- Sampling technique – random cluster sampling
- Sample size – a group of 30 (n=30) recreational football players are to be taken.
- Duration – 4 weeks
- Study setting – SRM university.

## OUTCOME MEASURES

### **BENT KNEE SIT UP TET –**

- The sit-up test is a measure the endurance of the abdominal and hip-flexor muscles. The aim of this test is to perform as many sit-ups as a player can do in one minute. The purpose of bent knee sit-up is to measure the muscular endurance of abdomen.
- Scoring Procedure: The completion of one sit up was coming up to knee and going back down flat on the mat. Only correctly performed sit up were counted.

### **MCDONALD SOCCER TEST-**

- The McDonald Soccer Skill Test involves a player kicking a ball against a wall as many times as possible in 30 seconds. The test is designed to measure general soccer ability and is widely accepted as being appropriate for most levels.
- **Scoring:** The number of kicks in each 30 second period in 4 trials is recorded, with the best 3 highest total added and being the score.

### **Subjects:**

#### Institutional Review Board Statement

The study was conducted in SRM University, according to the guidelines by the departmental Ethical Committee, approved by the HOD of School of Physiotherapy, VELS University, Chennai for Research Ethics Committee. Ethics number-SOPT/VISTAS/IEC/057/2021

#### Informed consent Statement

A written informed consent was obtained from all participants in the study. Appropriate consent has been gained by the SRM University for data collection.

### **INCLUSION CRITERIA**

- ✓ College football players is taken for data sample.
- ✓ All the players in age group of 19-26 years
- ✓ All participants are recreational players.
- ✓ Actively participated in physical activity for at least 3 days / week.

### **EXCLUSION CRITERIA**

- ✓ Females are not included.
- ✓ Any recent injury and pathology were excluded.
- ✓ Any known neurological disorder
- ✓ Professional athletes

### **MATERIALS USED**

- ✓ Inch tape.
- ✓ Stopwatch
- ✓ Paper and pen
- ✓ Stool and chairs.
- ✓ Football

## PROCEDURE

- The participants for the study will be selected based on the inclusion criteria and the informed consent form will be obtained from them.
- All related information from the subject is recorded including the demographic data and athlete's history. Assessment will be done based on outcome measures.
- The total number of participants for this study will be 30 (n=30).
- 30 recreational football players were chosen for this study (age between 19-26 years) and randomly assigned into experimental group (n=15) and control group (n=15)
- To improve the physical fitness of the football players, the subjects of Experimental Group were given 4-weeks of Plyometric exercises, and the Control Group was kept under practices only without giving any specific training.
- This test item was administered on the subjects before administering the Plyometric exercises to obtain the data of pre-test and post-test score by using Bent knee sit up test and MC Donald soccer test.
- Before conducting the test, the method of execution was clearly explained and practically demonstrated to the subjects.
- There was a total of six (6) stations with different activities in Plyometric exercises. Table no.1
- The group performed their respective Plyometric exercises for the period of 4-weeks (28) days, for three (3) days in a week alternatively on Monday, Wednesday, and Friday.

- The exercise programmed was consists of 10 minutes of warming up and cooling down exercises involving jogging, stretching and mobility exercises.
- The Experimental group performed Plyometric exercises in the gym. The subjects performed different exercises for 30 seconds in each station with a 30 second recovery.
- They performed 2 to 3 sets and 4 to 5 repetitions with a 2 to 3 minutes recovery time.

**Table 1. Training program for plyometric training periods (min/motion)**

<u>Weeks</u>	<u>Exercises</u>	<u>Repetition</u>	<u>Set</u>	<u>Volume of contact</u>	<u>Total no. Of contacts</u>
I& II week	Double leg hop Explosive steps up Jumping jacks	4	2	8	48
III & IV week	Jumping squat Lateral jump Running in spot	5	3	15	60

### **Statistical Analyses:**

The statistical analysis was done using SPSS Software version 21. Mean and standard deviation were used as descriptive statistics. To test the effect of plyometric exercise, the collected data from the two groups before and after experimentation on skill performance of football players were statistically analyzed by using t-test. In all the cases the level of confidence is fixed at 0.05 to test the significance.

### **RESULTS:**

#### **Inter-group analysis (between groups): -**

Comparing the effects of treatment on Group-A & B in terms of changes in 1Min Bent knee sit up test. It was observed from the results that p-value of Bent Knee Sit Up test is 0.0013, which shows that the result is significant.

The hypothesis is tested by unpaired sample t-test.

#### **Inter-group analysis (between groups): -**

Comparing the effects of treatment on Group-A & B in terms of changes in MC Donald Soccer Test. In result the p-value is 0.00001, which shows that that inter-group analysis of MC Donald Soccer test is significant.

The hypothesis is tested by unpaired sample t-test.

#### **Inter-group analysis (between groups)**

TABLE 1.1 Shows the mean difference between Group – A & Group – B for 1 Min Bent knee sit up test, which shows Mean difference value of Group A is 2.8 and Group B value is 0.2, also the Standard deviation of Group A is 1.20 and Group B value is 2.80..

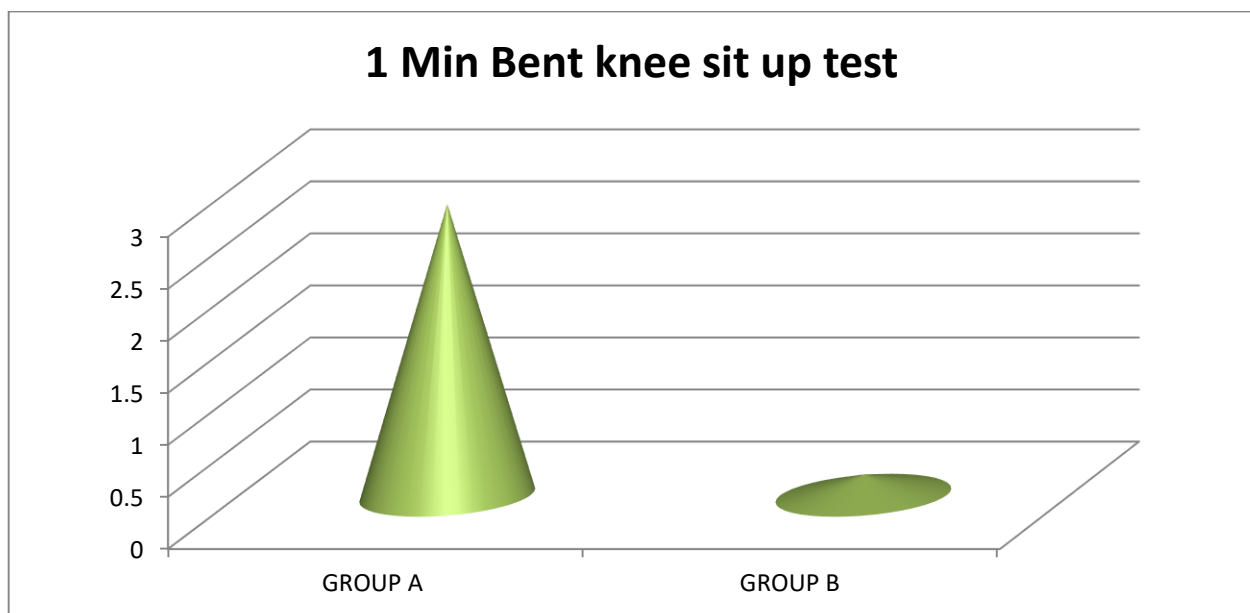
T value is 3.29 and P value is 0.0013, which shows significant result at  $p < 0.05$ .

GRAPH 1.1 shows the mean difference between Group – A & Group – B 1 Min Bent knee sit up test.

**TABLE 1.1 Mean difference between Group – A & Group – B for 1 Min Bent knee sit up test.**

OUT COME MEASURE	MEAN		STANDARD DEVIATION		T VALUE	P VALUE
	Group A	Group B	Group A	Group B		
MC Donald Soccer Test	-8.2	0.466	3.839	1.884	7.8474	0.00001

**GRAPH 1. Mean difference between Group – A & Group – B 1 Min Bent knee sit up test.**

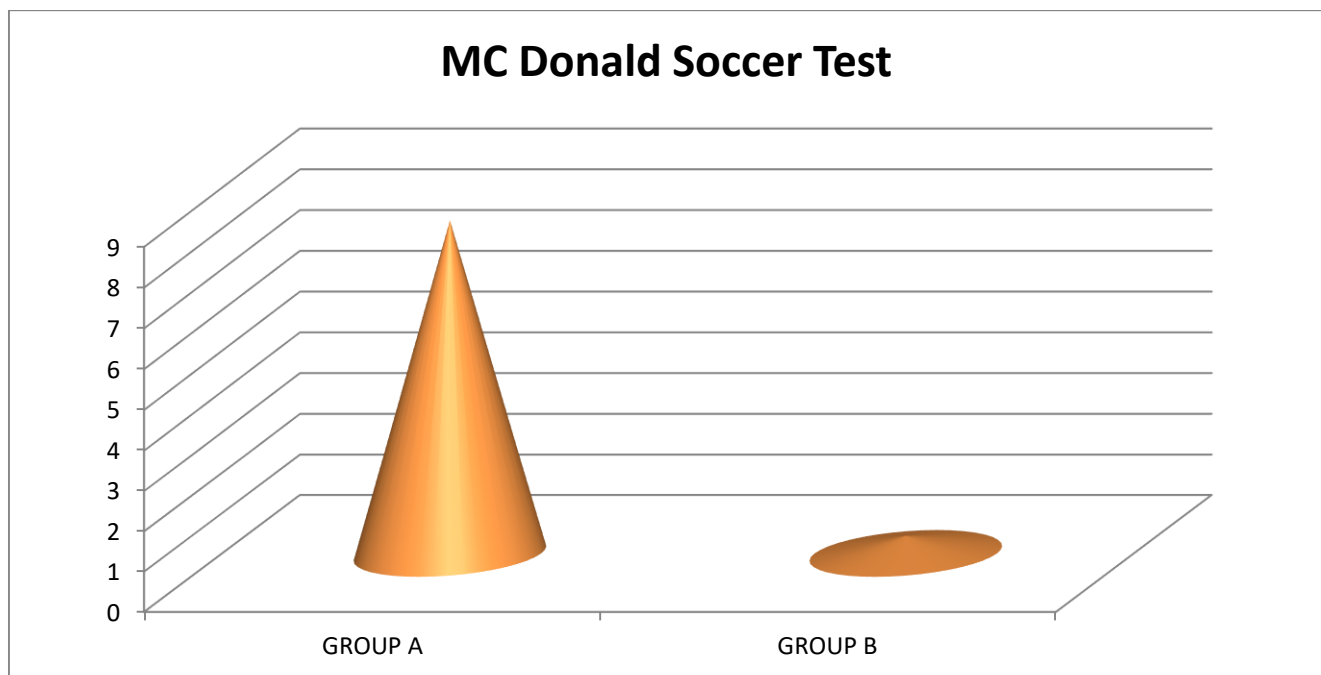


**Inter-group analysis (between groups)**

TABLE 2.1 Shows the mean difference between Group – A & Group – B for in MC Donald Soccer Test, which shows Mean difference value of Group A is 8.2 and Group B value is 0.46, also the Standard deviation of Group A 3.83 is and Group B is 1.88.

T value is 7.84 and P value is 0.00001, which shows significant result at  $p < 0.05$ .

GRAPH 2.1 shows the mean difference between Groups – A & Group – B for MC Donald Soccer Test.

**TABLE 2.1 Mean difference between Group – A & Group – B for in MC Donald Soccer Test.****GRAPH 2.1 Mean difference between Group – A & Group – B for MC Donald Soccer Test**

By the data mentioned above, it is concluded that when plyometric exercises were given for the experimental group, the Post Test values get significantly higher than the control group where the players were kept under practices (via warm up exercises) only without giving any specific exercises.

### DISCUSSION

The present study was designed to investigate the effects of 4 weeks of plyometric exercises on Muscular endurance and kicking performance. When the results were examined, a statistically significant improvement was observed in the experimental groups in terms of Muscular endurance and kicking performance. The results were consistent with (Rimmer, E. et al., 2000, Sandeep, PH., 2017 & Shamsuddin, M.H.B., 2020).

Further, it was confirmed that the experimental group's outcomes on Bent Knee Sit-Ups and McDonald Soccer Test were improved after subjecting to plyometric training. This means that there was a significant effect of plyometric training on players' Bent Knee Sit-Ups and MC Donald Soccer Test. However, the controlled group's Bent Knee Sit-Ups and MC Donald Soccer test did not significantly improve.

Pezzullo DJ et. al. In their study indicate that Plyometric are intense by nature with a lot of loads on joints, tendon and muscles and therefore recommend delaying of addition of PT exercises to a routine of an athlete till appropriate strength and flexibility have been built up with regular cardio, weight training and stretching. So, it's possible to think of plyometric' goal as "to increase the measurement." In testing or competition, sports performance outcomes such as throwing, serving velocity, jump height, or sprint speed are typically measured.<sup>[10]</sup> Evidence for the use of plyometric exercises in the Lower extremities are available regarding enhancement of performance in uninjured subjects and in those with injury or previous injury. Numerous authors have described increased jump height, sprint time reduction, improved running economy and improved joint position sense and postural control because of plyometric training for the lower extremities.<sup>[11]</sup>

By using plyometrics to develop the short stretch cycle, athletes are better able to accelerate their bodies or sports implements and generate greater force at high velocities therefore improving performance (Frank Dick, 2003).<sup>[12]</sup>

According to the results, it can be concluded that this type of exercises is suggested to football players and coaches for improving Bent Knee Sit-Ups and kicking performance and it can be more beneficial and effective only if the training programs are systematic, scientific, and properly planned. The conclusion is consistent with (Slimani, M. et al., 2016, Taheri, E. et al., 2014 & Wang, C.Y. et al., 2016).<sup>[13, 14, 15]</sup>

The results show that there is a statistical improvement in the McDonald soccer test in Group A and not much statistical difference between the pre and post values in control group (Group B). So, it is concluded that Group A (Plyometric exercise) is more effective than Group B (only kept under regular practice) for improving muscular endurance and kicking performance of the recreational football players.

## PRACTICAL IMPLICATIONS

The result of this study might be useful in future to set the abdominal endurance program as well as to rate the endurance level of the recreational players. This value will even be helpful to train the further recreational players to match the global standards.

Thus, Plyometric exercise should be a part of soccer player training programs as is the case in many types of sports. Safety considerations must be considered, including, evaluation of the athlete, ensuring facilities and equipment are safe, establishing sport-specific goals, determining program design variables, and teaching the athlete proper technique and properly promoting the program.

## AUTHOR'S CONTRIBUTION

- STUDY CONCEPTION AND DESIGN: Sonam Nidhi, V.K Jayasheelan
- DATA COLLECTION: Sonam Nidhi
- ANALYSIS AND INTERPRETATION OF RESULTS: Sonam Nidhi
- MANUSCRIPT PREPARATION: Sonam Nidhi, V.K Jayasheelan

## AUTHOR'S DETAILS

[1] Sonam Nidhi, Assistant Professor, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, ORCID id: 0009-0008-0165-3763

[2] VK Jayasheelan, Assistant professor, VELS University, Chennai, Tamil Nadu, ORCID id: 0009-0000-2863-8710

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