



THE EFFECT OF MUSCLE ENERGY TECHNIQUE ON CALF MUSCLE FLEXIBILITY, STRENGTH AND ENDURANCE IN AMATEUR FOOTBALL PLAYERS PLAYING ON DIRT FIELD- ONE GROUP PRETEST AND POSTTEST STUDY

AUTHORS: 1. NAGPAL YOGITA M -POST GRADUATE STUDENT, PES MODERN COLLEGE
OF PHYSIOTHERAPY, PUNE.

2. NAGRALE SANKET - ASSOCIATE PROFESSOR, PES MODERN COLLEGE OF
PHYSIOTHERAPY, PUNE

1. ABSTRACT

1.1 **BACKGROUND:** Football (soccer) matches traditionally take place on natural grass, although different playing surfaces are used including sand, dirt, clay, concrete, asphalt, and hardwood. In dry counties maintaining a natural grass surface is expensive; therefore in this area especially in parts of Asian and Africa most football fields are dirt fields (DFs) (bare earth) and many football players, especially amateur ones, play on DFs in these regions. Most common injured part on dirt field was ankle (28.5%) and on artificial turf was knee (24.3%) Results suggest that the incidence of match football injuries on DF are higher (about two times) than this rate on artificial turf. The calf muscle situated at the posterior side of the Lower limb is composed of the soleus muscle, the medial and lateral heads of the gastrocnemius (composing the triceps surae muscle), and the tibialis posterior. ROM of the ankle joint is related to performance in daily activities and sports. Reduction of ROM dorsiflexion is reflected in a lower efficiency of walking and running and is related to several lower limb disorders, including Achilles tendinitis. The decrease in ROM due to increased muscle stiffness can reduce the ability of the musculotendinous-unit to absorb impact and generate optimal force. Continuing sport performance during this stage of reduced impact absorption may increase the risk of injury. Muscle energy technique (MET) is a procedure that involves voluntary contraction of a patient's muscle in a precisely controlled direction, at varying levels of intensity. It is unique in its application as the client provides the initial

effort while the practitioner facilitates the process. MET is based on the concepts of 63 Autogenic Inhibition and Reciprocal Inhibition. If a sub-maximal contraction of the muscle is followed by stretching of the same muscle it is known as Autogenic Inhibition MET, and if a submaximal contraction of a muscle is followed by stretching of the opposite muscle, then this is known as Reciprocal Inhibition MET. Autogenic and reciprocal inhibition both occur when certain muscles are inhibited from contracting due to the activation of the Golgi tendon organ (GTO) and the muscle spindles. Various benefits of MET include reduction in tone of muscles and improved joint mobility

1.2 AIM AND OBJECTIVES: The aim of the study was to find out the effect of Muscle energy technique on calf muscle flexibility and strength and endurance in amateur football players playing on dirt field at the end of 10 sessions. The objectives of the study were 1. To find out the effect of MET on calf muscles flexibility in amateur football players playing on dirt field using ankle lunge test at the end of 10 sessions. 2. To find out the effect of MET on calf muscles strength and endurance in amateur football players playing on dirt field using standing heel rise test at the end of 10 sessions.

1.3 METHODOLOGY: Ethical clearance was obtained from the institutional ethical committee. Subjects satisfying the study inclusion criteria were enrolled and briefed about the study. Informed consent was obtained from all the subjects. 46 individuals were selected. Pretest measurement was taken, ankle lunge test was performed before heel rise test. Intervention in the form of post isometric relaxation technique to calf muscles was given for 10 consecutive days. Posttest measurement was taken ankle lunge test was done before heel rise test. Data was collected and analyzed.

1.4 RESULTS: There was significant difference ($p < 0.0001$) seen in the pre (12.37 ± 1.311) and post (13.45 ± 1.268) mean of right side and pre (12.4 ± 1.282) and post (13.83 ± 1.525) mean of left side of ankle lunge test Thus muscle energy technique is effective in improving flexibility of calf muscles in amateur football players at the end of 10 days. There was significant difference ($p < 0.0001$) seen in the pre (23.22 ± 5.072) and post (26.41 ± 5.651) mean of right side and pre (22.22 ± 5.696) and post (24.95 ± 4.784) mean of left side of single leg heel rise test. Thus muscle energy technique is effective in improving strength and endurance of calf muscles in amateur football players at the end of 10 days.

1.5 CONCLUSION: Hence, it is concluded that muscle Energy technique is effective in improving calf muscle flexibility, strength and endurance in amateur football players playing on dirt field at the end of 10 days.

1.6 KEYWORDS: Muscle energy technique, Post isometric relaxation, Amateur football players

3. INTRODUCTION: Muscle energy technique (met) is a procedure that involves voluntary contraction of a patient's muscle in a precisely controlled direction, at varying levels of intensity. The benefits of met include:

- Restoring normal tone in hypertonic muscles,
- Strengthening weak muscles,
- Preparing the muscle for subsequent stretching,

- Improved joint mobility.^[1] MET is based on the concepts of autogenic inhibition and reciprocal inhibition.^[2] Post isometric relaxation is a technique that was later developed by Karl Lewitt . Post isometric relaxation (PIR) is the effect of the decrease in muscle tone in a single or group of muscles, after a brief period of submaximal isometric contraction of the same muscle, PIR works on the concept of autogenic inhibition^[2]

Football (soccer) matches traditionally take place on natural grass, although different playing surfaces are used including sand, dirt, clay, concrete, asphalt, and hardwood. In dry counties maintaining a natural grass surface is expensive; therefore in this area especially in parts of Asian and Africa most football fields are dirt fields (DFs) (bare earth) and many football players, especially amateur ones, play on DFs in these regions.^[3] It was found out that ankle is most commonly injured in dirt field players and the reason can be attributed to uneven surfaces, lack of preparation on player's part, or reduced muscle flexibility .^[3] Lack of flexibility and increased muscle stiffness has been primarily offered as an explanation for strain muscle injuries, which are often associated with eccentric overload of the musculotendinous-unit .^[4] Amateur football players playing on dirt field have high risk of ankle injuries due to various factors intrinsic and extrinsic such as uneven surface, lack of preparation, history of previous injuries and reduced flexibility.^[3] In order to prevent these injuries from occurring there is a need for a technique which will help to increase flexibility, strength and endurance of calf muscles that will also lead to better adaptation to uneven surfaces and can also be performed by the players themselves before playing on field^[5]. Muscle energy technique has shown to improve muscle flexibility and performance by its various benefits and mechanisms, hence the need of the study to find out effect of MET in calf muscle flexibility and performance in amateur football players playing on dirt field.

4. METHODOLOGY:

The study was an experimental study conducted in Pune region in India. After receiving approval from Institutional Ethics Committee participants were screened as per inclusion and exclusion criteria as described below. The participants were then assessed for single leg heel rise test and ankle lunge test, post isometric relaxation was given for consecutive 10 days and post intervention assessment was done. Those willing to participate in the study were briefed about the nature of the study in the language best understood by them and written informed consent was obtained. The data collection sheet and flexibility was measured by ankle lunge test and strength and endurance by single leg heel rise test

4.1 SELECTION CRITERIA

Male players who were willing to participate within the age group of 18 to 28 years with a BMI of 18.4 to 24.9 kg/m² playing on dirt field who participated in competitive matches at least 1 to 2 every month scoring less than 14cm on ankle lunge test were selected and professional players or players with any lower limb injury and scoring more than 38 calf raises on heel rise test were excluded. ^[3,6,8,9,10]

4.2. OUTCOME MEASURES

4.2.1. ANKLE LUNGE TEST ^[10,11,12,14,15]

The subject is asked to lunge against the wall while a tape measure is marked from big toe to the vertical straight line of the mark and the distance is measured from the wall to big toe, the heel should be flat on the ground.

4.2.2. HEEL RISE TEST ^[13,15,16,17]

The subject is asked to perform single leg heel rises on a metronome of 60 beats per minute, the heel rises should be straight with knees straight and rising above 5cm from the ground, if on two occasions the subject slows down or is not going above the 5cm mark the test is terminated.

4.3 SAMPLING

Confidence coefficient 80%

$$Z(\alpha/2) = 1.28$$

$$p = 0.285, q = 1 - p = 0.715$$

E = Error 30% of p

$$= 0.3 \times 0.285 = 0.0855$$

$$\text{Sample size} = z^2 pq / E^2 = 1.28^2 \times 0.285 \times 0.715 / 0.0855^2 = 45.67$$

4.4. STATISTICAL ANALYSIS

The data was analyzed with the help of Graphpad Instat (Version 3.06, 32 Bit for Windows) and descriptive analysis was done with the help of Microsoft Excel 2003.

Total 46 students participated in the study. Various statistical measures such as mean, standard deviation (SD) and test of significance were utilized to analyze the data, 95% confidence interval was taken into consideration. The results were concluded to be statistically significant if p value was <0.05 and to be statistically insignificant if p value > 0.05. Data was analyzed using paired t test for the pre and post intragroup analysis.

5. RESULTS

There was significant difference ($p < 0.0001$) seen in the pre (12.37 ± 1.311) and post (13.45 ± 1.268) mean of right side and pre (12.4 ± 1.282) and post (13.83 ± 1.525) mean of left side of ankle lunge test. Thus muscle energy technique is effective in improving flexibility of calf muscles in amateur football players at the end of 10 days.

There was significant difference ($p < 0.0001$) seen in the pre(23.22 ± 5.072) and post(26.41 ± 5.651) mean of right side and pre(22.22 ± 5.696) and post(24.95 ± 4.784) mean of left side of single leg heel rise test. Thus muscle energy technique is effective in improving strength and endurance of calf muscles in amateur football players at the end of 10 days.

5.1 TABLES AND GRAPHS

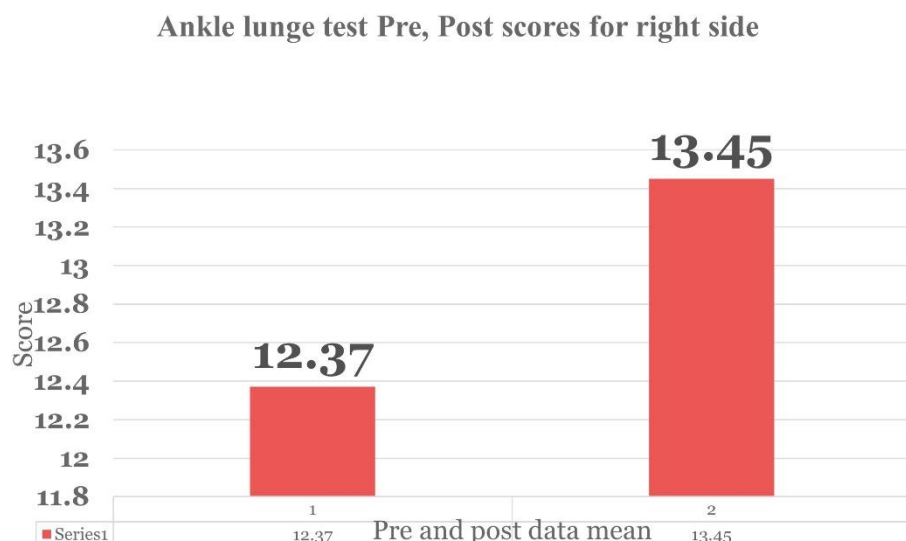
Table 1: Age distribution of subjects

Age	No. of subjects	Percentage(%)
18-19	5	10.86
20-21	3	6.5
22-23	8	17.39
24-25	14	30.43
26-27	12	26.08
28	4	8.69
Total	46	100

Table 2: Comparison of pre and post values of ankle lunge test

Parameters	Pre		Post		Difference		t value	p value	Result
	Mean	SD	Mean	SD	Mean	SD			
Right	12.37	1.311	13.45	1.268	-1.078	0.7183	8.948	<0.0001	Highly significant
Left	12.4	1.282	13.83	1.525	-1.428	0.8583	11.286	<0.0001	Highly significant

Graph 1: Ankle lunge test Pre and Post scores for right leg



Graph 2: Ankle lunge test Pre and Post scores for left leg

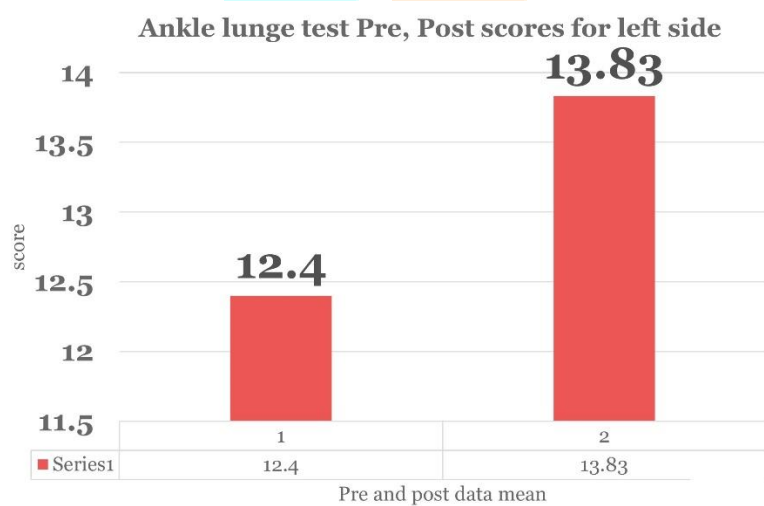
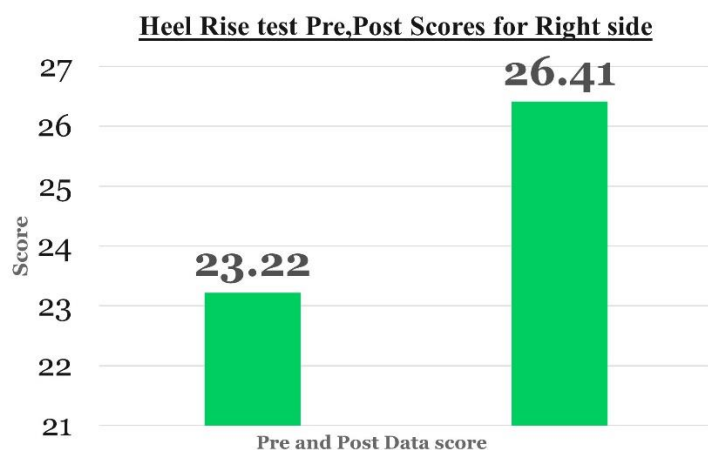


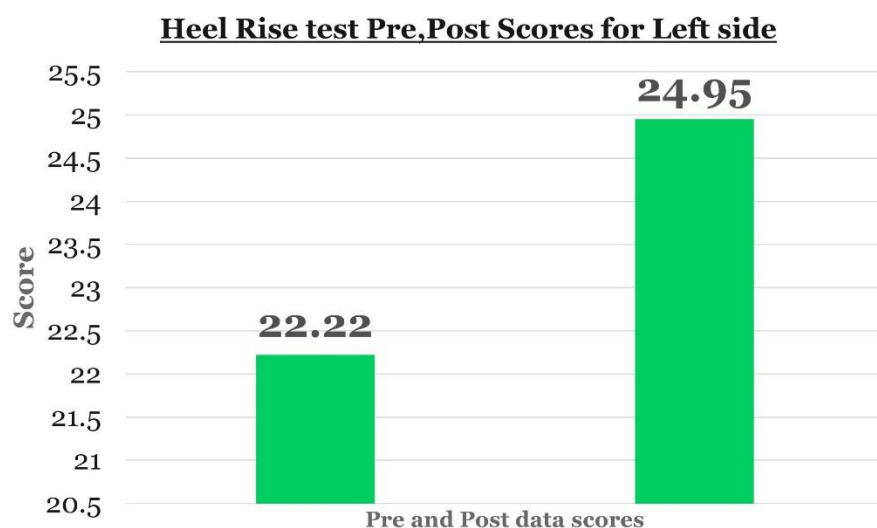
Table 3: Comparison of pre and post values of heel rise test

Parameters	Pre		Post		Difference		t value	p value	Result
	Mean	SD	Mean	SD	Mean	SD			
Heel Rise test									
Right	23.22	5.072	26.41	5.651	-3.196	2.197	9.865	<0.0001	Highly significant
Left	22.22	5.696	24.95	4.784	-2.739	2.38	7.806	<0.0001	Highly significant

Graph 3: Heel rise test Pre and Post scores for right leg



Graph 4: Heel rise test Pre and Post for left leg



6. DISCUSSION

The present study was undertaken with the intention to see the effects of muscle energy technique on flexibility, strength and endurance in amateur football players playing on dirt field after 10 consecutive days of treatment. Based on results from the systematic review, Pérez-Gómez, et. Al, Physical exercises for preventing injuries among adult male football players, football players can lower the incidence of match and training injuries by participating in dynamic warm-up programs that include preventive exercises before games or during training sessions, and by adding strength, balance, and mobility training to the training sessions^[25]

In a study by Kordi et al, comparison of the incidence, nature and cause of injuries sustained on dirt field and artificial turf field by amateur football players, it was concluded that that most common injured part on dirt field was ankle (28.5%) and on artificial turf was knee (24.3%), hence our study also aimed at dirt field players and amateur players as they usually play without any training or coaching and maybe more prone to injuries^[2]

Muscle energy technique (MET) is a procedure that involves voluntary contraction of a patient's muscle in a precisely controlled direction, at varying levels of intensity. The benefits of MET include: Restoring normal tone in hypertonic muscles, strengthening weak muscles, preparing the muscle for subsequent stretching, improved joint mobility. It includes two techniques postisometric relaxation technique and reciprocal inhibition. MET is said to inhibit motor activity via the Golgi tendon organs or the muscle spindles. Postisometric relaxation technique to a reduction of the tone of the muscles. [1,2]

In a study done by Iris Femmigje Lagas et al, the effect of eccentric exercises on improving ankle dorsiflexion range in healthy adolescent soccer players was seen, they found negative results instead of improving they found a decrease in calf flexibility, the test they used was also ankle lunge test, The increased stiffness might be explained by a loss of collagen crimp or increased crosslinking of the tendon fibrils. These mechanistic effects might explain the findings in their study, on the other hand Muscle Energy technique proved to be effective to increase the calf muscle flexibility, strength as well as endurance hence it was helpful in all the parameters of fitness which are required for optimal performance of muscles. [24]

Hence, Muscle Energy Technique is useful and can be used to improve flexibility, strength and endurance of calf muscles in football players as it helps in reducing tone and works on creep and plastic and elastic properties of the muscle.

7. CONCLUSION

Looking at the statistical analysis and results our study concluded that Muscle Energy technique is effective in improving calf muscle flexibility, strength and endurance in amateur football players playing on dirt field at the end of 10 days

8. REFERENCES

1. Roshan Adkitte, Shruti Gajendra Rane, et.al, Effect of muscle energy technique on flexibility of hamstring muscle in Indian national football players, Saudi Journal of Sports Medicine January - April 2016, Volume 16, Issue 1
2. Waxenbaum JA, Scafidi JM, Lu M. Physiology, Muscle Energy. 2020 Jul 6.22.
3. Kordi et al., Comparison of the incidence, nature and cause of injuries sustained on dirt field and artificial turf field by amateur football players, Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:3
4. Aleksandra Kisilewicz et.al, Effect of muscle energy technique on increased calf muscle stiffness after eccentric exercise in athletes, Antropomotoryka. Journal of Kinesiology and Exercise Science JKES 81 (28): 21-29, 2018
5. Adkitte R et al. Effect of muscle energy technique on flexibility of hamstring muscle in Indian national football players. Saudi J Sports Med 2016; 16:28-31.
6. World Health Organization, Body Mass Index- BMI <https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>

7. Hemant Hama et. al. A Study to find the Risk of Knee Injuries in Non-Professional Football Players, Journal of Chalmeda Anand Rao Institute of Medical Sciences , December 2019 Vol 18, Issue 2
8. Kordi et al. Comparison of the incidence, nature and cause of injuries sustained on dirt field and artificial turf field by amateur football players, Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology 2011, 3:3
9. Yash Adhyeet. al. Immediate effect of MET vs Static Stretching on Tendo–Achilles Tightness, April 2018JMSCR Vol 06, Issue 04, Page 373-376.
10. Megan M. Konor et. al. Reliability of three measures of ankle dorsiflexion range of motion, The International Journal of Sports Physical Therapy ,2012, Volume 7, 3, 279- 287
11. Gohil R et al. Normative data for calf muscle flexibility tested by weight bearing lunge test in age group of 20-30 years- pilot study. Int J Health Sci Res.2022;12(2): 71-75.
12. Hemant Hama et. al. A Study to find the Risk of Knee Injuries in Non-Professional Football Players, Journal of Chalmeda Anand Rao Institute of Medical Sciences , December 2019 Vol 18, Issue 2
13. Hébert-Losier et al: Updated reliability and normative values for the standing heel-rise test in healthy adults,2017.03.002
14. Mati Arend et al. Weekly ankle lunge test screening might help prevent ankle injuries, bjsports-2016-09 7372.10
15. Magee.D et al. 2017, Orthopaedic Physical Assessment, sixth edition, Saunders Elseveir, India
16. Amy D. Sman et. al. Design and Reliability of a Novel Heel Rise Test Measuring Device for Plantarflexion Endurance, BioMed Research International, Volume 2014, Article ID 391646, 7 pages
17. Ivan Miguel Pires et. al. Analysis of the Results of Heel-Rise Test with Sensors: A Systematic Review, July 2020, 9, 1154
18. Chaitow.L et al.2006, Muscle energy techniques, third edition, Churchill Livingstone Elseiver, China
19. Lewit K et al. Myofascial pain: relief by post-isometric relaxation. Archives of Physical medicine and rehabilitation. 1984 Aug; 65(8):452-6
20. D.Keshubhai et. al. Effects of muscle energy technique over static stretching on the flexibility of calf muscle in normal individuals - a comparative study, : Journal of Health sciences 2018, 10, 09,203-209
21. M. Prasad Naik et al. Effect of muscle energy technique on flexibility of hamstring and calf muscles and sprinting performance in sprinters, International Journal of Physiotherapy 2015,2(5),718-723
22. Ramesh M et al. Comparison of three different physiotherapeutic interventions in improving hamstring flexibility in individuals with hamstring tightness. Int J Health Sci Res 2014;4:129-34.
23. Sonali Patel et al. 2019, Immediate Effect of Post-Isometric Relaxation V/S Reciprocal Inhibition on Tendoachilles Tightness. Int J Recent Sci Res. 10(02), pp. 30724-30727
24. Holuskova Z et al. Efficacy of Post-Isometric Relaxation Technique on Muscle Tissue and its Viscoelastic Properties after Physical Activity. Praha, Duben; 2012.