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Effect of Barefoot Plyometric Training on Ankle Stability among Male Non-Professional Football Players-An Experimental Study

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Abstract

Background: Ankle injuries are among the most common musculoskeletal issues faced by football players, particularly at the non-professional level. Enhancing ankle stability is essential for performance and injury prevention. Plyometric training is known to improve neuromuscular control, and barefoot training may further engage stabilizing muscles through increased proprioceptive feedback.
Objective: This study aimed to investigate the effect of barefoot plyometric training on ankle stability in male non-professional football players.
Methods: A total of XX male non-professional football players aged between XX and XX years were randomly assigned to two groups: an experimental group that underwent an 8-week barefoot plyometric training program and a control group that followed their usual training routines. Pre- and post-intervention assessments of ankle stability were conducted using standardized balance and functional stability tests.
Results: Participants in the experimental group showed statistically significant improvements in ankle stability scores compared to the control group ($p < 0.05$). Improvements were most notable in dynamic balance and proprioceptive control.
Conclusion: Barefoot plyometric training significantly enhances ankle stability among male non-professional football players. Incorporating such training regimens may reduce the risk of ankle injuries and improve athletic performance.

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Keywords: Barefoot Training, Plyometric Exercise, Ankle Stability, Football Injuries, Proprioception, Dynamic Balance

Introduction

Ankle stability is integral to normal motion and to minimizing the risk of ankle sprain during participation in sport activities. The ability of the dynamic and static stabilizers of the ankle joint to maintain their structural integrity is a major component of the normal gait cycle. In sports, this quality assumes even greater importance given the range of movement and stresses imposed on the ankle during various sporting disciplines.

In the general population, the incidence of ankle sprain is very high. In several studies, injuries to the lateral ankle ligaments have been shown to be the most common sports-related injuries, accounting for approximately 25% of all sports- related injuries. Furthermore, up to 80% of all ankle sprains involve the lateral ligament complex. Aggressive treatment of the sprained ankle is essential to maintain foot and ankle mobility and prevent prolonged disability and subsequent overuse injuries among athletes, both professional and "weekend warriors" alike. Barefoot training has been advocated with the assumption that it will strengthen the musculoskeletal system and thus contribute to enhancement of performance. Although many athletes have trained and completed barefoot over the years [1], there recently has been renewed interest in barefoot running.

Researchers have mostly focused on the kinematic and kinetic differences between shod and barefoot running in distance runners. Apart from showing that barefoot running might be more economical compared to shoe running on a treadmill [2, 3] as well as over ground [4] there currently is a lack of information on the performance benefits of barefoot training. It is thought that barefoot training recruits muscles of the ankle joint as it senses changes in the training surface [5]. It was also shown that muscles of the ankle joint play a different mechanical role during barefoot running than shod running [6].

Nigg stated that it should be beneficial to train the muscles around the ankle joint through barefoot activities and training on unstable surfaces. It is generally accepted that the small muscles are responsible for quick joint stability in responses to changes in position and that they could be trained to increase general stability of the joint [7].

In a study by Emery *et al.* [8], adolescents exposed to wobble board training had a lower incidence of sport-related injuries than the control group. Results from a study investigating whether differences existed in mediolateral ground reactionforces among runners with different degrees of pronation, showed that the barefoot condition resulted in decreased eversion values [9]. This was also found by another study that looked at joint angles in barefoot, minimalist shoe and shod running conditions. Results showed that the barefoot condition landed with a more inverted ankle than the minimalist and the shod ankle [10].

Foot and ankle injuries in the barefoot sports are thankfully rare. In fact, there is some suggestion that barefoot activity actually may be protective from injury. In general, it makes sense to recommend that rehabilitation exercises and activities to decrease injury risk in the barefoot sports also should be done without shoes. Rapid evaluation of these injuries may help participants initiate rehabilitation in a timely fashion and allow for more rapid return to activity.

Plyometrics are training method including explosive-type exercises used by athletes in all of sports [11]. Plyometric exercises consist of two phases; a rapid stretching of a muscle (eccentric action) and a rapid shortening (concentric action) [12]. Plyometric exercises may facilitate peripheral and central neural adaptations that increase joint proprioception and kinaesthetic awareness. Previous studies have been reported that plyometric training was effective in improving muscle strength, vertical jump, speed, and agility in both children and adults [13, 14, 15, 16, 17].

Plyometric training involves explosive concentric contractions of the muscles via the stretch reflex and produce high stress on muscles and bones. Plyometric is an effective training mode for improving muscular power [18, 19, 20], speed [18, 21, 22, 23], agility [23, 24, 25] and strength [18, 19, 21]. Plyometric training involves a series of stretch-shortening cycle (SSC) movements designed to induce the repeated lengthening and shortening of various muscle-tendon complexes, and it also includes various types of body-weight jumping exercises, including drop- jumps, countermovement jumps, squat jumps, leg bouncing, and hopping [26].

Need of study

Football is a game that includes high speed run at full or subnormal speeds, high power projections, sudden changes in ball direction.

Barefoot training has been shown to increase muscle strength and endurance, stability, proprioception and coordination. Foot to ground contact recruits more sensory input from the ground causing the intrinsic muscle to work and make small adjustments ultimately increasing coordination and kinaesthetic sensations and better body awareness which increases stability of foot and ankle joint it will definitely beneficial to the football players to enhance their performance.

Aim

To identify the effect of barefoot plyometric training to improve ankle stability among football players.

Objective

To evaluate the effects of barefoot plyometric training among football players To improve ankle stability among football players.

Review of literature

1. Pi-Yin Huang 1, Amornthep Jankaew 2 and Cheng-Feng Lin 1,2,3, * (2021), conducted a study on Effects of Plyometric and Balance Training on Neuromuscular Control of Recreational Athletes with Functional Ankle Instability. This study aims to investigate the change of joint position sense and neuromuscular activity of the unstable ankle after six-week integrated balance/plyometric training and six-week plyometric training. Thirty recreational athletes with functional ankle instability were allocated into three groups: plyometric group (P) vs. plyometric integrated with balance training group (BP) vs. control group (C). Ankle joint position sense, integrated electromyography (EMG), and balance adjusting time during medial single-leg drop landing tasks were measured before and after the training period. Following the six-week period, both training groups exhibited a lower absolute error in plantar flexion(P group: pre: 3.79◦ ± 1.98◦,post: 2.20◦ ± 1.31◦, p = 0.016; BP group: pre: 4.10◦ ± 1.87◦, post: 2.94◦ ± 1.01◦, p = 0.045), and the integrated group showed a lower absolute error in inversion angles (pre 2.24◦ ± 1.44◦ and post 1.48◦ ± 0.93◦, p = 0.022), and an increased integrated EMG of ankle plantar flexors before landing. The plyometric group exhibited a higher integrated EMG of the tibialis anterior before and after landing (pre: 102.88 ± 20.93, post: 119.29 ± 38.33, p = 0.009 in post-landing) and a shorter adjusting time of the plantar flexor following landing as compared to the pre-training condition (pre: 2.85 ± 1.15 s, post: 1.87 ± 0.97 s, p = 0.006). In conclusion, both programs improved ankle joint position sense and muscle activation of the ankle plantar flexors during single-leg drop landing. The plyometric group showed a reduced adjusting time of the ankle plantar flexor following the impact.

2. **Francesco Fischetti1, Alessio Vilardi, Stefania** CATALDI3, GIANPIERO GRECO4 (2018), conducted a study on Effects of Plyometric Training Program on Speed and Explosive Strength of Lower Limbs in Young Athletes. Plyometric training can improve jumping performance and running velocity in both pubertal and prepubertal populations. It has been shown that jumps of various kinds can also precede the specific session of one's sport, with clear improvements on the various performances of jumping or running. However, it is unclear whether the resulting improvement in explosive performance is because of introduction of a new training regimen or whether it merely reflected the response to an

additional training load. Thus, this randomized controlled trial aimed to examine the effect of a combined plyometric and traditional athletics training on speed and explosive strength of the lower limbs. Participant (22 boys, 13-14 yr) were randomly assigned to an 8-wk experimental group (EG, n = \10) who performed plyometric training or a control group (CG, n = 12) who continued their traditional training. The EG performed twice weekly sessions of plyometrics (15 min.), in addition to their standard training without increasing the total training time (90 min.). At baseline and after training all participants were tested on the 20-m sprint (time) and Squat Jump (power, velocity, force and height). The EG group showed significantly ($p < 0.05$) improvement than CG in the 20-m sprint time (-0.1 vs. 0.1 sec) and Squat Jump (160.8 vs. -31.9 W; 0.3 vs. -0.2 m•s-1; 45.3 vs. -6.3 N; 10.9 vs. -2.2 cm) following training. Eight weeks of plyometric training added to the standard program of athletics was highly likely to improve the lower limbs speed and explosive strength in young athletes. Our findings highlight the potential value of combined training methods in a conditioning program aimed at maximizing power performance in youth.

Tarik OZMEN 1, Mert AYDOGMUS 2 (2017) conducted a study on Effect of plyometric training on jumping performance and agility in adolescent badminton players. Twenty adolescent (age, 12.5 ± 0.2 years) badminton players were randomly divided into two groups as plyometric group (PG) and control group (CG). All participants were tested to assess agility and vertical jump before (pre-test) and after 6-weeks training period (post-test). Agility performance was assessed with Illinois Agility Test. Vertical jump height was measured with squat jump test using a contact mat. The PG performed plyometric training twice a week, for 6 weeks. There was a significant difference between pre and post-test for squat jump test in both PG (26%) ($p = 0.00$) and CG (10%) ($p = 0.016$). However, squat jump height significantly increased in PG compared with CG ($p = 0.024$). The agility significantly improved in PG (6%) ($p = 0.01$), but not CG (2%) ($p = 0.294$). Our results show that a six-week plyometric training improved agility and vertical jump in adolescent badminton players.

Abbas Asadi (2015) conducted astudy on Influence of rest interval between plyometric training sessions on functional performance tests. The purpose of this study was to examine the effects of short-term plyometric depth jump training on sand interposed with 48 hours or 72 hours of rest between training sessions on power type muscular adaptations in recreationally physical active men. Fifteen collegiate physical active men, who were familiar with plyometric exercise, participated in this study and were randomly divided into 2groups: plyometric training with 48 h (PT48, N=7) and 72 h (PT72, N=8) of rest between training sessions. Pre and post training on sand, participants were measured in vertical jump (VJ), standing long jump (SLJ), agility t Test (TT), 20 and 40 m sprints, and one repetition maximum leg press(1RMLP). The plyometric training program on sand was applied during 6 weeks, 2 sessions per week, with 5 sets of 20 repetitions depth jump exercise from 45 cm box height. After completing 6 weeks training period, the PT48 and PT72groups showed significant improvement in all performance tests ($p<0.05$), with statistically significant differences between treatments in TT and 40 m sprint time. With regard to significant differences in TT and 40 m sprint for PT72 compared with PT48 and greater improvements for PT72 in all tests, it can be recommended that coaches, strength and conditioning professionals apply 72 h rest between plyometric training sessions when sand surface was used.

Johanna E. de Villiers and Rachel E. (2014)- Conducted a study on Barefoot Training Improved Ankle Stability and Agility in Netball Players. Twenty healthy women netball players from a university club volunteered to participate in the study. These players represented four teams who competed in the first and second leagues of the region's annual club competition and would be considered players of above average playing ability. Players were excluded from the study if they had an injury at the time of the study, had a lower-limb injury within six months prior to the study, or did not attend at least14 of the 20 training sessions. Players were randomly divided into a control (shod) (mean±standard deviation: age 20.1 ±1.2 years; stature 170 ±6.4 cm; body mass 67.95 ±7.9 kg) or an experimental (barefoot) (mean±standard deviation: age 20±1.9 years; stature 173.8 ±8.4cm; body mass 68.8 ±5.7 kg) group. All participants were fully informed about the nature and potential risks of the study. Participants gave written informed consent prior to the start of the study. Approval for the study was provided by the Institutional Research Ethic Committee.

Kara Vormittag, Ronald Calonje, and William W. Briner Lutheran General Hospital, Park Ridge, IL (2009) - Conducted study on Foot and Ankle Injuries in the Barefoot Sports. Playing sports barefoot has been contested since the very beginnings of athletic competition. Even today, some data suggest that shoes may limit the adaptive pronation that occurs after foot strike during running gait. This pronation likely protects runners from injury. Board sport participants who perform their sports barefoot on the water seem to be at risk for foot and ankle injuries. The high-impact forces in gymnastics place participants at risk for foot and ankle injuries, as well. Swimming and diving have a low rate of foot and ankle injuries. The risk of ankle sprain in beach volleyball, which is played barefoot, seems to be lower than that for indoor volleyball, played wearing shoes. Martial arts place competitors at risk for injuries to the foot and ankle from torsional and impact mechanisms. Athletes who hope to return to barefoot competition after injury should perform their rehabilitation in their bare feet.

Methodology

Study design: Experimental Study.
Study population: Football players (18 to 25 yrs).
Sampling technique: Convenient sampling.
Sample size: 30

$$n = \frac{Z1^2 S^2}{d^2}$$

M	Your guess of Population M	
S	Standard deviation of M	0.11
1-α	Set level of confidence (value < 1.0)	0.95
Z1	Z value associated with confidence	1.96
d	Absolute precision	0.04
n	Minimum sample size	30

Study duration: 6 months.
Place of study: Football Academy Jalgaon.

Materials

- Measuring Tape or Ruler.
- Non – Slip Floor Surface.
- Masking Tape or Athletic Tape.
- Notebook or Scoring Sheet.
- Assistant or Evaluator.
- Stopwatch.

Outcome Measures

Star Excursion Balance Test: It is a dynamic balance assessment that evaluates a person's ability to maintain balance while reaching in different directions with one leg while standing on the other.
How it's done:

- **Setup:** A grid with eight lines extending from a center point is placed on the floor.
- **Positioning:** The participant stands in the centre of the grid on one leg.
- **Reaching:** With the opposite leg, they reach as far as possible along one of the eight lines, while maintaining balance on the stance leg.

Measurements: The reach distance is measured and compared to a baseline (like leg length).

Selection Criteria
Inclusion criteria

- Male non- professional football players who play at the amateur, college or recreational level.
- Age- 18 to 25 years.
- Physically active and medically cleared for moderate to high-intensity exercise.
- Willing to follow the training protocol and attend regular sessions during the study period.

Exclusion criteria

1. Subjects with acute lower limb injuries in the past 6 months.
2. Subjects having any neurological condition affecting balance, proprioception or motor control.
3. Subjects already engaged in plyometric or balance training programs during the study period.

Procedure

To conduct the following study, approval will be taken from Institutional Ethical Committee (IEC) of Dr. Ulhas Patil Collage of Physiotherapy, Jalgaon.

Subjects were screened according to the inclusion and exclusion criteria.

Prior to starting the study, the procedure was explained.

Consent form will be taken from the subjects.

Subject have to perform pre-test and post-test

Participants were pre-tested the day before the first training session of the intervention programmer. Post-testing was performed four weeks after pre- testing.

Participants did not take part in any exercise either the day before, or the day of testing. The same test administrators conducted the assessments on both occasions. All tests were conducted on the same day on non-slip football courts.

The stability test was performed barefoot.

Test was done at the same time of day for the pre- and post-testing.

Exercise sessions focused on plyometrics and were performed on a firm grass surface next to the football courts.

The intervention programme consisted of two or three sessions per week, varying between 30 and 45 minutes per session.

Participants had to refrain from any other physical training for the duration of the study, except for their normal football training sessions.

Table 1: Pre-Testing & Post- Testing: Plyometrics Exercise

Week	Exercise	Repetition
Week 1	Forward – backward run Box Jump	6 reps x 2 Set
Week 2	Tuck Jump Box Jump Jump Squat exercise	6 reps x 3 Set
Week 3	Tuck Jump Box Jump Split Squat Jump Squat	10 reps x 2 Set
Week 4	Tuck Jump Box Jump Split Squat Jump Squat	10 reps x 3 Set

WEEK 1

1. Forward – Backward run
- How to perform: Player runs 5 meters forward, then 5 meters backward, maintaining posture and foot control.
- Repetitions: 6 reps x 2 sets

2. Box Jump
- How to perform:
- Stand in front of a sturdy box or platform.
- Jump explosively onto the box using both legs, land softly with knees slightly bent.
- Step down safely and repeat.
- Repetitions:6 reps x 2 sets WEEK 2

Tuck Jump

1. How to perform:
- Jump vertically while tucking knees toward the chest mid-air.
- Land with soft knees to minimize joint stress.
- Repetitions: 6reps x 3 sets

2. Jump Squat Exercise
- How to perform:
- Start in a squat position, then jump vertically.
- Land softly and immediately return to a squat position.
- Repetitions: 6 reps x 3 sets WEEK 3

1. Tuck Jump

(As described above)

3. **Box Jump (Same as above)**
- Increased Load:
- Repetitions increased to 10 reps x 2 sets to enhance endurance and control.

Week 4

1. Split Squat
- How to perform:
- One leg forward, one leg back (lunge position).
- Lower your body until both knees are at 90 degrees.
- Push up through the front heel to return to start.
- Repetitions: 10 reps x 3 set

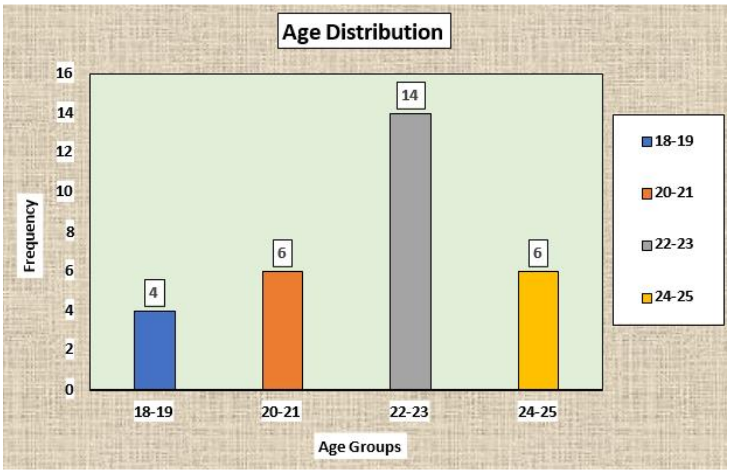
2. Jump Squat
- How to perform:
- Start in a squat position
- Explode upward into a jump.
- Land softly and immediately drop into the next squat.
- Repetitions: 10 reps x 3 set

JUMP SQUAT

SPLIT SQUAT

3. In this study, Star Excursion Balance test is used.
4. Initially, all the demographic data will be taken from the subject.
5. Data will be collected, managed and statistically analysed.

Statistical analysis
- The patient data and test result of subjects was entered in MS Excel sheet before it was statistically analysed.
- A total 30 male participants were included in this study.
- The data obtained from the participants was statistically analysed.
- Mean and standard deviations were calculated for all the needed variables.



Results

Table 1: Age wise distribution of study subjects.

Sr. No.	Variable	Groups	Frequency	Percentage
1	Age (in years)	18-19	4	13.33
		20-21	6	20.00
		22-23	14	46.67
		24-25	6	20.00

COMMENT – Total 30 subjects are included in this study.13.33% subjects are between the age of 18- 19 years, 20% subjects are between the age of 20 -21 years, 46.67% subjects are between the age of 22-23 years and 20% subjects are between the age of 24-25 years.

	Mean	SD	Min	Max
Age	21.86	1.92	18	25

Table 2: Showing Comparison of overall stability.

	Side	Test	Mean	S.D.	t value	P value
Overall Stability	Left	PRE	4.22	0.78	21.21	0.000
		POST	7.86	0.55		
	Right	PRE	4.21	0.80	25.12	0.000
		POST	7.82	0.46		

Left	The comparisons of average overall stability scores of pre and posttest was done by paired t test. The pretest average score was 4.22 with standard deviation of 0.78. The posttest average score was 7.86 with standard deviation of 0.55. The test statistics value of paired t test was 21.21 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

Right	The comparisons of average overall stability scores of pre and posttest was done by paired t test. The pretest average score was 4.21 with standard deviation of 0.80. The posttest average score was 7.82 with standard deviation of 0.46. The test statistics value of paired t test was 25.12 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

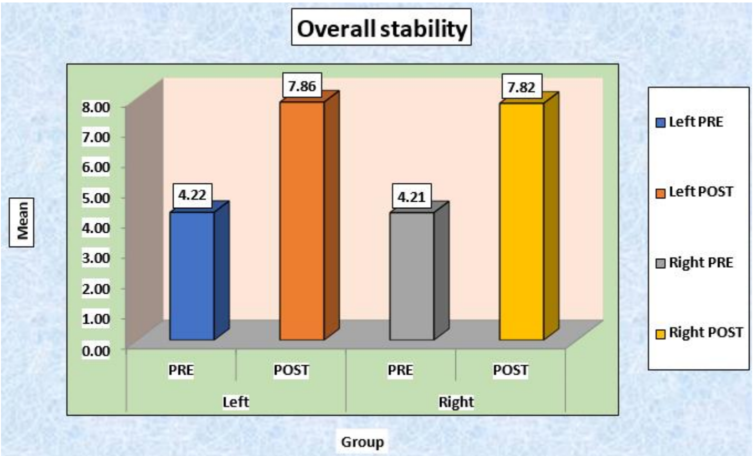


Table 3: Showing Comparison of anterior stability

	Side	Test	Mean	S.D.	t value	P value
Overall Stability	Left	PRE	4.17	0.74	19.04	0.000
		POST	7.88	0.55		
	Right	PRE	4.19	0.83	24.48	0.000
		POST	7.76	0.53		

Left	The comparisons of average anterior stability scores of pre and posttest was done by paired t test. The pretest average score was 4.17 with standard deviation of 0.74. The posttest average score was 7.88 with standard deviation of 0.55. The test statistics value of paired t test was 19.04 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

Right	The comparisons of average anterior stability scores of pre and posttest was done by paired t test. The pretest average score was 4.19 with standard deviation of 0.83. The posttest average score was 7.76 with standard deviation of 0.53. The test statistics value of paired t test was 24.48 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

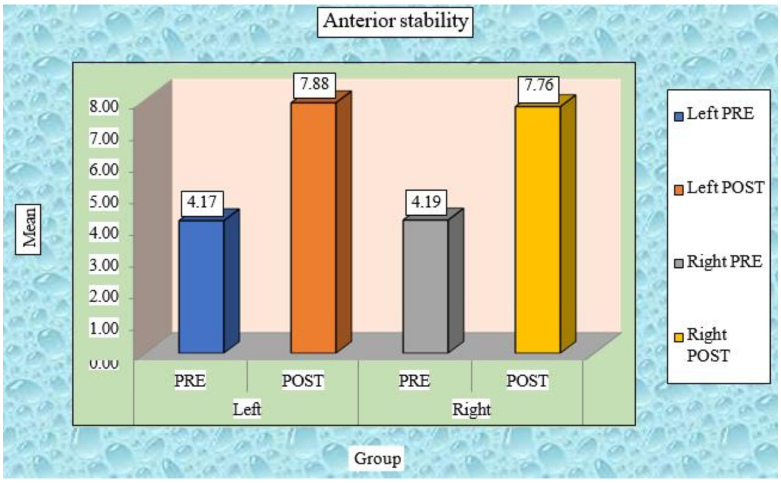


Table 4: Showing Comparison of posterior stability

	Side	Test	Mean	S.D.	t value	P value
Overall Stability	Left	PRE	4.48	0.92	17.65	0.000
		POST	7.87	0.46		
	Right	PRE	4.37	0.62	26.58	0.000
		POST	7.91	0.54		

Left	The comparisons of average Posterior stability scores of pre and posttest was done by paired t test. The pretest average score was 4.48 with standard deviation of 0.92. The posttest average score was 7.87 with standard deviation of 0.46. The test statistics value of paired t test was 17.65 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

Right	The comparisons of average Posterior stability scores of pre and posttest was done by paired t test. The pretest average score was 4.37 with standard deviation of 0.62. The posttest average score was 7.91 with standard deviation of 0.54. The test statistics value of paired t test was 26.58 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

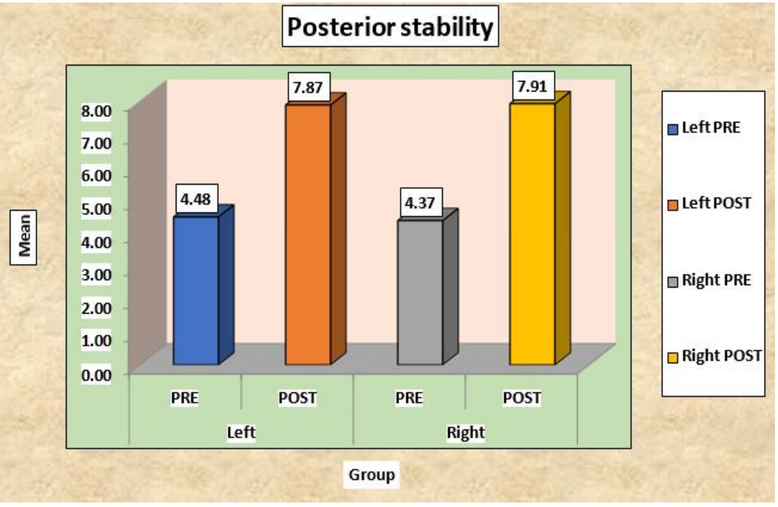


Table 5: Showing Comparison of medial stability.

	Side	Test	Mean	S.D.	t value	P value
Overall Stability	Left	PRE	4.46	0.79	18.23	0.000
		POST	7.95	0.52		
	Right	PRE	4.63	0.91	16.09	0.000
		POST	7.86	0.59		

Left	The comparisons of average Medial stability scores of pre and posttest was done by paired t test. The pretest average score was 4.46 with standard deviation of 0.79. The posttest average score was 7.95 with standard deviation of 0.52. The test statistics value of paired t test was 18.23 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

Right	The comparisons of average Medial stability scores of pre and posttest was done by paired t test. The pretest average score was 4.63 with standard deviation of 0.91. The posttest average score was 7.86 with standard deviation of 0.59. The test statistics value of paired t test was 16.09 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

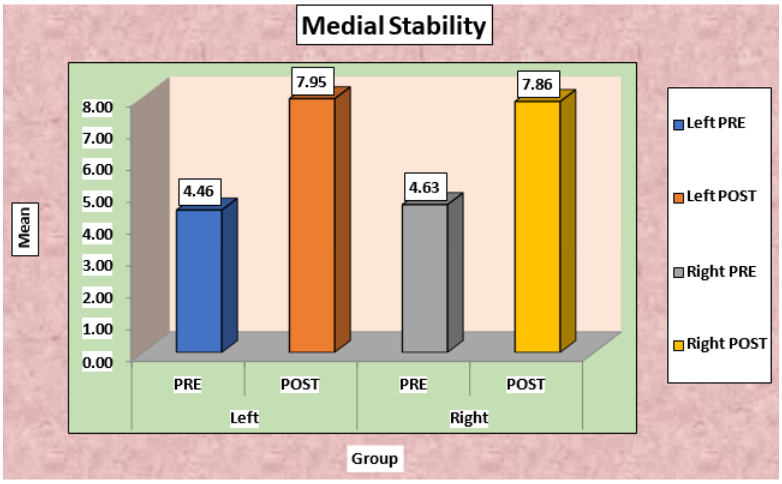
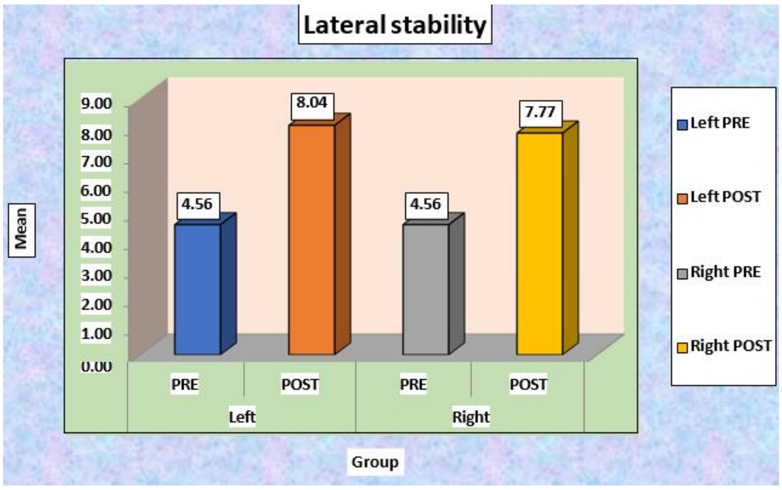


Table 6: Showing Comparison of over lateral stability.

	Side	Test	Mean	S.D.	t value	P value
Overall Stability	Left	PRE	4.56	0.90	15.98	0.000
		POST	8.04	0.53		
	Right	PRE	4.56	0.79	15.68	0.000
		POST	7.77	0.49		

Left	The comparisons of average Lateral stability scores of pre and posttest was done by paired t test. The pretest average score was 4.56 with standard deviation of 0.90. The posttest average score was 8.04 with standard deviation of 0.53. The test statistics value of paired t test was 15.98 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.

Right	The comparisons of average Lateral stability scores of pre and posttest was done by paired t test. The pretest average score was 4.56 with standard deviation of 0.79. The posttest average score was 7.77 with standard deviation of 0.49. The test statistics value of paired t test was 15.68 with p value 0.00. The p value less than 0.05, concludes that there is significant difference overall stability at the time of pre and posttest.



Discussion

According to statistical analysis there is significant improvement in ankle stability among Male non-professional football players.

The findings highlight the practical relevance of bare foot plyometric training in field base sports like football. Given its simplicity and lack of equipment requirement it can be easily incorporated into regular training sessions to enhance functional performance in prevent injuries. This is particularly beneficial for non- professional players to may not access to advanced rehabilitation or conditioning programs.

Ankle stability is integral to normal motion and to minimizing the risk of ankle sprain during participation in sport activities.

Football players rely heavily on ankle stability for agility, balance and injury prevention. Barefoot plyometric training is believed to enhance neuromuscular control, proprioception, and foot strength, which are essential for ankle stability. Barefoot training increases sensory input, improving the brain's ability to control ankle positioning.

Football involves constant sprinting, jumping, cutting, and lateral movements. Weak ankle stability can lead to injuries like sprains, or chronic ankle instability. Strengthening the ankle through barefoot plyometrics prepares players for these demands, improving performance and longevity in the sport.

Barefoot conditions place greater demand on the foots intrinsic musculature which is often underutilized when wearing traditional athletic footwear. Strengthening these small stabilizing muscles likely contributed to the improved joint control and reach distances demonstrated in this study. Additionally training without footwear challenges the central nervous system to process somatosensory input more efficiency thereby enhancing balance and movement precision.

Barefoot training has been advocated with the assumption that it will strengthen the musculoskeletal system and thus contribute to enhancement of performance. Although many athletes have trained and completed barefoot over the years1, there recently has been renewed interest in barefoot running. Plyometrics are training method including explosive-type exercises used by athletes in all of sports. Plyometric exercises may facilitate peripheral and central neural adaptations that increase joint proprioception and kinaesthetic awareness. One of the suggested benefits of barefoot running is an increase in proprioceptive ability[27]. It is possible that the barefoot training intervention could have improved proprioceptive abilities of the players.

In a study to determine the effect of neuromuscular training on stability, Paterno *et al.* [28] incorporated balance training, hip/pelvis/trunk strengthening, plyometric, dynamic movement training, and resistance training into their intervention programme.

Divert *et al.* [29] and a higher pre-activation of the plantar flexor muscles when running barefoot, which could increase strength of these muscle groups.

Improved ankle stability as a result of barefoot training in our study could have implications for injury prevention in football players. It has been reported that plyometric training affects the muscle activation level in healthy athletes.[30]

Conclusion

The results support the effectiveness of barefoot plyometric training in improving ankle stability among football players. These findings suggest that incorporating such training into regular conditioning programs could help reduce injury rates and improve on field performance.

FUTURE SCOPE

- Include larger and more diverse sample groups.

- Conduct long-term studies to track stability retention and injury prevention.
- Compare barefoot training with other ankle strengthening interventions.

Clinical implication
Improved ankle stability through barefoot plyometric training can reduce the risk of ankle sprains and recurrent injuries, which are common in football.

Limitation
- Comparing barefoot training with other ankle stability interventions (e.g., balance training, resistance exercises) would provide deeper insights into effectiveness.
- Barefoot plyometric training may increase stress on the foot and ankle, particularly for athletes who are not familiar to training without shoes.
- This study may not have accounted for injury risks or potential negative effects (e.g., increased soreness, stressed fractures)

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Declaration
I hereby declare that the project entitled “effect of barefoot plyometric traning on ankle stability among male non-professional football players- an experimental study” will be performed by me under the guidance and suggestion received from Dr. ANURAG MEHTA, Associate Professor, Dr. Ulhas Patil college of Physiotherapy, Jalgaon to the best of my knowledge. This will not be submitted in part or whole anywhere in any institution as project report.

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