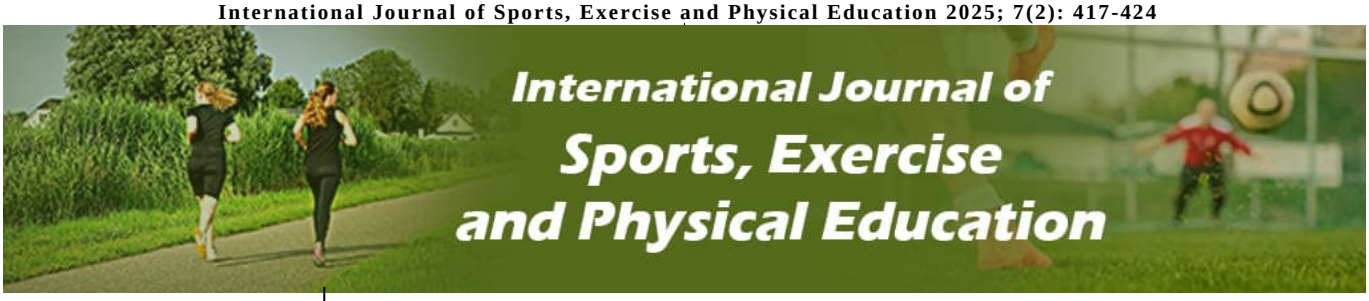

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Effect of balance training along with strengthening exercises on pain and functional performance among cricket bowlers with ankle instability

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Abstract
Background: Cricket is most popular game in the world. It is a bat and ball game played in teams. In cricket, Bowlers has more prone to ankle injuries. Ankle instability is lead to weakness, discomfort and difficulty with balance or mobility among cricket bowlers.
Objectives: The study is to find out the title effect of balance training along with strengthening exercise on pain and functional performance among cricket bowlers with ankle instability.
Methods: The study was a single group pre and posttest experimental study design. The balance training along with Strengthening exercise was given to 20 cricket bowlers with only male at age of 18-25years based on inclusion and exclusion criteria. The treatment duration was 4 weeks.
Result: The result showed that there is a significant difference in both Numerical Pain Rating Scale mean value is (pretest -7.17 & posttest-5.13) and Foot and Ankle Ability Measure mean value is (pretest- 52.5 & posttest -56.2).
Conclusion: The study concluded that the balance training and strengthening exercise both interventions to reduce the pain and increase the functional ability of the bowlers with ankle instability.

Keywords: Ankle instability, balance training, strengthening exercise, numerical pain rating scale, foot and ankle ability measure

1. Introduction
Cricket is most popular game in the world. It is a bat and ball game played in teams. Cricket is considered as non-contact low injury risk sport compared to other sports. It is a multidimensional sport in which participants perform a wide range of activities such as batting, bowling, fielding, and wicket keeping. [1]Cricket involves an intricate combination of abilities, tactics, and physical conditioning. The nature of cricket injuries among community players is not fully comprehended. [2] In cricket, most injuries tend to be noncontact injuries and have typically been regarded as “overuse” injuries [3]. The ankle joint is important during ambulation because it adapts to the surface on which one walks. The movements that occur at the ankle joint plantar flexion, dorsiflexion, inversion and eversion. The muscles of the leg divide into anterior, posterior and lateral compartments [4]. The ankle joint primarily maintains stability through the lateral ligamentous complex and the medial collateral ligament (MCL). The lateral collateral ligament consists of three components: The posterior talofibular ligament (PTFL), the anterior talofibular ligament (ATFL), and the calcaneofibular ligament (CFL). The ATFL and CFL play critical roles in providing stability to the lateral aspect of the ankle. [5] The various terms employed to characterize the occurrence of recurring ankle sprains have resulted in lateral ankle instability. Lateral ankle instability denotes the condition of an ankle being unstable due to lateral ankle sprains. [6]The ankle joint complex is comprised of the lower leg and the foot and forms the kinetic linkage allowing the lower limb to interact with the ground, a key requirement for gait and other activities of daily living. The ankle joint complex is made up of the talocalcaneal, tibiotalar and talocalcaneonavicular joint [7]. Ankle power fluctuates depending on whether the primary muscles influencing the ankle joint complex are absorbing or producing power while walking. The negative values indicate power absorption resulting from the eccentric contraction of the plantar flexors during the heel and ankle rocker phases. The joint-surface

orientation at the proximal tibiofibular syndesmosis is responsible for the three lateral rotations that the latter authors observed in one case during forceful dorsiflexion of the ankle. Both the knee's location and the collateral ankle ligament's tension affected the fibula's lateral rotation. [8] [9] The ankle joint complex's anatomy establishes that the biomechanics involve many axial motions taking place at the same time to support human walking, rather than merely being a basic hinge joint. Ankle biomechanics can be affected by basic variables like age and gender, and conditions like arthritis can affect ankle power and range of motion. Ankle biomechanical function is greatly impacted by surgical therapy for end-stage degeneration, which also has a noticeable effect on the surrounding joints. [10]The lateral collateral ligament complex (LCL) is composed of the anterior talofibular ligament, the calcaneofibular ligament, and the posterior talofibular ligament. The medial collateral ligaments (MCL), commonly referred to as the deltoid ligament, represent a multifascicular assembly of ligaments that can be broadly categorized into superficial and deep fiber groups. [11]Lateral ankle instability presents a multifaceted challenge that can sometimes make evaluation and treatment difficult for primary care physicians. This challenge arises partly because the ankle complex consists of three joints: the talocrural, subtalar, and tibiofibular syndesmosis. [12] Chronic lateral ankle instability encompasses a range of conditions that vary from functional instability to mechanical instability. Functional instability is characterized by symptoms of the ankle giving way, despite the absence of clinical or radiographic evidence of laxity. In contrast, mechanical instability pertains to patients who exhibit clear signs of ligamentous laxity.[13] Chronic ankle instability refers to a condition characterized by both mechanical and functional instability, accompanied by lingering symptoms from previous ankle sprains, such as pain, swelling, weakness, instability, and recurrent episodes of "giving way." These persistent symptoms can hinder the physical activity of younger patients, potentially detrimentally impacting their overall health and quality of life, contributing to issues such as obesity and other health-related concerns. While reductions in physical activity have been observed in adults, the implications for physical activity levels among adolescents remain unclear. [14]Ankle instability (AI) commonly arises as a result of lateral ankle sprains, with estimates suggesting that around 40% of individuals who experience an initial ankle sprain will go on to develop persistent ankle dysfunction. [15]Ankle sprains are recognized as one of the most frequently occurring recurrent injuries. Approximately 20% of individuals who experience an acute ankle sprain go on to develop Ankle instability. The inadequacy of functional rehabilitation following an acute ankle sprain contributes to the onset of Ankle instability. [16]Balance training (BT) is characterized as a systematic approach designed to enhance postural control. This form of training has been implemented across diverse age groups and patient populations to improve a range of neuromuscular functions, such as balance proficiency and both maximal and explosive force generation, particularly in the context of sports injury rehabilitation. [17] Proprioception is a type of somatosensory input that includes both kinesthesia and joint position sense (JPS). The perception of joint position arises from sensory signals transmitted to the central nervous system, which are influenced by muscle spindles, cutaneous receptors, capsular and articular receptors, as well as ligamentous receptors in reaction to various stimuli.[18] Performing exercise bilaterally is thought to be important for the prevention of ligamentous injuries at the ankle. The exercise like calf rise helps to improve lower body strength and mobility and improve the muscle strength, single leg stance strengthen the muscles around the ankle. [19]Ankle strength training plays crucial role in improving stability, and preventing injuries, and enhancing overall lower limb function. Ankle joint is essential for balance mobility and weight bearing activities. [20] There are numerous scales used to measure the pain like VAS, NPRS. verbal rating scale, McGill.In this study I have used to assess and evaluate the pain by NPRS.The NPRS can be administered verbally or graphically for self-completion. As mentioned above, the respondent is asked to indicate the numeric value on the segmented scale that best describes their pain intensity. [21]The numerous scale used to measure the ankle instability like Cumberland ankle instability tool (CAIT), functional assessment (IdFAI) and the global ration of change (GRC). In this study I have used to assess and evaluate the ankle instability by Foot ankle ability measure (FAAM).The FAAM has 29 items, scored between 0 and 4, divided into two subscales: activities of daily living (21 items) and sports (8 items). For score analysis, the percentage of each subscale is used separately. FAOS consists of 42 items, with scores between 0 and 4, subdivided into 5 subscales: pain (9 items), other symptoms, activities of daily living, sports and recreations (5 items), and quality of life related to ankle and foot. [22]

2. Methodology

A Total of 20 cricket Bowlers with ankle instability subjects were taken According to inclusion and exclusion criteria. The participants were explained about treatment safety and simplicity of the procedure and written consent was obtained. Initial two weeks pulsed ultrasound at 3MHZ is used to treat pain. The single group received balance training along with strengthening exercises. The total study duration was 6 months, Treatment duration was 4 weeks, 5 days per week, 2 sets / day, for 30 minutes / session.

Inclusion Criteria

- Only male cricket bowlers
- Age group 18-25 years
- NPRS Score between 5-10
- FAAM score between 30-70%
- Sports person with the ankle sprain grade 2 and 3 (Confirmed by Orthopaedician)
- Subjects willing to participate in study

Exclusion Criteria

- Recent lower extremity fractures-like Tibia fracture, fibula fracture
- Previous ankle injury
- Neurological impairment like (foot drop)
- History of Diabetes

Exercise Procedure

Balance training exercises

- Single leg stance (open and closed eyes)
- Single leg stance with the movement
- Arm out on hard surface.
- Arm across the chest.

- Single leg step down
- Tandem standing
- Heel and toe walking

Strengthening exercises

- Inversion isometric exercise
- Eversion isometric exercise
- Flexion isotonic exercise
- Inversion isotonic exercise
- Eversion isotonic exercise
- Calf raise
- Towel curl

Balance Training Exercise

Fig1: Tandem Walking

Fig 2: Toe Standing

Fig 3: Heel Standing

Fig 4: Single Leg Stance

Fig 5: Single Stance Arm out

Fig 6: Single Leg Stance across the Chest

Strengthening Exercise

Fig 1: Inversion Isometric

Fig 2: Eversion Isometric

Fig 3: Isotonic Inversion

Fig 4: Isotonic Eversion

Fig 5: Towel Curls

Fig 6: Heel Raise

Fig 7: Flexion Isotonic

3. Results: A total of 20 cricket Bowers with ankle instability were included for the study. Table 1 demonstrates the demographic data of the study sample. Comparison of Pre test and post-test scores of NPRS and FAAM of both groups is shown in Tables 2 and 3 respectively and in Figures 8 and 9.

Table 1: Demographic Data

Age	Participants	Percentage
18 - 22	10	50%
22 - 25	10	50%

Table 2: Pre and post test scores of NPRS

S. No	Groups	Mean	Mean difference	Standard deviation	Paired 'T' value
1	Pre test	6.40	2.75	1.05	14.45
2	Post test	3.65		0.99	

Table 3: Pre and post test scores of Foot and Ankle Ability

S. No	Groups	Mean	Mean difference	Standard deviation	Paired 'T' value
1	Pre test	52.5	3.7	11.25	23.97
2	Post test	56.2		11.62	

Graph 1 (Pre Test and Post Test Scores of NPRS)

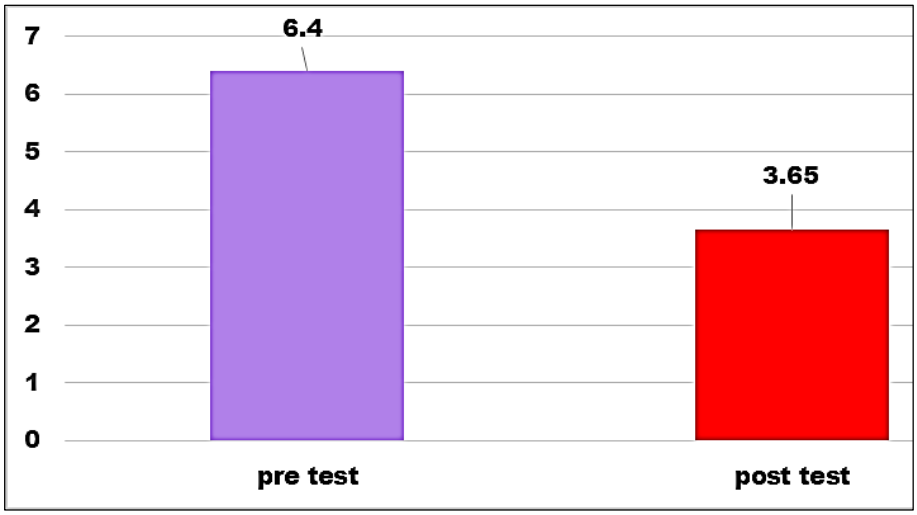

Fig 8: Pre Test and Post Test Scores of NPRS

Graph 2 (Pre Test and Post Test Scores for FAAM)

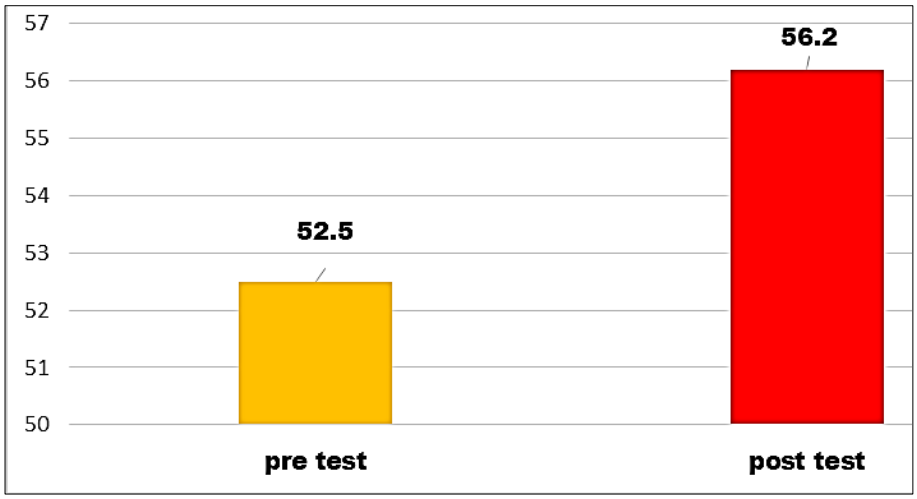

Fig 9: Pre Test and Post Test Scores for FAAM

4. Discussion

The objective of the study was to examine Effect of balance training along with strengthening exercise on pain and functional performance among cricket bowlers with ankle instability. A Total of 20 cricket bowlers with ankle instability in the age group of 18-25 years participated in the study, The participants who satisfied the selection criteria were conveniently assigned into Group I. Pretest Measurements were taken at baseline using Numerical pain rating scale and Foot and ankle ability measure. bowlers with ankle instability received Balance training exercises and strengthening exercises for the 4 weeks. At the end of 4 weeks the participants again underwent the post test evaluations using the outcome measures mentioned above.Ankle instability is a common issue among bowlers particularly in sports like cricket, where repeated and high-impact activities (such as bowling) place considerable stress on the ankle joint. This study aims to examine the combined effects of balance training and strengthening exercises on improving pain and functional performance in cricket bowlers with ankle instability. [18]. The rationale behind this balance training is that addressing both the neuromuscular control and muscle strength could have synergistic effects, improving overall stability, reducing pain, and enhancing performance.[20] Balance exercises are designed to enhance the body's proprioception (awareness of the body's position in space), which is critical for controlling joint movement and maintaining stability, especially when the ankle joint is under stress. In cricket bowlers with ankle instability, balance training Strengthening the muscles around the ankle joint (especially the peroneal, gastrocnemius, tibialis anterior, and soleus) helps to improve ankle stability and reduce the risk of further injury.[21] Both balance and strengthening exercises could lead to reduced pain by improving joint stability, reducing compensatory movements, and decreasing strain on the affected tissues. [32] Strengthening exercises will help reduce muscle fatigue and improve endurance, thus minimizing pain during and after activities. [33] Balance training may alleviate the excessive loading on the ankle joint by teaching the body to distribute forces more evenly during movement, preventing overstress of vulnerable areas. [30] Strengthening exercises will provide better muscular support, making the bowler more powerful and efficient in their action. This could result in better control of the body while bowling, improved running and sprinting mechanics, and a reduction in the likelihood of injury due to improved body posture and control. [35] Balance training likely enhances the feedback loops between the brain and the ankle joint, improving muscle recruitment to prevent unwanted ankle movements. [36] Strengthening exercises can restore muscle function around the ankle joint, which helps to support the ligaments and prevent the joint from moving excessively in response to stress. This is particularly important for cricket bowlers who face dynamic and unpredictable loading patterns during their activity. [40]

5. Summary and conclusion

The aim of the study was to find the Effect of Balance training along with strengthening exercises on pain and functional performance among cricket bowlers with ankle instability. The bowlers were selected based on inclusion and exclusion criteria. A detailed examination was done by orthopaedic doctor and senior physiotherapist for inclusion of the participants for the study. 20 cricket bowlers with age group of 15 - 25 years were selected. Group I received balance training along with strengthening exercise. The total study duration 6 months and individual treatment duration was 4 weeks, 5 days / week, 2 sets / day, 30 min / session. Pain was measured by Numerical Pain Rating Scale and Functional ability was measured by Foot and ankle ability measure. The Paired 't' test was used to measure within the group analysis. Based on statistical analysis at 5% level of significance. It shows significant difference in Numerical Pain Rating Scale and Foot and ankle ability measure. This Study therefore reject the Null hypothesis H_0 and support the alternate hypothesis H_1. There is a significant difference in Numerical Pain Rating Scale and Foot and ankle ability measure. Therefore, the study concluded that Balance training along with strengthening exercise both interventions to reduce pain and increase the Functional performance of the cricket bowlers with ankle instability.

6. Limitations and recommendation

- Study was done with small size
- This study is done in cricket bowlers and recommended other players

- This study only done with male cricket bowlers and recommended for female players also.
- Study was done with only two outcome measures
- Only ankle instability was included
- Long term follows up was not done
- Future studies to be done with large sample size
- Could be done with other outcome measures
- Long term follow up should be done
- Other interventions can be used for reduce the ankle instability

7. Abbreviations

NPRS: Numerical pain rating scale
FAAM: Foot and Ankle Ability Measure

8. Declaration by Authors Ethical Approval

The study was approved by the college committee, K.G. College of Physiotherapy, Coimbatore.

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