International Journal of Physical Education, Sports and Health 2019; 6(5): 192-196

P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2019; 6(5): 192-196

www.kheljournal.com
Received: 03-07-2019
Accepted: 06-08-2019

Atiyeh Majouni
Hakim Nezami Institute of Higher Education, Iran

Correspondence
Atiyeh Majouni
Hakim Nezami Institute of Higher Education, Iran

The effect of 6 weeks of neuromuscular training on the static, dynamic balance, limit of stability and Proprioception of the ankle joint between female college student athletes in prevention of ankle sprain

Atiyeh Majouni

Abstract
Introduction: Injury is one of the main concerns of instructors and athletes, which results in decreased physical activity and waste of time and imposes high costs of treatment on athletes. Hence, it seems that research aimed at investigating the effect of neuromuscular exercises on controlling risk factors among athletes at the risk of ankle sprain would provide useful information for designing and developing sports injury prevention programs.
Objectives: The purpose of this study is to investigate the efficiency of exercises to control some of the risk factors of ankle sprain in sport. The information gathered here can be used by both players and coaches in the form of a training package. It also allows people to reduce the risk of damage and to stabilize the ankle to increase performance in a game. Therefore, the purpose of this study was to investigate the effect of neuromuscular exercises on the static, dynamic, stability limits and Proprioception in athletes.
Method: The statistical population of this study included female athletes aged 20-30 years who participated in the research. The athlete's definition in this research is a person who attends sports athletics, volleyball, basketball and handball at least three times a week for more than an hour. A sample of 30 people was selected as a statistical sample by purposeful and accessible sampling. They were randomly separated into two groups, with 15 being in the intervention group (neuromuscular exercises with balance board and wobble boards). In this study, we used the Biodex balance instrument to measure the balance and stability of the subjects, and the sensory depth test was performed by an ankle-deep-goniometer (built-in 2012). The group is 0.97 and the external group reliability is 0.87. The raw data obtained from measuring variables of the research using male is analyze using descriptive and inferential statistics (SPSS version 22). In this study, we used both the t-test (for in-group differences) and covariance analysis (for inter-group differences in post-test).
Result: The results indicated that the six weeks of neuromuscular training had a statistically significant effect on the dynamic equilibrium (level 6 and 8 of Biodex balance instrument), stability and proprioception (goal recovery failure) in the inertial and perineal arthritis of female athlete students. ($P \leq$ 0/05).
Conclusion: The results of this research shows that the dynamic, static and stable sense of stability and proprioception has been significantly improved by performing neuromuscular exercises after 6 weeks. In this regard, the effect of equilibrium exercises in preventing the occurrence of ankle injury mechanism after obtaining statistical results in this study has become.

Keywords: Balance, proprioception, limit of stability, athlete student

Introduction
Jumping, running and shear maneuvers are associated with the most popular sports [1]. Therefore, it's not surprising that most sports involve lower limbs injuries [1]. Lower limb has been reported as one of the most common sites of injury in sports such as soccer, basketball, volleyball, gymnastics and racket sports [2] and ankle injuries are the most often injuries between all other lower limb injuries. The statistics show that ankle joint injuries are of the most common damages to the body and 85 to 90 percent of these injuries are due to ankle inversion [3, 4]. Ankle sprain accounted for 75% of foot injuries and involve 10 to 30 percent of sports injuries in football, basketball, and volleyball [5].

Today, recognizing and identifying the risk factors of injury is an important component of the prevention of sports injuries [6]. Ankle joint plays an important role in weight bearing, balance during exercises, jumps and sudden jump changes, and ankle injury in athletes has the highest prevalence [7]. However, the risk factors for ankle sprain among athletes are still unclear [7]. The high prevalence of ankle sprains and the following worrying side effects necessitates the identification of risk factors in people at the risk of this type of injury. Poor posture or balance control is one of the factors that is likely to put an athlete at the risk for an ankle sprain [8, 7]. Posture control often involves performing and keeping a position without losing the level of retention, which preserving it requires factors such as proprioception, stability, and muscle control [9]. Balance system is quite complex, which includes sensory and motor components. Among the sensory inputs for coordinating and balancing, the importance of information on the body sensation of the knees and ankle is now proven [10, 11]. The ankle joint is one of the most important joints in the body and it is important to absorb the shock and smooth the body while walking (when the foot is at an angle to the ground). Based on the sensory organization hypothesis [12], the central nervous system, by processing data from vision, vestibular, and proprioceptive systems, can adjust the proper mechanism for controlling the balance, This means that balancing the closed motor chain depends on the motor strategies and the coordinated feedback between the thighs, knees and ankles that reduces the feedback, or reduces the strength and mechanical stability of each joint alone or the entire structure in the motor chain. The lower limb, it can interfere with the balance [12]. Sensory information is one of the components of balance [13], which is one of the important factors in the ankle stability [14]. Considering that a good postural control is an important prerequisite for the daily activities (such as climbing the stairs) and sports (such as gymnastics) [15], maintaining and improving it, in all individuals, especially athletes and the elderly It is very important. In accordance with the principle of specificity, practicing in unstable or unbalanced situations creates the same instabilities that an individual may encounter during daily and sports activities, and can lead to a more effective transfer of workout adaptations [16]. Therefore, it seems that balance exercises on unsustainable levels have a special effect on improving the performance of athletes and preventing sports injuries [17]. Equilibrium exercises and posture stability increase deep-seated and motor consciousness intakes, increase muscle activity, and result in higher central-dynamic and better posture control [18]. In 2012, Bachman *et al*. (2003) stated in a review study that the balance and the proprioception were improved by 105% on the unstable levels (with an impact factor of 1.2), not only to reduce incidents such as falls but also features such as power, as well as performance enhancements [19]. Wobble boards or balance boards seem to stimulate various sensory receptors and enhance sensory-input and vestibular system, which can have central effects on joint stabilization motor programs. In this regard, in the review study of the effects of various therapeutic programs, Van Derwiss *et al*. Stated that therapeutic exercises using balance boards to prevent rebound ankle sprain are more effective than other therapeutic exercises [20]. At present, Swiss balls, BOSU balls, wobble board, tilted boards, and other unstable devices are used in parts of physical fitness and rehabilitation [21, 22]. Therefore, it can be deduced that there are numerous benefits is using unstable surfaces, such as wobble boards and tilted boards (as one of the most commonly used training tools in this field) [23], for improving balance, sensation depth and effective muscle functioning in maintaining central body stability. The purpose of this study was to investigate the effect of neuromuscular exercises on the static, dynamic, stability and proprioception balance of athletes in the field of injury prevention. Ankle corrosions are joint diseases and related disorders, including degenerative changes and arthritis, that are associated with their occurrence is in the relationship [27, 26, 25, 24].

Hence, it seems that a study aimed at investigating the effect of neuromuscular exercises on controlling risk factors among athletes at the risk of ankle sprain would provide useful information for designing and developing harm prevention programs. The purpose of this study is to increase the knowledge about useful exercises to control some of the risk factors of a sports ankle sprain. The information gathered here can be used by both players and coaches in the form of a training kit. It also allows individuals to reduce the risk of injury and make the ankle more stable to increase performance in a game [28].

Materials and Methods

This research is a two-group study with interventional (neuromuscular exercises with balance board and wobble board) in the training group and without intervention in the control group with pre-test and post-test in two groups. In the intervention (training program), the subjects were randomly divided into two groups of exercise and control, the present study is a randomized controlled trial (RCTS). The subjects of the study were 30 female athletes aged between 20 and 30 years old. The subjects should attend sports like Volleyball, Basketball, Footsal, and Handball at least an hour, three times a week. The subjects were selected as the statistical sample by purposeful and accessible sampling. They were randomly divided into control and the intervention group (neuromuscular exercises with balance board and slider boards), with 15 subjects in each group.

After controlling the entry, exit, and examination criteria, if the individual was qualified, then she was selected as one of the samples. Then she was asked to complete and sign the consent form and informed consent for participation in the research project. Subject's information was also collected by using forms and the height and weight indexes of the subjects were measured and recorded by the seca scale.

Balance measurement (static, dynamic, limit stability): In this research, we used the Biodex balance meter to measure the balance of subjects. This device is used for evaluating static and dynamic equilibrium. This device can also be used for balance exercises and deep sensation. The balance meter is adjustable in 12 levels of instability from almost stable (level 12) to completely unstable (level 1). This device has a monitor in front of the user, which simultaneously can provide feedback on the amount of deviation from the hypothetical line of gravity. The device is capable of recording and recording the amount of deviations and fluctuations and strength and weakness of the body in the front, back, left and right areas of the body, and the instructor can, based on the results, strengthen the athlete's weaknesses.

Measuring the balance: Each test was repeated for 20 seconds, and for three times, the rest interval between each repetition was 10 seconds. In all equilibrium tests, each person on a page with a degree of stability between 1-12 (one of the most unstable and one of the 12 most stable) was able to stand and balance in 20 seconds during the test, keeping the page

horizontally the device was kept. Subjects should put their hands on their wrists. For the present study, dynamic levels 6 and 8 are used to measure dynamic equilibrium (general index, anterior / posterior index, internal / external index) and static level (single foot) for static equilibrium (general index, anterior / posterior index, internal / external index) was considered to measure the range of athlete's stability on the platform of the Biydox balance system and the tendency of the individual's movement in 8 directions was checked for moving the cursor over the system screen.

Sensory Detection Measurement of ankle joint sensation is often used by researchers and therapists to detect sensory impairment in people with motor impairment. Clinical sense of sensation is measured at least in three ways: the threshold for inactive motion detection, the ability to re-establish active and passive status and test the sense of effort. There are various tools for measuring the sense of ankle position that the goniometer is one of these tools.

Goniometric reliability: Before the sampling, the Goniometric stability test was performed on a test by 15 subjects with a mean age of 25 years, weight of 56 kg, height of 164 cm, which were selected by sampling method. (Table 1). From each subject, 3 measurements were made. Subjects were healthy and did not have any musculoskeletal disorders or injuries.

Proprioception Measurement: Deep Sensing Measurement by Goniometer Sensing Ankle Anesthetic (Iran-2012) - In-group reliability was 0.97 and external reliability was 0.87. For measurement with this device, the subjects were in a state of Sitting on the chair with their knees at an angle of 70°, the subjects pulled out their shoes or any other cover from their feet, while their ankles were at 20° plantar flexion, on the goniometer surface. A goniometer is used to measure the angles. The goniometer can rotate inwards and in the direction of the inertia, according to the main axis, showing the angular momentum of the rotation. Subjects place their feet on the goniometer surface, with the index determined for the heel in its center while the second finger of the leg is placed on the central goniometer index. In this study, to measure the state of the joint, the previous regeneration method was used actively. The foot was guided by the tester to the target angle of 15° and at the target angle for 5 seconds were held and then returned to zero. Then, the subject's eyes were closed with an ophthalmologist to prevent visual feedback, and eventually she was asked to repeat the target angle with closed eyes actively. This work was carried out sequentially on each leg at the same angle three times. The difference between the angle of the target and the rebuilt angle was considered as an ankle joint sensation [29].

Exercise program: Participants in the training group on progressive neuromuscular exercise, derived from the Block and Bourdon exercise protocol (2005) [30]. In 18 supervised training sessions, they participated in three sessions per week. Considering that nerve adaptation in muscle performance occurs in about four weeks [31]. The duration of the training was six weeks. The duration of each training session was about 30 minutes. At the beginning of each session, a warm-up program, which included steady bike and tensile training for lower extremity muscles. Nervesculpture exercises were performed using a 40 cm-40 cm-wide board with a 10 cm height and slab board with a diameter of 40 and a height of 10 cm in the first week for 10 minutes. By the end of the sixth week, progressively increased by 20 minutes. Practical implementation of each exercise was performed by the researcher before being executed for the subjects. At the initial levels of exercise, to reduce the difficulty of putting the training exercise under the balance sheet, was placed. According to the training table, the researcher encouraged the participants to put the hands on the sides as little as possible to help stabilize the upper limbs in exercising the exercises. If necessary, at the beginning and for each practice, exercise with the help of the researcher. The time of exercises was controlled using a chronometer and controlled by the researcher.

Results

The raw data obtained from the measurements of the research variables were analyzed by SPSS software version 22 using descriptive and inferential statistics. In the present study, paired t-test (for in-group differences) and covariance analysis (for inter-group differences in post-test) were used. Also, a meaningful level throughout the research was at 95% level with an alpha smaller than or equal to 0.05 considered. The results indicated that 6 weeks of neuromuscular training had a significant effect on dynamic equilibrium (level 6 and 8 of Biodex balance instrument) and stability and proprioception (goal recovery failure) in inertial and perineal arthritis of female athlete students ($p \leq 0/05$). (Table 2)

Kolmogorov-Smirnov test (K-S) was used to check the normality of the groups. Considering that the significance level in all variables is greater than 0.05 ($p > 0.05$), it can be said that all quantitative variables in the two groups have a normal distribution and therefore the condition for using parametric tests is established. (Table 3)

Table 1: Age, height and weight of subjects in two groups

P	Experimental group (10=N)	control group (10=N)	Variable
0/40	2/75± 165/60	4/79±164/10	Height (cm)
0/76	3/86±56/40	3/34 ±56/90	Weight (kg)
0/15	2/96±27/10	3/69±24/90	Age (years)
0/81	1/29±20	1/24±21	Body mass index (kg / m²)

Table 2: Descriptive statistics of pre-test and post-test of experimental and control groups

Experimental group	control group	Time	Variable
4/52± 58/40	11/45± 54/80	Pre-test	Limit of stability
14/37± 50/10	10/93± 54/50	Post-test	
0/23± 0/60	0/17± 0/67	Pre-test	Dynamic balance (Overall level 6)
0/26±0/56	0/12± 0/67	Post-test	
0/08± 0/38	0/13± 0/44	Pre-test	Dynamic balance (Anterior-posterior level 6)
0/21± 0/37	0/17± 0/49	Post-test	
0/15±0/38	0/15± 0/42	Pre-test	Dynamic balance (Medial-lateral level 6)
0/20± 0/26	0/15±0/41	Post-test	
0/07± 0/49	0/22± 0/38	Pre-test	Dynamic balance (Overall level 8)
0/20± 0/46	0/2±0/44	Post-test	

0/08± 0/41	0/19±0/39	Pre-test	Dynamic balance (Anterior-posterior level 8)
0/03± 0/31	0/25±0/44	Post-test	
5/11± 0/23	0/15±0/29	Pre-test	Dynamic balance (Medial-lateral level 8)
5/09± 0/23	0/17±0/25	Post-test	
0/50± 1	0/47± 1	Pre-test	Static balance (Overall level)
0/18± 0/64	0/45± 1/1	Post-test	
0/31± 0/75	0/22± 0/70	Pre-test	Static balance (Anterior-posterior level)
0/14±0/54	0/26± 0/72	Post-test	
0/27± 0/74	0/49± 0/67	Pre-test	Static balance (Medial-lateral level)
0/16±0/44	0/50± 0/64	Post-test	
1/90± 1/50	1/98± 1/80	Pre-test	Proprioception (Eversion)
0/96±0/40	2/28± 1/90	Post-test	
1/26± 1/50	1/61± 1/20	Pre-test	Proprioception (Inversion)
0/97±0/50	1/71± 1/40	Post-test	

Table 3: K-S test results to investigate the normality of the research variables

P	Time	variable
0/67	Pre-test	Limit of stability
0/54	Post-test	
0/32	Pre-test	Dynamic balance (Overall level 6)
0/78	Post-test	
0/41	Pre-test	Dynamic balance (Anterior-posterior level 6)
0/18	Post-test	
0/56	Pre-test	Dynamic balance (Medial-lateral level 6)
0/22	Post-test	
0/75	Pre-test	Dynamic balance (Overall level 8)
0/09	Post-test	
0/07	Pre-test	Dynamic balance (Anterior-posterior level 8)
0/65	Post-test	
0/36	Pre-test	Dynamic balance (Medial-lateral level 8)
0/20	Post-test	
0/45	Pre-test	Static balance (Overall level)
0/30	Post-test	
0/28	Pre-test	Static balance (Anterior-posterior level)
0/56	Post-test	
0/51	Pre-test	Static balance (Medial-lateral level)
0/26	Post-test	
0/15	Pre-test	Proprioception (Eversion)
0/60	Post-test	
0/29	Pre-test	Proprioception (Inversion)
0/67	Post-test	

Conclusion

Ankle sprain is the most common traumatic injury to the ankle region, which involves up to 32% of sports injuries, and subsequently damage to the ankle ligaments (Wahrang, 2000) [32]. Disturbance in balance and performance is one of the most common and most commonly encountered problems in these injured people, and in most cases, this impairment in balance and performance causes another injury (McKean, 2008) [33]. The ankle is the most common anatomical location that is injured in people with athletic activities. Therefore, attention to risk factors and ankle injury prevention methods can be helpful in reducing the incidence of this injury and reduce the cost of the treatment. The reduction of strength, perception of Proprioception, range of motion and balance are important risk factors for the ankle sprain, and the reinforcement and rehabilitation of these exercises can help prevent ankle sprain. In this study, it was determined that the sense of deepness and balance of people after performing neuromuscular exercises improved after about one month. Considering that the increase in balance and sense of deepness prevent the occurrence of ankle injury in athletes, it can be concluded that performing neuromuscular exercises can have a profound sense of intubation and estrogen status, and the dynamic and stable balance of the ankle joint after an effective and lasting month.

References

1. Willems T. Intrinsic risk factors for sports injuries to the lower leg and ankle, Ghent University, Ph.D. Thesis, 2004.
2. Bahr R, Engebretsen L. Sports injury prevention. Translated by M. Sahebozamani, N. Rahnama, H. Mohamadi, Institute of Physical Education and Sports Science, 2009.
3. Otter SJ. The conservative management of lateral ankle sprains in the athlete. The Foot. 1999; 9(1):12-17.
4. Pellow JE, Brantingham JW. The efficacy of adjusting the ankle in the treatment of subacute and chronic grade I and grade II ankle inversion sprains. 2001; 24(1):17-24.
5. Pefanis N, Papaharalampous X, Tsiganos G, Papadakou E, Baltopoulos E. The Effect of Q Angle on Ankle Sprain Occurrence. 2009; 2(1):22-26.
6. Morrison KE, Kaminski TW. Foot Characteristics in Association with Inversion Ankle Injury, 2007, 42(1).
7. Witchalls J, Blanch P, Waddington G, Adams R. Intrinsic functional deficits associated with increased risk of ankle injuries: a systematic review with meta-analysis. British Journal of Sports Medicine. 2012; 46(7):515-523.
8. Willems TM, Witvrouw K, Delbaere N, Mahieu I, De. Bourdeaudhuij, De. Clercq D, Intrinsic Risk Factors for Inversion Ankle Sprains in Male Subjects A Prospective Study. Am J Sports Med, 2005; 33(3):415-423.
9. Gribble PA, Hertel J, Considerations for normalizing measures of the Star Excursion Balance Test. Measurement in physical education and exercise science. 2003; 7(2):89-100
10. Vaillant J, Vuillerme N, Janvey A, Louis F, Braujou R, Juvin R *et al*. Effect of manipulation of the feet and ankles on postural control in elderly adults. Brain Res Bull. Elsevier. 2008; 75(1):18-22.
11. Meyer PF, Oddsson L, De Luca CJ, The role of plantar cutaneous sensation in unperturbed stance. Exp. brain Res. Springer. 2004; 156(4):505-12.
12. Van Deursen RWM, Sanchez MM, Ulbrecht JS, Cavanagh P. The role of muscle spindles in ankle movement perception in human subjects with diabetic neuropathy. Experimental brain research. 1998; 120(1):1-8.
13. Bressel E, Yonker JC, Kras J, Heath EM. Comparison of static and dynamic balance in female collegiate soccer, basketball, and gymnastics athletes. Journal of Athletic Training. 2007; 42(1):42-46.
14. Willems TM, Witvrouw E, Delbaere K, Philippaerts R, De Bourdeaudhuij I, De Clercq D. Intrinsic risk factors for inversion ankle sprains in females–a prospective

study. Scandinavian Journal of Medicine & Science in Sports. 2005; 15(5):336-345.
15. Zazulak BT, Hewett TE, Reeves NP *et al*. The effects of core proprioception on knee injury: A prospective biomechanical-epidemiological study. Am J Sports Med. 2007; 35(3):368-73.
16. Kibele A, Behm DG, Seven weeks of instability and traditional resistance training effects on strength, balance and functional performance. J Strength Cond Res. 2009; 23(9):2443-50.
17. Cimadoro G, Paizis C, Alberti G *et al*. Effects of different unstable supports on EMG activity and balance. Neurosci Lett. 2013; 548:228-32.
18. Bird SP, Stuart W. Integrating Balance and Postural Stability Exercises into the Functional Warm-up for Youth Athletes. Strength & Conditioning Journal. 2012; 34(3):73-79.
19. Behm D, Colado JC. The effectiveness of resistance training using unstable surfaces and devices for rehabilitation. Int. J Sports Phys Ther. 2012; 7(2):226-41.
20. Van der Wees PJ, Lenssen AF, Hendriks EJM, Stomp DJ, Dekker J, de Bie RA. Effectiveness of exercise therapy and manual mobilisation in acute ankle sprain and functional instability: A systematic review. Australian Journal of Physiotherapy. 2006; 52(1):27-37.
21. Kean CO, Behm DG, Young WB. Fixed foot balance training increases rectus femoris activation during landing and jump height in recreationally active women. J Sports Sci. Med. 2006; 5(1):138-48.
22. The effect of motor control exercises on some kinetic and kinematic indices and deep sense in patients with low back movement control. Ph.D. Kharazmi University - Faculty of Physical Education and Sport Sciences, 2019.
23. Harrington KD. Degenerative arthritis of the ankle secondary to long-standing lateral ligament instability. J Bone Joint Surg Am. 1979; 61(3):354-361.
24. Fu SN, Hui-Chan CW. Modulation of prelanding lower-limb muscle responses in athletes with multiple ankle sprains. Med Sci. Sports Exerc. 2007; 39(10):1774-1783.
25. Delahunt, Eamonn. Neuromuscular contributions to functional instability of the ankle joint. Journal of Bodywork and Movement Therapies. 2007; 11(3):203-213.
26. Gross P, Marti B. Risk of degenerative ankle joint disease in volleyball players: study of former elite athletes. Int. J Sports Med. 1999; 20(1):58-63.
27. Cimadoro G, Paizis C, Alberti G *et al*. Effects of different unstable supports on EMG activity and balance. Neurosci Lett. 2013; 548:228-32.
28. The effect of motor control exercises on some kinetic and kinematic indices and deep sense in patients with low back movement control. Ph.D. Kharazmi University - Faculty of Physical Education and Sport Sciences, 1396.
29. Rajabi R, Karimizadeh ardakani M. Construction of the new Iranian and reliability analysis by measuring ankle proprioceptive. Studies of Sports Medicine. 2012; 0(0):4352. (Persian).
30. Clark, Victoria M, Adrian Burden M. A 4-week wobble board exercise programme improved muscle onset latency and perceived stability in individuals with a functionally unstable ankle. Physical therapy in sport. 2005; 6(4):181-187.
31. Riemann Bryan L, Nancy Caggiano A, Scott Lephart M. Examination of a clinical method of assessing postural control during a functional performance task. JSR 8.3, 2010.
32. Verhagen EA, Van Mechelen W, De Vente W. The effect of preventive measures on the incidence of ankle sprains. Clinical Journal of Sport Medicine. 2000; 10(4):291-6.
33. McKeon P, Ingersoll C, Kerrigan DC, Saliba E, Bennett B, Hertel J. Balance training improves function and postural control in those with chronic ankle instability. Medicine + Science in Sports + Exercise. 2008; 40(10):1810.