



**Research Article**

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## The Effect of TRX Training on the Balance Functions of Futsal Players

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### Abstract

**Introduction:** According to the previous studies, the balance is the important part of the success in the sports performance. Also, balance plays a great role in preventing sports injuries. So, Strengthening and improving balance functions to reduce injuries, costs of treatment and avoidance of competitions should be emphasized. So, The aim of the present study was to assess the effect of total resistance exercise on equilibrium functions of Futsal players. **Methods:** The present study was an experimental type with pretest and posttest design. The statistical population consisted of 24 qualified Futsal players that divided into equal groups in the intervention (12) and control (12) groups. The intervention group performed TRX training ones for six weeks in three sessions of 60 minutes per week. During the research, the control group performed their routine exercises. The dynamic equilibrium was evaluated by the star excursion balance Test before and 6 weeks after of exercise. Paired T and Independent t-test and were used for data analysis in Spss version 23. **Result:** According to the present research, the ability of the intervention group in performing the balance test was significantly improved. While these changes were not significant for the control group. **Conclusion:** TRX training seems to improve the futsal players balance performance and it is recommended that coaches and athletes use these exercises to improve their balance.

**Keywords:** TRX training, Core stability, Balance, Futsal players.

### INTRODUCTION

Increasing the number of athletes and sports enthusiasts has increased the number of sports injuries [1]. Various internal and external factors are the cause of injury in athletes; that among other things, the ability to control the situation and maintain balance is one of the most important factors. In order to prevent injury due to weakness in the balance or appropriate rehabilitation of injuries, after the occurrence, it is important to focus on the underlying causes of disturbing balance and also the weakness of individuals in maintaining balance. In high-intensity sports such as futsal, many injuries are non-contact and due to the inability of the athletes to maintain balance and cause the greatest injury to the lower limbs, especially the ankle-foot [1, 2]. According to previous study results, the majority of injuries to Futsal players during the redirection (38.6%) and landing (29.5%), that is, the situations where postural control plays a more important role in preventing collapse, it happens [1]. Thus, the disturbance in balance and the probability of unstable situations in high-intensity courses such as Futsal is high and the ability to maintain or restore disturbed balance is important.

One of the effective training to improve the balance and increase the strength and endurance of the athlete's trunk is the training of the core region of the body. In principle, this area of the body can be thought of as a foundation in which the abdominal muscles in front of it, and the erector spinae and gluteal muscles on the back, the diaphragm muscle on top of it, and the pelvic floor muscles are known as the lower part [3]. Current evidence suggests that reducing the stability of the core body's region can provide the basis for injury, and appropriate training can reduce injury [4]. The core region of the body increases muscle tension in region before it moves to create a base for movements. It is also the region where the center of gravity is inside it, and it acts Play an important role in preventing disturbance of the balance.[5]. Therefore, instability in the lumbar-pelvic region during run leads to poor technique and ineffective utilize [6]. Reducing muscle strength in the core region creates the basis for instability in the development of lower limb forces, which predicts lower limb injury [6].

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One of the effective training to improve balance and increase the strength and endurance of the athlete's trunk is TRX training. TRX training is a new form of core stability training that can develop all components of physical fitness. In this regard, the study with TRX training equipment showed Improve performance in sport, especially in soccer, golf, and handball [7-9]. Byern *et al.*, (2014) reported a positive effect of suspended training on the functional stability of the abdominal muscles as well as the muscles around the pelvis [10]. Kahle reviewed the effects of core stabilization training on balance testing in young, healthy adults, and results of the study showed improvement in the dynamic balance of the participants [11]. Samson studied the effects of a five-week core stabilization training program on dynamic balance in tennis athletes. According to results of this study, core stabilization training can be used to improve equilibrium functions in Tennis player athletes [12].

According to previous research, it is clear that in the futsal, knocking, passing, guiding the ball, and dribbling with the lower limbs are carried out, and the players constantly change direction during in the race, So maintaining balance is one of the basic needs of this sport; And with an overview, it's seen that many of the injuries that occur in the futsal are due to the loss of balance. So do research in this regard and designing training programs to prevent these injuries or appropriate rehabilitation after injury is necessary. Thus, due to the importance of dynamic balance in the optimal performance of sports skills, the present study aimed to evaluated the effect of total resistance exercise on balance functions of Futsal players.

**METHODS**

The present study was an experimental design with pre/post test design and with a control group. The statistical population of present study included all Futsal players in Qazvin town. Of these, 24 eligible subjects were selected by non-randomized targeting method. After evaluating the balance functions, they were matched based on the Y balance test score and were randomly divided into intervention and control. All subjects filled out the personal information questionnaire and the form of the injury record and were examined for physical health. Exit criteria were: ankle sprain over the past six months, knee surgery over the past year and hip surgery over the past six months, central nervous system defect, history of disease, or drug use affecting the nervous system. Visual and auditory defects, head injuries requiring the person to use medical care, lack of diversions in the spine (such as scoliosis, kyphosis) and lower extremities (such as flat feet, short one leg) [13].

Before the beginning of the study, all subjects signed the consent form of the company in the research, and then it was described during a session on how to conduct the research for the subjects. One week before the beginning of the exercise program, height and weight

measurements, body mass index and balance test were performed in both groups [13].

**ETHICAL CONSIDERATIONS**

The College's Ethics Council reviewed this study for ethics. The Department of Corrective Exercises and Sports Injuries of the University of Guilan approved the study. Before starting the research, the College's Ethics Council fully evaluated the whole research process (research objectives, how measurement of variables was going to be performed, duration of the research period).

**Y balance Test**

The Y balance test is a valid instrument for evaluating dynamic balance. [14]. The Balance Test is a functional instrument for evaluating the dynamic balance that is drawn in three directions in the Y pattern on a flat surface [13]. Participates placed their prominent foot on the middle of the Y pattern. Then reached the foot to furthest point in three different directions (anterior, posteromedial and posterolateral) and the furthest point in each direction was recorded as a score.

In order to eliminate the learning effect, each participant was trained six times before the balance function assessment. Then, each participant performed three trials and the average of all three attempts was calculated as the score of each participant. (Fig 1).

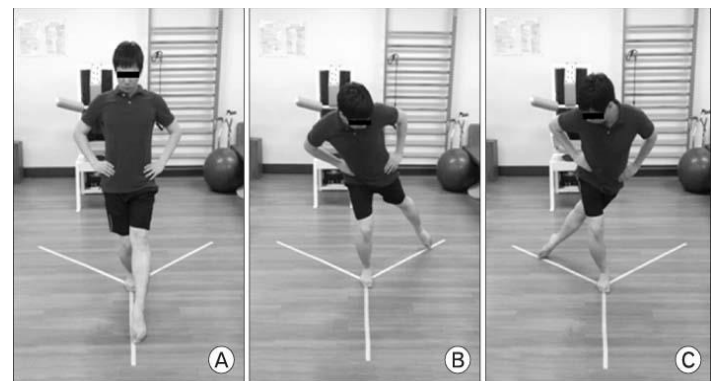


Fig 1: Method of performing the Y balance test

**Training Procedures**

intervention group performing the TRX training program in six sessions and three sessions for 60 minutes, which included eight moves to improve the strength and endurance of the core body region muscles [15]. But the control group performed their routine activities during the research, the intervention group performed the planned training program that presented in table 1.

Table 1: Training protocol

	Saturday	Monday	Wednesday
<b>Warm-up</b>	Running 10min	Running 10min	Running 10min
<b>Exercise Type</b>	Pike, Crunch (on hands), mountain climber, Oblique Crunch, Lunge, Plank, Hamstring Cruel, Squat	Pike, Crunch (on hands), mountain climber, Oblique Crunch, Lunge, Plank, Hamstring Cruel, Squat	Pike, Crunch (on hands), mountain climber, Oblique Crunch, Lunge, Plank, Hamstring Cruel, Squat
<b>Exercise Method</b>	1 Wks	2sets, 9reps, 2sets, 9sec 30sec rest (exercise), 2-3min rest (set)	
	2 Wks	2sets, 9reps, 2sets, 9sec 30sec rest (exercise), 2-3min rest (set)	
	3 Wks	2sets, 12reps, 2sets, 12sec 30sec rest (exercise), 2-3min rest (set)	
	4 Wks	2sets, 15reps, 2sets, 15sec 30sec rest (exercise), 2-3min rest (set)	
	5 Wks	3sets, 15reps, 3sets, 15sec 30sec rest (exercise), 2-3min rest (set)	
	6 Wks	2sets, 9reps, 2sets, 9sec 30sec rest (exercise), 2-3min rest (set)	
<b>Cool-down</b>		Stretching 15min	

**Table 2:** Anthropometric Indicators of Participants (mean ± SD)

Groups	Number	Age (Yare)	Height (cm)	Weight (kg)
CON	12	8.33±1.23	131.58±4.29	33.33±2.87
INT	12	1.24±8.08	129.58±5.57	33.50±5.40

**Table 3:** Pre/pos Test data for the Y balance test

Directions	Group	Pre Mean±SD	Pos Mean±SD	t	P
anterior	CON	67.70±2.77	68.28±3.13	0.556	0.592
	INT	69.52±1.64	75.05±1.86	6.828	*0.001
posteromedial	CON	86.28±4.32	84.53±4.76	0.867	0.409
	INT	83.65±5.98	93.22±7.64	6.858	*0.001
posterolateral	CON	81.31±3.22	81.09±4.37	0.267	0.795
	INT	85.70±8.65	91.73±9.07	7.357	*0.001
* Sig P ≤ 0.05					

**Table 4:** Comparing scores of Y balance test Pretest between INT and CON groups

Directions	Group	Mean ± SD	t	*p
Anterior	CON	67.70±2.77	1.845	0.092
	INT	69.52±1.64		
posteromedial	CON	86.28±4.32	1.152	0.276
	INT	83.65±5.98		
Posterolateral	CON	81.31±3.22	1.235	0.215
	INT	85.07±8.65		
* Sig P ≤ 0.05				

**Table 5:** Comparing scores of Y balance test Posttest between INT and CON groups

Excursion	Group	Mean ± SD	t	*p
Anterior	CON	68.28±3.13	1.845	0.092
	INT	75.05±1.86		
posteromedial	CON	84.53±4.76	1.152	0.276
	INT	93.22±7.64		
Posterolateral	CON	81.09±3.37	1.235	0.215
	INT	91.73±9.07		
* Sig P≤0.05				

### Statistical analysis

In the present study, paired t-test and independent T-test were used for statistical analysis of the groups. Also, SPSS software version 23 was used at a significant level of P <0.050 for data analysis.

### RESULTS

The results for anthropometric indices are presented in Table 2.

As shown in Table 3, the control and intervention groups in the anterior, posteromedial and, poster lateral directions indicated a significant increase in the achievement of the directions in the intervention group, but no significant increase was found in the control group. The results of paired t-test tests indicate that in the intervention group, balance functions significantly improved, but no significant changes were observed in the control group.

The table 4 shows the results of independent t-test and comparison of the results of the Y balance test pretest of the two groups. The results showed that there was no significant difference between the two groups before the beginning training program.

As shown in Table 5, the independent t-test of pos-test between intervention and control group after performing the training program was significantly different. The intervention group after performing six weeks of designed training program better than control group scores recorded.

### DISCUSSION

The aim of present study, was to evaluate the effect of total resistance exercise training on balance functions of Futsal players. The results showed that performing TRX training can improves the balance performance of Futsal players. Also, these findings were consistent with the findings of previous studies, kahle [11], Bayern et al. [10], Carps et al. [14], Samson [12], who all reported improvement in

balance after applying different exercises in the core body area. The probable cause of this improvement in maintaining balance can be seen as a result of the improvement in strength and endurance of the core region of the body.

The Y balance test requires neuromuscular control for proper joint position and muscle building power around the joint during performing the test. Olmstad et al. (2002) found in their study that the foot support during performing the test required anterior ankle dorsi flexion, knee flexion, and femoral flexion; Thus, the lower extremity requires a proper range of motion, strength, proprioception receptor activity and muscular control [4].

Earl et al. (2001) showed that performing the SEBT directly affects the activity of the lower limb muscles, except for the gastrocnemius muscle [3]. During perform the SEBT in all directions, hamstring and quadriceps are activated. The quadriceps muscle has the most activity in the three directions of anterior, anteriolateral and,anteriomedial. Because, in order to perform SEBT in these three directions, one has to create an extension on his own trunk to maintain his balance. In this situation, the force of gravity acting on the upper extremity causes a large torque of the knee flexion, which should be controlled by the torque extension (eccentric contraction) produced by the quadriceps muscles [16].

Based on these findings, it can be concluded that increased power and eccentric control of quadriceps muscles can improve balance control in these directions [16]. Each sport may require different levels of somatosensory processing to perform skills and protect the neuromuscular system from injury. For example, Futsal players will require high levels of balance and neuromuscular coordination in the implementation of many motor skills such as pass, dribbling and knocking that performed by the lower extremities.

The motor and skills requirements as well as the environmental requirements in the Futsal create different challenges for the somatosensory systems, and these systems increasingly affect the players' balance abilities [17]. Also, re-injury is a major risk for professional athletes, and especially those who return to competition after an injury. Thus, medical personnel have an important role in reducing the incidence of sports injuries and its consequences [6]. Inadequate rehab and early return to a competitive level is a serious risk factor for re-injury. Often, rehabilitation of injuries occurs without the supervision of a physician or physiotherapist, which leads to recurrence of injury [18]. It is essential to maintain dynamic balance in daily life activities and sports activities. Maintaining balance in the closed kinematic chain relies on motor strategies and coordinated feedback between the hips, knees and ankles that reduces efferent feedback or reduces the strength and mechanical stability of each joint to disturbs the balance. When there is instability in the vertebral column, movement is performed improperly, the coordinated neuromuscular pattern decreases and the risk of injury from loss of balance increases; Therefore, facilitating the simultaneous contraction of the muscles around the lumbar vertebrae, such as the internal and external oblique abdominis, the transverse abdominal, multifidos, may increase the stability of the vertebrae. Therefore, the goal of core stability training is to create a physical capacity to maintain a neutral position in the spinal column during the daily activities of life, which is done by increasing the tolerance and coordination of vertebrate stabilization muscles.

## CONCLUSION

Regarding theories of strengthening the core region of the body, it can be concluded that participating in TRX training may be can to improve the dynamic balance and performance of athletes. In some cases, the muscles of the core region of the body have a good strength and endurance, but the pattern of using the motor units in them has

changed, which causes the disturbs of the motor system. According to the findings of this study, TRX training improved the balance in the intervention group compared to the control group after performing six weeks of the training program, and considering the simplicity of these training and the ability to do so in each it is suggested that this training method be used to improve the athlete's balance performance by coaches.

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