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Comparative the Effect of TRX and Pilates Training Programs on the Balance of Futsal Players -

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ABSTRACT

The balance is an integral part of many daily activities and sports skills. In Futsal, the weakness in preserving the balance predicts many of the common injuries in the lower limb. The purpose of this study was to compare the effect of TRX, and Pilates training programs on the balance of Futsal players. The present study was carried out with pre-test and post-test design, which was performed on 36 Futsal players. The statistical sample of the study was available to the Futsal players from Qazvin who, were selected randomly and divided into three groups that one group performing TRX (i.e., total body resistant exercise) training program and another group performing Pilates training and also one control group (each group was 12). The training groups performed exercises for six weeks and three sessions per week for 60 minutes. During the same period, the control group performed their routine training program during the research period (six weeks). Before and after the training programs, the dynamic balance was measured using the star excursion balance test. The statistical analysis was performed with One-Way and, Two-way Analysis of Variance and Bonferroni Post-Hoc (SPSS, version 23.0). According to the results, after performing a six-week core strength training in the TRX training group and Pilates training group, the improvement was observed in dynamic balance. Although there was no significant difference in post-test between the two intervention groups, but Pilates exercises were most effective in improving balance. As a result, it is recommended that trainers should use these exercises to improve athletic performance and balance.

Keywords: TRX training; Pilates training; Core strength; Postural balance; Futsal

INTRODUCTION

Futsal is one of the most popular sports in most societies. All people within the community, including women, men, elderly, young and children, each with a different skill level, are interested in playing Futsal. The first reason Futsal has become so popular is that football does not require much equipment. Often times, attention is paid to tactics, techniques and increased physical fitness to improve Futsal performance in sports teams [1]. Physical performance is one of the most important factors in a Futsal game, in which the player has to decide at any given moment. When the athlete is tired, his movements are unbalanced and slow, and for this reason, his technique will be affected. A Futsal player requires a lot of explosive activities like jumping, shaking, tackling, changing direction, running fast, changing the playing area and creating strong contractions to maintain balance and control over the ball against the opponent's pressures [2]. Nowadays, there is a growing need for scientific advances in the practice of exercises, including those recently considered, to strengthen core stability in athletes. No longer, it focuses on enhancing the body's components to enhance athletic performance. However, the body is considered as an interconnected unit, which needs to be strengthened by exercises that use different components along the body as a single, integrated unit. In the same way, core stability exercises have become very popular during recent years, and have influenced various types of physical fitness programs, various sports disciplines that are very important in their performance and rehabilitation. Researchers from the core body have considered the body as the muscular box, with the abdominal muscles in the front, the muscles around the vertebral column and the gluteal muscles at the back, the diaphragm on top and the box body, the muscles of the pelvic girdle and the pelvic floor are at the bottom to the box [3]. There are 29 pairs of muscles in the box that help stabilize the spine, pelvis, and the kinematic chain during functional movements. Current evidence suggests that reducing the core stability can provide a ground for injuries, and appropriate training can reduce injuries [4]. The core section through the body as a connector, with the effective transfer of forces produced from the lower extremity to the upper limb, helps to exercise [5]. Therefore, instability in the pelvic girdle region during the running leads to a weak technique and an ineffective use of force [6]. Trunk activity is also performed prior to the lower extremity activity, which, by providing sufficient stability for the spine, provides the basis for functional movements [7]. Reducing muscle strength in the core region creates a source of instability in the development of forces on the lower extremity, which this lower instability predicts lower limb instability [5]. Probably no other section of the body is as important as the core body. Thousands of people every year need medical treatments to treat their own injuries; if they are properly trained, they will be avoided [8]. Although the benefits of core stability training have been widely reported in the prevention of athletic injury, lower-back pain and athletic performance, but research results are sometimes contradictory [8]. A weak to moderate relationship between core stability and sport performance of male college football players was observed [9]. This is whereas Okada et al. reported a significant correlation between body core stabilization and exercise performance [7]. In this regard, Sato et al. has shown that increasing the power of the core body can play an important role in improving running performance [10]. Kahle reviewed the effects of core stability exercises on the balance test in healthy young people, and the results of the study showed improvement in the dynamic balance of the participants [11]. Byrne et al. reported a positive effect of TRX exercises on abdominal musculoskeletal stability as well as pelvic muscles [12]. The study with equipment of TRX exercises showed an increase in strength, stability and specific performance in sport, especially in the fields of handball, softball, football and golf [13-15].

Considering the background of the research, the importance of examining the effect of these exercises on improving the athletic performance and preventing sports injuries, as well as the role of these exercises in the use of post-injury rehabilitation, has been somewhat proven. Therefore, the necessity of using and reviewing various types of training programs that follow core stability theories is felt. So, given the fact that the sport of Futsal has attracted a lot of enthusiasts, it is important to study the effect of these exercises on the performance of these athletes. The present study also seeks to measure the impact of two different types of core stability training programs, including TRX and Pilates exercises on the balance performance of Futsal players.

METHODS

The present study was carried out with pre-test and post-test design. The statistical population consisted of Futsal players in Qazvin. For this purpose, 47 subjects were selected, of which 7 ones were not eligible for inclusion, and 4 were not willing to cooperate, Subsequently 36 subjects were randomly divided into Pilates and TRX training groups and one control group. All subjects filled out the personal information questionnaire and the form of the injury record and were evaluated 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 legs) [16]. A week before the start of the exercise program, weight and height measurements, body mass index and balance test were performed in all three groups. A dynamic balance test was performed before and after the exercise program. The training period included six weeks of practice. A group of Pilates exercises and another group of TRX exercises, each week consisting of three sessions and each session for 60-50 minutes. After six weeks, the test was completed at the same time. The intervention group in the TRX and Pilates training program, which included eight moves to improve the strength and endurance of the core muscle of the trunk and back, participated in 60 sessions in six weeks and three weeks [17,18]. The control group performed their normal exercises during the research period (six weeks), but the experimental group performed the planned training program. Details of the exercises are given in table 1.

ETHICAL CONSIDERATIONS

The College's Ethics Council reviewed this study for ethics. The Physical Education Department 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).

Test star excursion balance

This test is a valid and reliable instrument for quantifying the dynamic balance [19]. The SEBT involved a taped star pattern with eight excursions each at 45 degrees from each other, on an even floor surface. Due to the similarity of the Test Star Excursion Balance results from the Y balance test, we used the Y balance test [16]. Subjects placed their non-dominant foot on the middle of the star pattern, while their dominant foot reached as far as possible to each of the three excursions (anterior excursion, posteromedial excursion, poster lateral excursion) while maintaining a single leg stance while reaching with the opposite leg to touch as far as possible along a chosen excursion. They touched the farthest point possible, and as light as possible, along a chosen excursion with the most distal part of their reach foot. Subjects were then instructed to return to a bilateral stance while maintaining their balance. A practice session of six times in each excursion followed by a one-minute rest and subsequently the measured average of three trials for each excursion was recorded as the subject's dynamic balance scores (Figure 1).

Training program

Participants in the TRX, and Pilates training program, which included eight moves to improve the strength and endurance of the core muscle of the trunk and back, participated in six sessions and three sessions for 60 minutes each [17,18]. The control group performed their routine exercises during the research period (six weeks), and according to the training program presented in table 1, both intervention groups received the same intensity and volume of exercise. The TRX training on sling and Pilates training on Swiss ball and unstable surface performed. The balance function measurements were performed in both groups, one week ago (pre-test) and one week later (post-test) from the TRX, and Pilates exercise period. In this study, Shaipiro-Wilk's statistical test was used to evaluate the normality of the data and then to determine the difference between the three groups of two-way ANOVA and Bonferron's post-hoc test. All statistical tests were performed using SPSS version 23.

RESULTS

The descriptive variations of the research samples, including height, weight, age, body mass index by groups are presented in Table 3. Three groups were homogeneous for anthropometrical variables such as height, age, weight and BMI, and did not differ significantly. Table 2 shows Mean and Standard Deviation of the general characteristics of subjects in training and control groups.

In order to compare the mean dynamic balance test scores in the three groups, two-way Anova was used and the results were presented in table 3.

As shown in table 4, the Bonferroni post-hoc test was used to assess the intra-group differences in the balance test scores. The results indicated a significant difference was found between pretest and posttest of dynamic balance for training groups ($P \leq 0.05$) which was not significant in the control group ($P > 0.05$) (Table 4).

Table 5, showed that no significant difference for pre-test all excursions of Y balance test between three groups ($P > 0.05$). On the contrary, significant differences were found for post-test of Y balance control group with the TRX group in anterior excursion ($p = 0.003$), and the control group with the Pilates group ($p = 0.001$), but there was no significant difference between the TRX and Pilates groups ($p = 0.252$). Also significant difference was found between the control group with the TRX group in the posteromedial excursion ($p = 0.033$), and the control group with the Pilates group ($p = 0.001$), but between the TRX and Pilates training, groups were not significantly different ($p = 1.000$). There was a significant difference between control group with the TRX group in the posterior lateral excursion ($p = 0.006$), and the control group with the Pilates group ($p = 0.001$), as well as between the TRX and Pilates was significantly different ($p = 0.011$). A significant difference was found between the control group with the

Table 1: Training Program for TRX, and Pilates intervention groups.

	Saturday	Monday	Wednesday
Warm-up	**Running 10min**	**Running 10min**	**Running 10min**
Exercise Type	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
Exercise Method	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)	
Cool-down		Stretching 15min	

TRX in the total dynamic balance ($p = 0.003$) and the control group with the Pilates group ($p = 0.001$), but between the TRX, and Pilates no significant difference ($p = 0.252$) was observed.

DISCUSSION

The purpose of this study was to assess the effect of six weeks of TRX and Pilates exercises on the balance functions of Futsal players in Qazvin. The findings showed that there was no significant difference between the two experimental groups and the control group in the Y-test in the pre-test. However, in the post-test, the two experimental groups showed better performance than the control group and there was a significant difference in the anterior, posteromedial, Poster lateral and total dynamic balance excursion of the general dynamic balance. Also, although the difference between the results of the star balance test between the two groups of TRX, and Pilates was not statistically significant, the results showed that the Pilates group recorded better scores for the star balance than the TRX group. These results are also consistent with the findings of previous studies, Okada et al. (2011), Sato et al. (2009), Kahle (2009) and Byrne et al. (2014), all of which reported improvement in balance after applying different programs for central body exercises. They were aligned and the probable cause of this improvement in maintaining balance can be seen as a result of improvement in strength and endurance of the core body region. The findings of the present study are not consistent with the results of research by Nesser et al. (2008), which indicate that core stability exercises do not improve athletic performance or have little effect on the performance of athletes. The probable cause of this difference in results can be the difference in the type and intensity of the training program. When there is instability in the vertebral column, motion has occurred incorrectly, the motor pattern of neuromuscular coordination decreases and the risk of injury to the spinal column increases [20]. Therefore, facilitating the

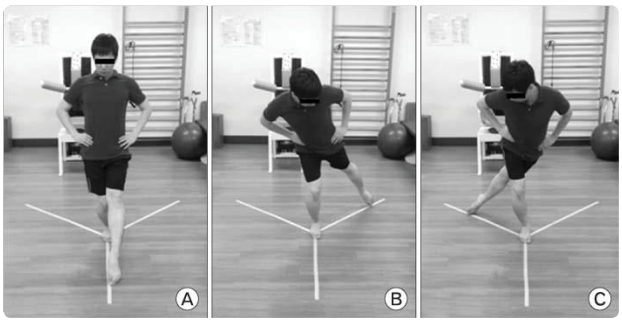

Figure 1: Subject performing Y excursion balance test.

Table 2: One-way Anova to compare anthropometrical variables between in three groups.

Variable	Group	No	Mean	SD	F	*p*
Age	Control	12	22.40	1.34		
	TRX	12	21.80	2.44	1.111	0.344
	Pilates	12	23.10	1.91		
	Control	12	174.90	4.30		
Height	TRX	12	173.90	4.04	1.037	0.368
	Pilates	12	172.40	3.30		
Weight	Control	12	65.80	6.66		
	TRX	12	66.40	4.67	0.309	0.737
	Pilates	12	67.80	6.01		
	Control	12	21.12	2.18		
BMI	TRX	12	21.35	1.55	0.175	0.840
	Pilates	12	21.63	1.99		

*Significance level is $P \leq 0.05$.

Table 3: The results of two-way Anova for mean scores of the Y balance test.

Excursion	Source	Mean square	F	*P*	Eta quare
Anterior	Group	276.368	18.625	0.000*	0.408
	Time	329.098	22.925	*0.000	0.298
Posteromedial	Group	306.573	8.390	*0.001	0.237
	Time	462.204	12.649	*0.001	0.190
Poster lateral	Group	444.642	8.256	*0.001	0.234
	Time	671.475	12.468	*0.001	0.188
Total dynamic balance	Group	480.463	16.990	*0.000	0.386
	Time	481.565	17.028	*0.000	0.240

*Significance level is $P \leq 0.05$.

Table 4: The results of Bonferroni post-hoc test for intra-group comparisons of the Y balance test.

Excursion	Groups	Mean difference	*P*
Anterior	Control	0.582	1.000
	TRX	5.537	0.028*
	Pilates	7.933	*0.001
Posteromedial	Control	1.749	1.000
	TRX	9.570	*0.012
	Pilates	8.832	*0.028
Poster lateral	Control	0.227	1.000
	TRX	10.119	*0.048
	Pilates	10.180	*0.046
Total dynamic balance	Control	1.071	1.000
	TRX	8.175	*0.017
	Pilates	9.894	*0.002

*Significance level is $P \leq 0.05$.

Table 5: The results of Bonferroni post hoc test for the comparison of the Y balance test

Excursion	Time	Group	Mean Difference	*p*
Anterior	Pre	Control & TRX	1.831	1.000
		Control & Pilates	3.598	0.575
		Pilates & TRX	1.785	1.000
	Pos	Control & TRX	6.768	*0.003
		Control & Pilates	10.949	0.001*
		Pilates & TRX	4.181	0.252
Posteromedial	Pre	Control & TRX	2.626	1.000
		Control & Pilates	2.478	1.000
		Pilates & TRX	5.104	0.966
	Pos	Control & TRX	8.693	*0.033
		Control & Pilates	13.059	0.001*
		Pilates & TRX	4.366	1.000
Poster lateral	Pre	Control & TRX	2.099	1.000
		Control & Pilates	3.632	1.000
		Pilates & TRX	1.533	1.000
	Pos	Control & TRX	12.445	*0.006
		Control & Pilates	14.039	*0.001
		Pilates & TRX	11.713	*0.011
Total dynamic balance	Pre	Control & TRX	1.813	1.000
		Control & Pilates	3.598	0.575
		Pilates & TRX	1.785	1.000
	Pos	Control & TRX	6.768	*0.003
		Control & Pilates	10.949	0.001*
		Pilates & TRX	4.181	0.252

simultaneous contraction of the muscles around the lumbar vertebra, such as abdominal muscles, transverse abdominal, multifidus, Para spinal, may increase the stability of the vertebrae [21]. Therefore, the purpose of the 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 does this by increasing tolerance and coordination in the vertebrate stabilizer muscles [22]. The core body as an interface, with the effective transfer of forces produced from the lower extremity to the upper extremity, helps in sporting activities [23]. Instability in the lumbar-pelvic region during running leads to a weak technique and an ineffective use of force [24]. The activity of the trunk prior to the activity of the lower limb is performed, which provides a basis for functional movements by securing stability to the spine. The participation of different muscle groups for the stability of the lumbar region of the spinal column depends on the size of the forces and loads loaded on the trunk [25]. The control of external forces that open, bend, or rotates the trunk, is the responsibility of the abdominal muscles, and the rotating muscles of the thigh and closers control the excessive movement of the pelvis [23]. Reducing muscle strength in the core region creates a source of instability in the development of lower extremity forces, which predicts lower instability injury to the lower limbs [23]. Core muscle weakness in sports requiring rapid jumps, jumps and running are directly related to lower extremity injury [25]. Regarding the discussion, it is observed that the strength of the surrounding and contracting muscles on their joint and contractions to fix the lower-limb joints, the proper range of motion, the activity of receptors and muscle control to maintain balance when performing the act of acquiring the greatest distance from it is very important.

CONCLUSION

According to theories of strengthening the core body and limb movement, it can be concluded that the participation in TRX, and Pilates exercises improves the dynamic balance and performance of athletes. Such exercises, by changing the pattern of muscle activation, increase the stability of the core body and improve balance. Although more research is needed for these exercises, the results of the present study suggest that TRX and Pilates exercises can be useful for improving balance by muscle strengthening, often associated with control of the spine and pelvis.

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