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Research Article

Does TRX Training Reduce Injury Rates in Futsal Athletes, as Measured by the Functional Movement Screening Test? -

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ABSTRACT

Objective: The Functional Movement Screening (FMS) measures the range of motion, balance, and stability in different situations. So performing exercises that increase the (FMS) scores may be helpful in reducing the number of exercise injuries. Therefore, the aim of this study was to assess does TRX training reduce injury rates in futsal athletes, as measured by the Functional Movement Screening Test?

Methods: Twenty-four futsal players (CON mean age: 22.40 ± 1.24 years and INT Mean age: 2.44 ± 21.80 years, age range: 18-28) were randomly assigned to a CON (n = 12) or an INT (n = 12) group. The intervention group carried out three times a week over six weeks during the same period, the control group continued its routine training that includes futsal specialist training and Tactical training. Both groups performed functional movement screening before and after the exercise program. Paired t test was used to analyze the data via SPSS software at the significance level of $P < 0.050$.

Results: The Paired t test analysis showed significant improvements in Deep squat ($p = 0.01$), Hurdle step ($p = 0.01$), In-line lunge ($p = 0.04$), Trunk rotary stability ($p = 0.021$) and total score of the FMS ($p = 0.002$) from the pre- to post – test in the INT group, But no significant changes were observed in control group performance.

Conclusion: According to the results, the suspension training seems to increase the FMS by strengthening the body's core region and modifying the patterns of utilizing motor units and it can reduce the injury rates to futsal players. So, it is recommended for athletic trainers and athletes to use these training to prevent sports injuries.

Keywords: Suspension training; Prevent injury; Core stability; FMS

INTRODUCTION

With increasing participation in sports activities, the number of athletes at risk of injury has increased. According to the National Collegiate Athletic Association reports, approximately 1,82,000 injuries occurred in athletes from 1988 to 2004 and Futsal is among the top ten injury prone sports with incidence rate of 20.3 and 55.2 injuries per 10000 hours sport participation, respectively [1,2]. Most injuries affect the lower extremity (i.e., knee and thigh) [3,4]. In futsal, prospective studies with hamstring injury rates are scarce, but Junge and Dvorak. demonstrated that thigh strain is among the most prevalent diagnoses of time-loss injuries in futsal players [3]. In addition, recently Martinez-Rianza et al. [5] analyzed medical assistance to Spanish national futsal team over five seasons and showed that in 43.3% of the cases, injuries were sustained in the thigh, followed by the leg (12.6%) and knee (10%) [5]. Most assistance cases (52.6%) were due to muscle overload (i.e., when the individual did not have an anatomical injury but the muscle was painful and slightly tight when manually explored) and 14.4% were due to residual pain.

Sport injuries can have various causes. For examples, improper methods of performing techniques, overuse, and insufficient recovery. According to previous studies, it is possible that athletes are vulnerable to various internal factors. These factors include inappropriate ratios of strength and endurance of agonist and antagonist muscles, structural abnormalities, gender, pre-seasonal physical fitness, and history of injury [6-8]. Recently, researchers have shown that muscular imbalance may be one of the causes of injury, in addition to improper motor control or muscle weakness [9]. In this regard, studies clearly show that knee injuries are more common in female athletes with inappropriate motor control in the body [10].

Core stability is created through stability in the trunk, thus allowing the production, transmission and optimum control of force and movement along an integrated kinematic chain [11-13]. The aim of this type of exercise is to correct movement patterns, increasing the range of motion, stretching and strengthening muscles, as well as proprioception training. Core strength training is based on the principle of high-strength, neuromuscular activity and the use of static and dynamic training [14,15].

Previous research has shown the importance of the stability of the core body region in human movements. Core stability plays a role in the effective functioning of the trunk and limbs for the production, transfer, and control of forces or energy in the activities [12,16,17]. For example, Richardson et al. [18] examined the sequence of muscle activity throughout the entire body movement, and a number of stabilizers in the core region (transverse abdominis, multifidus, rectus abdominis, and internal and external abdominals oblique) that were continuously before any movement in the limbs they were activated [18]. As a result, the authors found that trunk muscle strength, sprint, and kicking performance improved following 9 weeks of core strength training on unstable and stable surfaces, without differences between groups [19]. The results of previous research, confirm the theory that movement control and core area stability extend to limbs [17]. More recently suspension training systems have been added to the list of core stability training devices. In suspension training, as the name suggests, straps and/or ropes are used to suspend specific body segments in the air. Individuals then work against their body weight as they complete exercises in the unstable environment created by the suspension straps. Although considerable research has examined more traditional means of instability training [20]. Little previous research has evaluated the effects of suspension training.

Motor control is the ability to create and maintain a balance between mobility and stability throughout the kinematic chain while performing a precise and effective motor pattern [21]. Muscle strength, flexibility, endurance, coordination, balance, and fundamental performance are the components needed to perform a correct movement and exercise skills [21,22]. Disruption of basic motor patterns is associated with an increased risk of athletic injury [9,23]. Although direct and quantitative measurements of fundamental movements are limited, Cook et al. [24] proposed a qualitative assessment of the movement, indicating the degree of core stability of individuals and how they affect performance and injury [24,25]. The Functional Movement Screening (FMS) test evaluates the quality of the basic locomotor pattern and any possible limitations or asymmetry in the movement patterns performed. These tests are also used to assess pain in athletes, muscle strength, joint stability in the lower limbs, muscle flexibility, balance and proprioception [25]. The FMS is considered a comprehensive tool evaluating motor control through functional movement and dynamic coordination analysis [26,27]. The FMS has also been used as an injury prediction tool in competitive athletes. Recent studies have shown that athletes with an FMS score under 14 were more likely to sustain an injury than their peers who received more than 14 points [28,29].

Regardless of the sports level, prevention of injuries is one of the most important goals in sports medicine and physical therapy. This issue is of great importance at the professional level, where injury can prevent proper preparation, or completely excludes the possibility of participating in competitions. At the amateur level, often in youth sports clubs, the injury prevention aspect is not as highly stressed. However, comprehensive motor development at a younger age can bring significant benefits in the future. Given that the scores for the FMS test have a predictive value with regard to later susceptibility to injuries in competitive athletes the aim of the present study was to evaluate if injuries in futsal players can be reduced by performing TRX training?

METHODS

The present study was experimental and pre-test and post-test design with the control group, which was performed on a group of futsal players of Qazvin city who were selected. All participants participated in the futsal training program (six hours a week) and at least five years of futsal experience before the study.

The study plan was first reviewed and approved by the Ethics Committee of the University of Guilan. The participants were informed about the aim and methods of the study and signed the consent form of the study. Non-inclusion criteria included: ankle sprain over the past six months, knee surgery over the past year, hip surgery over the past six months if you have a history of a disease or drug that affects the nervous system, Visual and auditory defects [30]. All measurements were done alike by one person. The participants performed the FMS test once before the training program and the second time after completing the training program. The applied FMS tests consisted of seven motor tasks: a deep squat, a hurdle step, an in-line lunge, a shoulder mobility test, an active straight leg raise, a rotary stability test and a trunk stability push-up. All movement tasks were assessed on a scale from 0 to 3, where 3 meant the proper execution of the locomotor pattern; 2 meant the execution of the locomotor pattern with elements of compensation; 1 meant the inability to perform the motor pattern; 0 indicating pain during movement. Each trial was performed twice, and the better of the two results was registered for further analysis. Specific comments should be noted defining why a score of three was not obtained. Each test was performed 2 times, and the best score for the two runs was recorded for subsequent analyzes [24]. Score 21 was the maximum score earned.

Stabilization training was conducted in the gym, following a 15 min warm-up. The exercises were performed in strictly predetermined order, in closed kinematic chains using slings attached to the gym horizontal bar and ladders. The stabilization exercises, which lasted about 20 min, were conducted on a normal training day, always with a prior warm-up and before the subsequent futsal workout [31]. The control group performed only routine training during the research period (six weeks) that included futsal specialist training and tactical workout, but the intervention group performed a planned training program instead of a part of their routine training program. Details of the training are presented in table 1.

Suspension training

The FMS measurements were performed in both groups before (pre-test) and after (post-test) for the six-week period of sling training. All variables were normally distributed (Shapiro Wilks test). Data are presented as means with Standard Deviation (SD). Paired t-tests were used to identify differences Pre/Post-test results for FMS between control and intervention groups. Statistically significant differences were assumed at $P \leq 0.05$.

RESULTS

The descriptive characteristics of the research samples, including height, weight, age, Body Mass Index (BMI) are presented in table 2.

As shown in table 3, the results of the functional movement screen indicate that after performing the training program between the intervention and control groups Significant changes were observed in the Deep squat ($p = 0.01$), Hurdle step ($p = 0.01$), In-line lunge ($p = 0.04$), Trunk rotary stability ($p = 0.021$) and total score of the FMS ($p = 0.002$). Discussion

The aim of this study was to assess does TRX training reduce injury rates in futsal athletes, as measured by the Functional Movement Screening Test? The results of this study showed that the performing of TRX training significantly improves the scores of participants in the FMS. The results of the present study, confirm the conducted study by Peate et al. [32] who reported that the use of prevention training in people with a score of less than 14 in the FMS would improve the score obtained in the test and also reduce the probability of injury [32]. It also confirms the results of the Frost study, which reported that after completing the exercise program in the training group, improved FMS test scores compared with the control group [33]. Also in another study, Wright et al., used functional exercises in adolescents for four weeks and reported that

Table 1: Training program.

	Training Program		
	Saturday	Monday	Wednesday
Warm-up	Running 15min	Running 15min	Running 15min
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)	

Table 2: General characteristics of subjects (Mean ± SD).

Group	Number	Age(year)	Height (cm)	Weight (kg)	BMI
CON	12	22.40 ± 1.24	174.52 ± 4.30	65.80 ± 6.66	21.12 ± 2.18
INT	12	2.44 ± 21.80	173.25 ± 4.04	66.40 ± 4.67	21.35 ± 1.55

Table 3: Paired t-test to investigate the difference between pre-test and post-test FMS score between control and intervention groups.

Group	Tests	Pre-Test Score (Mean ± SD)	Post-Test Score (Mean ± SD)	t	p*
CON	Deep squat	2.00 ± 0.66	2.20 ± 0.42	1.00	0.34
	Hurdle step	2.10 ± 0.73	1.80 ± 0.78	0.81	0.43
	In-line lunge	2.20 ± 0.63	2.00 ± 0.66	0.82	0.44
	Shoulder mobility	2.00 ± 0.47	2.20 ± 0.63	1.00	0.34
	Active straight leg raise	2.30 ± 0.67	2.30 ± 0.67	0.80	0.44
	Trunk stability push up	2.10 ± 0.73	1.80 ± 0.78	1.96	0.08
	Trunk rotary stability	1.70 ± 0.48	1.80 ± 0.63	0.42	0.67
	TOTAL FMS Score	14.40 ± 1.07	13.90 ± 1.28	1.46	*0.17
INT	Deep squat	1.50 ± 0.52	2.40 ± 0.51	3.85	*0.04
	Hurdle step	2.00 ± 0.66	2.50 ± 0.84	3.00	*0.01
	In-line lunge	2.00 ± 0.47	2.60 ± 0.51	3.67	*0.04
	Shoulder mobility	2.10 ± 0.73	2.30 ± 0.67	1.50	0.16
	Active straight leg raise	2.20 ± 0.63	2.40 ± 0.51	1.50	0.16
	Trunk stability push up	2.00 ± 0.66	2.40 ± 0.51	2.44	*0.37
	Trunk rotary stability	1.40 ± 0.51	2.30 ± 0.48	9.00	*0.01
	TOTAL FMS Score	13.50 ± 1.08	16.60 ± 1.50	6.43	*0.01

*Significantly different from the pre to post test within each groups $P \leq 0.05$.

performing 4 weeks of the training program in adolescents did not improve the scores obtained from the FMS [34]. The results of the present study are not consistent with the results of Wright et al. this difference can be attributed to the fact that in the present study, the training was completed within six weeks, but in the study of Wright et al. The study period was four weeks, which suggests that perhaps utilizing Such a short-term training program can individually affect components of physical fitness, but will not affect the FMS results, because a suitable training program is a program that coordinates all the core components of the body for a univalent action and has the correct execution order. After completing the suspended training, the subjects scored a mean score of FMS 16.60, slightly higher than the score of the adult FMS results, with an average score of 15.8 [35]. In the study of male athletes between the ages of 8-14, the average score FMS was 15.2 [36]. This amount was also lower than the average obtained in the present study. This difference in the results can be due to the difference in age between those surveyed in this study and other studies, as well as differences in training program and physical activity level.

The core region of the body as an interface, with the effective transfer of forces produced from the lower extremity to the upper limb, helps in perform the training [21]. Therefore, instability in the pelvic region during the running leads to a weak technique and an ineffective use of force [37]. Lumbar-pelvic muscle region plays an important role in flexion, extension, and resistance to shear force in the spine and perform a complete activity in the trunk movements. For a good performing in sports activity, core stability is needed for resistance to shear forces in the spine, which occurs in several directions [17]. Due to the movement of the vertebral column at the same time in three dimensions, many stresses on passive bone structures-spinal ligaments carry a lot of stress; therefore, the spine is susceptible to injury. As a result, it is necessary to control the movement of the lumbar and abdominal muscles by providing the optimal stiffness against the loads on the lumbar spine and preventing excessive damage. The main purpose of the vertebra stabilization exercises is to create a physical capacity to maintain normal position in the spinal column during daily activities; it does this by increasing the endurance and coordination of the vertebrate stabilizer muscles [38]. However, suspended training, which are a new form of core stabilization training, practice the whole body in an unstable condition, the ability to enhance the activity of the roots of the nerves, to establish coordination between the trunk and the hip joint, and to reduce abnormalities and asymmetry in the limb during the execution of the movement to be [15]. Also, these trainings have a positive effect on the muscular reactions in the closed kinematic chain and improve the ability to control the balance.

CONCLUSION

Regarding the results of this study, suspension training lead to improving the scores of FMS Futsal athlete's players. Research has shown that continuous training in suspended exercises can potentially improve the body's core body region by improving the use of motor units and creating coherence in the core body region. These exercises strengthen the core muscles of the body by improving the performance of the FMS scores and thus TRX training can reduce injury rates in futsal players.

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