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The effect of balancing and resistive selected exercise on young footballers' dynamic balance

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ABSTRACT

Balance is known as an important factor in many athletic skills which its weakness is related to some injuries such as ankle or knee instability or pain, knee Osteoarthritis and acute ankle sprain. The goal of this research is to study the effect of balancing and resistive selected exercise on young footballers' dynamic balance. In this study thirty six young footballers (Age: 18.22±0.83 year, Height: 173±5.73 cm, Weight: 62.1±6.88) participated as volun teers and were divided randomly in three groups of Experimental 1 (Resistive), Experimental 2 (Balancing) and Control. Subjects dynamic balance in pre-test and post-test was measured using Biodex balance system. Experimental Group 1 and 2 took part in an eight-week designed program of balance and resistive exercises. Descriptive statistics methods, ANOVA and Tukey post hoc test in significance level of $p<0.05$ were utilized for statistical analysis. They showed which there is a significant difference among three groups in subjects dynamic balance after balance and resistive exercises, while balance exercises showed much improvement in comparison to resistive exercises in subjects dynamic balance.($p<0.05$). Results confirmed the significant influence of these exercises on subjects' dynamic balance. According to the results, using balance and resistive exercises can be recommended in order to improve athlete's dynamic balance and injury probability decrease.

Keywords: Balance Exercises, Resistive Exercises, Dynamic Balance, Young Footballers

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INTRODUCTION

Gambta and Gary (2000) defined balance as the most important part of an athlete ability which deals with different activity forms [1]. Balance is of basic daily activities and it is an important factor for sportsmen athletic behavior [2].

Balance importance in daily physical activities such as sitting, standing and walking is obvious to prevent injuries in sports like Basketball, Football and Volleyball. By a lot of scholars, all physical activities have comprised of two aspects: keeping balance (keeping appropriate body position and spatial orientation) and specific moving components [3].

For each sportsman who acts in his best ability conditions, all exercise variables should be optimum. Balance is known as an important factor in many athletic skills such as Gymnastic, Basketball, Volleyball, Football and so on, which its weakness relates to some injuries like ankle and knee instability or pain, knee Osteoarthritis and acute ankle sprain [4 , 5].

In one hand, football is of the most popular sports which its injury rate is much high. It is estimated that 10 to 15 injuries occur for each 1000 play hour [6, 7 and 8]. It has been specified that in sports which need to sudden stop and start - such as football and basketball – result in most injuries [9]. Also, football study results show the bottom limbs are more vulnerable in comparison to other parts of the body and it is because of involving the bottom limbs in running, shooting and jumping during football match [9].

Football injuries not only threaten athletes' health but also can impose a lot of economical expenses on people and society. As an example, it has been reported that approximately 2 percent of UK professional soccer players leave matches because of severe injuries and as well, a lot of footballers because of chronic injuries. Also, the average treatment expense for each injury in football is estimated around 150 USD [10, 11].

Also in another research about treatment expenses of these injuries – ankle sprain- among 4.8 million sportsmen in primary schools and 1.7 million sportsmen in high schools who were active in basketball and football in the USA, 15% of them - one million - were infected by ankle sprain which has got staggering treatment expense [11].

According to the population of soccer players in the world and injuries economical-social consequences, it is highly necessary to suggest a prevention program to decrease injuries [10]. Research indicates that resistance training, balance and multi-modal training can all significantly improve various measures of functional performance in athletics [28].

This study tries to investigate the influence of balance and resistive selected exercises on young footballers' dynamic balance.

The results of this study concludes better understanding of balancing exercises (using balancing board) and resistive exercises (using Traband) while using in patients rehabilitation, sports teams also utilize balancing and resistive exercises in their exercise programs design so that decrease population, intense and even expenses of treatment and athletes absence during competition season.

This study is aimed at comparing the influence of balancing and resistive selected exercises on young footballers' dynamic balance. In other words, we have tried by offering exercise program to a group of young footballers in this study to investigate whether balancing and resistive exercises improve young footballers' dynamic balance.

MATERIALS AND METHODS

Research population has comprised of young footballers of Dehdari and Pishgaman football teams with the background of participation in Khorasan Razavi League 1 who volunteered in the research. After handing over the background information questionnaire and injuries report and their analysis, 36 persons were selected voluntarily among them according to the research conditions and as research sample. Thirty six young footballers (Age: 18.22±0.83 year, Height: 173±5.73 cm, Weight: 62.1±6.88 Kg) were divided randomly in three groups of Experimental 1 (Resistive), Experimental 2 (Balancing) and Control.

Conditions for participating in the study were:

1- No injury in femur, tibia, ankle and foot bones and a thin reed
2- No injury in knee joint and ACL
3- No injury in muscles operating in thigh ,knee ankle joints, sprain and ankle sprain
4- Age range 17-19.

Data Collection Method

This study has been done in eight weeks with considering exercise protocol of 3 to 5 times a week and 55 to 65min each in Labors' Sports Complex. In addition, Experimental Group 1 and 2 made the resistive exercises group using Traband and balancing exercises group using balancing board. Samples' Height, weight and balance were measured before starting exercises.

Seca height meter and scaled and fixed ruler - which had been installed vertically beside wall - was used to measure height. This ruler has a horizontal bar which sits on head. Each participant stood up whit no shoes, back to the wall so that the body weight was divided equally on each legs and shoulders stayed in the same level and also head and eyes were in parallel to the horizon. Then, the horizontal bar sat on head so that it was tangential on cranium and made a vertical angle to the vertical ruler. In this way, the height of each participant was measured.

Digital scale was used to measure the participants' weight. Subject (sample) stood with no shoes and minimum clothes and his weight was measured in kilogram. Biodex Stability System (BSS) Biodex Stability System was used for the evaluationof balance in single limb stance for all the participants.This system consists of a movable balance platform, which provides up to 20° of surface tilt in a360° range. It is a dynamic postural stability assessment,which assesses neuromuscular performanceby evaluating the ability of remaining stable on the unstable platform.

The motion of the unstable platform is represented asdeviations from the horizontal plane (Overall stability index "OSI", Anterior/Posterior stability index "AP", Medial/Lateral stability index "ML"). All the information, concerning the motion of the balance platform is represented by a small movable cursor on the system screen.

The platform provides eight different stability levels, which range from a completely firm surface (stability level 8) to a very unstable surface (stability level 1). Balance evaluations in the current study made at stability level 2 on the electronic stability system, for total groups. Balance abilitywas assessedin all subjects at baseline and after the completion of the 8-week balance program.

Exercise program

Exercise program was divided in three parts which includes:

1- Warm up: warm up part in ten minutes including slow running along football playground, stretching practices for whole parts of body, especially practices dedicated to bottom limbs and muscles such as Hamstring, four-headed femoral, thigh and twin groin along with jumping practices.
2- Protocol running: main protocol was done for 35 to 45 minutes.
3- Cool down: cool down part in ten minutes including slow running along footsall playground, stretching practices for whole parts of body.

Exercise protocols: balancing exercises protocol using balance board: [13, 14, and 15].

Phase	Surface	Eyes	Exercise
Week 1	Floor	Open Open Open Open	*Quickly hop to one position and back in a controlled manner. *On maintaining the center of the knee over the 1st and 2nd toe while performing the exercises. *Hopping and jumping activities is fundamental. * Star-Excursion Test.
Week 2	Floor	Open Open Open Open	*leg stance Single. *Single-leg stance while swinging the raised leg. *Single-leg squat (30°-45°). *Single-leg stance while performing functional activities (dribbling, catching, kicking).
Week 3	Floor	Closed Closed Closed	*Single-leg stance. *Swinging the raised leg. *Single-leg squat (30°-45°).
Week 4	Board	Open Open Open Open	*Single-leg stance. *Swinging the raised leg. *Single-leg squat (30°-45°). *Double-leg stance while rotating the board.
Week 5	Board	Closed Open Open Open	*Single-leg stance. *Swinging the raised leg. *Single-leg squat (30°-45°). *Single-leg stance while rotating the board.
Week 6	Board	Closed Open Open Open	*Single-leg stance *Single-leg squat (30°-45°). *Single-leg stance while rotating the board *Single-leg stance while performing functional activities (dribbling, catching, kicking).
Week 7	Board	Open	* Stand with both feet in the center of the balance board (Right edge, left edge, right edge, etc.) *Stand on the balance board with two feet, rotate the board 360 degrees. *Stand on the balance board with two feet, rotate the board 360 degrees.
Week 8	Board	Open	* Stand with both feet in the center of the balance board (Right edge, left edge, right edge, etc.) *Stand on the balance board with two feet, rotate the board 360 degrees. *Stand on the balance board with two feet, rotate the board 360 degrees. *Do a single leg balance in the middle of the balance board

***Phases I through IV were performed 5 days per week. Phase V was performed 3 days per week for the rest of the season. Each exercise was performed for duration of 30 seconds per leg, and legs were alternated during a rest period of 30 seconds between repetitions.*

Strength exercises protocol using Traband (elastic bands): [16, 17, and 18].

Phase	color band	rest (seconds)	Exercise
Week 1	silver	120	*Dorsiflexion (tibialis Anterior). *Planter Flexion (Gastrocnemious). *Inversion (Tibialis Posterior). * Eversion Peroneus langus. **3*6**
Week 2	silver	120	*Hip flexion. *Hip Extension. *Hip Abduction. *Closed-Chain Hip Rotation.. **3*8**
Week 3	silver	120	* Monster Walk. *Reciprocal Arm and Leg. *Basic Kicking Diagonal. **3*8**
Week 4	gold	120	*Single-leg knee bend. *Balance squat with Cheri. *Total-body Extension. *Concentric and Eccentric Hamstrings. **3*8**
Week 5	gold	120	*Tuck squat. *Monster Walk. * Basic Kicking Diagonal. *squat. **3*8**
Week 6	gold	120	* Tuck squat. *Lunge. * Reciprocal Arm and Leg. *Squat Walk. **3*8**
Week 7	gold	120	* Abduction Pattern with Soccer Ball. *Throw-in Simulation and Overhead Pass. *Explosion out of Three-point stance. *Side to side Lateral Agility. **3*8**
Week 8	gold	120	* Monster Walk. *Resisted Backward Ruining. * Side to side Lateral Agility. * Explosion out of Three-point stance. **3*8**

*** First and fourth weeks, 5 days a week and fifth week of exercise, exercise three days a week will do.*

Descriptions: Trabands resistance in term of week: silver: first (50%), second (75%), third (100%). Golden: fourth (50%), fifth (75%), sixth (100%), seventh (100%), eighth (100%).

Descriptive and inferential statistics were used in this research in the following way:

Descriptive statistics was used in order to organize, brief, classify the raw scores and describe sample measures (population, average, standard deviation, drawing the diagram and tables). Also, SPSS ver.16 and Excel2007 were used to analysis the data. Inferential statistical method was utilized to study the influence of balancing and resistive selected exercises on young footballers' dynamic balance and K-S test was used to determine research variables normality. Leven's test to prove homogeneity and normality in the groups, Paired-samples t test for intra-group comparison and One-way ANOVA and Tukey test in significant level of $p<0.05$ were used.

RESULTS

This section contains all specifications and measured characteristics of participants including age, height, weight and the scores obtained from the participants in Biodex balancing test in a table to facilitate conclusion. As said before, the population of this research includes 36 persons who were homogenized in some characteristics such as height, weight and age by using K.S Test and were divided in three groups (experimental 1 and 2 and control).(table1)

Demographic characteristics of the three participant groups

Group	Age (years)	Height (cm)	Mass (kg)	BMI (kg) / (m2)
Experimental.1	**18/25 ±0/86**	**172±4/99**	**60/85±6/31**	**20/61±2/51**
Experimental.2	**18/25±0/86**	**175±6/57**	**64/20±7/38**	**21/51±2/47**
Control	**18/16±0/83**	**173/±6/59**	**61/25±7/0**	**20/51±2/57**

ANOVA result (tables 2,3,4) and also tables 5,6,7 of difference among groups shows that after applying protocol by Tukey test there is a significant difference among experimental 1 and 2 and control.

Table (2): Investigating the influence of balancing and resistive exercises on general balance among groups (ANOVA Test)

		Sum of Squares	df	Mean Square	F	Sig.
Pre-test Overall balance	Between Groups	1/46	2	0/73	0/47	0/625
	Within Groups	50/69	33	1/53		
	Total	52/16	35			
Post-test Overall balance	Between Groups	23/98	2	11/99	11/37	0/001
	Within Groups	34/78	33	1/05		
	Total		35			
SD Pre-test v Post-test Overall balance	Between Groups	34/66	2	17/33	51/59	0/001
	Within Groups	11/08	33	0/33		
	Total	45/75	35			

Table (3): Investigating difference among groups after applying protocol by Tukey test

Dependent Variable	Groups		Mean Difference	Std. Error	Sig.
Overall balance	Experimental.1	Experimental.2	-0/32	0/23	0/36
		control	1/90	0/23	0/001
	Experimental.2	Experimental.1	0/32	0/23	0/36
		control	2/22	0/23	0/001
	control	Experimental.2	-2/22	0/23	0/001
		Experimental.1	-1/90	0/23	0/001

**. The mean difference is significant at the 0.05 level.*

Table (4): Investigating the influence of balancing and resistive exercises on side balance (ANOVA test)

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Pre-test M-L balance	Between Groups	1/98	2	0/99	1/09	0/34
	Within Groups	30/09	33	0/91		
	Total	32/07	35			
Post-test M-L balance	Between Groups	8/98	2	4/49	7/80	0/002
	Within Groups	19	33	0/57		
	Total	27/99	35			
SD Pre-test v Post-test M-L balance	Between Groups	15/58	2	7/79	36/13	0/001
	Within Groups	7/11	33	0/21		
	Total	22/70	35			

** Medial-Lateral (M-L)*

Table (5): Investigating difference among groups after applying protocol by Tukey test

Dependent Variable	Groups		Mean Difference	Std. Error	Sig.
Medial-Lateral balance	Experimental.1	Experimental.2	-0/20	0/189	0/54
		control	1/28	0/189	0/001
	Experimental.2	Experimental.1	0/20	0/189	0/54
		control	1/48	0/189	0/001
	control	Experimental.2	-1/48	0/189	0/001
		Experimental.1	-1/28	0/189	0/001

**. The mean difference is significant at the 0.05 level.*

Table (6): Investigating the influence of balancing and resistive exercises on frontal-postern balance among groups (ANOVA test)

		Sum of Squares	df	Mean Square	F	Sig.
Pre-test A-P balance	Between Groups	0/604	2	0/30	0/37	0/73
	Within Groups	31/99	33	0/97		
	Total	32/60	35			
Post-test A-P balance	Between Groups	13/52	2	6/76	13/61	0/001
	Within Groups	16/36	33	0/49		
	Total	29/90	35			
SD Pre-test v Post-test A-P balance	Between Groups	8/55	2	4/27	21/60	0/001
	Within Groups	6/53	33	0/19		
	Total	15/08	35			

**Anterior-Posterior (A-P)*

Table (7): Investigating difference among groups after applying protocol by Tukey test

Dependent Variable	Groups		Mean Difference	Std. Error	Sig.
Anterior-Posterior balance	Experimental.1	Experimental.2	-0/21	0/181	0/46
		control	0/90	0/181	0/001
	Experimental.2	Experimental.1	0/21	0/181	0/46
		control	1/12	0/181	0/001
	control	Experimental.2	-1/12	0/181	0/001
		Experimental.1	-0/90	0/181	0/001

**. The mean difference is significant at the 0.05 level.*

❖There is a significant difference between Experimental Group 1 and Control Group in post test.
❖There is a significant difference between Experimental Group 2 and Control Group in post test.
❖There is not a significant difference between Experimental Group 1 and Experimental Group 2 in post test.
❖Both exercise methods increase the young footballers' dynamic balance but balancing exercises are more effective.

DISCUSSION

Dynamic balance as a controversial concept in sensational-movement system, studies the mutual and complicated relationship between sensational data and movement responses in order to keep or change posture. Considering the increase of athletes' preparation level is very important in achieving an appropriate balance during applying athletic skills [1].

Preventing sports injuries has had increasing importance because of sports professionalization and people's increasing sports activity. Creating effective methods for treatment the sports injuries is important and it is more important to know and control factors causing dangers. As an example, recent data shows that knee muscular-neural control improvement may decrease the amount of intangible injuries anterior cruciate ligament knee. Balancing exercise and elastic exercises (Traband) are valuable exercises which can be included - as a main part – in preparation or rehabilitation program because of being less expensive and executable in clinic and at home and less needs to expensive tools with cordial-vascular power, perseverance and provision and flexible programs. These exercises come to an end faster than other one and are pleasure to patient [20, 2].

According to the researches in this field, Wilmes (2002) studied the effect of six week exercises using Traband for people with chronic ankle instability in two different researches. According to the results of these researches, strength exercises had positive influence on improvement of the proportion of opposing muscles of the ankle joint [20]. Current study with Hann et al (2009) investigated the effect of four weeks of exercise program using Traband on the weak people balance with ankle sprain background balance. Results showed that exercises using Traband caused balance improvement in both Experimental groups with and without ankle sprain background [21].

Scholars have described that exercise effectiveness on balance needs to response in three movement levels. Its main role is muscle reflex adjustment in the level of medullar. The acquired sensational data from joint mechanical

sensors following balancing reflexes cause a supportive contraction reflexively around the joint and prevent from excessive pressure on the joint movement limiting passive factors. In one hand, the researches show that the surrounding power of operative muscles on joint and their contraction for bottom limb joint consolidation, sensors' activity and neural-muscular control to keep balance during operation and getting maximum score have a very special importance. So, one of the reasons for balance improvement because of resistive exercise in current study can be related to under test bottom limbs muscles power increase after taking part in strength exercise protocol. The main reason for power increase during primary weeks of strength exercise is to match within neural system [23, 3].

But, this research with Mahio's etal (2006) who had studied power improvement and pasture control among young skiers by resistive exercises and whole body vibration resulted, that vibration and resistive exercises do not influence balance [22].

The reason for incongruity of this study with other studies' result in resistive exercises is lack of agreement about a specific exercise protocol with specific duration, intensity , session counts and gender of the under test samples, and it is not clear that how long and how much intensity have had the most influence on dynamic balance. It was observed that an exercise protocol with a specific intensity and duration has had a significant increase in balance and athletic functions and on the other hand a significant increase and change has not been observed when the same protocol is used with few changes in another research. There is not any agreement about resistive exercise duration in one session and how long could have the most influence with no side effects. Being the results of a research aligned or non-aligned with other researches is because of similarity or difference between test subjects and or even time and place of exercises in different researches.

According to the investigations in this field, Erkman et al (2010) studied the relationship between balance and footballers' executive function. Results showed that the activities which need to explosive power require an appropriate balance [23].

In one hand, Ebrahimi et al (2005) studied the effect of balancing exercises on balancing tests and healthy men's dynamic stability range using Biodex balancing system. Balancing criteria comparison indicated a statistical significant difference in some of them including the stability of the dominant and non-dominant limbs, the anterior - posterior non-dominant limb, the inner –outer index of the dominant organs, and the overall time of stability range of Biodex test of dominant organ after balance board exercises [5]

In order to express, the reasons for justifying mechanisms for balance improvement, it is necessary to point to sensational- movement system of different components which are responsible to keep balance. This system includes sensational, movement and central processor components. This system operation is resulted from combining the acquired data from different senses which show a flexible and adaptive behavior in relationship with different movement skills. Thus, balance occurs on the basis of flexible functional movement skills and they could be improved by practice and experiment [25, 26, and 27].

Proprioception has a vital role in balance control. An aspect of Proprioception role in movement control and pasture is to design and modify the endogenous movement orders before and during executing a movement order. Movement control system should consider current and changing position of joints to estimate the mechanical complicated balance resulted from its execution. Proprioception has the best conditions for data acquisition and transmitting them to central neural system, because it is a complicated process which only system makers are able to answer to this question. Proprioception data play a basic role in keeping both whole body stability and local area - joint functional stability -. Proprioception capability and functionality decreases following articular injuries and or oldness. In fast return of the injured one to the conditions before injury, increase the person's knowledge about joint position and movement is very important factor and so increasing static and dynamic balance and stability[25, 26, and 27].

We should consider that balancing exercises need to movement control response in brain stem. Movement control can be improved using balancing exercises in its all levels which this is of balance rehabilitation and Proprioception important basis, because proper movement control needs to reflex response in the medullar level, postural and spontaneity balancing reactions in the level of brain stem and consciously responses in the level of cortex [25, 26, and 27].

CONCLUSION

This research showed generally that running resistive and balancing exercises for eight weeks improves some balancing parameters and balance process with its related factors. It is recommended for future researches to run these exercises utilizing a combinational group - balancing and resistive – and for the people with ankle sprain.

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