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Walking Backwards Improves High School Female Athletes' Balance

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ABSTRACT

The main objective of study was to investigate the effect of backward walking on balance in healthy athletic high school girls. Thirty athletic high school girls were selected with mean age 16.4±0.50 and mean weight of 59.4±12.5 and mean height 1.61±0.05. The participants attended backward walking training sessions 3 times a week for period of 6 weeks. Prior and middle and after training pre-test and post-test of semi dynamic balance and dynamic balance were administered using Modified Romberg and Y test. The data were analyzed using repeated measures ANOVA and Bonferroni post-hoc test (p<0.05). Results showed that backward walking would have significant impact on semi dynamic and dynamic balance (p≤0.000). Due to its positive impact on balance of athletic girls, backward walking training can be used as a complementary training program to increase their efficiency and prevention of injuries.

Keywords: Backward walking, Semi dynamic Balance, Dynamic Balance, Proprioception

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INTRODUCTION

With the daily increase in the youth's tendencies towards numerous fields of sports, the number of individuals who incur injuries from sports activities is on the rise and the most injuries incurred are by those within this age group. In training programs, if balance, proprioception, and neuromuscular coordination are not emphasized, the risk of injury and reduction in motor abilities will increase. Information from the somatosensory system, vestibular and visual systems helps maintain balance, alongside smooth and coordinated implementation of neuromuscular activity [1].

The lower limb's main responsibility is bearing weight and walking and running and the use of learning programs for walking and running, including walking backwards, increases the effects of sports training. Winter and colleagues (1989) identified walking backwards as a close representation of walking forwards and suggested that for creating active engaged muscle patterns in walking all that is needed is to reverse the interim cycle of muscle contractions [2]. Hao and Chen (2011) found that the kinematics of walking backwards is somewhat different from walking forwards. During backward walking, the speed and length of each step is less, whereas the duration of each step is not significantly different to walking forwards [3]. In addition to this the thigh, ankle, and foot's range of motion is reduced in comparison to walking forwards [4, 5]. The lower limb's muscle contraction type, when walking backwards, is reversed. For example, while walking forwards in the loading phase the quadriceps muscle has an eccentric contraction, whereas during backward walking, in this stage the quadriceps muscle has a concentric contraction [6].

Previous research has shown that the strength of the quadriceps and hamstrings muscles after backward walking training increases [7]. Also backward walking trainings because increased flexibility in the hamstrings. Backward walking training reduces the strain on the lower limb joints to the minimum amount and increases the strength of the lower limbs muscles. Special equipment and features are not required and it is effective and safe. This research is in search of the answer to the question of what effects 6 weeks of training backwards walking imposes on students' balance.

MATERIALS AND METHODS

The participants of this research consisted of 30 healthy female student athletes from high schools in Tehran that had been participating in track and field, and a mean age of (16.4±0.5) years, mean weight of (59.4±12.5) kilograms, and a mean height of (1.64±0.05) centimeters. In the briefing session conducted one week prior to the start of the training, all participants were informed of the training procedure and given information on the tests that would be conducted. Y balance test scores were used to assess dynamic balance in the anterior, posterior-external, and posterior-internal directions and also the Modified Romberg test was used for assessing semi-dynamic balance. Every subject went through each direction 3 times (Barati and colleagues, 2015). Y balance test scores in each direction was divided by the real length of the foot, meaning from the anterior superior iliac spine to the internal ankle. These tests were conducted once before backwards walking training, once at the end of the third week, and finally once on the sixth week and after the end of the backwards walking training.

During the first session. The participants were taught backwards walking for a duration of 10 minutes. Participants walked at their desired pace and at the beginning of each training session warm ups and at the end cool-downs would take place. This training would take place 3 days per week with a steady rhythm, on a basketball court. The duration of each training session was initially 15 minutes (Hao Chen, 2011and Fakharian, 1999 and Ebrahimi, and Terbalanche, 2005) and would gradually increase, and finally reached 25 minutes 2010, for every session (Tarblanche, 2005).

RESULTS

The general characteristics of the participants of this study including height, weight, age, and the length of this lower limbs are shown in **Table 1**.

Table1:- The height, lower limb length, weight, and age

Demographic Information	Minimum	Maximum	Mean	Standard Deviation
height(cm)	153	173	161	5
weight(kg)	39.7	98.7	59.4	12.5
Age(year)	16	17	16.4	0.50
lower limb length(cm)	80	95	87	4.2

Table 2:- The results of the Bonferroni post hoc test repeated measures for the Modified Romberg test scores before, third week and sixth week training backwards walking high school female athletes

Test time	Mean	Deviation	P Value
Pre test	10.09	5.26	0.000≤P
Middle test	15.8	9.8	
Pre test	10.09	5.26	0.000≤P
Post test	21.9	14.1	
Middle test	15.8	9.8	0.000≤P
Post test	21.9	14.1	

Table 3. The Bonferroni post hoc test results repeated measures for the Y balance test results, third week and sixth week performing backwards walking high school female athletes

Direction	Time	Mean	Deviation	*P Value*
Anterior	Pre test	68.4	0.79	P≤ 0.000
	Middle test	74.9	0.10	
	Pre test	68.4	0.79	P≤ 0.000
	Post test	79.5	0.09	
	Middle test	74.9	0.10	P≤ 0.000
	Post test	79.9	0.09	
Posteromedial	Pre test	45.9	0.10	P≤ 0.000
	Middle test	58.9	0.11	
	Pre test	45.9	0.10	P≤ 0.000
	Post test	59.9	0.10	
	Middle test	58.9	0.11	P≤ 0.001
	Post test	59.3	0.10	
Posterolateral	Pre test	57.8	0.12	P≤ 0.001
	Middle test	64.2	0.10	
	Pre test	57.8	0.12	P≤ 0.086
	Post test	69.8	0.88	
	Middle test	64.2	0.10	P≤ 0.013
	Post test	69.8	0.88	

The scores for the modified Romberg test for the assessment of semi-dynamic balance in three time points of before, during, and after backwards walking training are shown in **Table 2**. The Y balance test scores for assessing dynamic balance in the three anterior, medial, and poster lateral directions in the three pre, middle, and post times of performing backwards walking training are shown in Table 3.

The results of the Bon ferroni post hoc test showed that weeks of backwards walking training resulted in a significant increase in the Modified Romberg test score (table 2) and Y balance test for high school female athletes in all directions (table 3). Three weeks of backwards walking training resulted in significant increase in the Modified Romberg test scores and Y balance test scores in all directions except the poster lateral direction (table 3) for healthy high school female athletes. Y balance test scores for the medial direction did not change statistically from the third to the sixth week.

DISCUSSION

The results of this research showed that six weeks of backwards walking training improves the semi-dynamic and dynamic balance of high school female athletes. In some cases, this improvement could be seen after just three weeks of training. The results of the present research were in line with researchers that had examined the effect of backwards walking on the balance of diabetic patients [8], the balance of elderly females [9], and the balance of stroke patients (yang and colleagues 2005). Fakharian (1999) reported that walking and running backwards has no effect on the semi-dynamic balance of non-athletic high school girls. It is possible that the difference in the results of that research are related to the fact that the subjects were not athletes [10].

Balance is maintained via the postural control system with the integration of sensory data and with the help of the muscoskeletal systems ability [11] and the effect of exercise on these factors results in athletes having more balance compared to non-athletes [12].

Following six weeks of backwards walking training the Y balance test scores for all three anterior, posterior-internal, and posterior-external directions improved. These results were in line with the findings of Kachantao and colleagues (2016), Givecha and colleagues (2016), Ya Ho Uchen (2011), and Ebrahimi Dolat Abadi (2010). Physical training causes increased balance [1]. Backwards walking is one of the training methods that requires more motor control and balance [3], and more postural control [13] compared to walking forwards. The kinematic model of the foot's hip and ankle joints for walking forwards and backwards is reversed Min Hiun and colleagues, 2013 and the electromyography activity of the lower extremity muscles during backwards walking is increased compared to walking forwards. Changes in lower limb muscle strength that come about as a result of backwards walking could be the reason for improved balance [4, 5]. The mechanisms that may be effective in improving motor balance and control from backwards walking training, are still being assessed. The belief is that backwards walking limits the role of the visual system and enhances the role and effect of other sensory systems for balance control (the process of implementation of sensory organization) [11] and thus improves the individuals balancing ability (balance performance). Training backwards walking occurs in a closed kinetic chain and so the mechanoreceptors in the skin, joint, and theca (capsule) are utilized more [14].

During backwards walking individuals must organize the various information they receive from the visual, proprioception, skin sensory, and vestibular sensory systems and maintain their motion control during dynamic balance. Decreased usage of vision during backwards walking could be the justifier for improved Modified Romberg test scores with eyes closed during which the inputs of the vestibular and somatosensory systems become more important [15].

Backwards walking trainings result in the matching of soleus H reflex (Schneider and Capadi 2003 & Ung 2005). Van Dorsen (1998) and Fritz (2013) stated that walking forwards and walking backwards consists of a central template builder. The muscles responsible for acceleration during walking forwards function as decelerators during backward walking [16] and it is possible that improved control over the eccentric contraction of quadriceps muscles is one of the reasons for improved dynamic balance.

CONCLUSION

Backwards walking training improved healthy high school female athletes' balance. Considering the importance of the role of balance in improving motor functions and preventing students' fall injuries, it is suggested that backwards walking should be incorporated into the schools' physical education programs as a sport exercise.

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