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Balance performance in sedentary and active healthy young individuals – a cross-sectional study

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: Balance ability has a fundamental role in many activities of daily living, as well in athletic activities. The Balance Error Scoring System is a valid and reliable test used to evaluate postural balance. The aim of this study was to assess the postural balance in active and sedentary healthy young individuals.

Material: A cross-sectional study was carried out to evaluate the balance performance in forty-four healthy young individuals (mean age 21.69±4.87 years), based on their physical activity level. Balance was assessed using the Balance Error Scoring System (BESS), and the total number of errors was scored, for the non-dominant limb (the left leg for both groups). The errors were counted for each of the six situations (double leg stance, single leg stance and tandem stance, on hard and soft surface).

Results: Group 1 consisted of twenty-two active subjects (mean age 21.18±2.32 years, 59.09% females), with a BESS score of 9.87±1.6. The sedentary group (group 2), with twenty-two young subjects (mean age 22.22±6.61 years, 59.09% females), scored a significantly higher BESS score for the sedentary group (15.48±2.24) ($p<0.001$). No gender differences were recorded.

Conclusions: Physically active young people have a better postural balance than do the sedentary ones, as scored with the BESS.

Keywords: balance, physical activity, Balance Error Scoring System, young individuals.

Introduction

Balance is defined as an ability to maintain a stable base of support in either static or dynamic conditions [1, 2]. Both static and dynamic balance abilities have a fundamental role in many activities of daily living, as well in athletic activities. Impaired balance is a risk factor for sports-related injuries or falls across life span [3]. There are different tests commonly used to assess static and dynamic balance as a screening method to identify athletes at risk of lower limb injuries [4, 5] or people with an increased risk of falls. Balance tests can be applied in order to diagnose different conditions or to evaluate the rehabilitation outcomes [1, 6].

Physical activity has a crucial role in providing an independent healthy life, maintaining postural stability [7], mobility, strength [8], and normal weight, preventing falls and injuries, and protecting against the cardiovascular diseases [9, 10] and stroke [11]. Although the physical activity benefits are well known, there is a relative high percentage of young adults characterized by a sedentary behaviour [12, 13]. Previous studies have showed that physical inactivity is associated with overweight and obesity and high psychological distress [14, 15].

To our knowledge there are only few studies evaluating the effects of being physically active on postural balance in healthy young adults. Many studies have focused on the effect of exercise and physical activity on balance in older individuals. Based on the data found in the literature, we hypothesised that the physically active young people will have a better postural balance than the sedentary ones.

The aim of this study was to assess the static balance performance of healthy young individuals related to their level of physical activity.

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Material and methods

Participants

A cross-sectional design was adopted to evaluate the balance performance in healthy young individuals based on their physical activity level. The study was carried out in accordance with the Declaration of Helsinki.

A convenience sample of forty-four healthy young individuals (mean age 21.69±4.87 years) was recruited. Participants were excluded from this study if they had a history of lower limb injuries or surgery, concussion, vestibular or neurological disorders or were not currently experiencing any symptoms that could affect their postural control. All participants who met the inclusion criteria and agreed to participate signed an informed consent. Before balance testing, participants` demographic data were collected – age, sex, weight, height, body mass index, dominant leg (preferred kicking leg) [16].

Procedure

Participants were assigned into two groups (sedentary and physical active), according to the International Physical Activity Questionnaire (IPAQ) – short form. Physical active participants (group 1) were considered those who conduct five or more days a week of moderate-intensity physical activity, for at least 30 minutes per session, or at least three days of vigorous physical activity for at least 20 minutes per session. In the sedentary group

were assigned subjects with no physical activity during the week (group 2) [17, 18].

Balance performance was assessed using the Balance Error Scoring System (BESS). The BESS protocol [19] requires the participants to complete six testing conditions – three stances (double leg, single leg and tandem stance) on both firm and foam surfaces. The non-dominant foot was tested. Participants were instructed to place their hands on the hips, eyes closed and to maintain their stability in that position for 20 seconds. The feet position was side-by-side in the double leg stance; standing on the non-dominant foot in single leg stance; and heel-to-toe with the non-dominant foot in the back. The number of errors was counted for each condition. An error was considered if the participants moved the hands off the iliac crests, opened the eyes, stepped stumble or fell, moved the hip (abduction or flexion beyond 30°), lifted the forefoot or the heel of the testing surface, remained out of proper testing position for more than 5 seconds. For any single condition, the maximum number of errors was 10. The total BESS score is the sum of each stance position scores. A higher total score represents a poor performance. The participants completed three trials for each BESS condition and an average score was calculated.

Statistical analysis

Statistical analysis was performed using MedCalc (Software bvba, Belgium, version 18.11.6). Descriptive statistics were used to describe the participants` data and the BESS scores (means and standard deviations, median and interquartile range for non-normal distributed data). Mann Whitney tests and independent t-tests were used to compare BESS scores between groups. Significance level was set at .05.

Results

Group 1 consisted of twenty-two active young subjects (mean age 21.18±2.32 years, 59.09% females). The sedentary group (group 2) consisted of twenty-two young subjects (mean age 22.22±6.61 years, 59.09% females). All subjects were normal-weighted with no significant differences between groups (BMI for group 1 was 22.51±2.24 kg/m^2 and for group 2, 20.88±2.41 kg/m^2).

The total BESS score was 9.87±1.6 for group 1 and 15.48±2.24 for group 2. The sedentary group scored significantly higher than the physically active group ($p<0.001$). Significant differences between groups were also found for bipodal stance and tandem stance on the foam surface ($p<0.01$). The results of BESS scores are presented in Table 1.

No significant gender differences were found for any of the assessed testing conditions.

Table 1. BESS scores for both groups

Scores	Group 1 (n=22)	Group 2 (n=22)	*p*
Bipodal stance firm surface (number of errors, median, IQR)	0 (0)	0 (0.5)	NS
Bipodal stance, foam surface (number of errors, median, IQR)	0 (0.37)	0.75 (1.5)	0.008
Unipodal stance, firm surface (number of errors, median, IQR)	3 (0.88)	3.5 (1)	NS
Unipodal stance, foam surface (number of errors, median, IQR)	4 (1.5)	4 (2)	NS
Tandem stance, firm surface (number of errors, median, IQR)	2 (0.88)	2 (1)	NS
Tandem stance, foam surface (number of errors, median, IQR)	3 (2.5)	4 (1)	0.005
Total BESS score (number of errors, mean±SD)	9.87±1.6	15.48±2.24	<0.001

Discussion

The main aim of our study was to assess the static balance performance of healthy young individuals according to their physical activity level. Static balance performance was evaluated using the BESS test in sedentary and physical active young individuals.

Balance performance can be evaluated using a series of clinical tests or computerized force platforms systems. Systems like posturography (static or dynamic) or wearable inertial sensors provide precise data about centre of mass position and sway, information about sensory and motor postural control [20–22]. Unfortunately, these systems are very expensive and used with great difficulty in daily clinical practice. Clinical balance tests provide clinicians sufficient information in order to identify balance deficits.

BESS is a relatively easy-to-administer, rapid test that can be used for screening, monitoring, and identifying static balance deficits [23]. BESS has a moderate to good reliability [24, 25] and a good to high content validity in identifying balance deficits in concussed, fatigued and aging individuals, and also in ankle instabilities [26–29]. In the present study, the average of three BESS trials was used, as this was showed to increase the reliability, not only in BESS case, but also in other balance tests [25, 30].

The results of current study showed that sedentary young adults had a significantly greater BESS score than physically active young people. The results of the present study are in accordance with previous studies. A better balance was found in active healthy young individuals when compared to the sedentary ones.

Previous studies have shown the beneficial effects of physical activity on balance in elderly [31, 32], after ankle instabilities or fractures [1] or on the quality of life in people with chronic diseases [33, 34]. The effects of physical exercises on postural balance have been investigated by Jakobsen et al. They found an improvement in postural control after 12 weeks of training [35].

No gender differences were found in this study. Torres et al found a weak balance in sedentary men and no differences between sexes in physically active adults [36]. Height was the only anthropometrical measure that was correlated with BESS score in group 1. Same results were found in past studies [37, 38].

The current work has some limitations. The static balance was the only one evaluated. Thus, the effects of physical activity on the dynamic balance could not be investigated. The relative small number of participants is another limitation. Further studies are needed to assess the impact of different levels of physical activity on both static and dynamic balance across the lifespan.

Conclusions

The results of the present study showed that physically active young people had significantly better postural balance than sedentary ones. These results expand the previous data, sustaining the overall benefits of physical activity on the health status by reducing the impact of a majority of lifestyle diseases and improving the postural balance. We found no gender-specific differences independent of the physical activity level.

Highlights

Physical activity has beneficial effects on balance performance.

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Conflict of interest

The authors declare no conflict of interest.

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