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The Effect of Aerobic Training on Dynamic Balance (Biodex Balance System) In 35-45 Aged Sedentary Female

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Abstract

The purpose of this study was to determine the effect of the aerobic training on dynamic balance (Biodex Balance System) in 35-45 aged (mean age 40,6±3,8) sedentary female. 40 female voluntarily involved in this study. Dynamic balance was measured by the Biodex Balance System (BBS). Data were obtained from 60-sec trials during which participants were asked to maintain an upright standing position on their both leg on the unstable surface of the BBS. Trials of dynamic stability began level 8 and completed at level 3. The assessments were performed before and after the aerobic training program. Volunteers were set into control group (CG) (n = 20) and Exercise Group (EG) (n = 20) randomly. EG joined 8 weeks of aerobic-run-walk training: 3 times a week, 1- hour sessions. The results showed that a significant difference between the EG and CG in OSI (eyes open) (p<0.05) while no significant difference was observed between the groups in OSI (eyes closed) (p>0.05). The findings of this study showed aerobic run-walk training had a positive effect on dynamic balance in 35-45 aged healthy sedentary female.

Keywords: 35-45 Aged; Aerobic Run-Walk Exercises; Dynamic Balance; Women

Introduction

Balance is generally defined as the ability to maintain the body's center of gravity within its base of support with minimal sway or maximal steadiness and can be categorized by either static or dynamic balance [1,2]. Complex interaction between sensorimotor control system and integrating motor output to muscles is required to maintain balance [3]. Dynamic balance is defined as the ability to maintain the body's center of mass whilst performing movement or a functional task [4]. Dynamic balance is believed to be more challenging than static balance because it requires the ability to maintain equilibrium during a transition from a dynamic to a static state [5]. Dynamic balance is critical for the acquisition and execution of motor skills [6]. Dynamic controls are important in many functional tasks as it requires integration of appropriate levels of proprioception, range of motion, and strength [7]. Also, balance is associated with age, gender, anthropometric structure and support points [8]. The ability to control balance while walking is a fundamental skill that is frequently compromised by advanced age. In humans, the ability to walk depends not only on being able to generate a rhythmic locomotor pattern, to maintain upright stance, and to control the trajectory of the Center of Mass (COM) despite a narrow and moving base of support [9]. It is essential to maintain proper balance control in order to maintain posture and perform routine activities.

There are several studies that have evaluated the effects of balance training on static and dynamic balance abilities, but to our knowledge, there is no clear consensus available from this body of literature to help clinicians and fitness professionals make clinical decisions [1]. Whereas walking helps build lower-body strength, an important element of good balance. Walking is a safe exercise for most people, in addition to improving balance, counts toward your aerobic activity goals. Technological development has led to significant decreases in physical activity, both at work and at home. As a consequence, nearly 60% of the world population is now sedentary. This occurs more frequently in women and the older population [10]. Therefore, this study was carried out to determine the effect of aerobic run-and-go exercise on dynamic balance in sedentary women.

Subjects and Methods

Study Design and Participants

40 female volunteers between the ages of 35 - 45 with sedentary life style participated in the study. Individuals were selected by criteria on to be sedentary women in premenopausal period and between

the ages of 35 - 45. Individuals with a history of chronic disease, surgery, smoking, having or had on a diet or exercise program for last one year or in a pregnancy or breastfeeding period were excluded. Volunteers were randomized into two groups; CG with 40.30 ± 4.47 mean age (n = 20) and EG with 41.05 ± 3.26 mean age (EG) (n = 20). Before starting the research, participants were informed about the content of the study, its purpose, application and the potential risks. Voluntary consent forms were distributed and were signed to all participants. Consent was obtained from "Malatya Clinical Research Ethics Committee" for this research. Subsequently, CG had not undergone exercise program; EG did aerobic-run-walk exercise 1- hour a day, 3 days a week for 8 weeks.

Experimental Protocol

Height and Weight Measurement

Height measurement was made by a device working with ultrasound method (Soehnle) [11]. Weight measurement was made by Tanita bioelectrical impedance analyzer (Tanita Body Composition Analyser BC-418). Weights of subject's clothes were allowed to be deducted from the weight of subject. After all, reading from the device's LCD screen values have been saved [11]. BMI in kg/m^2 was calculated from weight and height [12].

Dynamic Balance Measurement

Dynamic balance was measured using the BSS (Biodex Medical Systems Inc., 1999, Shirley, NY) from all of the subjects before and after the aerobic exercise program. The BSS has been proven to provide reliable measures of dynamic balance [13,14]. The BSS consists of a movable circular platform measuring 55 cm in diameter and can tilt 20 from horizontal in all directions (360 range of motion), anterior-posterior and medial-lateral, simultaneously. Resistance levels range from 8 (most stable) to 1 (least stable). One of the outcome measures for the BSS is the Overall Stability Index (OSI). The OSI is an index of the average tilt in degrees from the center of the platform. OSI is considered to be the best indicator of an individual's overall stability to balance the platform [15]. The higher the OSI numeric value, the greater the variability from horizontal positioning-that is, the greater the instability in balancing the platform. Conversely, lower scores indicate greater stability. Therefore, the outcome of our study is presented considering OSI results.

Dynamic balance test was performed double leg and without footwear. Subjects were instructed to establish a foot position and comfortable stance width that allowed them to maintain the platform as stabilized (leveled horizontally) as possible. They were asked to hold their arms crossed over the chest and look forward (Figure 1).

Figure 1: Biodex Balance System (BBS) measurement.

Exercise Protocol

Aerobic run-walk training was made in the 1700-meters trekking pathway located on the Inonu University campus, Malatya, Turkey. Heart rate was controlled with portable polar device during training. Exercise intensity was determined with Karvonen Method [16] and the numbers of heart beats were calculated for each subject separately [17]. Exercise group did aerobic run-walk training in the intensity of 60% target heart rate 1- hour a day, 3 days a week for 8 weeks. Aerobic training program was consisted;

- Warm-up Period (10 min):
  - Warm-up and stretching exercises for the muscle groups.
  - Balancing exercises consisted of walking in the tandem position (one foot in front of the other), walking on the tips of the toes and on the heel, walking sideways, walking while raising the leg and the contra-lateral arm, standing on one leg [18] (5 min.)
- Training Period (40 min.)
- Cool-down Period with stretching (5 min.)

Statistical Analysis

Normality of all data was checked using the Shpiro-Wilk test ($p > 0.05$). The data were expressed as the mean and Standard Deviation (SD) for each variable and differences between the EG and CG were tested by the Student's t-test. The level of statistical significance was set at $p<0.05$.

Results

All 40 participants (mean age 40,6±3,8: mean height 160.7±5.8 cm) completed the measurements and EG (n=20) completed aerobic run-walk training. The baseline characteristics of the participants are presented in (Table 1).

Characteristics	EG (n= 20) Mean ± SD	CG (n= 20) Mean ± SD	Total (n= 40) Mean ± SD
Weight (kg)			
Pretest	74.8±11.6	81.1±15.1	77.9±13.7
Posttest	72.0±11.6	80.8±14.8	76.4±13.8
Body mass index (kg/m2)			
Pretest	29.4±3.9	30.9±5.9	30.1±5.0
Posttest	28.4±3.7	30.6±5.7	29.5±4.9
Values were presented as mean ± standard deviation.			

Table 1: Weight and Body mass index (kg/m^2) of study subjects.

Effect of intervention

Independent t-test showed significant difference ($p < 0.05$) in the OSI-EO between EG and CG (Table 2).

Parameter	Tests	EG (n = 20)	CG (n= 20)	p-Value
OSI -EO	Pretest	4.49±1.0	4.62±1.3	0.74
	Post-test	3.22±0.7	3.89±1.1	**0.03***
OSI EC	Pretest	5.92±1.6	6.0±1.4	0.86
	Post-test	5.97±1.0	6.5±09	0.07
OSI-EO: Overall stability index-eyes open; OSI-EC: Overall stability index-eyes closed; The level of statistical significance was set at p<0.05.				

Table 2: Balance test results.

Discussion

There is an increasing demand for exercise studies which define clearly the dimensions of exercise needed to improve health. Our data indicate that aerobic exercise has positive effect on eyes open dynamic balance in 35-45 aged sedentary female. Previously, it has been shown that elderly women who are continuing with moderate exercise programs over many years have better muscle strength, balance, gait and health ratings and sustain fewer fractures than women in general [19]. Cress, et al. [20] stated that dynamic balance can be improved by decreasing the base of support while walking. For example, a way to challenge dynamic balance is to progress from the normal walking pattern to walking on a straight line and then walking heel-to-toe. Our study result supports this information.

There is evidence that regularly performed aerobic exercise has positive effects on bone health in healthy, postmenopausal women too. The aerobic exercise training program can improve bone density in bone health by maintaining or increasing bone mineral density and total body mineral content. However, in addition to its effect on bone, strength training also increases muscle mass and strength, dynamic balance, and overall levels of physical activity [21].

Balance control is the outcome of concerted interaction between the neuromusculoskeletal, proprioceptive, vestibular, and visual systems [22]. In the literature plenty of studies detailing various exercise interventions intended to improve dynamic balance. These interventions have emphasized a variety of balance training program including stages transferring from eyes open to eyes closed, double-leg stance to single-leg stance, and firm stable surface to soft or unstable surface. More dynamic progressions that were at times used include throwing a ball, kicking with an elastic band on the nondominant limb, or moving the body to cause changes in the location of the center of mass [1].

In conclusion, this study emphasizes the concept that in order to maintain healthy aging, bone density and dynamic balance, sedentary lifestyle should be avoided. Women should make regular physical activity and invest in their old age. Instead of very complex exercise methods to improve dynamic balance, brisk walking in an aerobic environment is a safe and free exercise that can be done by women.

References

1. Distefano LJ, Clark MA, Padua D (2009) Evidence Supporting Balance Training in Healthy Individuals: A Systemic Review. Journal of Strength and Conditioning Research 23: 2718-2731.
2. Horak FB (1987) Clinical measurement of postural control in adults. Physical Therapy 67: 1881-1885.
3. Hughes S, Freemont A, Hukins D, McGregor A, Roberts S (2012) The pathogenesis of degeneration of the intervertebral disc and emerging therapies in the management of back pain. Journal of Bone & Joint Surgery, British 94: 1298-1304.
4. Chtara M, Rouissi M, Bragazzi NL, Owen AL, Haddad M, et al. (2016) Dynamic Balance Ability in Young Elite Soccer Players: Implication of Isometric Strength. The Journal of sports medicine and physical fitness 2016: 1827-1928.
5. Ross SE, Guskiewicz KM (2004) Examination of static and dynamic postural stability in individuals with functionally stable and unstable ankles. Clin J Sport Med 14: 332-338.
6. Pugh SF, Heitman RJ, Kovaleski JE, Keshock CM, Bradford SH (2012) Effects of Augmented Visual Feedback and Stability Level on Standing Balance Performance using the Biodex Balance System. The Sport Journal 2012.
7. Thakkar HH, Kumar S (2015) Static and dynamic postural stability in subjects with and without chronic low back pain. Int J Res Med Sci 3: 2405-2409.
8. Hrysomallis C (2011) Balance Ability and Athletic, Performance. Sports Med 41: 221-232.
9. Shkuratova N, Morris ME, Huxham F (2004) Effects of Age on Balance Control During Walking. Arch Phys Med Rehabil 85: 582-588.
10. Blümel JE, Fica J, Chedraui P, Mezones-Holguín E, Zuñiga MC, et al. (2016) Sedentary lifestyle in middle-aged women is associated with severe menopausal symptoms and obesity. Menopause: The Journal of The North American Menopause Society 23: 488-493.

11. Baumgartner RN, Cameron C, Roche AF (1998) Bioelectrical Impedance for Body Composition. American Journal of Clinical Nutrition 48: 16-25.

12. World Health Organization (1995) Expert Committee on Physical Status: The Useand Interpretation of Anthropometry. WHO 1995.

13. Cachupe WJC, Shifflett B, Kahanov L, Wughalter EH (2001) Reliability of Biodex Balance System Measures, Measurement in Physical Education and Exercise Science 5: 97-108.

14. Sung ES, Kim JH (2018) The influence of ovulation on postural stability (Biodex Balance System) in young female. Journal of Exercise Rehabilitation 14: 638-642.

15. Costa P, Graves, BS, Whitehurst M, Jacobs PL (2009) The Acute Effects of Different Durations of Static Stretching on Dynamic Balance Performance. Journal of Strength and Conditioning Research 23: 141-147.

16. Fox EL, Bowers RW, Foss ML (1993) The Physiological Basis for Exercise and Sport. 5th Edition, Brown & Benchmark, New York 1993.

17. Ganong WF (2005) Review of Medical Physiology. McGraw-Hill Medical Publication, Edition 22, New York 2005.

18. Madureira MM, Takayama L, Gallinaro AL, Caparbo VF et al. (2017) Balance training program is highly effective in improving functional status and reducing the risk of falls in elderly women with osteoporosis: a randomized controlled trial. Osteoporos Int 18: 419-425.

19. Ringsberg KA, Gardsell P, Johnell O, Josefsson PO, Obrant KJ (2001) The impact of long-term moderate physical activity on functional performance, bone mineral density and fracture incidence in elderly women. Gerontology 47: 15-20.

20. Cress ME, Buchner DM, Prohaska T, Rimmer J, Brown M, et al. (2005) Best Practices for Physical Activity Programs and Behavior Counseling in Older Adult Populations, Journal of Aging and Physical Activity 13: 61-74.

21. Mazzeo RS, Cavanagh P, Evans WJ, Fiatarone M, Hagberg J, et al. (1998) Exercise and physical activity for older adults. Medicine and Science in Sports and Exercise 30: 992-1008.

22. Bellew J, Fenter PC, Chelett B, Moore R, Loreno D (2005) Effects of a Short-term Dynamic Balance Training Program in Healthy Older Women. Journal of Geriatric Physical Therapy 28: 4-8.