European Journal of Physical Education and Sport Science
ISSN: 2501 - 1235
ISSN-L: 2501 - 1235
Available on-line at: www.oapub.org/edu

10.6084/m9.figshare.3382819 Volume 1 | Issue 2 | 2016

THE IMPACT OF STABILITY RANGE EXERCISES ON GAIT PARAMETER AND QUALITY OF LIFE AMONG ACTIVE ELDER WOMEN

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Abstract:
The purpose of this research is to discuss the impacts of stability range exercises on certain gait parameters and quality of life among active elder women. The population of this research includes 100 women aged between 61 and 88 years who inhabit in the nursing home of Kahrizak, Karaj. Among the population, 40 individuals matched our research criterions and consequently, these 40 were selected as the sample group. The subjects' age range was 61-88 years, also their height range was 139.5-160cms and their weight range was 48-88 kilograms. The subjects of the experimental group were administered 24 sessions of reformation exercises. In addition, the control group performed morning exercises, under the supervision of the facility's coach. The collected statistical data were subjected to further analyses through the independent-t and independent-t tests as well as the Kolmogorov-Smirnoff test for confirming the normality of data distributions at the confidence level of P= 0.05. Results indicated that stability range exercises are capable of increasing the lengths of both the left and right paces significantly. The variables of life quality, pace speed, pace frequency, stance time and swing time were significantly increased among the subjects of experimental group, however compared to the control group; this increase was not statistically significant.

Keywords: stability range, kinematic parameters, gaiting, life quality, elder

Introduction

Population aging and rapid increase in the number of elders is a global phenomenon. Recued birth rate and increased life expectancy have led to faster growth of the population of elders compared to the growth rate of total population (Jadidi et al. 2011). Since the population of a society's elders is known as a fragile stratum, this population is faced with a series of problems specific to their ages which, however by reforming the life style is avoidable (Heidari and Shahbazi, 2012). In this context, a healthy life style is a method of living which supports the supplication, maintenance and promotion of the general health level as well as improving the life quality of an individual (Hekmatpoor et al, 2014). In addition, the global organization of health considers life quality as an individual's perception of his or her life, values, goals, standards and interests.

Furthermore, in recent years the implication of the concept of life quality has been identified as an important index for evaluation of personal decision making health and judgment about society's general health in addition to finding core problems in medical and nursing researches (Hekmatpoor et al. 2014; jafarzadeh et al. 2010). A category which can have significant impacts on individuals' life quality, especially the elders, is the ability for performance of daily activities which requires moving the body while maintaining control and balance. An example of these activities is gaiting (walking). The ability and quality of gaiting significantly diminishes during the elderly ages and on the other hand, the reduction of the former and the latter may result in disorders including shorter pace lengths or even interruption of the normal gaiting pattern. Ultimately, this disorder can provide the context for injuries which are caused by losing control or falling down. (Sadeghi et al, 2013). Falling down is one of the major causes of death among elders in a way that, annually more than 11 thousand people around the world die as a result of falling down. Nowadays, the spread of falling down among elders has turned into a major health threat for them. 35 to 45 percent of people aged over 65, experience falling down at least once a year (Azim Zadeh et al. 2014). In addition, buy the growth of age, not only the occurrence of falling down increases, but also the severities of injuries also increase (D. R. Daniel, 2011). Among the serious injuries caused by falling down, it can be referred to femoral fractures, subdural hemorrhage and hematoma, bruising, sprain of joints, stretch marks, death, psychological effects, fear of falling in 20% of patients, loss of confidence and performance limitations (Hasani et al. 2011).

Studies have revealed that administration of exercises can significantly impede the process of losing balance and other physical fitness factors among elders. Administration of exercises, especially balance exercises increase the postural control

among elders and therefore, provides the contexts for avoiding certain serious injuries some of which may even result in death of elders. On this basis, performance of sports exercises is necessarily crucial for this stratum. One of the goals of such exercises can be the improvement of elders' gaiting pattern which results from muscular abilities such as strength, endurance and flexibility. On the other hand, ability for controlling the body while moving and gaiting can have a beneficial effect (Sadeghi et al. 2013).

Since during the elderly ages the rates of compensatory postural responses to disturbances falls, the elder will have less ability for compensating this disturbance and keeping control over the body. Therefore, improvement of the so-called compensatory responses can help with reducing the risk of falling down. Previous studies have indicated that balance and endurance exercises can lead to improvement of strength and balance and reduce the risk of falling down. However, nowadays it is believed that these exercises are not merely sufficient for improvement of balance specific neuromuscular compatibilities (Granacher et al, 2011). Because the so-called compensatory responses which are activated due to external disturbances are not under the direct control and that there are different ways of neutrally controlling them through voluntarily moves, therefore usual and traditional balance exercises which are focused on voluntarily control of steps, will not improve these so-called compensatory responses (Shapiro et al, 2010).

On this basis, the present study is aimed at development of a compatibility between systems and control postural control through administration of specific balance exercises aimed at displacement of the center of gravity in an individual's range of stability through formation of a disturbance in neuromuscular system in an eight weeks length of time. The aforementioned compatibility can have impacts on the pattern of gaiting and consequently on life quality.

Therefore with respect to the fact that balance, life quality and kinematics of gaiting change during the elderly ages, the researcher of this article ran into the question that if administration of specific balance exercises which are designed aimed at displacement of the gravity center in an individual's stability range can lead to adaptability of systems and Postural control through forming a disturbance in the neuromuscular system within an 8 weeks length of time?

Methods

This research is performed in a semi-experimental and the design of the research included a pre-test, a post-test and a control group. The population included 100 elder women aged between 61 and 88 who inhabited in the nursing home of Karaj, Kahrizak.

40 individuals were identified as a match with research criterions and therefore, these 40 were selected as the sample group of the research. Upon signing the terms of experiments and the questionnaires regarding life quality, the sample was divided into two groups of experimental (n= 15) and control (n= 15). The entire subjects had a previous experience of participating in morning exercises of the facility. The aforementioned healthy active elder women who aged between 61 and 88, mad presences at the facility for three times a week and for the length of eight weeks. The experimental group was administered with a certain protocol of stability range exercises under the supervision of the researcher and also, the experimental group participated in morning exercises of the facility under supervision of a coach (the exercises given to the control group lacked the specific exercises of stability range exercises).

For the purpose of measurement the demographic information form and the testimonials signed by the subjects (the testimonial form was concerned with information about the method of exercising and video capturing in pre and post-test situations) as well as subjects' medical information forms (this form includes the criterions of exclusion from research including diabetes, mental and psychological problems, blood pressure, dizziness, having severe deformities at under body parts, severe joint issues, cardinal problems and severe aspiratory problems, addiction to drugs or painkillers, severe vision problems and hearing issues, surgery record during the last year and etc.) and the pretest and posttest information collection forms (health status, pace length, pace speed, pace frequency, pace swing time and pace stance time).

On the other hand, another tool for data collection which was used in this research was the SF-36 questionnaire. This self-reporting is mainly used for discussion of health and life quality. This questionnaire is developed by Ware and Sherburne and includes 36 elements in terms of 8 contexts of physical performance, performance restriction related to physical health, performance restriction related to mental health, energy and fatigue, feeling of being good, social performance, pain and general health. The collected statistical data were subjected to further analyses with the independent and dependent t tests and also for assuring the normality of data distributions, the Kolmogorov-Smirnoff test was applied at a confidence level of P= 0.05.

Findings

Table 1, indicates the descriptive data related to the personal characteristics of the subjects such as height, weight and age for both the experimental and control group.

Table 1: The descriptive data related to the personal characteristics of the subjects for both the experimental and control group

Height (cm)	Weight (Kg)	Age (year)	group
151.70±6.32	72.16±9.67	70.20±7.91	experimental
150.20±4.00	65.50±11.85	69.53±5.93	control

Hypothesis testing

First hypothesis

Null hypothesis: a single period of stability range exercises does not have an impact on the life quality of active elder women.

Table 2: Results of correlated t-test for comparison of posttest and pretest levels of life quality among the groups

Post-test and pre-test comparison	Changes level	Post-test	Pre-test	Group	variable
t14 = 4.505, sig = 0.000*	1200±10.32	70.33±18.75	58.33±23.11	experimental	Physical performance
t14 = 6.077, sig = 0.000*	14.67±9.35	74.67±18.06	60.00±19.36	Control	
t14 = 2.820, sig = 0.014*	13.33±31.15	65.00±47.68	51.66±47.68	experimental	performance restriction related to physical health
t14 = 2.882, sig = 0.012*	30.00±40.31	70.00±41.40	4.00±44.11	Control	
t14 = 2.476, sig = 0.027*	28.89±45.19	88.88±29.99	59.99±47.68	experimental	performance restriction related to mental health
t14 = 2.823, sig = 0.014*	33.11±45.43	86.44±30.77	53.33±51.64	Control	
t14 = 4.183, sig = 0.001*	11.16±10.80	76.00±17.34	64.33±22.90	experimental	Energy and fatigue
t14 = 5.325, sig = 0.000*	17.00±12.36	75.67±18.16	56.67±17.18	Control	
t14 = 2.869, sig = 0.012*	18.27±11.15	82.40±16.54	64.13±23.80	experimental	Feeling of being good
t14 = 4.955, sig = 0.000*	21.33±16.68	75.20±20.35	53.87±14.33	Control	
t14 = 2.314, sig = 0.036*	15.83±26.50	86.66±11.68	70.83±27.00	experimental	Social performance
t14 = 3.995, sig = 0.001*	17.67±17.12	78.33±20.30	60.67±2019	Control	
t14 = 3.254, sig = 0.006*	19.00±22.61	67.67±24.41	48.33±27.64	experimental	pain
t14 = 2.467, sig = 0.027*	10.33±16.22	56.17±17.56	45.83±19.83	Control	
t14 = 3.205, sig = 0.006*	13.33±16.11	78.00±21.3	64.66±20.57	experimental	General health
t14 = 3.007, sig = 0.009*	11.00±14.17	72.33±18.31	61.33±1445	Control	
t14 = 4.616, sig = 0.000*	16.46±12.48	76.83±15.05	61.53±21.63	experimental	Sum of life quality
t14 = 6.321, sig = 0.000*	19.39±11.88	73.35±16.72	53.69±19.38	Control	
*a significant difference between pre-test and post-test in the same group) P < 0.05					

Results of the correlated t-test for making a comparison between post-test and pre-test values of physical performance, performance restriction related to physical health, performance restriction related to mental health, energy and fatigue, a feeling of being good, social performance and pain and general health and quality of life for control and experimental groups indicated that in all variables and for both the control and experimental groups, there exists a significant difference between the pre-test and post-test results. However, the results of implementing the independent t-test for making comparison between the changes of physical performance, performance restriction related to physical health, performance restriction related to mental health, energy and fatigue, a feeling of being good, social performance and pain and general health and quality of life, did not reveal any significant difference between the control and experimental groups. Therefore, it can be stated that the stability range exercises are not impactful on the quality of life among active elder women.

Second hypothesis

Null hypothesis: one period of stability range exercises does not have any influence on pace length profile and right and left step lengths in right and left paces of active elder women.

Results of the correlated t-test for making a comparison between the changes of right and left pace lengths and the length of the left step in right pace and the length of the right step in both left and right paces of both the experimental and control groups are summarized in table 3.

Table 3: Results of the correlated t-test for making a comparison between the changes of right and left pace lengths and the length of the left step in right pace and the length

	changes		
Independent t-test results	Left pace	Right pace	Compared variables
t 14 = -0.686, Sig = 0.504	0.055±0.038	0.052±0.043	Left and right paces' length
t 14 = 0.483, Sig = 0.636	0.031±0.015	0.026±0.028	Length of left step in right pace
t 14 = -0.790, Sig = 0.443	0.024±0.031	0.026±0.024	Length of the right step in left and right paces

With respect to the obtained results, it can be interpreted that stability range exercises significantly increased both pace lengths. On the other hand, these exercises have significantly increased the lengths of both and left steps in both the left and right paces.

However, the effect of the aforementioned exercises on the length of right and left paces and the left and right steps of each pace is not different and the effect of the exercises is equally significant and increasing for both paces.

Third hypothesis

Null hypothesis: one period of stability range exercises does not have any influence on pace speed among active elder women.

Results of the correlated t-test for comparing the changes of speed of both the left and right paces of both the experimental and control groups are summarized in table 4.

Table 4: Results of the correlated t-test for comparing the changes of speed of both the left and right paces of both the experimental and control groups

	changes		
Independent t-test results	Left pace	Right pace	Compared variables
t 14 = 0.613, Sig = 0.550	0.027±0.022	0.028±0.021	Pace speed in left and right paces

With respect to the results it can be inferred that the effect of stability range exercises have not made a significant change in the pace speed in left and right paces and that the effect was equal for both paces.

Fourth hypothesis

Null hypothesis: one period of stability range exercises does not have any influence on gaiting frequency among active elder women.

Results of the correlated t-test for comparing the changes in frequency of both the left and right paces of both the experimental and control groups are summarized in table 5.

Table 5: Results of the correlated t-test for comparing the changes in frequency of both the left and right paces of both the experimental and control groups

	changes		
Independent t-test results	Left pace	Right pace	Compared variables
t 14 = 1.089, Sig = 0.295	24.51 ±14.35	23.63 ±16.15	Pace frequency in left and right paces

With respect to the results it can be inferred that the effect of stability range exercises have not made a significant change in the pace frequency in left and right paces and that the effect was equal for both paces.

Fifth hypothesis

Null hypothesis: one period of stability range exercises does not have any influence on swing time of one gaiting cycle among active elder women.

Results of the correlated t-test for comparing the changes in swing time of one gaiting cycle of both the experimental and control groups are summarized in table 6.

Table 6: Results of the correlated t-test for comparing the changes in swing time of one gaiting cycle of both the experimental and control groups

	changes		
Independent t-test results	Left pace	Right pace	Compared variables
t 14 = -0.071, Sig = 0.944	0.537±2.34	0481±2.619	Left and right pace swing time

With respect to the results, it can be inferred that the effect of stability range exercises have not made a significant change in the swing time of one gaiting cycle in left and right paces and that the effect was equal for both paces.

Sixth hypothesis

Null hypothesis: one period of stability range exercises does not have any influence on stance time of one gaiting cycle among active elder women.

Results of the correlated t-test for comparing the changes in stance time of one gaiting cycle of both the experimental and control groups are summarized in table 7.

Table 7: Results of the correlated t-test for comparing the changes in stance time of one gaiting cycle of both the experimental and control groups

	changes		
Results of the independent t-test	Left pace	Right pace	Compared variables
t 14 = 0.071, Sig = 0.944	0.537±2.34	-0481±2.619	Stance time of right and left paces

With respect to the results it can be inferred that the effect of stability range exercises have not made a significant change in the stance time of one gaiting cycle in left and right paces and that the effect was equal for both paces.

Discussion and Conclusions

With respect to the results obtained from the present research, it can be concluded that:

Despite of the type, sports exercises have a significant and beneficial effect on the quality of life of elders. During the elderly ages, the pace length reduces and an element which is crucial in this phenomenon, is a reduction is muscular strength. Reduced pace length as a result of age can be in fact the consequence of firmness of muscles, reduced ability of muscles of knee, reduced movement range for hip rotation, hip rotation, flexion and pelvis extension, limitation of motion in the pelvis muscle-skeletal, joint sedentary and weak muscles.

Possible reasons for improved pace and step lengths:

a) Effect of exercises on the body and under body parts result in strengthening of the core muscles;

b) Improved performance in under body parts;
c) Improved movement range, improved flexibility and improved strength of leg muscles.

The aforementioned exercises lead in increased pace length equally for both legs and also helps avoiding and treating certain gaiting disorders among elders which are resulted from lack of symmetry in pace lengths. Therefore, perturbation balance exercises can be used for especially increasing the length of pace and steps.

Stability range exercises significantly increase the length of both paces. On the other hand, the aforementioned exercises significantly increase the length of both the left and right steps. However, the effects of these exercises are equally for both steps and the aforementioned exercises have an equal, significant and increasing effect on both paces. In other words, these exercises lead to a symmetrical increase in pace length and therefore, these exercises could be utilized for improving and increasing the pace length among 61-88 year old women.

Reduction of speed of taking steps during gaiting is due to their reduced levels of strength. This reduction is a sign of a muscular weakness in under body parts, flection in hip muscles, and flexibility of the hip joint and the vertical force of the ground. Increasing the length of speed and obtaining a faster gaiting rhythm can lead to increased gait speed.

Results indicate the effects of perturbation balance exercises on improvement of pace frequency and pace speed in both left and right steps of elder women in both groups. In addition, none of the aforementioned exercise protocols were prioritized over each other. The exercises administered by the researcher were not aimed at improving the contraction speed and muscular-strength. Therefore, one of the reasons for constancy in pace cycle may be that the pace of contraction and muscular strength have not been changed.

Reduced movement in under body joints, results in shortening of gait swing phase. Therefore, these people spend a large time of their gait cycle at the double support phase. A possible reason for these changes lies in neuromuscular changes due to aging. However, this research has pointed that increased pace length increases the float time. But the findings of other researchers have shown just the opposite and the most crucial reason for this lack of consistency may lie in difference in the manner of imposing the disturbance on the individual. For improving the gait cycle, it is important to consider for reduction of stance time and increasing the swing time and closure of the aforementioned times to a normal state. In this research, the stability range exercises were unable to leave a significant impact.

With respect to the fact that there exists a reverse relation between gait speed and the length of the deployment phase, a reason which is seemingly the cause of prevention of changes in stance phases and gait frequency, as it was mentioned earlier; could be resulted from restriction of performance of balance exercises for elders.

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