Original Article

The Effect of Vestibular Training on the Quality of Life and Components of Physical Fitness in the Inactive Elderly

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Abstract:

Introduction: The aim of this research was to determine the effect of twelve sessions of Vestibular training on the quality of life and physical fitness components in the inactive elderly.

Methods: This is a quasi-experimental study with the pretest, post-test and control group, in which 30 inactive male volunteers over age 60 were randomly divided into experimental and control groups. In order to assess the quality of life, agility and strength of the lower extremity, a questionnaire, a TUG test, and sit-to-stand test were used. The exercise protocol included Vestibular training for twelve sessions, three sessions per week and 60 minutes each session. Data obtained from pre-test and post-test measurements were analyzed using covariance analysis.

Findings: There was a significant difference between the experimental and control groups in the post-test regarding the quality of life, agility and strength of the lower extremity.

Conclusion: Vestibular training interventions for 12 weeks can improve the quality of life and the components of physical fitness of elderly men.

Keywords: Vestibular Training, Elderly, Physical Fitness, Quality of Life, Intervention.

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Introduction:

Nowadays, the issue of health and well-being in the physical and psychological areas of aging is one of the most important global subjects. The World Health Organization considers health as a state of person with complete physical, mental and social health so that s/he has no symptoms of disease or weakness (1). In other words, health assessment should not focus solely on traditional health factors, namely the rate of mortality and disease, but should address all aspects of (physical, mental, and social) health (2). Senior citizens of the society must enjoy appropriate physical, mental and social health (3).

According to the World Health Organization, the population over the age of 60 is considered to be elderly. It is expected that an increase of 10% in 2000 would reach 21.8 in 2050 and then increase by 32.2% in 2100 (4). By entering the aging period, some changes in the functioning of musculoskeletal, Vestibular, sensory-physical, and visual systems occur; that the physiological systems are balanced. What is certain is that with increasing age, the progressive erosion in various systems of the body, loss of physical fitness, followed by inertia and increased risk of acute and chronic diseases, reduces the performative ability of individuals and their senses and perceptions (5). Hence, identifying problems and issues of the elderly with the aim of improving their health level is necessary. Although today, with the use of drug therapies, some of the physical and mental failures of aging can be resolved, it seems that in order to cope with this great and growing situation of the societies, there must be safer and more suitable strategies. In this regard, many experts from medical and sports sciences believe that the choice of an active lifestyle in which regular physical and sportive activities play a special role is one of the important strategies which, given the ability to create internal and external motivation and its low cost, can be used as a suitable replacement for most of the physical and mental problems of the elderly, and it can help maintain the health of the body and mind at this critical stage of human life (6).

What is being considered today is not only a prolongation of life and an increase in life expectancy, but also the importance of passing life, in other words, "quality of life" (7). In the past 40 years, the introduction of quality of life has been proposed in the United States, and the social science has been responsible for raising, evaluating and measuring the quality of life in medical sciences, and in particular examining it in clinical trials (8). Quality of life as a basic index involves several dimensions such as physiological aspects, performance, and individual’s existence. Various studies have shown that the physiological problems, including disabilities and the most common decay of aging due to inactivity and non-proper use of muscles, affect the quality of life of aging period (9, 10). Therefore, attention to the behaviors promoting health and quality of life can increase the efficiency and independence of the elderly and help them control the many complications of aging and various therapies (11, 12). Physical activity as one of the most effective preventive measures for aging disorders leads to postponement of aging

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and enjoy health and vitality of the elderly (13).

The results of studies have shown that physical activity has a positive effect on the quality of life and physical health of the elderly (14,15,16,17). Vestibular exercises are another type of exercise that is used to manage chronic vestibular dysfunction (18, 19). Its positive effect on balance is based on neural flexibility mechanisms of the central nervous system and its goals are to enhance visual stability, improve vestibular-visual interaction during head movements, thereby improving the static and dynamic postural stability in the situations where they produce inconsistent sensory information and reduce sensitivity to the head movements (20).

The American Physiotherapy Association published in 2016 some practical clinical guidelines for Vestibular Rehabilitation for the patients with peripheral vestibular function decline (21). These guidelines determined the effectiveness of vestibular Rehabilitation in improving balance performance, functional improvement, quality of life, and reducing the risk of fall in the patients with acute, subacute and chronic unilateral and bilateral abnormalities and reduced environmental vestibular function (21). This is an exciting step in the field of vestibular rehabilitation, because it is the first clinical practice guide in this population. In the review of McDonnell and Hillier (19) , it has been determined that Vestibular Rehabilitation can improve the mental symptoms, perceived handicap, performance of walking, balance, and everyday life activities of individuals with peripheral vestibular disorders. They concluded that vestibular rehabilitation was a safe and effective way, and could provide long-term benefits for the patients with peripheral vestibular disorders (19).

Vestibular training is an autonological treatment widely accepted in the literature because its favorable results have been confirmed in numerous studies (22). Although there is still no solid evidence to determine the type and duration of Vestibular exercises, the need for the research in this area is felt. Therefore, the purpose of this research was to investigate the effect of Vestibular training on the quality of life and components of physical fitness in inactive elderly people.

Methods:

This is a semi-experimental study with pretest, post-test, and control group. After the announcement of the retirement center of government departments and public places, 30 inactive elderly (over 60) were examined for general/physical health. Inclusion criteria for participating in the study include being male, age over 60 years, and the ability to participate in exercises. History of participation in regular physical activities during the past year, smoking and consuming alcohol, having sleep problems, insulin consumption, body weight changes (more than 10%), general health problems, psychological and neurological problems (Parkinson's disease, stroke, and so on) based on the diagnosis and medical reports, having cognitive disorders, taking medication (psychoactive drugs, tranquilizers, etc.) and drugs, and having musculoskeletal disorders (amputation and

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arthritis disorders), were considered as the exclusion criteria.

Specified questionnaire of measuring the quality of life of elderly people: This questionnaire consists of 19 items that were designed in England based on the needs compensation model (Heidi, 2003) and then tested in European countries (Sim, 2001). This questionnaire has four subscales of control (five items), autonomy (five items), self-realization (five items) and pleasure (five items). The lowest score in this questionnaire is zero and the highest score is three, with a zero score for “never” option and the score three for the "Most often" option. The designers considered the maximum score for the full satisfaction of all four dimensions of the questionnaire being equal to 57 and the minimum score for the complete lack of quality was considered as zero (23). The validity and reliability of this test have been confirmed in the previous studies (24).

Agility Test TUG (timed up and go test): To measure agility, sit-to-stand test was used. This test evaluated the person's speed during multiple maneuvers, including standing up, walking, turning and sitting. In this test, the subject sat on a chair (seat height of 44 cm) and relied on it. The subject was asked to rise, walk 3 m as quickly as possible, pass around the marked area, walk around, back to the chair, sit on it and rely on it. The time was recorded from the moment of the command to start the movement until the subject came back and relied on the chair (25).

To measure the strength of the lower extremity, sit-to-stand test was used. The test included rising from the chair and sitting on it. The test's starting condition was that the subject sat down on the chair, placed his legs on the floor, and placed his hands in a multiplication-sign position on chest. The subject was asked to do as many as possible to rise and sit in the chair in 30 seconds. The time was calculated from the sitting position and the number of sitting and rising from the chair was considered to be the subject's record in 30 seconds (26).

In this research, the participants were selected according to the inclusion criteria for participating in the research. After obtaining consent, they were asked to complete the QOL questionnaire and run agility and strength tests (pre-test). After expressing the research goals, the participants were randomly assigned into experimental and control groups. The intervention of the experimental group was conducted during 12 sessions, three sessions per week and 45 minutes per each session. The exercise protocol involves central and peripheral Vestibular exercises used by the experimental group. These exercises include general equilibrium exercises and state stability exercises. General balance exercises include jumping over the trampoline, placing on the ball-therapy in different laying down and sitting conditions, maintaining equilibrium on the equilibrium board in standing, sitting, squatting, taking different stand positions, cross-legged and on all fours on the turning board, scooter, walking on equilibrium rail, rotational and linear moves forward, backward, left and right on normal swing, crossing obstacle, rolling, walking on spiral paths, running in spiral paths, replacing under rolling-pin,

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simple moving back, and difficult moving back. The stability training included standing on one leg with open and closed eyes, standing with legs, moving back and forth, staring and standing by changing legs spacing, exercising with headlights, head-body rotations, head-to-head rotations, head rotation while walking, focusing with Cerebral Palsy Ball, exercising on the ramp, exercising on the narrow surface, exercising up and down the stairs, using saccadic eye movements to stabilize eye dying, using simultaneously the Vestibular and sensory inputs, simultaneous use of visual and ventricular inputs, use of all senses to control the condition, and use of all senses to control the state of the body (27). The exercises used in the present research are consistent with the training curriculum obtained from the studies (27). It should be noted that in each treatment session, a total of five to six exercises were conducted with the subject, and according to each person's progress, further exercises was followed up or their difficulty was increased in subsequent sessions. The control group did not undergo any intervention during the interventions of the experimental group. At the end of the intervention, all participants reiterated the quality of life questionnaire and the implementation of agility and strength tests to investigate the effect of Vestibular training on quality of life and the components of agility and strength of the elderly. The collected data was described by calculating the mean and standard deviation and drawing the classification table. Kolmogorov-Smirnov test and covariance analysis were used to analyze the data and test the research hypotheses.

Findings:

Mean and standard deviation of pre-test and post-test scores of the research variables of the two experimental and control groups have been presented in Table 2. Also in this table, the results of the Kolmogorov-Smirnov test (K-S Z) have been reported to examine the normal distribution of variables in the groups. According to this table, the statistic Z of the Kolmogorov-Smirnov test for all variables is not significant. Therefore, it can be concluded that the distribution of these variables is normal One-way covariance analysis was used to investigate the effect of Vestibular training on quality of life, agility and lower extremity strength. The results of the pre-test and post-test regression homogeneity slope test in both the experimental and control groups showed that regression slope in both groups is for the quality of life ($P = 0.08$, $F1.26=3.47$), agility ($P=0.058$, $F1.26=2.94$) and lower extremity strength ($P = 0.067$, $F1.26=3.25$). The results of the Levene test for homogeneity of variance of the dependent variable in the groups showed that the variance of quality of life is ($P = 0.178$, $F1.28=2.48$), agility ($P = 0.54$, $F1.28=1.23$) and the strength of the lower extremity ($P = 0.184$, $F1.28=2.77$). In Table 3, the results of one-variable variance analysis have been reported to examine the difference of the experimental and control groups in the pre-test and post-test of the variablesAccording to Table 3, the F statistic of the quality of life in the post test is (125.792) which is significant at the level of 0.001 and it shows that there is a significant difference between the two groups in the quality of life. The effect size of 0.823 also shows that this difference is great in the population. The F statistic of the pre-test of quality of life is

(15.777) which is significant at the level of 0.001. This indicates that the pre-test has a significant effect on the post-test scores. The results of covariance analysis showed that the corrected mean of the experimental group was 44.15 in the quality of life and the mean of the control group is (36.22), which is significant at the level of 0.001 according to F statistic. According to this finding, it can be concluded that Vestibular excitation exercises increase the quality of life in inactive elderly people.

Also, the F statistic of agility in post-test is (463.944) which is significant at the level of 0.001, and this shows that there is a significant difference between the two groups in agility. The effect size of 0.89 also shows that this difference is great in the population. The F statistic of the pre-test for agility is (10.904) which is significant at the level of 0.001. This indicates that the pre-test has a significant effect on the post-test scores. The results of covariance analysis showed that the corrected mean of the experimental group in agility is (15.48) and the mean of control group is (16.55) which regarding the F statistic is significant at the level of 0.001. According to this finding, it can be said that Vestibular stimulation exercises increase agility in the elderly.

Also, the F statistic of the strength of lower extremity in the post-test is (111.204) which is significant at the level of 0.001 and this shows that there is a significant difference between the two groups in the strength of the lower extremity. The effect size of 0.805 also indicates that this difference is great in population. The F statistic of the pretest of lower extremity strength is (7.34) which is significant at the level of 0.001. This indicates that the pre-test has a significant effect on the post-test scores. The results of covariance analysis showed that the corrected mean of the experimental group in the strength of the lower extremity is (11.93) and the mean of the control group is (10.72), which regarding the F statistic is significant at the level of 0.001. According to this finding, it can be concluded that Vestibular excitation exercises increase the strength of the lower extremity in the elderly .

Discussion:

The purpose of this research was to determine the effect of twelve sessions of Vestibular training on quality of life and physical fitness components in the inactive elderly people. In this regard, the findings showed that Vestibular training had a significant effect on the quality of life and the components of physical fitness of agility and lower extremity strength; that is, twelve sessions of Vestibular training increased the quality of life and components of their physical fitness. Based on the effect of physical activity on the improvement of quality of life, these findings are consistent with the results of Ahmadi et al (28), Borzu et al (29), Bahrami et al (30), Kamrani Faraz, Letafatkar and Javdaneh (31), Khalaji et al (32) and Curi (16) and not consistent with the results of Ribeiro et al (22) and Zareiy, Norasteh and Koohboomi33. The reason for the inconsistency of the results of this study with the study of Zarey et al (33) may be attributed to the type of exercise program and with the study of Ribeiro et al (22) to the different statistical population. Also, the results of the effect of physical activity on the improvement of components of physical fitness are in accordance with the results of studies done by Koohboomi, Norasteh Samami (34), Hosseinpour et al

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(35) and Curi16, Bastani et al (36), and Miko et al (37).

Unbalance and dizziness have a profound effect on the quality of life of the elderly38. The main consequences of imbalance and dizziness are falling of the elderly (39). Therefore, in line with the results of this research, some studies have shown that Vestibular training reduces the symptoms of dizziness (40), improving the physical, functional and emotional components (41) and reducing emotional problems (42), increasing the quality of life (43), improving balance, improving quality of life, walking and depression (44) in the elderly. Massias (45) also described these exercises as an effective therapeutic approach to reduce the dangers of falling of the patients with dizziness.

The effectiveness of Vestibular training in improving the quality of life through the creation of essential stimuli can be explained. Vestibular exercises provide the necessary stimuli for reorganization and sensory physical integrity, thereby improving the correct control of the body's condition through three mechanisms of replacement, adaptation, and habit (46); these allow the brain to maintain balance and reduce the symptoms of dizziness through the signals that it receives from the inner ear, and with the integrity of the signals received from the eyes, knees, legs and neck (47). Unilateral destruction of the equilibrium system reduces the nerve signal at the level of the one-party equilibrium cores, causing dizziness, but after some time the communication paths cause the passive nuclei to be re-triggered by the stimuli from the opposite side and be eliminated the non-symmetric status. The central nervous system causes a gradual decrease in system dysfunction, which is referred to as the inactive rebalance method, when the symmetric information of the ear’s balance system is distorted by altering the neurons and activities of the cerebellum and brain stem. The central nervous system processes the input signals and integrates them with other sensory information in order to estimate the consciousness of the head; in this condition, the central Vestibular system output reach the ocular muscles and spinal cord and generates two major ophthalmic and spinal cord ventricular reflexes and activates anti-gravity muscles, extensors and inhibition of flexor muscles (47); it plays an important role in creating appropriate postural responses and motor strategies such as the ankle, thigh, and walking strategy (48, 49). Some other benefits of these exercises include increased balance, relaxation of neck and shoulder muscles, and impact on balance mechanisms in the neck (50), reducing the risk of falling, and consequently increasing self-confidence and participation in social activities, improving ophthalmic Vestibular and spinal cord Vestibular reflex performance, vertigo reduction, eye training for visual stability, efficient detection of appropriate motor strategies, and improved natural status strategies, improvement of walking, especially in patients who are dizzy with head movements, using alternative strategies through the Sensory physical system, residual vestibular and visual function, increased movement and endurance of walking, reduction of anxiety that may occur

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as a result of the sensory imbalance resulting from abnormal signals from the vestibular system, improvement of general physical and general coordination and the support of natural and automatic movements, increased motivation, socialization and positive effects (48,49,51).

Other findings indicated improvement in the participants' physical fitness components after Vestibular training. The explanation of this finding can be attributed to the role of the Vestibular system in homeostasis. The Vestibular system is not only an important part of the balance but also plays a major role in homeostasis (52). The role of the Vestibular system in the function of homeostasis can be clearly seen when we switch from sitting to standing position. Doing so causes blood to accumulate in the legs and as a result a decrease in the topical blood pressure, which can lead to a decrease in the brain blood pressure and fainting. The traditional view is that baroreceptors detect pressure changes in the vascular tree and act to correct it (52). However, although baroreceptors play an important role, such a feedback system can only act in a reactive way to correct deviations after it occurs. On the contrary, any change in position is immediately recorded by the vestibular system, which actively acts through the sympathetic system that causes blood pressure and also maintains blood pressure in a favorable homeostasis (52). In short, it can be said that at the beginning it is a Vestibulo-sympathetic response that passes through this situation whenever we stand. The role of the Vestibular system in homeostasis is more than maintaining cardiovascular stability. There is evidence that this system can modulate the pattern of respiratory muscle activation for optimizing blood oxygen during movement, and the Vestibular stimulation has also been shown to have a range of motor effects and not merely related to motor disorders (52). The Vestibular system also plays a role in maintaining bone mineral density, so any damage to this system can reduce bone mineralization, an effect that is mediated by the sympathetic nervous system, and is not related to the reduced physical activity (53, 54).

Conclusion:

In general, the results of this research showed that twelve sessions of Vestibular exercises have positive effects on the quality of life and physical fitness components of inactive elderly people. So, given the many benefits of these exercises, including ease of implementation, availability and low cost, we suggest that sports clubs, rehabilitation centers, and the families use this practice for the elderly.

Ethical Considerations:

In order to observe ethical considerations, the subjects were fully informed about the goals of the research; while obtaining written consent, they were assured that the information obtained from the study would remain confidential. They were also assured that their participation do not involve any losses in the research, and those who did not want to continue to cooperate were free to leave the study**.**

References:

1. World Health Organization. (2009). Health Promotion Glossary.

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Division of Health Promotion, Education and Communications (HPR) and Health Education and Health Promotion Unit (HEP), Geneva, Switzerland.

2. Saxena S, O'Connell K, Underwood L. A commentary: cross-cultural quality-of-life assessment at the end of life. The Gerontologist. 2002;42(3):81-5.

3. Bashir J, Hadi, H., Bashir, M., Rostam Khani, H. Evaluate the effect of Resistance-Balance, Velocity-Balance and Balance training on dynamic balance in active elderly males. Journal of Rehabilitation Sciences. 2010;5(2):104-15. [Persian].

4. Nilson F, Moniruzzaman S, Gustavsson J, Andersson R. Trends in hip fracture incidence rates among the elderly in Sweden 1987–2009. Journal of public health. 2012;35(1):125-131.

5. Resende SM, Rassi CM. Effects of hydrotherapy in balance and prevention of falls among elderly women. Brazilian Journal of Physical Therapy. 2008;12(1):57-63.

6. Aslankhani M. The relationship between the level of physical activity and general health amang older adults of the city of Tehran. Journal of human movement. 2008;1(2):13-19. [Persian].

7. Newsom JT, Schulz R. Social support as a mediator in the relation between functional status and quality of life in older adults. Psychology and aging. 1996;11(1):34.

8. Rosendahl E, Gustafson Y, Nordin E, Lundin-Olsson L, Nyberg L. A randomized controlled trial of fall prevention by a high-intensity functional exercise program for older people living in residential care facilities. Aging clinical and experimental research. 2008;20(1):67-75.

9. Wood RH, Reyes-Alvarez R, Maraj B, Metoyer KL, Welsch MA. Physical fitness, cognitive function, and health-related quality of life in older adults. Journal of aging and physical activity. 1999;7(3):17-30.

10. Wood L, Peat G, Thomas E, Hay EM, Sim J. Associations between physical examination and self-reported physical function in older community-dwelling adults with knee pain. Physical Therapy. 2008;88(1):33-42.

11. Patterson SL, Rodgers MM, Macko RF, Forrester LW. Effect of treadmill exercise training on spatial and temporal gait parameters in subjects with chronic stroke: a preliminary report. Journal of rehabilitation research and development. 2008;45(2):221.

12. Robertson M, Campbell J, Gardner M, Devlin N. Prevating Injury and increase quality of life in older people: A meta analysis of individual-level data. J Am Geriatr Soc. 2004;14(20):118-21.

13. Koltyn KF. The association between physical activity and quality of life in older women. Women's health issues. 2001;11(6):471-80.

14. Lok N, Lok S, Canbaz M. The effect of physical activity on depressive symptoms and quality of life among elderly nursing home residents: Randomized controlled trial. Archives of gerontology and geriatrics. 2017;70:92-8

15. de Lira CAB, Taveira HV, Rufo-Tavares W, dos Santos Amorim A, Ferreira LMC, Andrade MS, et al. Engagement in a Community Physical Activity Program and Its Effects Upon the Health-Related Quality

of Life of Elderly People: A Cross-Sectional Study. Value in health regional issues. 2018;17:183-8.

16. Curi VS, Haas AN, Alves-Vilaça J, Fernandes HM. Effects of 16-weeks of Pilates on functional autonomy and life satisfaction among elderly women. Journal of bodywork and movement therapies. 2018;22(2): 424-29

17. Chang S-F, Lin P-C, Yang R-S, Yang R-J. The preliminary effect of whole-body vibration intervention on improving the skeletal muscle mass index, physical fitness, and quality of life among older people with sarcopenia. BMC geriatrics. 2018;18(1): 1-7.

18. Badke MB, Shea TA, Miedaner JA, Grove CR. Outcomes after rehabilitation for adults with balance dysfunction1. Archives of physical medicine and rehabilitation. 2004;85(2):227-33.

19. McDonnell MN, Hillier SL. Vestibular rehabilitation for unilateral peripheral vestibular dysfunction. Cochrane database of systematic reviews. 2015. (1).

20. Galea JM, Jayaram G, Ajagbe L, Celnik P. Modulation of cerebellar excitability by polarity-specific noninvasive direct current stimulation. Journal of Neuroscience. 2009;29(28): 9115-22

21. Hall CD, Herdman SJ, Whitney SL, Cass SP, Clendaniel RA, Fife TD, et al. Vestibular rehabilitation for peripheral vestibular hypofunction: an evidence-based clinical practice guideline: from the American physical therapy association neurology section. Journal of Neurologic Physical Therapy. 2016;40(2):124.

22. Ribeiro KMOBdF, Freitas RVdM, Ferreira LMdBM, Deshpande N, Guerra RO. Effects of balance vestibular rehabilitation therapy in elderly with benign paroxysmal positional vertigo: a randomized controlled trial. Disability and rehabilitation. 2017;39(12):1198-206.

23. Hyde M, Wiggins RD, Higgs P, Blane DB. A measure of quality of life in early old age: the theory, development and properties of a needs satisfaction model (CASP-1.(Aging & mental health. 2003;7(3):186-94.

24. Heravi Km, Rejeh N, Garshasbi E, Nikkhah M, Montazeri A. A Validation Study of the Persian Version of Older People’s Quality of Life Questionnaire (CASP-19). 2016.

25. Khajavi D, Farokhi A, Jabery-Moghadam A. Kazem nejad A. The effect of an exercise intervention program on motor functions associated with falls in the elderly Without regular physical activity Learning and Development of motor-sport. 2013;12:49-65. [Persian]

26. Różańska-Kirschke A, Kocur P, Wilk M, Dylewicz P. The Fullerton Fitness Test as an index of fitness in the elderly. Medical Rehabilitation. 2006;10(2):9-16.

27. Farokhi MS HH, Pishyareh E, Hosseini SA, Bakhshi E, Rezazadeh N, et al. Effects Of Active Vestibulotherapy On Motor Disorders In Children With Attention Deficit Hyperactivity Disorder. J Rehab Med. 2017;6(1):74-82. [Persian]

28. Ahmadi M, Noudehi M, Esmaeili M, Sadrollahi A. Comparing the quality of life between active and non-active elderly women with an emphasis on physical activity. Iranian Journal of Ageing. 2017;12(3):262-75. [Persian]

[DOR: 20.1001.1.23222913.2019.8.3.6.0]

29. Borzu S, Arasto A A, Ghasemzadeh R, Zahidnezhad Sh, Habibi AH, Latifi SM. The Effect of Aerobic Exercise Exercise on Quality of Life in Elderly Residents of Ahvaz. Iranian Journal of Ageing. 2011;6(19):47-51.

30. Bahrami L, Salianeh MA, Farsi AR, Nik Ravan A. The Effect of Mindfulness and Working Memory Training on Quality of Life in Active Elderly Persian. Journal of Sport Psychology Studies. 2017;21:1-16. [Persian]

31. Kamranifaraz N, Letafatkar A, Javdaneh N. The effect of a Compound exercises in the water on muscle strength, flexibility, and quality of life of elderly women 60-70 years old in tehran. nvj. 2017;3(9):24-37. [Persian]

32. Khalaji H, Bahramy B, Noroozian M, Mohammadzadeh Heravi S. The effect of physical activity on functional fitness and quality of life in people with Parkinson's disease. Medical Journal of Mashhad University of Medical Sciences. 2014;57(3):542-54. [Persian]

33. Zareiy H, Norasteh A, Koohboomi M. Effect of Combined Training (Strength and Stretching) on Balance, Risk of Falling, and Quality of Life in the Elderly. J Rehab Med. 2018;7(2):201-8. [Persian]

34. Koohboomi M, Norasteh AA, Samami N. Effect of Yoga training on physical fitness and balance in elderly females. Iranian Journal of Ageing. 2015;10(3):26-35. [Persian]

35. Hosseinpour S, Behpour N, Tadibi V, Ramezankhani A. Effect of cognitive-motor exercises on physical health and cognitive status in elderly. Iranian Journal of Health Education and Health Promotion. 2017;5(4):336-44. [Persian]

36. Bastani M, Ghasemi G, Sadeghi M, Afshon A, Sadeghi H. The Effect of Selected Core Stability Exercises on Balance and Muscle Endurance in the Elderly Patients Undergoing Hemodialysis. Physical Treatments-Specific Physical Therapy Journal. 2017;7(2):89-96. [Persian]

37. Miko I, Szerb I, Szerb A, Bender T, Poor G. Effect of a balance-training programme on postural balance, aerobic capacity and frequency of falls in women with osteoporosis: a randomized controlled trial. Journal of rehabilitation medicine. 2018;50(6):542-7.

38. Perez IG, Marta García-Granero, Eduardo Martin, Rafael García-Tapia, Nicolas. Factor analysis and correlation between Dizziness Handicap Inventory and Dizziness Characteristics and Impact on Quality of Life scales. Acta oto-laryngologica. 2001;121(545):145-54.

39. Bekibele C, Gureje O. Fall incidence in a population of elderly persons in Nigeria. Gerontology. 2010;56(3):278-83.

40. Jung JY, Kim J-S, Chung PS, Woo SH, Rhee CK. Effect of vestibular rehabilitation on dizziness in the elderly. American journal of otolaryngology. 2009;30(5): 295-9.

41. Zeigelboim BS, Liberalesso PBN, Jurkiewicz AL, Klagenberg KF. Clinical benefits to vestibular rehabilitation in multiple sclerosis. Report of 4 cases. International Tinnitus Journal. 2010;16 (1).

42. Meli A, Zimatore G, Badaracco C, De Angelis E, Tufarelli D. Effects of vestibular rehabilitation therapy on emotional aspects in chronic vestibular

patients. Journal of psychosomatic research. 2007;63(2):185-90.
43. Zanardini FH, Zeigelboim BS, Jurkiewicz AL, Marques JM, Martins-Bassetto J. Vestibular rehabilitation in elderly patients with dizziness. Pró-Fono Revista de Atualização Científica. 2007;19(2):177-84.
44. Ghasemi E, Shayegannejad V, Ghorbani A, Momeni N, F. K. The effectiveness of exercise-therapy on improvement of balance, gait, quality of life and depression in elderly patients with vertigo due to peripheral disturbances of vestibular system. . Journal of Research in Rehabilitation Sciences. 2010;4 (2). [Persian]
45. Macias JD, Massingale S, Gerkin RD. Efficacy of vestibular rehabilitation therapy in reducing falls. Otolaryngology—Head and Neck Surgery. 2005;133(3):323-5.
46. Hebert JR, Corboy JR, Manago MM, Schenkman M. Effects of vestibular rehabilitation on multiple sclerosis–related fatigue and upright postural control: a randomized controlled trial. Physical therapy. 2011;91(8):1166-83.
47. Herdman SJ, Clendaniel R. Vestibular rehabilitation: FA Davis; 2014.
48. Han BI, Song HS, Kim JS. Vestibular rehabilitation therapy: review of indications, mechanisms, and key exercises. Journal of Clinical Neurology. 2011;7(4):184-96.
49. Simoceli L, Bittar RSM, Sznifer J. Adaptation exercises of vestibulo-ocular reflex on balance in the elderly. Journal of Otolaryngology of the World. 2008;12(2):183-8.
50. Tavanai E, Hajiabolhassan F. Cervicogenic vertigo: etiology, diagnosis and treatment. Bimonthly Audiology-Tehran University of Medical Sciences. 2013;22(3):1-13.
51. Alghadir AH, Iqbal ZA, Whitney SL. An update on vestibular physical therapy. Journal of the Chinese Medical Association. 2013;76(1):1-8.
52. Balaban C, Yates B. Vestibuloautonomic interactions: A teleologic perspective. The vestibular system: Springer; 2004. p. 286-342.
53. Carabotti M, Scirocco A, Maselli MA, Severi C. The gut-brain axis: interactions between enteric microbiota, central and enteric nervous systems. Annals of gastroenterology: quarterly publication of the Hellenic Society of Gastroenterology. 2015;28(2):203.
54. Denise P, Normand H, Wood S. Artificial Gravity, (Eds: G. Clement, A. Bukley), Springer-Verlag, New York, USA 2006, pp. 233.

Tables and Charts:

Table 1: Descriptive information of subjects in two experimental and control groups (n = 30).

Group	Age	Weight	Height
Experiment	08.4 ± 4.66	7.5 ± 5.68	7.5 ± 32.167
Control	2.52±4.66	1.5± 4.68	4.5 ± 12.168

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Table 2: Descriptive indices of pre-test and post-test scores in both experimental and control groups (n = 30).

Variable	Condition	Group	Mean	Standard deviation	K-S Z	P
Quality of life	Pretest	Experiment	04.36	5.4	1.15	0.36
		Control	62.35	5.32	1.12	1.08
	Posttest	Experiment	15.44	4.95	1.25	0.27
		Control	22.36	5.34	1.17	0.19
Agility	Pretest	Experiment	16.74	1.47	1.22	0.64
		Control	68.16	1.28	1.08	0.58
	Posttest	Experiment	48.15	1.35	0.88	0.74
		Control	55.16	1.14	0.81	0.72
Strength of lower extremity	Pretest	Experiment	87.10	1.22	1.28	0.78
		Control	68.10	1.36	1.32	0.68
	Posttest	Experiment	95.11	1.28	0.67	0.83
		Control	10.72	1.34	0.75	0.79

Table 3: Univariate covariance analysis results for the difference between the experimental and control groups (n = 30).

Variable	Source of change	Total squares	Degree of freedom	Mean of squares	F statistic	p	Size of effect
Quality of life	**Pretest**	851.20	1	851.20	777.15	001.0	369.0
	Group membership	242.166	1	242.166	792.125	001.0	823.0
	Error	682.35	27	322.1			
Agility	**Pretest**	187.0	1	187.0	904.10	003.0	288.0
	Group membership	936.7	1	936.7	944.463	001.0	89.0
	Error	462.0	27	017.0			
Strength of lower extremity	**Pretest**	358.0	1	358.0	34.7	012.0	214.0
	Group membership	427.5	1	427.5	204.111	001.0	805.0
	Error	318.1	27	049.0			

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