

Investigation of the Relationship of Recommended Home Exercises with Dual-Task Training for the Elderly with Physical Activity Level, Life Quality and Kinesiophobia

Yaşlılarda Çift Görev Eğitimiyle Önerilen Ev Egzersizlerinin Fiziksel Aktivite Düzeyi, Yaşam Kalitesi ve Kinezyofobiyle İlişkisinin İncelenmesi

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Amaç: Yaşlılarda ev egzersizlerinin çift görev eğitimiyle birlikte yapılmasının fiziksel aktivite düzeyi ve yaşam kalitesine etkisini incelemek ve ev egzersizlerinin hareket korkusuna etkisini araştırmaktır.

Gereç ve Yöntemler: Çalışmaya 65 yaş üstü 60 gönüllü katılımcı alındı. Katılımcıların yaş ortalaması 81, yüzde 70'i kadınlardan oluşmaktadır. Katılımcılar randomize kontrollü olarak tek ve çift görev grubu adında 2 eşit gruba ayrıldı. Her iki gruba standart ev egzersiz protokolü uygulanırken; çift görev grubuna ek bilişsel görevler verildi. Katılımcılara haftada 3 gün olacak şekilde 4 hafta boyunca ev ortamında fizyoterapist eşliğinde 45dk'lık 12 seans egzersiz yaptırıldı. İlk seans öncesi ve son seans sonrası katılımcılara Dünya Sağlık Örgütü Yaşam Kalitesi Ölçeği Yaşlı Modülü, Berg Denge Ölçeği, Düşme Etkinlik Ölçeği, Tampa Kinezyofobi Ölçeği, Yaşlılar için Fiziksel Aktivite Ölçeği, Zamanlı Kalk Yürü Testi ve Montreal Bilişsel Değerlendirme Ölçekleri ile değerlendirme yapıldı.

Bulgular: Gruplar arasında yapılan analizde Berg Denge Ölçeği, Yaşlılar için Fiziksel Aktivite Ölçeği ve Montreal Bilişsel Değerlendirme Ölçeklerinin sonuçları istatistiksel olarak anlamlı bulundu ($p<0,05$). Tek ve çift görev eğitimi ile yapılan ev egzersizlerinin hareket kaygısı üzerine etkisinin anlamlı olmadığı bulundu ($p>0,05$).

Sonuç: Çift görev eğitimi ile yapılan ev egzersizleri; tek görev eğitimi ile yapılan ev egzersizlerine göre dengeyi geliştirme, fiziksel aktivite düzeyini artırma ve bilişsel performansı artırma konusunda daha başarılıdır. Yaşlılarda ev egzersizlerinin çift görev eğitimi ile birlikte verilmesi bilişsel performansın ve günlük yaşam aktivitelerinde bağımsızlığın artması için olumlu katkı sağlamaktadır.

Anahtar kelimeler: Çift görev egzersizleri, ev egzersizleri, geriatric fizyoterapi, fiziksel aktivite, yaşlanma

Aim: To examine the effect of home exercises combined with dual-task training on physical activity level and quality of life in the elderly, and to investigate the impact of home exercises on fear of movement.

Material and Methods: 60 volunteer participants over the age of 65 were included in the study. The average age of the participants was 81 years, and 70% of the participants were women. Participants were randomly divided into two equal groups called single and dual-task groups. While standard home exercise protocol was applied to both groups, additional cognitive tasks were assigned to the dual-task group. Participants were given 45 minutes of exercise under a physiotherapist monitor in a home environment three days a week for four weeks. Before the first session and after the last session, the participants were evaluated with the World Health Organization Quality of Life Scale Elderly Module, Berg Balance Scale, Fall Efficiency Scale, Tampa Kinesiophobia Scale, Physical Activity Scale for Elderly, Timed Up and Go Test, and Montreal Cognitive Assessment Scales.

Results: In the analysis performed between the groups, the results of the Berg Balance Scale, the Physical Activity Scale for the Elderly, and the Montreal Cognitive Assessment Scales were found to be statistically significant ($p<0.05$). It was found that home exercises performed with single and dual-task training did not significantly affect movement anxiety ($p>0.05$).

Conclusions: Home exercises with dual-task training; It is more successful in improving balance, increasing physical activity level, and increasing cognitive performance compared to home exercises performed with single-task training.

Keywords: Dual-task exercises, geriatric physiotherapy, home exercises, physical activity, aging

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INTRODUCTION

With aging, the increase in distraction and the necessity of adapting walking to environmental factors make walking difficult. Therefore, the risk of falling increases in the elderly. Although research has focused on this topic, little is known about the interaction between dual-task and gait adaptation (1). Studies have shown that physical exercise improves walking, increases physical fitness, and prevents falls. However, adding cognitive training components to rehabilitation could potentially reduce these effects, as cognitive impairments are associated with gait disturbances and the risk of falls. Simultaneous cognitive-physical training has been shown to provide more improvement in dual-task walking compared to physical training (2). Improving walking performance in dual-task situations has become an important goal of rehabilitation for patients with neurological disorders (3). Studies examining the ability to participate in dual tasks while maintaining walking and balance simultaneously have suggested that centers in the brain display planning, blocking, and coordination functions to manage dual tasks. The prefrontal cortex, responsible for executive processes in the central nervous system, changes with age. In the literature, it is suggested that cognitive functions that are weakened due to this change can be improved by physical exercise and cognitive training. Single-task; it contains only one stimulus/task. Dual-task is defined as the simultaneous performance of two tasks that can be performed independently, measured separately, and have different goals(4). As a result of the changes in the nervous system with aging, slowing, and inability to perform dual task combinations is observed. With the dual-task training, re-learning processes are tried to be activated, and performance is aimed to be increased. Dual-task performances are evaluated with tests such as inability to walk while speaking, arithmetic calculation, tray, full glass test, and verbal fluency test. It is known that dual-task exercises are applied in

diseases such as stroke, multiple sclerosis, Parkinson's disease, obesity, and dementia (5).

Walking and balance exercises and cognitive activities should be done at the same time to perform many activities in daily life. Falls are frequently seen when performing a cognitive task during physical activity, especially in the elderly. It has been shown that the exercises performed with dual-task training in the elderly are effective in reducing the frequency of falling. Increasing the effectiveness of exercises protects against falls in daily life activities and during home exercise. More effective results are obtained when cognitive and physical exercises are applied together (6). A direct proportion was found between the two parameters in a study examining the risk of falling and dual-task performance. The importance of working on this issue in the clinic and dual-task training is emphasized (7). A sedentary lifestyle increases with age due to physiological changes in the body, and older adults spend 65% to 80% of their time while sitting. This deficiency in physical activity leads to adverse effects on cardio-metabolic health, muscle-tendon health, functional fitness, physical independence, and body composition (8).

Physical inactivity is a major health problem worldwide and causes many chronic degenerative diseases such as cardio-cerebrovascular disease, metabolic disease, musculoskeletal disorders, and frailty. Physical exercise has proven benefits for many health problems, including cardiovascular disease and all-cause mortality (9). Physical activity and participation in "leisure time" activities contribute positively to the quality of life in the elderly (10). Physical therapy applications at home are essential for reducing the rate of returning the elderly to hospital and reducing the need for the hospital. It is a preferred method to prevent hospitals and health institutions' density and reduce health expenses. Also, the sustainability of health

Table I. Inclusion and exclusion criteria from the study

INCLUSION CRITERIA	EXCLUSION CRITERIA
<ul style="list-style-type: none">➤ Persons who read the information form and signed the consent form➤ People aged 65 and over➤ People who applied to Beşiktaş Municipality Health Affairs Directorate to receive physiotherapy and rehabilitation services at home from Beşiktaş Municipality.➤ Those who have 'Physical therapy at home' report➤ Getting 24 or more points from the Mini-Mental Test.➤ Being literate➤ No history of dizziness vestibular➤ Not having an uncontrolled systemic disease➤ People who do not have any cognitive and orthopedic health problems that prevent evaluation	<ul style="list-style-type: none">➤ Persons with disabilities that affect the assessment such as vision and hearing➤ Having a cardio-respiratory disease that may interfere with the activity➤ People who score less than 24 points in the mini-mental test

services that patients can benefit from in a limited time is also ensured.

MATERIAL AND METHODS

The study was initiated after obtaining approval from the Bahçeşehir University Clinical Research Ethics Committee (04.09.2019 - 2019-12/07) and conducted under the Declaration of Helsinki. Written informed consent was obtained from patients who participated in this study.

Participants:

Participants in the study were informed that the information would only be used for research purposes, and verbal and written approval was taken. In our randomized controlled study, people aged 65 and above who live in the Beşiktaş district of Istanbul province and receive physiotherapy and rehabilitation services at home were included. Inclusion and exclusion criteria from the study are shown in Table I. Participants were divided into a single task and dual-task group in a randomized and controlled manner.

Testing:

Home exercises were given to the dual-task group together with the dual-task training. Only home exercises were given to the single-task group. The exercises were done in the participants' own homes for four weeks, three days a week, in the presence of a physiotherapist. All exercises were performed

by the same physiotherapist. A total of 12 sessions of 45-minute exercise training were conducted. MMT (Mini-Mental Test) and EHSCT (Evaluation of Home Safety Conditions in Terms of Fall) tests were performed for participation in the study. WHOQL-OLD (World Health Organization Quality of Life Elderly Module), BBS (Berg Balance Scale), FES (Falling Efficiency Scale), TSK(Tampa Kinesiophobia Scale), TUGT (Timed Get Up and Go Test), PASE (Physical Activity Scale for the Elderly) and MOCA (Montreal Cognitive Assessment Scale) tests were applied (11-19).

Exercises:

Rehabilitation protocols applied to the participants are shown in Table II and Table III.

Statistical Analysis

Statistically, the p-value (<0.05) was considered significant, with 95% of a confidence interval. The data suitable for normal distribution was determined using the Shapiro Wilk and Kolmogorov-Smirnov tests. The groups are evaluated with paired sample t-test; intergroup evaluation was analyzed by independent t-test.

Table II. Single-task exercise group rehabilitation protocol

EXERCISES	DURATION (min)	SINGLE TASK GROUP
Warm-up moves	~5	Breathing exercises, raising the shoulders, pulling the knee to yourself, shaking the arms, counting as if walking slightly, circular movements of the head, lifting and turning the arms
Calisthenic exercises (muscle strengthening)	~10	Straight leg raising and lowering, Towel exercises, Stick exercises, Isometric exercises
Walking exercises	~10	Lightweight pre-walking exercises in the form of counting on the spot, Soldier walking exercises, walking exercises around the chair, walking exercises at light or varying pace
Balance exercises	~10	Standing exercises on one and two legs, Balance exercises with eyes open and closed, Standing exercises with or without support,
Stretching exercises	~5	Lying down exercises against movements that provoke balance
Cooling movements	~5	Static and dynamic stretching exercises involving large muscle groups

Table III. Dual-task exercise group rehabilitation protocol

EXERCISES	DURATION (min)	DUAL TASK GROUP
Warm-up moves	~5	Breathing exercises, raising the shoulders, pulling the knee to yourself, shaking the arms, counting as if walking slightly, circular movements of the head, lifting and turning the arms
Calisthenic exercises (muscle strengthening)	~10	Raising and lowering the leg straight, Towel exercises, Sticks exercises, Isometric exercises. The patient is asked to count the colors while moving to the sitting position while standing. While exercising, the patient is asked to count 5 and 5 from 100. The patient is asked to count by adding 3 to 1 while exercising.
Walking exercises	~10	Lightweight pre-walking exercises in the form of counting on the spot, Soldier walking exercises, walking exercises around the chair, walking exercises at light or varying tempo. The patient is asked to carry a glass of water in his hand while walking. The patient is asked to repeat the words said while walking. The patient is asked to count by adding 3 to 1 while exercising. The patient is asked to turn the arms in a circle while walking.
Balance exercises	~10	Standing exercises on one and two legs, Balance exercises with eyes open, standing exercises with or without support, Lying-down exercises against movements that provoke balance. While sitting, the person is asked to count the months of the year while standing up is asked to count forward. While the patient is standing without support; patients are asked to count the geographical regions of Turkey. While the patient is standing with eyes closed; the patient is asked to count the names starting with the letter 'O'.
Stretching exercises	~5	Static and dynamic stretching exercises involving large muscle groups
Cooling movements	~5	Exercises involving slightly large muscle groups before returning to normal following exercises

RESULTS

Sixty volunteer participants over the age of 65 were included in the study. While 70% of the participants were women, the average age of all participants was 81. Descriptive information of the participants is shown in Table IV. Information on the health history of the participants is shown in Table V. While the results of WHOQL-OLD, FES, TUGT, and TSK among single and dual-task groups were statistically insignificant, the results of BBS,

PASE, and MOCA were found to be statistically significant between groups ($p < 0.05$). The results of the tests evaluated before and after the treatment are shown in Table VI.

DISCUSSION

We evaluated the balance statically and dynamically using the Berg Balance Scale and Falling Efficiency Scale. Dual or single tasks

Table IV. Distribution of demographic information of participants

	Single-task group (n:30)	Dual-task group (n:30)
Age (years)	81.4 ± 7.25 (66-94)	80.5 ± 7.48 (66-95)
Gender (female/male)	18 / 12	24 / 6
Education (pre-school/high school)	16 / 14	13 / 17
Body Mass Index (kg/cm ²)	28.11 (20.1-36.7)	27.8 (20.2-35.4)

Values are means ± standard deviations (minimum-maximum)

Table V. Descriptive information about the health history of the participants

Disease	Single-Task (n)	Dual-Task (n)
Parkinson's	3	2
Cervical DH	4	3
General old age	1	2
Lumbar DH	7	6
Gonoarthritis	7	8
Knee arthroplasty	3	2
Coxarthrosis	1	1
Hip arthroplasty	3	2
Diabetes	1	1
Hip fracture	0	1
Hemiparesis	0	2

DH: Disc Herniation

Table VI. Comparison of test results of single-task and dual-task groups

Results		Single-Task Group	Dual-Task Group	Inter-group difference
Parameters	Tests	Before/After	Before/After	
Life Quality	WHOQLOLD	80.23 / 82.46	77.36 / 79.66	0.967
Balance	BBS	42.40 / 46.50	36.53 / 43.56	0.002*
	FES	35.36 / 28.10	39.23 / 29.83	0.324
Agility and Dynamic Balance	TUGT(second)	13.96 / 11.46	13.53 / 10.90	0.736
Kinesiophobia	TSK	42.73 / 43.10	43.13 / 43.23	0.788
Physical Activity	PASE	25.36 / 29.33	20.73 / 28.00	0.010*
Cognitive Functions	MOCA	20.90 / 22.10	20.10 / 23.43	0.000*

**p* < 0.05

WHOQLOLD: World Health Organization Quality of Life Elderly Module, BBS: Berg Balance Scale, FES: Falling Efficiency Scale, TUGT: Timed Get Up and Go Test, TSK: Tampa Kinesiophobia Scale, PASE: Physical Activity Scale for the Elderly, MOCA: Montreal Cognitive Assessment Scale

involving physical activity during walking were evaluated with the TUGT and PASE. In the studies conducted, the duration of intervention and the number of sessions is very variable, and it has been observed that there

are studies that mostly last four weeks (20-21). It has been observed in the literature that the longest interventions lasted 24 weeks and 16 weeks. The remainder of the interventions is reported to have a duration of 6 to 10 weeks.

This study was planned as three sessions per week for a total of 4 weeks. While session duration in the literature is 45 minutes in most studies; In some studies, it was planned as 50 minutes and some 60 minutes. In our study, the sessions were planned to be 45 minutes (21-25). It was observed that dual-task exercises had a positive effect on balance, physical activity level, and cognitive performance compared to single-task exercises. Both single-task and dual-task home exercises did not cause a significant change in reducing fear of exercise or reducing anxiety. The functional decline that occurs with aging causes difficulties in daily life activities and causes a decrease in the efficiency and speed of the brain's executive function (26). Daily actions such as walking while talking or reading advertisements while shopping in the market cause difficulties for the elderly. When the two actions' processing levels begin to deteriorate due to a decline in cognitive or executive functions, it becomes a potential threat to the elderly. The World Health Organization (WHO) estimates that people over the age of 60 make up 12% of the world population, and this rate will rise to over 22% by 2050. Dual-duty actions affecting walking performance are effective not only in individuals with neurological problems but also in healthy individuals (26-28). The aging of the population will cause a demographic change in the coming years, bringing about lifestyle changes. However, by increasing fragility, the risk of disability will increase, increasing addiction in the elderly (29). There is evidence that dual-task training has positive effects on improving balance, walking, and cognitive functions in the elderly (30-31). However, there is controversy in the literature regarding dual-task training. In our study, all these examples and evidence-based physical and cognitive functions were discussed together. The rate of female participants is higher in studies in the literature and our study. This is because women spend more time at home, have more weight problems, and have a longer life span (32). In studies involving dual-task

training, the effects on balance and walking were mostly examined, but cognitive functions remained in the background. The difference in our study from its peers in the literature is that it evaluates cognitive functions and examines the effectiveness of kinesophobia. No relationship was found between kinesophobia and physical activity. More studies are needed on this subject. While only orthopedic and neurological problems were the majority in the studies, healthy elderly individuals were also included in our study (33). In our study, the agility and dynamic balance performances of the patients who received single and double task training showed an improvement compared to the TUGT. In the literature, while the results of double-task training are superior to single-task training, the effect of single and double task training on walking speed was not found statistically significant in our study. There are some contradictions in evaluating the results obtained due to the sample size ($n < 30$) in some studies showing a shortcoming of these studies. Therefore, the sample size was decided to be 60 to prevent these contradictions (33).

The absence of fear and anxiety or minimizing them increases the effectiveness of the exercises given in the home environment. Studies have been conducted in a variety of settings, including clinical settings or nursing homes. Studies performed in the home environment are rare; one of them is our study. This is another advantage that distinguishes the study from others. In our study, double-task and single-task exercises positively affect balance, physical activity level, and cognitive functions. However, while the change in patients who received dual-task training was significant; This change was found to be statistically insignificant in patients who received single task training. Kinesiophobia results were normal before and after treatment. There was no significant difference in kinesophobia values before and after the treatment in both groups. It was observed that the patients did not have any anxiety that could

prevent them from doing the exercises. Physical activation levels showed a positive change in both groups. There was a significant change in physical activities, such as the patients' participation in housework, gardening, and social life. There was no significant difference in reducing kinesiophobia with home exercises. It is known that physical activity reduces cognitive impairment in the elderly, aerobic exercises and resistant exercises improve executive functions, and cognitive impairment decreases even in low-intensity physical activity.

Our study determined that the cognitive performance development associated with executive functions with dual-task training was higher. We can also increase cognitive performance and reduce falls by providing dual-task training to older adults who exercise at home.

Conflict of Interest and Funding

The authors declare no conflict of interest.

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Ethics Committee Approval

The study was initiated after obtaining approval from the Bahçeşehir University Clinical Research Ethics Committee (04.09.2019 - 2019-12/07)

REFERENCES

1. Conradsson D, Hinton DC, Paquette C. The effects of dual-tasking on temporal gait adaptation and de-adaptation to the split-belt treadmill in older adults. *Exp Gerontol.* 2019; 125:110655.
2. Eggenberger P, Theill N, Holenstein S et al. Multicomponent physical exercise with simultaneous cognitive training to enhance dual-task walking of older adults: a secondary analysis of a 6-month randomized controlled trial with 1-year follow-up. *Clin Interv Aging.* 2015; 10:1711-32.
3. Fritz NE, Cheek FM, Nichols-Larsen DS. Motor-Cognitive Dual-Task Training in Persons with Neurologic Disorders: A Systematic Review. *J Neurol Phys Ther.* 2015;39(3):142-53.
4. Falbo S, Condello G, Capranica L et al. Effects of Physical-Cognitive Dual Task Training on Executive Function and Gait Performance in Older Adults: A Randomized Controlled Trial. *Biomed Res Int.* 2016; 2016:5812092.
5. Guedes RC, Dias RC, Pereira LS et al. Influence of dual task and frailty on gait parameters of older community-dwelling individuals. *Braz J Phys Ther.* 2014;18(5):445-52.
6. Buckner RL. Memory and executive function in aging and AD: multiple factors that cause decline and reserve factors that compensate. *Neuron.* 2004; 44(1):195-208.
7. Muir-Hunter SW, Wittwer JE. Dual-task testing to predict falls in community-dwelling older adults: a systematic review. *Physiotherapy.* 2016; 102(1):29-40.
8. Silsupadol P, Shumway-Cook A, Lugade V et al. Effects of single-task versus dual-task training on balance performance in older adults: a double-blind, randomized controlled trial. *Arch Phys Med Rehabil.* 2009; 90(3):381-7.
9. Ansai JH, Aurichio TR, Rebelatto JR. Relationship between balance and dual task walking in the very elderly. *Geriatr Gerontol Int.* 2016; 16(1):89-94.
10. Bohannon RW, DePasquale L. Physical Functioning Scale of the Short-Form (SF) 36: internal consistency and validity with older adults. *J Geriatr Phys Ther.* 2010; 33(1):16-8.
11. Gungen C, Ertan T, Eker E. Standardize Mini Mental Test'in Türk toplumunda hafif demans tanısında geçerlik ve güvenilirliği. *Türk Psikiyatri Dergisi.* 2002; 13:273-81.
12. Eser S., Saatlı G., Eser E et al. The reliability and validity of the Turkish version of the World Health Organization Quality of Life Instrument-Older Adults Module (WHOQOL-Old). *Türk Psikiyatri Dergisi.* 2010; 21(1): 1-10.
13. Sahin F., Yılmaz F., Ozmaden, A et al. Reliability and Validity of the Turkish version of The Berg Balance Scale. *Journal of Geriatric Physical Therapy.* 2008; 31(1): 32-37.
14. Ağırca D. Tinetti Balance and Gait Assessment'in (Tinetti Denge ve Yürüme Değerlendirmesi) Türkçeye uyarlanması, geçerlilik ve güvenilirliği. Yüksek lisans tezi. Pamukkale Üniversitesi Sağlık Bilimleri Enstitüsü. Denizli. 2009.
15. Yılmaz ÖT, Yakut Y, Uygur F et al. Tampa Kinezyofobi Ölçeği'nin Türkçe versiyonu ve Test-tekrar Test Güvenirliği. *Fizyoterapi Rehabilitasyon Dergisi.* 2011; 22:44-49.
16. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc.* 1991; 39(2): 142-8.
17. Ayvat E, Kılınç M, Kırdı N. The Turkish version of the Physical Activity Scale for the Elderly (PASE): its cultural adaptation, validation, and reliability. *Turkish Journal of Medical Sciences.* 2017; 47: 908-915.
18. Akın B. ve Lök N. Yaşlılarda Düşme Yönünden Ev içi Çevre Özellikleri Değerlendirme Formunun Geçerlilik ve Güvenirliği. *Akademik Geriatri Dergisi.* 2012; 4:142-151.
19. Kaya Y, Aki O. Validation of Montreal Cognitive Assessment and Discriminant Power of Montreal Cognitive Assessment Subtests in Patients with Mild Cognitive Impairment and Alzheimer Dementia in Turkish Population. *J Geriatr psych and neuro.* 2014; 27(2): 54-55.
20. Galloza J, Castillo B, Micheo W. Benefits of Exercise in the Older Population. *Phys Med Rehabil Clin N Am.* 2017; 28(4):659-669.
21. Gobbo S, Bergamin M, Sieverdes JC et al. Effects of exercise on dual-task ability and balance in older adults: a systematic review. *Arch Gerontol Geriatr.* 2014; 58(2):177-87.
22. Çakar M, Cankurtaran M., Geriatri ve Gerontoloji. Geriatrik Populasyonda kas iskelet sistemindeki fizyolojik değişimler. *MN Medikal & Nobel yayınları.* 2006; 645-655.
23. Fredman ML, Berk BZ., Rehabilitation medicine. Medikal management of geriatric rehabilitation, 1998; 384-420.
24. LaMonte MJ, Buchner DM, Rillamas-Sun E et al. Accelerometer-Measured Physical Activity and Mortality in Women Aged 63 to 99. *J Am Geriatr Soc.* 2018; 66(5):886-894.

25. Martinez-Gomez D, Guallar-Castillon P, Garcia-Esquinas E et al. Physical Activity and the Effect of Multimorbidity on All-Cause Mortality in Older Adults. *Mayo Clin Proc.* 2017; 92(3):376-382.
26. Barnes DE, Mehta KM, Boscardin WJ et al. Prediction of recovery, dependence or death in elders who become disabled during hospitalization. *J Gen Intern Med.* 2013; 28(2):261-8.
27. Logan GD, Schulkind MD. Parallel memory retrieval in dual-task situations: I. Semantic memory. *J Exp Psychol Hum Percept Perform.* 2000; 26(3):1072-90.
28. Azadian E, Torbati HR, Kakhki AR et al. The effect of dual task and executive training on pattern of gait in older adults with balance impairment: A Randomized controlled trial. *Arch Gerontol Geriatr.* 2016; 62:83-9.
29. Clegg A, Young J, Iliffe S et al. Frailty in elderly people. *Lancet.* 2013; 381(9868):752-62.
30. Campbell AJ, Robertson MC, Gardner MM et al. Randomised controlled trial of a general practice programme of home-based exercise to prevent falls in elderly women. *Br Med J.* 1997; 315: 1065-9.
31. Kumar, Chandan. "Effect of training balance under dual task with fixed and variable priority instructions with balance impairment in institutionalized elderly population." *Indian Journal of Physiotherapy and Occupational Therapy.* 2014; 8(3):152.
32. Silsupadol P, Lugade V, Shumway-Cook A et al. Training-related changes in dual-task walking performance of elderly persons with balance impairment: a double-blind, randomized controlled trial. *Gait Posture.* 2009; 29(4):634-40.
33. Lemke NC, Werner C, Wiloth S et al. Transferability and Sustainability of Motor-Cognitive Dual-Task Training in Patients with Dementia: A Randomized Controlled Trial. *Gerontology.* 2019; 65(1):68-83.