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## From The Editor In Chief

Scientific reviewers play a pivotal role in Turkish Journal of Geriatrics since 1998. They not only validate the academic researches, but surely improve the quality of our journal as well for 20 years.

So we cordially thank the 2018 term reviewers of our journal who gave valuable constructive criticism to the authors and helped to increase the success of the journal.

As the members of the editorial board we wish a very happy and prosperous new year to all of our readers, authors and reviewers and at last, but not the least to the technical staff of the journal.

Prof. Yeşim GOKCE KUTSAL, M.D.
Editor in Chief

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RESEARCH

# PARKINSON'S DISEASE: IS IT ACTUALLY AN INFLAMMATORY DISORDER?

## Abstract

***Introduction:*** Parkinson's disease is the second leading neurodegenerative disease worldwide; however, its pathogenesis remains unclear. Recently, the neuroinflammation theory, one of the theories explaining the pathogenesis of Parkinson's disease, has become prominent. We investigated the relationship between Parkinson's disease and inflammatory markers including epicardial adipose tissue thickness, neutrophil-lymphocyte ratio, and thrombocyte-lymphocyte ratio.

***Materials and Method:*** Seventeen patients with Parkinson's disease and 21 healthy individuals (control group) were enrolled. All the patients were evaluated by a neurologist using the Unified Parkinson's Disease Rating Scale and Hoehn and Yahr staging scale. A cardiologist measured epicardial adipose tissue thickness using echocardiography. After routine laboratory analyses, neutrophil-lymphocyte and thrombocyte-lymphocyte ratios were calculated for each patient.

***Results:*** Both epicardial adipose tissue thickness and thrombocyte-lymphocyte ratio were higher in the patient group than in the control group, but the difference was significant only for the former. Epicardial adipose tissue thickness was significantly correlated with the scores of 2nd and 3rd sections of the Unified Parkinson's Disease Rating Scale, which evaluate activities of daily living and motor functions, respectively, and with the total Unified Parkinson's Disease Rating Scale score. Inflammatory marker evaluation according to the disease stage based on the Hoehn and Yahr staging scale revealed a significant difference in epicardial adipose tissue thickness between stage 1 and stage 2 patients. Moreover, there was a significant correlation between disease duration and thrombocyte-lymphocyte ratio.

***Conclusion:*** Our results support the hypothesis that inflammation plays a role in the pathogenesis of Parkinson's disease.

***Keywords:*** Parkinson disease; Inflammation; Echocardiography

ARAŞTIRMA

# PARKİNSON HASTALIĞI; GERÇEKTE İNFLAMATUAR BİR HASTALIK MI?

## Öz

***Giriş:*** Parkinson hastalığı, dünya üzerinde ikinci en sık görülen nörodejeneratif hastalıktır; buna rağmen patogenezi halen aydınlanmış değildir. Parkinson hastalığı patogenezini aydınlatan teorilerden biri olan nöroinflamasyon teorisi son yıllarda ön plana çıkmıştır. Bu çalışmada Parkinson hastalığı ile epikardiyal yağ dokusu kalınlığı, nötrofil lenfosit oranı ve trombosit lenfosit oranı gibi inflamatuar göstergeler arasındaki ilişki araştırılmıştır.

***Gereç ve Yöntem:*** Çalışmaya 17 parkinson hastası ve 21 sağlıklı birey (kontrol grubu) dahil edildi. Hastaların tümüne nöroloji uzmanı tarafından Birleşik Parkinson Hastalığı Değerlendirme Ölçeği ve Hoehn Yahr Evrelemesi yapıldı. Kardiyoloji uzmanı tarafından ekokardiyograji ile epikardiyal yağ dokusu kalınlığı ölçümü yapıldı. Tüm hastalardan rutin laboratuvar tetkikleri yapıldıktan sonra nötrofil lenfosit oranı ve trombosit lenfosit oranı hesaplandı.

***Bulgular:*** Hem epikardiyal yağ dokusu kalınlığı hem de trombosit lenfosit oranı Parkinson grubunda kontrol grubuna göre anlamlı olarak yüksekti ancak aradaki fark sadece ilki için anlamlıydı. Epikardiyal yağ dokusu kalınlığının Birleşik Parkinson Hastalığı Değerlendirme Ölçeği'nin günlük yaşam aktivitelerini yansıtan ikinci parçası ve motor fonksiyonları yansıtan üçüncü parçası ile Hoehn Yahr Evrelemesi arasında anlamlı ilişki saptandı. Bu ilişki özellikle Hoehn Yahr Evrelemesi'ne göre Evre-1 ile Evre-2 arasında belirgindi. Ayrıca hastalık süresi ile trombosit lenfosit oranı arasında anlamlı ilişki vardı.

***Sonuç:*** Elde ettiğimiz sonuçlar Parkinson Hastalığı patogenezinde inflamasyonun rol aldığı hipotezini desteklemektedir.

***Anahtar sözcükler:*** Parkinson hastalığı; İnflamasyon; Ekokardiyografi

## INTRODUCTION

Parkinson's disease is a chronic, progressive neurodegenerative disease involving the loss of dopaminergic neurons in the substantia nigra pars compacta of the brain and the formation of inclusion bodies, called alpha-synucleins, in the remaining cells. The reported prevalence of this disease is around 1% among individuals aged above 55 years (1), and although its etiology remains unclear, a combination of environmental and genetic factors is thought to play a role in its pathogenesis. Oxidative stress, mitochondrial dysfunction, and neuroinflammatory mechanisms (2), along with microglia- and reactive astrocyte-mediated inflammation, play a critical role in the pathogenesis of Parkinson's disease (3).

Neutrophil, lymphocyte, and thrombocyte counts can be easily detected via complete blood count analysis. Rapidly accumulated neutrophils in the infected or inflamed area account for a substantial proportion of the circulating immune cells. Both neutrophil-lymphocyte ratio (NLR) and thrombocyte-lymphocyte ratio (TLR) are considered important markers of systemic inflammation (4), and both have been reported to be high in patients with Parkinson's disease (5).

Epicardial adipose tissue (EAT), which is found in the right ventricular free wall, left ventricular apex, and atrium, surrounds the subepicardial branches of the coronary arteries. This structure is in fact a complex endocrine organ thought to play a role in the development of coronary atherosclerosis. Biopsy studies have demonstrated that EAT contains plenty of inflammatory mediators such as interleukin (IL)-1, IL-6, and tumor necrosis factor-alpha (TNF-$\alpha$) (6). Magnetic resonance imaging (MRI) was considered the best method to measure EAT thickness (EATT); however, Lacobellis et al. (7) introduced echocardiographic measurements for the first time. The echocardiographic measurements of EATT have shown a high correlation with the measurements obtained using MRI (8). A relation between EATT and inflammation has been clearly revealed by the recent studies (6,9).

We aimed to determine the relation between Parkinson's disease and inflammatory markers NLR, TLR, and EATT and to investigate the relationship of these markers with disease stage and duration.

## MATERIALS AND METHOD

We included 17 patients diagnosed with idiopathic Parkinson's disease and followed in the Movement Disorders Polyclinic from January 2016 through August 2016 and 21 healthy individuals as a control group. The diagnosis of Parkinson's disease was based upon the UK Parkinson's Disease Society Brain Bank clinical diagnostic criteria (10). Imaging procedures were performed in all the patients, and the potential causes for secondary Parkinsonism were excluded. Detailed physical and neurological examinations were performed in all the patients and controls, and their medical histories and demographic characteristics were recorded. Individuals with autoimmune, neoplastic, or inflammatory diseases that are likely to influence inflammatory marker levels; those with uncontrolled diabetes mellitus or hypertension; those with impaired thyroid function tests; those with hepatic or renal insufficiency; those who had experienced myocardial infarction or undergone surgical procedures in the last 3 months; those with coronary artery disease or atrial fibrillation; those with significant infection at presentation or until 7 days earlier; those with signs of infection documented by physical examination and laboratory analyses; and those having an axillary temperature >37.5°C were excluded from the study. Individuals in the control group had no documented Parkinson's disease or any other neurodegenerative disorder. This study was conducted in accordance with the World Medical Association Declaration of Helsinki, and written informed consent was obtained from each participant.

Echocardiography measurements were performed by a cardiologist in all the participants

on the free wall of the right ventricle during the simultaneous contraction of both ventricles. EATT was determined by calculating the arithmetical mean of the three maximum measurements of the short- and long-axis thicknesses from a section close to one-third of the basal part of the ventricle. Participants for whom unclear images were obtained were excluded. Furthermore, routine laboratory analyses were performed in all the participants and NLR and TLR were calculated.

Disease staging was based on the Hoehn and Yahr staging (HYS) scale, and clinical severity was graded using the Unified Parkinson's Disease Rating Scale (UPDRS). UPDRS was developed in 1987 by Fahn, Elton, and the members of UPDRS Development Committee; it comprises four sections and evaluates mental status, activities of daily living, motor functions, and treatment complications (11). The scale includes a total of 42 items, each rated between 0 and 4. The 1st section of the scale (UPDRS-1) comprises items related to mentation, behavior, and mood; the 2nd section (UPDRS-2) comprises activities of daily living; the 3rd section (UPDRS-3) comprises motor examination; and the 4th section (UPDRS-4) comprises treatment complications. High scores indicate a poor status [11]. The HYS scale is a system developed in 1967 by Hoehn and Yahr that allows both the patients and clinicians to easily define disease severity and assess disease progression (12). This study was approved by Bursa Regional Ethics Committee.

### Statistical analysis

Data analyses were performed using IBM SPSS Statistics 21 program (IBM Corp., Armonk, NY, USA). Normal distribution of the variables was analyzed using Shapiro–Wilk test. Comparisons between two independent groups were performed using independent sample t-test for normally distributed variables and Mann–Whitney U test for non-normally distributed variables. Multiple-group comparisons (three or more groups) were performed using one-way analysis of variance for normally distributed variables and Kruskal–Wallis test for non-normally distributed variables. Normally distributed variables were expressed as mean±standard deviation and non-normally distributed variables as median and range (minimum and maximum). Pearson's chi-square test was used to compare categorical variables, which were expressed as numbers and percentages. Relationships between variables were analyzed using Spearman's correlation coefficient. The significance level was determined as $p<0.05$.

## RESULTS

The study participants included 17 patients with Parkinson's disease (10 females and 7 males; mean age: 65.06±6.38 years) and 21 healthy subjects (control group; 14 females and 7 males; age: 62.29±5.77 years). There was no difference between the groups in terms of age, gender, and body mass index (BMI). Furthermore, no significant difference was found between the groups regarding serum glucose levels or systolic and diastolic blood pressures. The mean EATT was significantly higher in the patient group than in the control group (0.39±0.10 vs. 0.29±0.10 cm; $p=0.004$); the median TLR was also higher in the patient group than in the control group (113.79 vs. 107.07; however, the difference was not significant ($p=0.772$). The median NLR was similar in both the groups. Between-group comparisons are summarized in Table 1.

Within the patient group, correlation analysis between the UPDRS scores and inflammatory markers revealed EATT to be significantly correlated with the total UPDRS score ($r=0.581$, $p=0.014$) and with the UPDRS-2 and -3 scores ($r=0.657$, $p=0.004$ and $r=0.586$, $p=0.013$, respectively). The relationship between the UPDRS scores and the inflammatory markers in the patient group is summarized in Table 2.

The correlation analysis between disease duration and inflammatory markers in the patient group (Table 3) revealed a significant correlation only between disease duration and TLR ($r=0.780$, $p<0.001$).

**Table 1.** Group comparisions on evaluated parameters.

| Parameter | Patient Group | Control Group | p |
|---|---|---|---|
| | (n=17) | (n=21) | |
| **Age, years** | 65.06±6.38 | 62.29±5.77 | 0.169 |
| **Gender** | | | |
| **Female** | 10 (58.8) | 14 (66.7) | |
| | | | 0.618 |
| **Male** | 7 (41.2) | 7 (33.3) | |
| **BMI, kg/m2** | 31.09±5.91 | 29.52±3.64 | 0.324 |
| **SBP, mmHg** | 130.00±16.95 | 128.10±17.21 | 0.735 |
| **DBP, mmHg** | 70 (60–90) | 70 (60–90) | 0.862 |
| **EATT, cm 0.39±0.10 0.29±0.10 0.008** | | | |
| **Smoking** | | | |
| **Yes** | 16 (94.1) | 17 (81) | |
| | | | 0.355 |
| **No** | 1 (5.9) | 4 (19) | |
| **WBC** | 7.44±1.48 | 6.64±3.09 | 0.368 |
| **TLR** | 113.79 (61.29–227.50) | 107.07 (49.86–404.28) | 0.772 |
| **NLR** | 2.03 (1.23-4.00) | 2.04 (0.95-7.14) | 0.750 |
| **Glucose** | 103 (86-329) | 101 (71-145) | 0.416 |
| **Hemoglobin** | 13.66±1.39 | 14.11±1.69 | 0.383 |

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; EATT, epicardial adipose tissue thickness; WBC, white blood cell; TLR, thrombocyte-lymphocyte ratio; NLR, neutrophil-lymphocyte ratio Data are presented as mean±standard deviation, median (minimum–maximum), or number (percentage), as appropriate.

**Table 2.** Results of the correlation analysis between the Unified Parkinson's Disease Rating Scale (UPDRS) scores and inflammatory markers in the patient group.

| | NLR | | TLR | | EATT | |
|---|---|---|---|---|---|---|
| | r | p | r | p | r | p |
| **UPDRS-1** | - | 0.847 | - | 0.212 | - | 0.185 |
| **UPDRS-2** | - | 0.275 | - | 0.490 | 0.657 | 0.004 |
| **UPDRS-3** | - | 0.365 | - | 0.911 | 0.586 | 0.013 |
| **UPDRS-4** | - | 0.162 | - | 0.414 | - | 0.597 |
| **UPDRS-Total** | - | 0.200 | - | 0.522 | 0.581 | 0.014 |

NLR neutrophil-lymphocyte ratio; TLR, thrombocyte-lymphocyte ratio; EATT, epicardial adipose tissue thickness.

**Table 3.** Results of the correlation analysis between disease duration and inflammatory markers in the patient group.

| | | NLR | TLR | EATT |
|---|---|---|---|---|
| **Disease Duration** | r | - | 0.780 | - |
| | p | 0.090 | <0.001 | 0.698 |

NLR, neutrophil-lymphocyte ratio; TLR, thrombocyte-lymphocyte ratio; EATT, epicardial adipose tissue thickness

## DISCUSSION

Although Parkinson's disease is the second leading neurodegenerative disease worldwide, its etiology remains unclear. According to the neuroinflammation theory, which has been recently dwelled on, microglia are activated and transformed into an M1 phenotype by aging, protein aggregates, genetic mutations, environmental factors, and cytokines released from T cells. Nitric oxide and superoxide radicals, which are released from the astrocytes activated by pro-inflammatory mediators secreted from M1 microglia, cause degeneration of dopaminergic neurons, releasing products that trigger an inflammatory response through activation of glial cells. In some stages of Parkinson's disease, microglia can transform into an activated M2 phenotype, which plays a neuroprotective role in Parkinson's disease by releasing anti-inflammatory factors such as tumor growth factor-beta. The microglia- and reactive astrocyte-mediated inflammation plays a critical role in the pathogenesis of Parkinson's disease (3).

Epicardial adipose tissue exerts a cardioprotective effect under physiological conditions; however, under pathological conditions, it causes the release of pro-inflammatory cytokines, thus, affecting the heart and coronary arteries. The mechanism underlying the impairment of this balance remains unclear (13). A previous study comparing the expression of inflammatory mediators in the epicardial and subcutaneous adipose tissues revealed that among the inflammatory cytokines, IL-1β, IL-6, and TNF-α levels were higher in EAT (6).

The levels of nuclear factor-ĸB (NF-ĸB) and c-jun N terminal kinase (JNK), which play a key role in inflammation, have been found to be significantly higher in EAT samples. Furthermore, Toll-like receptor (TLR) 2 and TLR4 expression, which is considered as a strong evidence of the presence of activated macrophages, has also been found to be higher in EAT samples. All these data reveal that macrophages, JNK, and NF-ĸB play an important role in the inflammation in EAT (14).

Epicardial adipose tissue is thought to be affected by many factors, and EATT has been found to be correlated with age, BMI, blood pressure alterations, and NLR (15). Varying results have been reported regarding the correlation of EATT with age. Although most autopsy studies have found no correlation between EATT and age, some of them have demonstrated a lower EATT in young individuals (16). Moreover, no significant relationship has been reported between age and EATT measured using echocardiography (17). In this study, no significant difference was found between the patient and control groups in terms of age, BMI, and blood glucose and blood pressure levels. EATT, which is an accepted inflammatory marker, was significantly higher in the patient group than in the control group.

Research into inflammatory markers is usually based on quantification of NLR and TLR as these are easily measurable and computable. NLR is also considered as an important marker of systemic inflammation (4,18-20), whereas TLR has been demonstrated as a potential inflammatory marker in cardiac, oncologic, and rheumatologic diseases (4,21-23). NLR and TLR, which have been studied in

several inflammatory diseases, have been found to be high in patients with Parkinson's disease (5). In this study, although not significant, TLR was found to be higher in the patient group than in the control group; however, NLR was found to be similar in both the groups.

An NLR of ≥2.25 has been accepted as predictive of the presence of Parkinson's disease. Carcinoembryonic antigen, which is used to demonstrate gastrointestinal system inflammation, has not been determined to be related with disease duration, age, and HYS in patients with Parkinson's disease (5). In this study, NLR was determined to be 2.18 in the patients with Parkinson's disease. Significant correlations were found between TLR and disease duration ad well as between EATT and HYS.

The neuroinflammatory theory is supported by various studies evaluating high-sensitive C-reactive protein (CRP) levels (5, 24-25). Because CRP has been frequently studied in the earlier studies, we focused on a different inflammatory marker, i.e., EATT aiming to present a new point of view to this issue and contribute to the existing literature.

It has been demonstrated that CRP levels can rise even before the appearance of Parkinson's disease symptoms (24). Song et al. (25) failed to demonstrate a significant correlation between HYS and CRP levels; however, in this study, we demonstrated that EATT differs significantly among the patients grouped according to disease stages (stages 1–4) based on HYS. Pairwise comparisons revealed a significant difference between stage 1 and stage 2 patients, which was attributed to the fact that a substantial proportion of the patients were in the stage 1 and stage 2 groups. This result supports the hypothesis that more severe the inflammation, the more severe the disease.

In this study, EATT was found to be significantly correlated with UPDRS-2 score (which evaluates activities of daily living), UPDRS-3 score (which evaluates motor function), and total UPDRS score, indicating that increased EATT affected not only the motor prognosis but also the activities of daily living.

Our study results support the hypothesis that inflammation plays a role in the pathogenesis of Parkinson's disease. To the best of our knowledge, this is the first study investigating EATT, NLR, and TLR in patients with Parkinson's disease. Further studies with higher number of patients are required to support these results. Elucidation of the pathogenesis of Parkinson's disease, which affects millions of people worldwide, would help develop new treatment strategies in the future.

**Conflict of interest**

The authors declare that they have no conflict of interest.

**REFERENCES**

1. Emre M, Hanağası HA, Şahin HA, Yazıcı J. Movement Disorders. In: Öge AE, Bahar SZ (Eds). Neurology. 1st edition, Nobel press, İstanbul 2004, pp 417-47.
2. Hwang O. Role of oxidative stress in Parkinson's disease. Exp Neurobiol 2013;22(1):11-7. (PMID:23585717).
3. Wang Q, Liu Y, Zhou J. Neuroinflammation in Parkinson's disease and its potential as therapeutic target. Transl Neurodegener 2015;4:19. (PMID:26464797).
4. Boyraz I, Koç B, Boyacı A, Tutoğlu A, Sarman H, Ozkan H. Ratio of neutrophil/lymphocyte and platelet/lymphocyte in patient with ankylosing spondylitis that are treating with anti-TNF. Int J Clin Exp Med 2014;7(9):2912-5. (PMID:25356158).
5. Akıl E et al. The increase of carcinoembryonic antigen (CEA), high-sensitivity C-reactive protein, and neutrophil/lymphocyte ratio in Parkinson's disease. Neurol Sci 2015;36(3):423-8. (PMID:25288159).
6. Mazurek T, Zhang L, Zalewski A, et al. Human epicardial adipose tissue is a source of inflammatory mediators. Circulation 2003;108(20):2460-6. (PMID:14581396).


7. Lacobellis G, Assael F, Ribaudo MC, et al. Epicardial fat from echocardiography: a new method for visceral adipose tissue prediction. Obes Res 2003;11(2):304-10. (PMID:12582228).

8. Lacobellis G, Ribudo MC, Assael F, et al. Echocardiographic epicardial adipose tissue is related to anthropometric and clinical parameters of metabolic syndrome: a new indicator of cardiovasculer risk. J Clin Endocrinol Metab 2003;88(11):5163-8. (PMID:14602744).

9. Malavazos AE, Ermetici F, Cereda E, et al. Epicardial fat thickness: relationship with plasma visfatin and plasminogen activator inhibitör-1 levels in visceral obesity. Nutr Metab Cardiovasc Dis 2008;18(8):523-30. (PMID:18083357).

10. Hughes AJ, Daniel SE, Kilford L, Lees AJ. Accuracy of clinical diagnosis of idiopathic Parkinson's disease. A clinicopathological study of 100 cases. J Neurol Neurosurg Psychiatry 1992;55(3):181-4. (PMID:1564476).

11. Fahn S, Elton RL, members of the UPDRS Development Committee. Unified Parkinson's Disease Rating Scale. In: Fahn S, Marsden CD, Goldstein M, Calne CD (Eds). Recent Developments in Parkinson's Disease. Macmillan, Florham Park, New Jersey 1987, pp 153-63.

12. Hoehn MM, Yahr MD. Parkinsonism: onset, progression, and mortality. Neurology 1967;17(5):427-42. (PMID:6067254).

13. Iacobellis G, Bianco AC. Epicardial adipose tissue: emerging physiological, pathophysiological and clinical features. Trends Endocrinol Metab 2011;22(11):450-7. (PMID:21852149).

14. Baker AR, Harte AL, Howell N, et al. Epicardial adipose tissue as a source of nuclear factor-kappaB and c-Jun N-terminal kinase mediated inflammation in patients with coronary artery disease. J Clin Endocrinol Metab 2009;94(1):261-7. (PMID:18984670).

15. Cho KI, Heo JH, Kim HS, Im SI, Cha TJ. OS 14-09 epicardial fat thickness and neutrophil to lymphocyte ratio are increased in the non-dipper pattern. J Hypertens 2016;34 Suppl 1:e214. (PMID:27642972).

16. Tansey DK, Aly Z, Sheppard MN. Fat in the right ventricle of the normal heart. Histopathology 2005;46(1):98-104. (PMID:15656892).

17. Iacobellis G, Willens H. Echocardiographic epicardial fat: a review of research and clinical applications. J Am Soc Echocardiogr 2009;22(12):1311-9. (PMID:19944955).

18. Gökhan S, Ozhasenekler A, Mansur Durgun H, Akil E, Ustündag M, Orak M. Neutrophil lymphocyte ratios in stroke subtypes and transient ischemic attack. Eur Rev Med Pharmacol Sci 2013;17(5):653-7. (PMID:23543449).

19. Zahorec R. Ratio of neutrophil to lymphocyte counts--rapid and simple parameter of systemic inflammation and stress in critically ill. Bratisl Lek Listy 2001;102(1):5-14. (PMID:11723675).

20. Uslu AU, Deveci K, Korkmaz S, et al. Is neutrophil/lymphocyte ratio associated with subclinical inflammation and amyloidosis in patients with familial Mediterranean fever? Biomed Res Int 2013;2013:185317. (PMID:23865042).

21. Wang J, Wang S, Song X, et al. The prognostic value of systemic and local inflammation in patients with laryngeal squamous cell carcinoma. Onco Targets Ther 2016;9:7177-85. (PMID:27920556).

22. Huang GY, Yang LJ, Wang XH, Wang YL, Xue YZ, Yang WB. Relationship between platelet-leukocyte aggregation and myocardial perfusion in patients with ST-segment elevation myocardial infarction after primary percutaneous coronary intervention. Heart Lung 2016;45(5):429-33. (PMID:27425196).

23. Balta S, Ozturk C. The platelet-lymphocyte ratio: A simple, inexpensive and rapid prognostic marker for cardiovascular events. Platelets 2015;26(7):680-1. (PMID:25549287).

24. Song IU, Chung SW, Kim JS, Lee KS. Association between high-sensitivity C-reactive protein and risk of early idiopathic Parkinson's disease. Neurol Sci 2011;32(1):31-4. (PMID:20532580).

25. Song IU, Kim JS, Chung SW, Lee KS. Is there an association between the level of high-sensitivity C-reactive protein and idiopathic Parkinson's disease? A comparison of Parkinson's disease patients, disease controls and healthy individuals. Eur Neurol 2009;62(2):99-104. (PMID:19521085).

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RESEARCH

# INFLUENZA VACCINATION FREQUENCY AND ASSOCIATED FACTORS AMONG ELDERLY POPULATION, A DESCRIPTIVE STUDY

## Abstract

***Introduction:*** Influenza vaccination is the most effective method of preventing influenza infection in elderly, reducing complications, hospitalizations and mortality rates due to influenza. This study aimed to assess the frequency of influenza vaccination, attitude about the vaccine, and reasons why not getting vaccinated in individuals aged >65 years.

***Materials and Method:*** In total, 598 participants aged >65 years were enrolled in this descriptive study, and data were collected via a face-to-face survey.

***Results:*** In total, 22% of the 598 participants received the influenza vaccine. The top three reasons for not seeking vaccination were not knowing about the influenza vaccine (45.2%), feeling of no need to get vaccinated (21.2%), and not believing in the influenza vaccine's effectiveness (10.9%). Participants who had chronic obstructive pulmonary disorder, heart failure, and ischemic heart disease were vaccinated more than participants who had other comorbidities. Among participants, advice from their physician was noted as an effective means for prompting vaccination (OR, 20.34; 95% CI, 10.17–40.70).

***Conclusion:*** We evaluated the reasons associated with the low influenza vaccination frequency among the elderly. Informing the elderly of the benefits of receiving the influenza vaccine should be encouraged. Communication between healthcare providers and people aged >65 years is essential for improving vaccination frequency.

***Keywords:*** Aged; Comorbidity; Hospitalization; Influenza vaccines; Surveys and questionnaires; Vaccine refusal

ARAŞTIRMA

# YAŞLILARDA GRİP AŞISI SIKLIĞI VE İLİŞKİLİ FAKTÖRLER, TANIMLAYICI BİR ÇALIŞMA

## Öz

***Giriş:*** Yaşlı bireylerde influenza aşısı, influenza hastalığının önlenmesinde en etkili yöntem olup influenzanın komplikasyonlarını, hastane yatışlarını ve ölüm oranlarını azaltmaktadır. Bu çalışmada 65 yaş üzeri bireylerde, influenza aşısı yaptırma sıklığı, bireylerin aşı hakkındaki tutumları ve aşılanmama nedenleri değerlendirilmiştir.

***Gereç ve Yöntem:*** Bu tanımlayıcı çalışmaya 65 ve yaş üzeri toplamda 598 kişi katılmıştır ve veriler yüz yüze anket yoluyla toplanmıştır.

***Bulgular:*** Toplamda 598 katılımcıdan %22'si influenza aşısı olmuştur. Aşı yaptırmamak için ilk üç neden, grip aşısı hakkında bilgi sahibi olmama (%45.2), aşılanmaya ihtiyaç duymama (%21.2) ve grip aşısının etkinliğine inanmama (%10.9) idi. Kronik obstrüktif akciğer hastalığı, kalp yetmezliği ve iskemik kalp hastalığı olan katılımcılar, diğer komorbiditelere sahip olanlardan daha fazla aşılanmış idi. Katılımcılar arasında doktorlarından aldıkları tavsiye, aşılamanın yapılmasında etkili bir araç olarak görülmüştür (OR, 20.34; %95 GA, 10.17–40.70).

***Sonuç:*** Bu bulgular ile yaşlılarda düşük influenza aşılama oranları ile ilişkili nedenler değerlendirilmiştir. İnfluenza aşısının yapılmasının yararları hakkında bilgilendirilmeler teşvik edilmelidir. Sağlık hizmeti sağlayıcıları ile 65 yaş üstü kişiler arasındaki iletişim, aşı oranlarının iyileştirilmesi için şarttır.

***Anahtar sözcükler:*** Anket; Aşı reddi; Grip aşısı; Hastane yatışları; Komorbidite; Yaşlı

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## INTRODUCTION

Influenza is a seasonal viral infection that typically occurs during the winter months and is capable of spreading easily. The influenza viruses can cause pandemics and severe illnesses, leading to hospitalizations, and even death in children and the elderly. A report from the Centers for Disease Control and Prevention in 2015 indicated that 3%–5% of residents of the USA were affected by influenza. Hospitalizations were reported in over 200,000 patients because of influenza-associated complications. These annual epidemics are estimated to result in about 3–5 million cases of severe illness worldwide, and approximately 250,000–500,000 deaths, with most deaths in industrialized countries occurring among people aged ≥65 years (1). Influenza infections usually cause milder symptoms lasting for 5–7 days in healthy adults, whereas it can cause severe pulmonary symptoms such as primary influenza, pneumonia, and secondary bacterial infections that contribute to morbidity and mortality, especially among individuals aged ≥65 years (2).

A simple and effective way to prevent influenza infections is annual vaccination. The United States Advisory Committee on Immunization Practices recommends universal annual influenza vaccinations for all individuals aged ≥6 months (3). The influenza vaccination not only reduces the risk of influenza infection but also reduces the severity of the illness in those who are infected (4,5). The Turkish Ministry of Health recommends and supplies free influenza vaccines to a wide range of individuals, including pregnant women; individuals aged ≥65 years; children aged 6 months to 2 years; residents of nursing homes and other chronic-care facilities; individuals who suffer from chronic pulmonary (including asthma), cardiovascular, renal, hepatic, neurologic, hematologic, or metabolic disorders [including diabetes mellitus (DM)]; individuals with obesity; health care personnel; and individuals aged 6 months to 18 years and receiving long-term aspirin therapy. Annual immunization is necessary even if the previous year's vaccine contains one or more of the antigens to be administered because the immunity declines during the year following vaccination (4,6).

This investigation assesses the influenza vaccination frequency and the associated factors that influence the vaccination of those aged ≥65 years attending outpatient clinics in Yedikule Research and Training Hospital for Chest Diseases and Chest Surgery.

## MATERIALS AND METHOD

### Participants

This descriptive study was conducted between October 2015 and June 2016 in a tertiary hospital, Yedikule Research and Training Hospital for Chest Diseases and Chest Surgery, Istanbul, Turkey. Participants were randomly selected from patients who were aged ≥65 years and who had an appointment at the hospital's outpatient clinic. Initially, selected patients were given a mini-mental test (7). The most commonly used test for dementia scanning is the mini mental test. It is evaluated over 30 points and it is determined that the ideal threshold value is 24 in the Turkish society for mild dementia.

The participants of the test were asked whether they had any allergic reactions to the influenza vaccine and were excluded from the investigation if they had experienced any allergic reaction.

### Sample size

The prevalence of influenza vaccination was assumed to be 20%, and the sample size was calculated with a significance level of 0.05 and a power level of 0.80. Dementia patients and non-responders were assumed to represent 5% of the population. A minimum sample size of 660 participants was required.

### Data collection

Data was collected via a face-to-face survey that was developed through a comprehensive literature search and was finalized after the pilot study with 15 participants. Sociodemographic features, comorbidities, vaccination status, knowledge about the influenza vaccine, and reasons for not being vaccinated were assessed in the questionnaire.

The research was approved by Yedikule Research and Training Hospital for Chest Diseases and Chest Surgery Ethics Committee (2015/04). Oral informed consent was obtained from every participant before starting the questionnaire.

### Statistical analysis

Continuous variables are expressed as mean±standard deviation (SD). Statistics were calculated using the Student's *t*-test. Descriptive statistics were created for questions with responses expressing frequencies and percentages. The chi-square and Fisher's exact tests were used as appropriate. Univariate and multivariable logistic regression analyses were conducted to evaluate associations between vaccination and demographic features and patients' knowledge. Odds ratios (OR) and 95% confidence intervals (CI) were calculated. A p-value <0.05 was considered statistically significant.

## RESULTS

Thirty-two out of 660 participants with a mini-mental score <24 (4.6%) and 9 (4.5%) non-responders were excluded from the study. In total, 598 participants completed the questionnaire. All participants were aged 65–93 years (median, 71 years; interquartile range, 9 years). The majority of participants were males (M: F=1.56). Among participants, 74.75% were graduated from at least elementary school, 11.2% were active smokers, 46.5% had quit smoking, and 42.3% never smoked. Chronic obstructive pulmonary disorder (COPD) was found in 39.0%, asthma in 14.9%, diabetes mellitus (DM) in 13%, heart failure (HF) in 23.9%, hypertension (HT) in 9.5%, ischemic heart disease (IHD) in 3.5%, and miscellaneous comorbidities in 11.6% of the population. 11.2 % of the participants were healthy. Table 1 shows the characteristics of participants according to vaccination status. In total, 131 out of 598 participants received the influenza vaccine (22.0%; 95% CI, 21.87–21.93). The three most common reasons for not getting vaccinated (Figure 1) were as follows: (1) didn't know much about influenza vaccine (45.2%), (2) didn't need to get vaccinated (21.2%), and (3) didn't believe the influenza vaccine was effective (10.9%). Other reasons included forgetting about the vaccination period, prior adverse reactions (other than allergic reactions), pain, being ill at the time, costs, and other miscellaneous reasons.

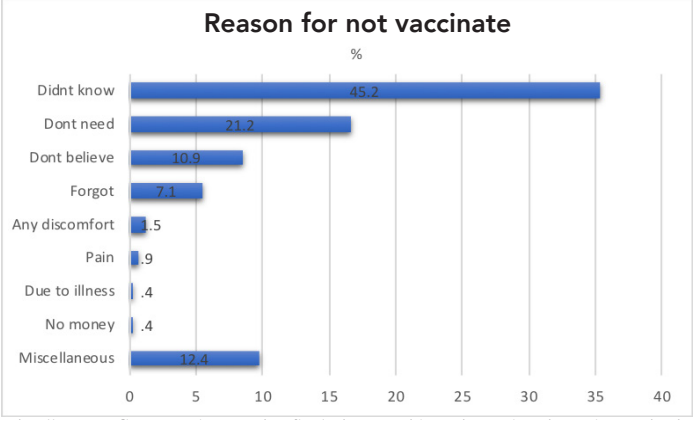
Among vaccinated participants, there was a greater percentage of educated (graduated from at least elementary school) individuals compared to uneducated (illiterate) individuals (15.9% vs 23.9%, p=0.039). Among comorbidities, participants with COPD (28.3%, p=0.02), HF (15.4%, p=0.031), and IHD (33.3%, p=0.001) had significantly higher vaccination frequency.

The majority of the respondents (67.4%) were aware of the influenza vaccine. However, vaccination frequency was only 32.5% among these individuals. Knowledge and perception of the influenza vaccine of the participants are shown in Table 2. Participants who had heard of the vaccine from doctors were more vaccinated than other participants (OR, 20.34; 95% CI, 10.17–40.70; p=0.001). Recommended by any healthcare worker was the most influential factor to get vaccinated with an OR, 73.26 (95% CI, 34.46–155.76; p=0.001). Participants were more likely to get vaccinated when they were recommended by a chest physician (OR, 4.82; 95% CI, 2.02–11.46; p=0.016). Knowing that the influenza vaccine is free of charge for individuals aged 65 years was a promoter of vaccine (OR, 36.35; 95% CI, 16.257–79.74; p=0.001).

**Table 1.** Characteristics of participants according to vaccination status.

| | Not vaccinated n (%) | Vaccinated n (%) | p | OR (95% CI) |
|---|---|---|---|---|
| | 467 (78.0) | 131 (22.0) | | |
| **Age (median, IQR)** | 71 (9) | 70 (9) | 0.515 | |
| **Gender** | | | | |
| **Male** | 267 (77.0) | 80 (23.0) | 0.485 | |
| **Female** | 200 (79.7) | 51 (20.3) | | |
| **Education** | | | | |
| **Non-Educated** | 127 (84.1) | 24 (15.9) | | Ref |
| **Educated** | 340 (76.1) | 107 (23.9) | **0.039** | **1.66 (1.02–2.71)** |
| **Smoking habit** | | | | |
| **Nonsmoker** | 206 (81.4) | 47 (18.6) | 0.092 | Ref |
| **Smoker** | 54 (80.6) | 13 (19.4) | 0.599 | 1.05 (0.53–2.09) |
| **Exsmoker** | 207 (74.5) | 71 (25.5) | **0.045** | **1.50 (0.99–2.28)** |
| **Comorbidities** | | | | |
| **COPD doesn't exist** | 300 (82.2) | 65 (17.8) | | Ref |
| **COPD exists** | 167 (71.7) | 66 (28.3) | **0.02** | **2.03 (1.25–3.26)** |
| **Asthma doesn't exist** | 399 (78.4) | 110 (21.6) | | Ref |
| **Asthma exists** | 68 (76.4) | 21 (23.6) | 0.676 | 1.61 (0.86–3.00) |
| **DM doesn't exist** | 408 (78.5) | 112 (21.5) | | Ref |
| **DM exists** | 59 (75.6) | 19 (24.4) | 0.574 | 1.50 (0.81–2.78) |
| **HF doesn't exist** | 346 (76.0) | 109 (24.0) | | Ref |
| **HF exists** | 121 (84.6) | 22 (15.4) | **0.031** | **0.73 (0.41–1.28)** |
| **HT doesn't exist** | 422 (78.0) | 119 (22.0) | | Ref |
| **HT exists** | 45 (78.9) | 12 (21.1) | 0.870 | 0.78 (0.36–1.65) |
| **IHD doesn't exist** | 453 (78.5) | 124 (21.5) | | Ref |
| **IHD exists** | 14 (66.7) | 7 (33.3) | **0.001** | **2.28 (0.82–6.31)** |

Bold characters indicate statistical significance p<0.05; IQR: interquartile range, COPD: Chronic obstructive pulmonary, DM: Diabetes mellitus, HF: Heart Failure, HT: Hypertension, IHD: İschemic Heart Disease.




Miscellaneous: Concerns about getting flu, laziness, residence in another city at the vaccine interval

**Figure 1.** Reasons for receiving the influenza vaccine.

**Table 2.** Participants' knowledge and perception of influenza vaccine.

| | Not vaccinated n (%) | Vaccinated n (%) | Univariate analysis p | Multivariate analysis OR, 95% CI |
|---|---|---|---|---|
| Heard of influenza vaccine before? | | | | |
| No | 195 (100) | 0 (0) | **0.001** | |
| Yes | 272 (67.5) | 131 (32.5) | | |
| If yes from whom? | | | | |
| Media | 109 (88.6) | 14 (11.4) | **<0.001** | Ref |
| Pharmacist | 49 (68.1) | 23 (31.9) | **0.001** | 3.65 (1.73–7.70) |
| Doctors | 31 (27.7) | 81 (72.3) | **<0.001** | 20.34 (10.17–40.70) |
| Miscellaneous† | 83 (86.5) | 13 (13.5) | 0.630 | 1.21 (0.54–2.73) |
| Ever been recommended | | | | |
| No | 386 (98.0) | 8 (2.0) | | Ref |
| Yes | 81 (39.7) | 123 (60.3) | **<0.001** | 73.26 (34.46–155.76) |
| If yes from whom? | | | | |
| Pharmacist | 24 (65.0) | 13 (35.0) | **0.005** | Ref |
| Family doctor | 31 (37.3) | 52 (62.7) | 0.006 | 3.10 (1.38–6.94) |
| Chest Phys. | 18 (27.7) | 47 (72.3) | **0.001** | 4.82 (2.02–11.46) |
| Miscellaneous‡ | 8 (42.0) | 11 (58.0) | 0.107 | 2.53 (0.81–7.88) |
| Did you know the vaccine is free >65 | | | | |
| No | 264 (97.4) | 7 (2.6) | | Ref |
| Yes | 153 (55.2) | 124 (44.8) | **0.001** | 36.35 (16.57–79.74) |

Bold indicates statistical significance $p<0.05$. $\chi^2$ test was used for univariate analyses, logistic regression was used for multivariate analysis. Ref for reference. †miscellaneous: friends, relatives, neighbors, colleagues, other patients, ‡ miscellaneous: Physicians other than pulmonary medicine, nurses.

## DISCUSSION

This investigation was the first to present the frequency of vaccination, knowledge, and behaviors of the influenza vaccination of Turkish residents aged ≥65 years. The findings suggest that the frequency of influenza vaccination, knowledge, and recommendation is quite low among participants. Former studies in Turkey showed similar results. In particular, Ciblak et al. in 2012 searched two national medical databases and PubMed using terms associated with relevant diseases and vaccination frequency and reported a vaccination coverage frequency for individuals aged ≥65 at 5.9% and for patients with COPD at 14.9% (8). Another recent study from Turkey by Akturk et al. included COPD patients from six different centers, which included a total of 296 patients and concluded that the frequency of influenza vaccination is 36.5% (9). Ciftci et al reported 33.4 % vaccination frequency among patients admitted to outpatient clinic with a mean age of 47.7 years (10). Present study showed that the vaccination frequency is 22.0% (95% CI, 21.87–21.93) for people who aged ≥65 years and 28.3% vaccination frequency (95% CI, 0.226–0.346)

in COPD patients. However, the results reported herein are still lower than those reported in European countries and other countries of the world. Sevin et al. conducted a survey-based study in an urban environment using a multicultural population in Central Ohio, USA, reported a 51.5% immunization frequency (11). Likewise, a different study from Kansas, USA, Santaularia et al, showed a 64.8% vaccination frequency within people aged ≥65 years (12). According to an Australian study conducted by Dyda et al., 57.3% of individuals aged ≥65 years were vaccinated in the previous year (13), whereas Bödeker et al. reported 49% in those older than 60 years in Germany (14). According to GP reports, Mangtani demonstrated that 85% of men and 75% of women aged ≥74 years were vaccinated against influenza in London (15).

Present study showed no differences in vaccination prevalence between age and gender. However, in our study educated participants were more often vaccinated than noneducated ones (OR, 1.665; 95% CI, 1.023–2.711; p=0.039). Responders who had quit smoking tended to get the flu vaccine more than active smokers and nonsmokers (OR, 1.50; 95% CI, 0.992–2.279; p=0.045). Akturk et al reported that gender, marital status, and smoking habits had no effect on the pneumococcal or influenza vaccination frequency (9). In Ciftci's study Among the vaccinated patients, the ratio of patients with an educational level of high-school or above (60.6%) was greater than that of patients with a lower educational level (39.4%) (10).

In the present study participants who had COPD, HF, and IHD ( 1) were vaccinated more often than participants who had other comorbidities (OR, 2.03; OR, 0.73; OR, 2.28; respectively). Bödeker et al. mentioned if an underlying chronic disease exists and not specified, stated that 56.3% of participants aged 60 years and older who had an underlying chronic disease got vaccinated (OR, 2.07) (14). In addition, Ciftci et al showed that vaccination frequency were greater among those with chronic lung disease (43.6%), heart disease (21.2%), and diabetes mellitus (19.3%) (10).

Results from the present study highlight popular reasons why individuals do not get vaccinated. The majority of the patients (45.2%) did not have information about the influenza vaccine. The second main reason was the belief that they did not need the vaccine (21.2%). Participants made comments such as "I don't get flu, so I don't need the vaccine." 10.9% of participants mentioned that they did not believe the vaccine was effective, so they did not get vaccinated. Yeung et al. showed that the majority of the cases (80.8%) were not aware that they were recommended the influenza vaccine and among the controls (71%), a high percentage of participants deemed vaccination to be unnecessary. Similar to our study, the authors mentioned that this finding showed a failure in communicating the importance of the vaccination to this age group (16). Sevin et al. reported ethnic disparities in the knowledge of the influenza vaccine indication, including concern for getting sick from the following treatment (11). Another study by Santalauria et al. reported a 64.8% vaccination frequency and stated that adults aged ≥65 years had Medicare coverage and might likely have other medical conditions that could steer them toward receiving the vaccination (12). In Cıblak's study, the most common reported reason for not becoming vaccinated was that the "vaccine is not effective," which was reported in 46% of participants. The second most reported reason was that the "vaccine causes influenza," which was reported by 26% of participants (8). Ciftci et al reported the reasons of not getting vaccinated were considering the vaccine useless (OR, 2.46), having concerns about side-effects

(OR, 2.14) and having inadequate knowledge (OR, 7.12) (10). Akturk et al. had similar results, the most notable reason for not being vaccinated for influenza or pneumococcus was 'my doctor didn't advise me to' (57.2% for influenza and 46.8% for pneumococcus vaccine) (9). Dyda et al. mentioned that in all unvaccinated participants, the most frequent reason for not obtaining the vaccine was a perception of being at low-risk of contracting influenza (26.7%), not having thought about the influenza vaccination (21.5%) and a mistrust of the vaccination (18.3%). Among those opposed to the vaccine, older people rejected vaccination more frequently than younger individuals (<60 years, 7.8%;>60 years, 15.9%) (13).

In present study 67.5% of nonvaccinated and 32.5% of vaccinated participants had heard of the influenza vaccine before. In contrast to the vaccinated group, individuals have heard of the vaccine mostly from doctors, pharmacies, and media. Getting information about the flu vaccine from doctors could improve the likelihood of the individual becoming vaccinated (OR, 20.34, p< 0.001) (Table 2). Among participants recommended to receive the vaccine, 60% are ultimately vaccinated (OR, 73.26, p=0.001). Ciftci's study showed men, as compared to women, had a significantly greater frequency of considering the vaccine useful (p< 0.001), getting vaccinated during campaigns held by workplaces (p=0.002), and obtaining information through bills, brochures, or bulletins (p=0.003) (10).

This study suggests that recommendation by chest physicians was associated with vaccination (OR, 4.82, p=0.016). This finding is similar to those being recommended by the family doctor and was associated with vaccination. Knowing that the vaccine is free of charge in those aged ≥65 years impacts the vaccination frequency (OR, 36.35, p=0.001). Ciftci et al reported similar results among participants who had been informed by doctors had more vaccination frequency (10).

One of the limitations of present study is that it cannot be generalized due to a single centered study; therefore, results should be interpreted in this way. Secondly, the study was conducted using a nonvalidated survey and the participants' knowledge, awareness of influenza disease, and associated complications were not questioned.

In conclusion, despite the intense efforts of the Ministry of Health, including free vaccination, extensive recommendations to those aged >65 years, and improved accessibility throughout the country, the current vaccination frequency was determined low. This study's objective was to investigate vaccination frequency and related factors among those aged ≥65 years. These findings suggest that participants rely on family doctors and specialists that they are familiar with to make a recommendation, which they will value. However, if general practitioners emphasize the value of the influenza vaccine to the patient's life and insist on vaccination, a higher frequency of influenza vaccination could be seen. This study's findings are practical and will likely lead to increased awareness among the society in both patients and doctors. The communication between doctors and individuals must be improved with regard to developing novel and efficient influenza vaccination policies. Participant responses to the questionnaire may suggest that responders use media so that it can be empowered more efficiently.

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## REFERENCES


1. Aktürk ÜA, Dilektaşlı AG, Şengül A, et al. Influenza and pneumonia vaccination rates and factors affecting vaccination among patients with chronic obstructive pulmonary disease. Balkan Med J 2017;34(3):206-211. (PMID:28443565).
2. Bödeker B, Remschmidt C, Schmich P, Wichmann O. Why are older adults and individuals with underlying chronic diseases in Germany not vaccinated against flu? A population-based study. BMC Public Health 2015;15:618-27. (PMID:26148480).
3. Castilla J, Godoy P, Domínguez A, et al; CIBERESP Cases and Controls in Influenza Working Group Spainet al. Influenza vaccine effectiveness in preventing outpatient, inpatient, and severe cases of laboratory-confirmed influenza. Clin Infect Dis 2013;57(2):167-75. (PMID:23532475).
4. Ciblak MA, Flu Platform. Influenza vaccination in Turkey: Prevalence of risk groups, current vaccination status, factors influencing vaccine uptake and steps taken to increase vaccination rate. Vaccine 2013;31(3):518-23. (PMID:23174194).
5. Ciftci F, Sen E, Demir N, Kayacan O. Which factors effects patients belief and attitudes about influenza vaccination? Tuberk Toraks 2017;65(4):308-316. (PMID:29631530).
6. Dyda A, Karki S, Hayen A, et al. Influenza and pneumococcal vaccination in Australian adults: a systematic review of coverage and factors associated with uptake. BMC Infect Dis 2016;16(1):515-29. (PMID:27670446).
7. Ehrlich HJ, Singer J, Berezuk G, et al. A cell culture-derived influenza vaccine provides consistent protection against infection and reduces the duration and severity of disease in infected individuals. Clin Infect Dis 2012;54(7):946-54. (PMID:22267715).
8. Grohskopf LA, Sokolow LZ, Broder KR, et al. Prevention and control of seasonal influenza with vaccines. MMWR Recomm Rep 2016;65(5):1-54. (PMID:27560619).
9. Güngen C, Ertan T, Eker E, Yaşar R, Engin F. Standardized Mini Mental Test validity and reliability as a diagnostic tool of dementia in Turkish population. Turkish Physciatry 2002;13(4):273-81. (PMID:12794644).
10. Kamboj M, Sepkowitz KA. Risk of transmission associated with live attenuated vaccines given to healthy persons caring for or residing with an immunocompromised patient. Infect Control Hosp Epidemiol 2007;28(6):702-07. (PMID:17520544).
11. Mangtani P, Breeze E, Stirling S, Hanciles S, Kovats A, Fletcher A. Cross-sectional survey of older peoples' views related to influenza vaccine uptake. BMC Public Health 2006;6:249-55. (PMID:17034625).
12. Santaularia J, Hou W, Perveen G, Welsh E, Faseru B. Prevalence of influenza vaccination and its association with health conditions and risk factors among Kansas adults in 2013: a cross-sectional study. BMC Public Health 2016;16:185-90. (PMID:26911615).
13. Sevin AM, Romeo C, Gagne B, Brown NV, Rodis JL. Factors influencing adults' immunization practices: a pilot survey study of a diverse, urban community in central Ohio. BMC Public Health 2016;16:424-31. (PMID:27216805).
14. Thompson WW, Weintraub E, Dhankhar P, et al. Estimates of US influenza-associated deaths made using four different methods. Influenza Other Respir Viruses 2009;3(1):37-49. (PMID:19453440).
15. Treanor JJ. Influenza vaccination. N Engl J Med 2016;375(13):1261-8. (PMID:27682035).
16. Yeung MP, Ng SK, Tong ET, Chan SS, Coker R. Factors associated with uptake of influenza vaccine in people aged 50 to 64 years in Hong Kong: a case-control study. BMC Public Health 2015;15:617-23. (PMID:26148496).

RESEARCH

# INFLUENZA, PNEUMOCOCCAL AND HERPES ZOSTER VACCINATION RATES AMONGST PEOPLE AGED 65 YEARS AND OLDER AND RELATED FACTORS


## Abstract

***Introduction:*** We determined influenza, pneumococcal and herpes zoster vaccination rates amongst people aged ≥65 years and evaluated factors affecting the vaccination rates.

***Materials and Method:*** The vaccination rates were investigated using face-to-face interview in 543 patients aged ≥65 years who were admitted to the internal medicine outpatient clinics of Kafkas University School of Medicine and public hospitals in the 30th health service area. Subjects were divided into two groups: vaccinated and unvaccinated. Vaccination status was the dependent variable; knowledge of vaccination and socioeconomic and sociodemographic characteristics were the independent variables.

***Results:*** The number of unvaccinated subjects was 6.6 times higher amongst participants with no knowledge of vaccination than amongst those with knowledge of vaccination (95% confidence interval, 2.9–14.9, p=0.001), 2.6 times higher amongst participants with no primary education than amongst those with primary education (confidence interval, 1.5–4.5, p=0.001), 2.7 times higher in participants with insufficient income than amongst those with sufficient income (confidence interval, 1.2–5.9, p=0.006) and 2.2 times higher amongst participants living in rural areas than amongst those living in urban areas (confidence interval, 1.2–3.7, p=0.006). These were the factors affecting the vaccination status in the elderly.

***Conclusion:*** Additional solutions are required to encourage physicians and other healthcare providers to provide the elderly with information and encourage them to be vaccinated as recommended by the 'Centre for Disease Control and Prevention', increasing the vaccination rates amongst those living in villages and rural areas and with low income.


***Keywords:*** Aged; Influenza vaccines; Pneumococcal vaccines; Herpes Zoster vaccine

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ARAŞTIRMA

# ALTMIŞ BEŞ YAŞ VE ÜZERİ KİŞİLERİN İNFLUENZA, PNÖMOKOK VE HERPES ZOSTER AŞILARINI YAPTIRMA DÜZEYİ VE İLİŞKİLİ FAKTÖRLER


## Öz

***Giriş:*** Bu araştırmada 65 yaş ve üzeri kişilerde influenza, pnömokok ve herpes zoster aşılarını yaptırma düzeyi ile bu düzeyi etkileyen faktörlerin belirlenmesi amaçlanmıştır.

***Gereç ve Yöntem:*** Araştırmanın verileri Kafkas Üniversitesi Tıp Fakültesi ve kamu hastaneleri iç hastalıkları polikliniğine başvuran 65 ve üzeri yaş 543 kişi ile yüz yüze görüşme tekniği ile toplandı. Kişiler aşı yaptıranlar ve yaptırmayanlar olarak iki guruba ayrıldı. Aşılanma durumu araştırmanın bağımlı değişkeni iken, aşı bilgisi, sosyoekonomik ve sosyodemografik özellikler ise bağımsız değişkenleri olarak belirlendi.

***Bulgular:*** Aşı bilgisi olanlar referans alındığında olmayanlarda 6.6 (CI, 2.9–14.9; p=0.001), temel eğitimi olanlar referans alındığında olmayanlarda 2.6 (CI, 1.5–4.5; p=0.001), gelir düzeyi yeterli olanlar referans alındığında yetersiz olanlarda 2.7 (CI, 1.2–5.9; p=0.006), il ve ilçe merkezinde yaşayanlar referans alındığında köy ve beldelerde yaşayanlarda aşılanmama 2.2 kere (CI, 1.2–3.7; p=0.006) daha yüksek olup yaşlılarda aşılanmayı etkileyen faktörler olarak belirlendi.

***Sonuç:*** Yaşlı nüfusun "Hastalık Kontrol ve Önleme Merkezi" tarafından önerilen aşıları yaptırmasında hekimlerin aşılar hakkında yaşlıları bilgilendirmesi, köy ve beldelerde yaşayanlar ve gelir düzeyi düşük olanların aşılanma oranlarının arttırılması için doktorlar ve diğer sağlık sunucularının yaşlıları aşılanma konusunda bilgilendirmeleri ve yönlendirmeleri gibi ilave çözümler gerekmektedir.


***Anahtar sözcükler:*** Yaşlı; İnfluenza aşısı; Pnömokok aşısı; Herpes Zoster aşısı

## INTRODUCTION

Elderly population aged 65 years and older is growing worldwide with increasing average life expectancy. As of 2015, there are 900 million people in the world who are 60 years and older, and it is estimated to reach 2 billion by 2050 (1). According to the Turkish Statistical Institute, the percentage of people aged 65 years and older was 8.5% in 2017 (2).

Changes occur with ageing in innate and acquired immunities. Thymic involution results in the reduction of the number of T cells and low CD4/CD8 ratio, affects B-cells that provide antibody response, affects dendritic cells responsible for antigen uptake and presentation, decreases the diversity of the T cell repertoire, negatively affects natural killer cells that eliminate infected cells and affects monocytes and macrophages that govern chemotaxis. These changes, termed as 'immunosenescence', increase the risk of exposure to infections in the elderly (3–5).

It is estimated that approximately 3.5 million serious cases of influenza infection are observed every year worldwide, and approximately 250,000–300,000 of these infections are fatal (6). Influenza, which increases and peaks especially in autumn and winter, causes complications and deaths, making the elderly susceptible to pneumococcal infections (7).

Pneumococcal infections occur in a spectrum comprising acute otitis media, sinusitis, meningitis and invasive pneumococcal disease, and the effectiveness of vaccination in protecting against these conditions has been demonstrated (8). If the vaccination status of an elderly patient is unknown or the patient has not been vaccinated, one dose of pneumococcal conjugate vaccine (PCV13) is initially administered followed by one dose of pneumococcal polysaccharide vaccine 23 (PPSV23) after 6–12 months (9); the interval between the two vaccinations should be 2 months at a minimum.

Most people become infected with varicella during childhood, and varicella remains dormant in cranial nerve ganglia. Post-herpetic neuralgia, which is a common complication caused by the spread of the virus to the sensory nerve dermatoma, can be observed in up to 18% of adults and 33% of the elderly (10,11). This leads to pain that lasts for months and patients show poor response to analgesics, disrupting their social activity (12).

Owing to these reasons, vaccination strategies for the prevention of diseases, such as influenza, pneumococcal infections, herpes zoster (HZ), as suggested by the Centre for Disease Control and Prevention (CDC) are important in terms of preventive health services in the elderly (9).

The aim of this study was to determine the level of knowledge of individuals aged 65 years and older on influenza, pneumococcal and HZ vaccines, and evaluate the factors that may affect vaccination status.

## MATERIALS AND METHOD

The population of this descriptive study comprised individuals aged 65 years and older who were admitted to internal medicine outpatient clinics of Kafkas University School of Medicine and public hospitals located in Kars, Kağızman, Sarıkamış, Ardahan, Göle, Iğdır and Doğubayazit. Approximately 167,760 people aged 18 years and older were admitted to the internal medicine outpatient clinics of these hospitals within 1 year, and the number of patients aged 65 years and older was approximately 33,552 (approximately 20% of the applicants were 65 years and older). In addition, the average number of repeated admissions to university and public hospitals was 6.6 in the cities where this study was conducted (13). When the number of the elderly admitted to the hospitals (33.552) was divided by the number of repeated admissions (6.6), the population of the study was determined to be approximately 5,089 people. Accordingly, sample size was calculated

as 537 considering 50% prevalence rate, 4% error margin and 95% CI.

**Data collection form**

The form consisted of questions inquiring sociodemographic and socioeconomic levels of the elderly, information regarding vaccinations and vaccination status.

**Data collection**

Data was collected using face-to-face interview. After establishing preliminary diagnosis and planning investigations and treatments on the basis of the reason of admission, participants were taken to a quiet room and the questions were read by the investigator at a sound level wherein his/her voice could be clearly heard by the participants. Verbal answers of the participants who heard and understood the questions were recorded on the forms. Seven people who had communication problems were not included in the study and 27 people did not consent to participate in the study; therefore, the study was completed with 543 participants.

The dependent variable of the study was the vaccination status of the elderly, whereas the independent variables were the socioeconomic and sociodemographic characteristics of the elderly and the level of knowledge on vaccination.

The study protocol was approved by the Clinical Trials Ethics Committee of Kafkas University Faculty of Medicine, Kars, Turkey. The study was conducted in accordance with the declaration of Helsinki, and verbal informed consent was obtained from each patient.

**Statistical analysis**

SPSS Statistics of Windows v.21.0 (SPSS; IBM Corporation, New York, USA) was used. Chi-square test was used in the analysis of numeric variables; $p<0.05$ was considered statistically significant. Logistic regression analysis was used for independent variables that were found to be statistically significant in the chi-square test.

## RESULTS

In total, 63 subjects received influenza vaccination only, three received both influenza and pneumococcal vaccinations, one received pneumococcal vaccination and one received all three vaccinations. Consequently, 68 subjects received at least one vaccination.

Table 1 shows the association between influenza, pneumococcal and HZ vaccination rates and demographic and socioeconomic characteristics, level of knowledge on vaccination and the participants' personal characteristics.

Table 2 shows the percentages of patients who have previously heard of influenza, pneumococcal and HZ vaccines. The percentages of participants who have heard of these vaccines were 52.7%, 26.9% and 6.6%, respectively.

Independent variables with statistically significant differences in Table 1 were included in the logistic regression analysis. The following were the parameters affecting the vaccination rate of the participants.

As shown in Table 3, the number of unvaccinated subjects was 6.6 times higher amongst participants with no knowledge of vaccination than amongst those with knowledge on vaccination (CI, 2.9–14.9, p=0.001), 2.6 times higher amongst participants with no primary education than amongst those with primary education (CI, 1.5–4.5, p=0.001), 2.7 times higher in participants with insufficient income than amongst those with sufficient income (CI, 1.2–5.9, p=0.006) and 2.2 times higher amongst participants living in rural areas than amongst those living in urban areas (CI, 1.2–3.7, p=0.006) (Table 3).

**Table 1.** The association between influenza, pneumococcal and HZ vaccination rates and demographic and socioeconomic characteristics, level of knowledge on vaccination and the participants' personal characteristics. (Kars, Turkey; 2017).

| Independent Variables | | *Vaccinated | Unvaccinated | Number (%) | p |
|---|---|---|---|---|---|
| | | Number (%) | Number (%) | | |
| **Place of residence** | Village/suburb | 25 (8.2) | 281 (91.8) | 306 (56.4) | 0.001 |
| | City/town | 43 (18.1) | 194 (81.9) | 237 (43.6) | |
| **Age** | 65–74 | 45 (13.2) | 295 (86.8) | 340 (62.6) | 0.516 |
| | ≥75 | 23 (11.3) | 180 (88.7) | 203 (37.4) | |
| **Sex** | Female | 26 (9.3) | 253 (90.7) | 279 (51.4) | 0.020 |
| | Male | 42 (15.9) | 222 (84.1) | 264 (48.6) | |
| **Vaccination information provided**[a] | Yes | 14 (46.7) | 16 (53.3) | 30 (5.5) | 0.001 |
| | No | 54 (10.5) | 459 (89.5) | 513 (94.5) | |
| **Marital Status** | Widowed | 12 (7.8) | 142 (92.2) | 154 (28.4) | 0.036 |
| | Married | 56 (14.4) | 333 (85.6) | 389 (71.6) | |
| **Elementary school and higher** | No | 29 (8.3) | 321 (91.7) | 350 (64.5) | 0.001 |
| | Yes | 39 (20.2) | 154 (79.8) | 193 (35.5) | |
| **Mode of residence** | Rental | 4 (22.2) | 14 (77.8) | 18 (3.3) | 0.206 |
| | Family's property | 64 (12.2) | 461 (87.8) | 525 (96.7) | |
| **Living with** | Alone | 2 (5.9) | 32 (94.1) | 34 (6.3) | 0.227 |
| | Spouse/children | 66 (13.0) | 443 (87.0) | 509 (93.7) | |
| **Number of people in the family** | ≤4 | 51 (14.0) | 314 (86.0) | 365 (67.2) | 0.144 |
| | >4 | 17 (9.6) | 161 (90.4) | 178 (32.8) | |
| **Health insurance** | Green card | 12 (7.3) | 153 (92.7) | 165 (30.4) | 0.015 |
| | SSI | 56 (14.8) | 322 (85.2) | 378 (69.6) | |
| **Family**[b] **income** | Insufficient | 8 (5.2) | 147 (94.8) | 155 (28.5) | 0.001 |
| | Sufficient | 60 (15.5) | 328 (84.5) | 388 (71.5) | |
| **Smoking**[c] | Smoker | 6(11.5) | 46 (88.5) | 52 (9.6) | 0.822 |
| | Non-smoker | 62 (12.6) | 429 (87.4) | 491 (90.4) | |
| **Alcohol Consumption**[c] | Yes | 7 (31.8) | 15 (68.2) | 22 (4.1) | 0.005 |
| | No | 61 (11.7) | 460 (88.3) | 521 (95.9) | |
| **Chronic disease** | Yes | 60 (12.8) | 409 (87.2) | 469 (86.4) | 0.632 |
| | No | 8 (10.8) | 66 (89.2) | 74 (13.6) | |
| **Total** | 68[d] (12.5) | 475 (87.5) | 543 (100.0) | | |

(Age range of participants: 65–95 years; average age: 72.9±6.5 years)

* having received one, two or all three of the mentioned vaccinations; a, whether subjects received information about vaccination by a healthcare provider or a doctor; SSI, Social Security Institution; b, income perceived by subject; c, whether or not smoking or alcohol habits continue, regardless of the previous situation ; d, In total, 63 subjects received influenza vaccination only, 3 received both influenza and pneumococcal vaccinations, 1 received pneumococcal vaccination and 1 received all three vaccinations. As a result, 68 subjects received at least one vaccination.

**Table 2.** Subjects indicating that they have only heard about a particular vaccination before.

| Vaccination | Have heard about vaccination | Have not heard about vaccination | Total |
|---|---|---|---|
| | Number (%) | Number (%) | |
| **Influenza** | 286 (52.7) | 257 (47.3) | 543 (100.0) |
| **Pneumococcal** | 146 (26.9) | 397 (73.1) | 543 (100.0) |
| **Herpes zoster** | 36 (6.6) | 507 (93.4) | 543 (100.0) |

**Table 3.** The results of binary logistic regression analysis containing factors affecting influenza, pneumococcal and herpes zoster vaccination among people aged 65 years and older.

| Independent variables | | B | S.E | Wald | Odds Ratio | 95% Confidence Interval | p |
|---|---|---|---|---|---|---|---|
| **Vaccination information provided** | No | 1.888 | 0.414 | 20.787 | 6.6 | 2.9–14.9 | 0.001 |
| | Yes | | | | Reference | | |
| **Elementary school and higher** | No | 0.963 | 0.278 | 11.966 | 2.6 | 1.5–4.5 | 0.001 |
| | Yes | | | | Reference | | |
| **Family income*** | Insufficient | 0.987 | 0.400 | 6.083 | 2.7 | 1.2–5.9 | 0.006 |
| | Sufficient | | | | Reference | | |
| **Place of residence** | Village/suburb | 0.770 | 0.283 | 7.424 | 2.2 | 1.2–3.7 | 0.006 |
| | City/town | | | | Reference | | |

***** income perceived by individual

**Table 4.** Percentage and reasons of subjects indicating that they will not undergo vaccination when their doctor advises influenza, pneumococcal and herpes zoster vaccinations.

| I will not get vaccinated | |
|---|---|
| **Response** | **Number (%)** |
| Fear of side effects | 34/543 (6.3) |
| I do not think it is necessary because I am healthy | 30/543 (5.5) |
| I do not think it is necessary because I am old | 13/543 (2.4) |
| No idea | 5/543 (0.9) |
| **Total number (%)** | **82/543 (15.1)** |

## DISCUSSION

Similar to that reported in previous studies, the vaccination rates amongst the elderly for the three vaccines investigated in the present study in the study area was 12.5%, and this rate is insufficient (14–16). The lack of knowledge regarding the vaccine, lack of primary education, low income level and living in villages and rural areas were determined as factors affecting this situation.

In Europe, the highest rate of influenza vaccination in the elderly was achieved in the Netherlands with a percentage of 77%, and the lowest rate was in Estonia with a percentage of 1% (10). In the western part of Turkey, the influenza vaccination rate in the population was 15% (14), whereas that in the present study was 12.3%. Influenza is one of the leading causes of vaccine-preventable infections. A recent study in Taiwan found that the rates of pneumonia and acute coronary syndromes were lower in individuals immunised for influenza in locations with high air pollution during the winter season, and patients who were vaccinated against influenza were less affected on days when the air temperature decreased (17). In an extensive study, it was found that influenza vaccination during influenza seasons between 2000 and 2009 not only reduced mortality rates but also reduced hospitalisation rates (18). In the present study, when participants (patients aged ≥65 years) were asked about pneumococcal vaccine, 26.9% of the participants stated that they had previously heard of this vaccine.

The Community-Acquired Pneumonia Immunization Trial in Adults study demonstrated the efficacy of PCV13, and another study found that 38% of invasive pneumococcal diseases was caused by the serotypes that could be prevented by PPSV23 administration (19,20). In Scotland during the 2003/2004 winter season, PPSV23 was found to reduce the risk of invasive pneumococcal disease in the elderly by one-third, and similarly, a study investigating a large number of the elderly in Sweden found that influenza and 23-valent pneumococcal vaccination significantly reduced both influenza infection and invasive pneumococcal disease (8,21).

Furthermore, 68% of patients suffering from HZ and its complications are aged 50 years and older. When postherpetic neuralgia develops, it may impair social activity and sleep patterns of the person by causing pain that lasts for months or even years that does not respond well to analgesics. In addition, it may cause various ophthalmologic complications and zoster meningitis (6,11).

Oxman et al. found that the efficacy of HZ vaccine is 51% against HZ infection and 67% against postherpetic neuralgia (22). In the present study, the percentage of participants who were aware of HZ vaccination was 6.6% (36/543), and the vaccination rate was only 0.2% (1/543). In a large-scale cohort study conducted by Langan et al., the rates of HZ vaccination were 2.5% and 1.5% in the age groups of 65–79 years and ≥80 years, respectively, and this rate was 0.3% in African Americans (12). In this study, it was found that 5.5% of participants (30/543) were previously provided with information on any of the vaccines, and 46.7% of previously informed participants received at least one vaccine of influenza, pneumococcal or HZ vaccines.

A study conducted in the United States found that family physicians and internists remain unclear regarding the importance of vaccination (16). Similar to our results, Schneeberg et al. in Canada found that 16.7% of those who were not informed of pneumococcal vaccination by a physician or healthcare provider were vaccinated, whereas 79.8% of informed patients were vaccinated (23).

These findings indicate that the knowledge of vaccination affects vaccination rates. In immunisation of the elderly, healthcare providers must initially insist on emphasising the importance of each of these vaccinations. In our study, 84.9% of the participants indicated that they would

receive vaccination if the doctor advises (Table 4), demonstrating the power of healthcare providers in persuading them for vaccination (14,23).

In the logistic regression analysis of the data, the number of unvaccinated subjects was 2.6 times higher in those with low educational level. In this study, the vaccination rate amongst participants with 'primary and higher education' was 20.2%, whereas this rate was 8.3% amongst participants with insufficient education (p=0.001). In the aforementioned study, influenza vaccination rate was found to be 3.2 times lower amongst those without primary education (14). In the above-mentioned Canadian study, the rate of people who did not receive pneumococcal vaccine was 1.6 times higher in elderly with primary/secondary education compared with those with university education (23).

When the effect of income level on vaccination status was analysed, it was found that the rate of subjects who did not receive influenza, pneuomococcal or HZ vaccines was 2.7 times higher in participants with insufficient income compared with those with sufficient income (Table 3).

In a study conducted on 2,000 people in Pakistan, pneumococcal vaccination rate amongst people in lower socioeconomic classes was 2.3%, whereas this rate was 16.5% amongst people in higher socioeconomic classes (24). In the above-mentioned cohort study, HZ vaccination rate in individuals with low income was 0.6%, whereas it was 2.6% in those with high income (12).

In this study, the rate of unvaccinated participants living in villages and suburbs was 2.2 times higher than the rate in participants living in cities and town centres (Table 3). This finding may indicate that people living in the villages are in higher need of education. In this study, the rate of participants indicating that they 'would not get vaccinated' for all three vaccinations on the doctor's recommendation vaccination was 15.1%. When we looked at the distribution, we found that the proportion of participants who would not get vaccinated due to the fear of side effects was 34/82, and they had concerns regarding vaccination. In one of the previous studies, it was found that 58% of people believed that pneumococcal vaccination would protect against the disease, but they were concerned about the side effects of vaccination (25).

Although awareness of influenza vaccine has increased due to outbreaks in recent years, awareness of the other vaccines is low, and the level of awareness appears to be related to the socioeconomic levels of individuals (24). Low level of awareness of HZ vaccine compared with influenza and pneumococcal vaccines may be due to insufficient information by doctors, relatively high price of HZ vaccine and less appearance on social media platforms such as television and the Internet.

In conclusion, the rate of vaccination against influenza, pneumococcal disease and HZ in elderly was found to be low. The level of pneumococcal and especially HZ vaccination is very low compared with that of influenza. The lacks of knowledge in the elderly, low educational level, insufficient income and living in villages and suburbs have an impact on the low vaccination rate for all three diseases. Independent of these factors, the majority of participants have stated that they would get vaccinated if the physician advises. In light of this information, healthcare providers and physicians should inform the elderly about vaccinations and recommend vaccination. In addition, although HZ is not as common as other diseases, the importance of HZ vaccination should not be overlooked because it may cause neurological pain and other serious complications in the elderly.

**Conflicts of interest**

The authors declare that there are no conflicts of interest.

## REFERENCES


1. World Health Organization. Ageing and health: Fact sheet. [Internet] Available from: http://www.who.int/news-room/fact-sheets/detail/ageing-and-health. Accessed: 05.08.2018.
2. Turkish Statistical Institute. Main statistics results of 2017: population and demography, population statistics. [Internet] Available from: http://www.turkstat.gov.tr/Start.do. Accessed: 05.08.2018.
3. Montecino-Rodriguez E, Berent-Maoz B, Dorshkind K. Causes, consequences, and reversal of immune system aging. J Clin Invest 2013;123(3):958-65. (PMID:23454758).
4. Weinberger B, Herndler-Brandstetter D, Schwanninger A, Weiskopf D, Grubeck-Loebenstein B. Biology of immune responses to vaccines in elderly persons. Clin Infect Dis 2008;46(7):1078-84. (PMID:18444828).
5. Weinberger B, Grubeck-Loebenstein B. Vaccines for the elderly. Clin Microbiol Infect 2012 Suppl;18(5):100-8. (PMID:22862783).
6. Lang PO, Aspinall R. Vaccination in the elderly: what can be recommended? Drugs Aging 2014;31(8):581-99. (PMID:24928553).
7. Ludwig E, Bonanni P, Rohde G, Sayiner A, Torres A. The remaining challenges of pneumococcal disease in adults. Eur Respir Rev 2012;21(123):57-65. (PMID:22379175).
8. Mooney JD, Weir A, McMenamin J, et al. The impact and effectiveness of pneumococcal vaccination in Scotland for those aged 65 and over during winter 2003/2004. BMC Infect Dis 2008;8(1):53. (PMID:18433473).
9. CDC. Recommended immunizations for adults: by age. 2018. [Internet] Available from: https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-schedule-easy-read.pdf. Accessed: 05.08.2018.
10. Trıglav TK, Poljak M. Vaccination indications and limits in the elderly. Acta Derm-Venereol 2013;22(3):65-70. (PMID:24089135).
11. Yawn BP, Saddier P, Wollan PC, Sauver JLS, Kurland MJ, Sy LS. A population-based study of the incidence and complication rates of herpes zoster before zoster vaccine introduction. Mayo Clin Proc 2007;82(11):1341-9. (PMID:17976353).
12. Langan SM, Smeeth L, Margolis DJ, Thomas SL. Herpes zoster vaccine effectiveness against incident herpes zoster and post-herpetic neuralgia in an older US population: a cohort study. PLoS med 2013;10(4):e1001420. (PMID:23585738).
13. Köse MR. Utilization of Health Care Services (Chapter 8). In: MR Köse, BB Başara, C Güler et al. (Eds). Republic of Turkey Ministry of Health: Health Statistics Yearbook 2015, General directorate of health research. Ankara 2016, pp 134-40. [Internet] Available from: http://ekutuphane.sagem.gov.tr/kitaplar/health_statistics_yearbook_2015.pdf. Accessed: 06.08.2018.
14. Polat HH, Öncel S, Turhan Ö, Akcan A, Eravşar K, Yalcin AN. İnfluenza vaccination in 65 and over age adults in Antalya/Turkey. Turk J Geriatr 2012;15(4):371-7 (in Turkish).
15. Lang PO. Why influenza viruses continue to pose a significant threat to aging and aged populations worldwide. Curr Geriatr Rep 2014;3(1):56-65.
16. Hurley LP, Bridges CB, Harpaz R, et al. Physician attitudes toward adult vaccines and other preventive practices, United States, 2012. Public Health Reports 2016;131(2):320-30. (PMID:26957667).
17. Huang CH, Chao DY, Wu CC, et al. Influenza vaccination and the endurance against air pollution among elderly with acute coronary syndrome. Vaccine 2016;34(50):6316-22. (PMID:27823899).
18. Wong K, Campitelli MA, Stukel TA, Kwong JC. Estimating influenza vaccine effectiveness in community-dwelling elderly patients using the instrumental variable analysis method. Arch Intern Med 2012;172(6):484-91. (PMID:22371873).
19. Webber C, Patton M, Patterson S, Schmoele-Thoma B, Huijts SM, Bonten MJ. Exploratory efficacy endpoints in the community-acquired pneumonia immunization trial in adults (CAPiTA). Vaccine 2017;35(9):1266-72. (PMID:28173960).
20. Chiou WY, Lee MS, Hung SK, et al. Effectiveness of 23-valent pneumococcal polysaccharide vaccine on elderly long-term cancer survivors: a population-based propensity score matched cohort study. BMJ open 2018;8(5):e019364. (PMID:29769253).
21. Hedlund J, Christenson B, Lundbergh P, Örtqvist A. Effects of a large-scale intervention with influenza and 23-valent pneumococcal vaccines in elderly people: a 1-year follow-up. Vaccine 2003;21(25-26):3906-11. (PMID:12922125).
22. Oxman MN, Levin MJ, Johnson GR, et al. Shingles Prevention Study Group. A vaccine to prevent herpes

zoster and postherpetic neuralgia in older adults. N Engl J Med 2005;352(22):2271-84. (PMID:15930418).

23. Schneeberg A, Bettinger JA, McNeil S, et al. Knowledge, attitudes, beliefs and behaviours of older adults about pneumococcal immunization, a Public Health Agency of Canada/Canadian Institutes of Health Research Influenza Research Network (PCIRN) investigation. BMC Public Health 2014;14(1):442. (PMID:24884433).

24. Baig SA, Hassan M, Ahmed SM, Moazzam W, Inayat A. A cross-sectional study to investigate pneumococcal vaccination in the elderly in a low income county: patient knowledge, awareness, and attitudes of vaccination and prevalence rates by socioeconomic status. Hum Vaccin Immunother 2014;10(4):1024-7. (PMID:24495898).

25. Shijun L, Erping X, Yan L, et al. Factors associated with pneumococcal vaccination among an urban elderly population in China. Hum Vaccin Immunother 2014;10(10):2994-9. (PMID:25483646).

# ERRATUM

The authors and institutions of the article titled "DEATH ANXIETY IN THE ELDERLY: RELATION TO PARTICIPATION IN DAILY LIFE" (TJG 2018;21(3):383-93. DOI:10.31086/tjgeri.2018344053) should be as follows:

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RESEARCH

# EVALUTION OF GERIATRIC INFECTIONS IN PALLIATIVE CARE CENTER

## Abstract

***Introduction:*** Palliative care aims to improve quality of care by providing symptom control among geriatric patients; therefore, infection control is of utmost importance as complications increase symptom burden, thus decreasing quality of life.

***Materials and Method:*** Medical records of patients aged ≥65 years hospitalized at the palliative care center were retrospectively reviewed. Data on age, sex, diagnosis, comorbidities, length of stay, discharge status and cultures were collected.

***Results:*** Mean age of 305 patients was 80.4±7.1 years and length of stay was 31.1±38.1 days. In total, 131 patients died, whereas 74 were referred to the intensive care unit, and 100 were discharged home. Main comorbidities included cerebrovascular diseases (37.4%), cancer (31.8%), hypertension (40%) and diabetes mellitus (21.3%) in patients who had dementia and Parkinson's disease. The highest growth was observed in urinary culture (67.9%), followed by blood, wound with the least growth in the tracheal aspirate (8.2%). E.coli was most commonly isolated in urinary, wound and tracheal aspirate culture, whereas Methicillin-Resistant Coagulase Negative Staphylococ was more in blood culture. While wound culture growth was less common in cancer patients, it was significantly more common in patients with Parkinson's disease, diabetes, and pressure ulcer ($p<0.05$). Growth in the tracheal aspirate was also significantly more common in patients with hypoxic brain, percutaneous endoscopic gastrostomy, and tracheostomy ($p<0.05$).

***Conclusion:*** Among patients receiving inpatient palliative care, bacterial growth was most common in urinary cultures, whereas it was higher in the tracheal aspirates of patients with diabetes, tracheostomy, and percutaneous endoscopic gastrostomy.

***Keywords:*** Palliative care; Geriatrics; Infections

ARAŞTIRMA

# PALYATİF BAKIM MERKEZİNDE GERİATRİK ENFEKSİYONLARIN DEĞERLENDİRİLMESİ

## Öz

***Giriş:*** Palyatif Bakımın amacı semptom kontrolünün sağlanarak hastaların yaşam kalitesinin artırılmasıdır. Geriatrik hastalar en fazla palyatif bakım ihtiyacı olan hasta grubu olması nedeniyle semptom yükünü artırarak yaşam kalitelerinin azalmasına yol açan enfeksiyonların kontrolü daha önemli hale gelmektedir.

***Gereç ve Yöntem:*** Palyatif bakım merkezinde yatan 65 yaş ve üstü hastaların yaşı, cinsiyeti, tanıları ile eşlik eden komorbiditeleri ve kültürleri retrospektif olarak değerlendirildi.

***Bulgular:*** Toplam 305 hastanın yaş ortalaması 80.37±7.1 yıl, yatış süreleri 31.11±38.07 gün idi. 131 hastanın exutus olduğu 74 hastanın yoğun bakım ünitesine çıktığı 100 hastanın da eve taburcu edildiği gözlendi. Başta serebro vasküler hastalık (%37.37) olmak üzere, sırasıyla kanser, demans ve parkinson tanısı olan hastaların %40 da hipertansiyon %21.31 de diyabet eşlik ettiği tespit edildi. En fazla üreme idrar kültüründe (%67.86) olup sırasıyla kan, yara ve en azda trakeal aspirat (%8.19) üremesi gözlendi. İdrar, yara ve trakeal aspirat kültüründe en fazla oranda E.coli izole edilirken, kan kültüründe Methicillin-Dirençli Koagulaz Negative Staphylococ daha fazla idi. Kanser hastalarında yara kültür üremesi daha düşük, parkinson, diyabet ve bası ülseri olan hastalarda yara kültürlerinde üreme oranı istatiksel olarak anlamlı derecede yüksek ($p<0.05$) bulundu. Hipoksik beyin tanısı, perkütan endoskopik gastrostomi ve trakeostomisi olan hastalarda TA kültür üremesi istatistiksel olarak da anlamlı derecede fazla gözlendi ($p<0.05$).

***Sonuç:*** Palyatif bakımdaki geriatrik hastalarda en fazla yüzde ile idrar kültürlerinde üreme gözlenirken diyabeti olan trakeostomili ve perkütan endoskopik gastrostomili hastalarda trakeal aspirat üremesinin daha yüksek olduğu tespit edildi.

***Anahtar sözcükler:*** Palyatif bakım; Geriatrik; Enfeksiyon

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## INTRODUCTION

With the worldwide life expectancy increasing, chronic critical diseases associated with aging, and their symptom burden are also increasing day by day (1,2). Palliative care (PC) is defined as an approach that increases the quality of life of patients/their relatives who experience difficulties due to life-threatening diseases by preventing or eliminating all physical, psychosocial, and psychological problems, especially pain, after performing early and effective assessment (3). At present, 80% of deaths occur during old age, a majority of which are in patients requiring PC in the last stages of their disease course (4). Most of the deaths are observed in individuals who are >65 years of age in developed countries, and as the life expectancy increases, the elderly population also increases with a relative reduction in the ratio of working population and an increasing mean age of potential caregivers. For this reason, the importance of PC is gradually becoming more acknowledged (5). In recent years, it was reported that increased health expenditures for the geriatric population with both chronic conditions and functional impairment led to the integration of geriatrics and PC implementation principles, which resulted in improved care quality and reduced use of costlier emergency services, hospitals, and nursing homes (6). It is estimated that only 14% of the 20 million patients who require PC every year receive such services (7,8). The effective utilization of PC services is very important given the very limited access to PC. Several studies have shown that PC-related infections prolong the length of hospitalization. The prevention of infectious diseases is of paramount importance in cancer patients receiving PC. However, little is known with regard to the factors that cause infection in these patients (9). Despite the high infection prevalence, antimicrobial therapy in the PC setting remains unclear as its indications and benefits are not well understood (10).

Furthermore, it is known that infection management would be more effective with the identification of infectious agents and implementation of necessary precautions in the care of geriatric patients requiring PC. Therefore, in this study, we aimed to investigate the infections and affecting factors in the geriatric patients who were followed up in a PC setting.

## MATERIALS AND METHOD

This study was performed in accordance with the Declaration of Helsinki principles after being granted an approval by the Ethics Committee of Ankara Numune Training and Research Hospital (Ankara, Turkey) in 06/07/2018 (Approval no. 1974). Medical records of patients aged ≥65 years admitted at the PC Center of Ulus State Hospital between 01/01/2013 and 12/31/2017 were retrospectively examined. Patients with missing file records were excluded from the study, whereas those with growth in their cultures were included in the study. Collected data comprised information on age, sex, and presence of comorbidities or conditions including cancer, cerebrovascular disease (CVE), dementia, chronic obstructive pulmonary disease (COPD), hypoxic brain (HB), Parkinson's disease (PD), motor neuron disease(MND), heart failure (HF),, hypertension (HT), diabetes mellitus (DM), percutaneous endoscopic gastrostomy (PEG), tracheostomy, and pressure ulcer (PU). The length of stay (LOS) at the PC center and discharge status [death, intensive care unit (ICU), or at home] were determined. Culture growth in blood, urine, wound, and tracheal aspirate (TA) were recorded.

### Statistical analysis

In this study, the data obtained from patients hospitalized at the PC center were entered into the computerized program. Where in necessary error checks and corrections were made. Normal distribution of continuous variables (age and LOS) was graphically examined using the Kolmogorov Smirnov test. Chi-square test was employed to investigate the relationship between two independent categorical variables. Categorical variables and frequency distributions are expressed as numbers and percentages, whereas numerical variables were expressed as mean±standard deviation.

All statistical analyses and calculations were performed with the use of MS Excel 2010 and IBM SPSS Statistics Ver. 23.0 software (IBM Corp., Armonk, NY, USA). An overall type I error level of 95% was used to indicate statistical significance.

**Table 1.** Demographic characteristics of the patients.

| Variable | | Value |
|---|---|---|
| **Ages (Years) *** | | |
| | | 80.37±7.1 |
| **Gender**** | | |
| | Female | 139 (45.6) |
| | Male | 166 (54.4) |
| **LOS in PCC (days)*** | | |
| | | 31.11±38.07 |
| **Discharge**** | | |
| | Exutus | 131 (43.0) |
| | Intensive Care Unit | 74 (24.3) |
| | Home | 100 (32.8) |
| **Diagnosis** | | |
| | Cancer | 97 (31.80) |
| | Cerebrovascular Disease | 114 (37.37) |
| | Dementia | 55 (18.03) |
| | COPD | 26 (8.52) |
| | Hypoxic Brain | 7 (2.29) |
| | Parkinson's disease | 23 (7.54) |
| | Motor Neurone Disease | 4 (1.31) |
| | Trauma | 11 (3.60) |
| | Other | 7 (2.29) |
| **Comorbidity** | | |
| | Heart Failure | 52 (17.04) |
| | Hypertension | 122 (40.00) |
| | Diabetes Mellitus | 65 (21.31) |
| | PEG | 95 (31.14) |
| | Tracheostomy | 68 (22.29) |
| | Pressure Ulcer | 179 (58.68) |

* Values are presented as the mean±standard deviation. **Values are presented as n (%).

LOS in PCC: Length of Stay in PCC; COPD: Chronic Obstructive Pulmonary Disease; PEG: Percutaneous Endoscopic Gastrostomy;

**Table 2.** Culture results of patients.

| Organism | Type of culture | | | |
|---|---|---|---|---|
| | Urine n (%) | Blood n (%) | Wound n (%) | Tracheal Aspirate n (%) |
| **Acinetobacter spp.** | 29 (14.00) | 20 (20.40) | 27 (29.34) | 6 (24.00) |
| **Enterococcus spp.** | 27 (13.04) | 9 (0.09) | 3 (3.26) | _ |
| **Escherichia coli** | 179 (86.47) | 70 (71.42) | 67 (72.82) | 18 (72.00) |
| **MR-CoNS** | 120 (5.79) | 80 (81.63) | 15 (16.30) | 4 (16.00) |
| **MRSA** | _ | 3 (3.06) | 8 (8.69) | 3 (12.00) |
| **MS-CoNS** | 3 (1.44) | 17 (17.34) | _ | 2 (8.00) |
| **MSSA** | _ | 9 (0.09) | 8 (8.69) | _ |
| **Proteus spp.** | 22 (10.62) | 4 (4.08) | 41 (44.56) | 3 (12.00) |
| **Pseudomonas spp.** | 59 (28.50) | 14 (1.28) | 43 (46.73) | 15 (60.00) |
| **Total of isolates n (%)** | 207 (67.86) | 98 (32.13) | 92 (30.16) | 25 (8.19) |

MR: Methicillin-Resistant; CoNS: Coagulase Negative Staphylococci; SA: Staphylococcus Aureus; MS: Methicillin-Sensitive

**Table 3.** Comparison of culture results according to discharge status of the patients.

| | | Exutus n (%) | ICU n (%) | Home n (%) | $\chi 2$ value | p |
|---|---|---|---|---|---|---|
| **Blood** | Present | 38 (26.76) | 66 (46.48) | 37 (26.06) | 5.463 | 0.065 |
| | Absent | 64 (39.26) | 36 (22.09) | 63 (38.65) | | |
| | Total | 131 (42.95) | 74 (24.26) | 100 (32.79) | | |
| **Ürine** | Present | 86 (41.55) | 48 (23.19) | 73 (35.27) | 1.81 | 0.405 |
| | Absent | 45 (45.92) | 26 (26.53) | 27 (27.55) | | |
| | Total | 131 (42.95) | 74 (24.26) | 100 (32.79) | | |
| **Wound** | Present | 36 (39.13) | 19 (20.65) | 37 (40.22) | 3.374 | 0.185 |
| | Absent | 95 (44.6) | 55 (25.82) | 63 (29.58) | | |
| | Total | 131 (42.95) | 74 (24.26) | 100 (32.79) | | |
| **Rectal** | Present | 20 (37.04) | 12 (22.22) | 22 (40.74) | 1.913 | 0.384 |
| | Absent | 111 (44.22) | 62 (24.7) | 78 (31.08) | | |
| | Total | 131 (42.95) | 74 (24.26) | 100 (32.79) | | |
| **Tracheal Aspirate** | Present | 7 (28) | 11 (44) | 7 (28) | 5.98 | 0.051 |
| | Absent | 124 (44.29) | 63 (22.5) | 93 (33.21) | | |
| | Total | 131 (42.95) | 74 (24.26) | 100 (32.79) | | |

Chi-square test was used, and $p<0.05$ is significant

**Table 4.** Comparison of culture results according to diagnosis and co-morbidities of the patients.

| | | Blood | | Urine | | Wound | | Rectal | | Tracheal Aspirate | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n (%) | p | n (%) | p | n (%) | p | n (%) | p | n (%) | p |
| **Cancer** | Present | 42 (29.58) | 0.436 | 64 (30.92) | 0.629 | 19 (20.65) | **0.006** | 13 (24.07) | 0.179 | 4 (16) | 0.077 |
| | Absent | 100 (70.42) | | 143 (69.08) | | 73 (79.35) | | 41 (75.93) | | 21 (84) | |
| **Cerebrovascular Event** | Present | 56 (39.44) | 0.488 | 80 (38.65) | 0.505 | 38 (41.3) | 0.351 | 24 (44.44) | 0.237 | 11 (44) | 0.475 |
| | Absent | 86 (60.569 | | 127 (61.35) | | 54 (58.7) | | 30 (55.56) | | 14 (56) | |
| **Demantia** | Present | 27 (19.01) | 0.677 | 36 (17.39) | 0.672 | 22 (23.91) | 0.079 | 10 (18.52) | 0.918 | 3 (12) | 0.391 |
| | Absent | 115 (80.99) | | 171 (82.61) | | 70 (76.09) | | 44 (81.48) | | 22 (88) | |
| **COPD** | Present | 14 (9.86) | 0.436 | 15 (7.25) | 0.346 | 5 (5.43) | 0.295 | 2 (3.7) | 0.126 | 5 (20) | 0.059 |
| | Absent | 128 (90.14) | | 192 (92.75) | | 87 (94.57) | | 52 (96.3) | | 20 (80) | |
| **Hypoxic Brain** | Present | 3 (2.11) | 0.576 | 3 (1.45) | 0.217 | 2 (2.17) | 0.644 | 0 (0) | 0.096 | 3 (12) | **0.011** |
| | Absent | 139 (97.89) | | 204 (98.55) | | 90 (97.83) | | 54 (100) | | 22 (88) | |
| **Parkinson's Disease** | Present | 10 (7.04) | 0.928 | 190 (91.79) | 0.679 | 13 (14.13) | **0.009** | 5 (9.26) | 0.607 | 3 (12) | 0.411 |
| | Absent | 132 (92.96) | | 17 (8.21) | | 79 (85.87) | | 49 (90.74) | | 22 (88) | |
| **Motor Neurone Disease** | Present | 2 (1.41) | 0.635 | 2 (0.97) | 0.596 | 2 (2.17) | 0.587 | 0 (0) | 0.457 | 1 (4) | 0.291 |
| | Absent | 140 (98.59) | | 205 (99.03) | | 90 (97.83) | | 54 (100) | | 24 (96) | |
| **Trauma** | Present | 4 (2.82) | 0.702 | 7 (3.38) | 0.762 | 4 (4.35) | 0.654 | 1 (1.85) | 0.41 | 0 (0) | 0.166 |
| | Absent | 138 (97.18) | | 200 (96.62) | | 88 (95.65) | | 53 (98.15) | | 25 (100) | |
| **Other** | Present | 5 (3.52) | 0.171 | 6 (2.9) | 0.436 | 2 (2.17) | 0.644 | 2 (3.7) | 0.474 | 0 (0) | 0.271 |
| | Absent | 137 (96.48) | | 201 (97.1) | | 90 (97.83) | | 52 (96.3) | | 25 (100)) | |
| **Heart Failure** | Present | 19 (13.38) | 0.112 | 33 (15.94) | 0.455 | 11 (11.96) | 0.12 | 9 (16.67) | 0.934 | 2 (8) | 0.172 |
| | Absent | 123 (86.62) | | 174 (84.06) | | 81 (88.04) | | 45 (83.33) | | 23 (92) | |
| **Hypertension** | Present | 55 (38.73) | 0.673 | 77 (37.2) | 0.147 | 42 (45.65) | 0.185 | 27 (50) | 0.098 | 10 (40) | 1 |
| | Absent | 87 (61.27) | | 130 (62.8) | | 50 (54.35) | | 27 (50) | | 15 (60) | |
| **Diabetes Mellitus** | Present | 30 (21.13) | 0.941 | 46 (22.22) | 0.572 | 28 (30.43) | **0.011** | 15 (27.78) | 0.201 | 3 (12) | 0.207 |
| | Absent | 112 (78.87) | | 161 (77.78) | | 64 (69.57) | | 39 (72.22) | | 22 (88) | |
| **PEG** | Present | 51 (35.92) | 0.093 | 64 (30.92) | 0.9 | 37 (40.22) | 0.025 | 18 (33.33) | 0.702 | 15 (60) | **0.002** |
| | Absent | 91 (64.08) | | 143 (69.08) | | 55 (59.78) | | 36 (66.67) | | 10 (40) | |
| **Tracheal Aspirate** | Present | 31 (21.83) | 0.856 | 47 (22.71) | 0.802 | 17 (18.48) | 0.293 | 9 (16.67) | 0.273 | 19 (76) | **0.001** |
| | Absent | 111 (78.17) | | 160 (77.29) | | 75 (81.52) | | 45 (83.33) | | 6 (24) | |
| **Pressure Ulcer** | Present | 84 (59.15) | 0.877 | 122 (58.94) | 0.898 | 92 (100) | **0.0001** | 38 (70.37) | 0.055 | 17 (68) | 0.869 |
| | Absent | 58 (40.85) | | 85 (41.06) | | 0 (0) | | 16 (29.63) | | 8 (32) | |

Chi-square test was used, and P<0.05 is significant COPD: Chronic Obstructive Pulmonary Disease; PEG: Percutaneous Endoscopic Gastrostomy;

## RESULTS

Medical records of patients aged ≥65 years admitted at the PC Center of Ulus State Hospital between 1/01/2013 and 12/31/2017 were retrospectively examined. With the exclusion of 35 patients with missing data, a total of 305 patients who had growth in their cultures were included in the study. The mean age of the patient population, comprising 139 females and 166 males, was 80.34±7.1 years. The LOS in PC was 31.1±38.1 days. The distribution of patients' prognosis showed death in 131 patients, referral to ICU in 74 patients, and home discharge in 100 patients (Table 1).

The main comorbidities included CVE (37.4%), cancer (31.8%), HT (40%), and DM (21.3%) in patients who had dementia and PD. More than half of the patients (58.7%) had PU, followed by PEG (31.1%) and tracheostomy (22.3%; Table 1). Growth in cultures is demonstrated in Table 2 as follows: highest growth was observed in urinary culture (67.9%), followed by blood, wound, and the least in TA (8.2%). E.coli was most commonly isolated in urine, wound and tracheal aspirate culture (respectively 86.5%, 72.8%, 72.0%) whereas Methicillin-Resistant (MR) Coagulase Negative Staphylococci (CoNS) was more in blood culture (81.6%). When the prognosis of the patients was compared by the growth in their cultured specimens, growth was most likely to be observed in the blood culture (37%) of patients referred to the ICU, whereas growth in urinary culture was higher (n=86, 41.6%) in cases that resulted in death, albeit not statistically significant (p=0,065) (Table 3). The growth in cultures was also compared in terms of the patients' diagnosis (Table 4). While wound culture growth was less common in cancer patients, it was significantly more common in patients with PD, DM, and PU ($p<0.05$). Growth in TA was also significantly more common in patients with HB, PEG, and tracheostomy ($p<0.05$).

## DISCUSSION

Patients requiring PC, especially those in the terminal stage, are very susceptible to infections, with the symptom burden from these infections further reducing their quality of life (11). The main purpose of PC is to improve the quality of life of patients by providing symptom control (12). Infection control becomes a top priority as the geriatric population is the group of patients with the greatest need for PC, whereby the emergence of particularly resistant bacterial strains and infection control measures may result in additional burden on the patients and their family (13,14). In our study, we found that among geriatric patients receiving PC, the most common condition was urinary tract infections, and growth in TA was more frequent in diabetic patients with PEG and tracheostomy. Bacterial growth was observed in urine cultures of 207 out of 305 patients. Consistent with our results, a study performed in a PC unit reported growth in cultures from the urinary tract (42.5%), respiratory tract (22.9%), blood (12.5%), and skin and subcutaneous tissues (12.5%) (11). In our study, growth in urinary culture was 67.9%, in blood culture 32.1%, and in wound culture 30.2%. Pereira et al. (15) reported a retrospective chart review of the prevalence of infections in 100 consecutive admissions to palliative care unit. There were 74 infections in 55 patients, with urinary tract, respiratory tract, skin and subcutaneous tissue, blood, and mouth as the most common infection sites. E. coli S. aureus, and Enterococcus were the most common organisms. Another study conducted on 255 patients having advanced cancer in order to develop guidelines for the use of antimicrobials in PC reported that the most frequent infections were urinary tract infections, followed by respiratory tract and skin/subcutaneous tissue infections. It was further reported that the use of antimicrobials did not improve survival yet provided effective symptom control (16). Similar to our results, Reinbolt et al.(12) reported that E. coli was the most common urinary tract infection. The most frequent urinary tract organisms were E. coli. Also, that patients' survival was not affected by the presence of infection or use of antimicrobials and that, despite improving symptoms in most of the patients with urinary tract infections, antimicrobial use was less successful in symptom control in respiratory tract,

oral/pharyngeal, skin/subcutaneous tissue, or blood infections. Yamada et al. (17) reported that MR-CoNS are the most common microorganisms in blood cultures and most patients are malignant. In studies, CoNS is a major cause of nosocomial bacteremia and septicemia, especially for the patients who have been reported to be immune deficiency and malignancy (11,17). Patients with prosthetic devices, intravascular catheters, or other implanted foreign bodies are at particular risk of CoNS infection (17). In accordance with the literature, we assume that the high rate of MR-CoNS isolation in blood cultures is due to the patients in terminal period in our study and the frequent use of urinary catheter and intravenous catheter.

As additionally reported by Reinbolt et al. (12), blood infections manifest with more dramatic symptoms such as fever, disorientation, and hypotension compared to urinary tract and wound infections. In fact, urinary tract infections are mostly asymptomatic and usually overlooked due to often atypical presentations (18). We also believe that patients who had growth in their blood cultures were referred to the ICU upon patients' or families' requests for a more effective therapy due to the observation of more dramatic symptoms and that urinary tract infections were relatively more common in those who died as they were not referred to the ICU because of the atypical course of these infections.

In our study, the rate of wound culture in PD, DM and PU patients was significantly higher than that of wound culture in cancer patients ($p<0.05$). The fact that wound culture growth is less common in cancer patients and more common in patients with PD is consistent with the literature. In fact, it is acknowledged that the disease course is usually shorter in cancer, whereas in neurological diseases such as PD, the decline in functional capacity has a slow progression with longer patient life span; however, patients become gradually dependent. After the diagnosis of cancer, the prognosis becomes worse with a shortened life span (19,20). Therefore, PU was less observed in cancer patients with less common growth in wound cultures compared to the higher occurrence of PU and wound infections in patients with PD, whereby immobilizatio was also more frequent with a longer disease course. Thomsen et al. (21) compared diabetic patients to non-diabetic patients and reported that diabetes increased the risk of community-acquired bacteremia and was associated with poor prognosis. Consistent with the literature, our findings suggest that DM increases susceptibility to infections, a probable reason explaining the observation of high frequency of growth in wound cultures of DM patients in our study.

In patients with HB, PEG, and tracheostomy, growth in TA culture was significantly more common ($p<0.05$). At present, the insertion of gastrostomy and tracheostomy tube is a common practice in cases of hypoxic encephalopathy, especially in those whom rapid clinical improvement is not expected (22,23). By providing viruses and bacteria a direct entry to the lower respiratory tract, tracheostomy cannulas are known to predispose patients to respiratory tract infections and additionally lead to a local inflammatory reaction, further increasing the risk for infection (24,25). Furthermore, patients with chronic tracheostomy are exposed to bacterial colonization of the respiratory tract, a risk factor for respiratory tract infections (25).

In conclusion, we mostly observed urinary tract infection in geriatric patients receiving PC and noted TA growth to be more common in diabetic patients with tracheostomy and PEG. Therefore, we believe an effective symptom control could be achieved in patients receiving PC with the early detection of urinary tract infections and of pulmonary infections in diabetic patients with tracheostomy and PEG. As a limited number of studies exist both in our country and in the literature, further studies are warranted to support these findings.

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**Conflicts of interest**

None declared

## REFERENCES


1. Allareddy V, Rampa S, Nalliah RP, et al. Prevalence and predictors of gastrostomy tube and tracheostomy placement in anoxic/hypoxic ischemic encephalopathic survivors of in-hospital cardiopulmonary resuscitation in the United States. PloS One 2015;10(7):e0132612. (PMID:26197229).
2. Caterino JM. Evaluation and management of geriatric infections in the emergency department. Emerg Med Clin North Am 2008;26(2):319-43, viii. (PMID:18406977).
3. Cheng HW, Sham MK, Chan KY. Emergence of vancomycin-resistant enterococci in the palliative care setting-how to strike the right balance in infection control measures? J Pain Symptom Manage 2014;47(1):e7-8. (PMID:24211119).
4. Christensen K, Doblhammer G, Rau R, Vaupel JW. Ageing populations: the challenges ahead. Lancet 2009;374(9696):1196-208. (PMID:19801098)
5. Connor SR, Bermedo MC. (Eds). Global atlas of palliative care at the end of life. London: Worldwide Palliative Care Alliance; 2014. [Internet] Available from: http://www.who.int/nmh/Global_Atlas_of_Palliative_Care.pdf. Accessed: 06.23.2018.
6. Davies E, Higginson I (Eds). Palliative care. The solid facts. [Internet] Available from: http://www.euro.who.int/__data/assets/pdf_file/0003/98418/E82931.pdf?ua=1. Accessed: 05.07.2018.
7. Katz MJ, Roghmann MC. Healthcare-associated infections in the elderly: What's new. Curr Opin Infect Dis 2016;29(4):388-93. (PMID:27306562).
8. Lusuardi M, Capelli A, Cerutti CG, Gnemmi I, Zaccaria S, Donner CF. Influence of clinical history on airways bacterial colonization in subjects with chronic tracheostomy. Respir Med 2000;94(5):436-40. (PMID:17132052).
9. Lynn J, Adamson DM. Living well at the end of life. Adapting health care to serious chronic illness in old age. 2003. [Internet] Available from: https://www.rand.org/content/dam/rand/pubs/white_papers/2005/WP137.pdf . Accessed: 05.07.2018.
10. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med 2006;3(11):e442. (PMID:17132052)
11. Pereira J, Watanabe S, Wolch G. A retrospective review of the frequency of infections and patterns of antibiotic utilization on a palliative care unit. J Pain Symptom Manage 1998;16(6):374-81. (PMID:9879162).
12. Pignatti P, Balestrino A, Herr C, Bals R, Moretto D, Corradi M. et al. Tracheostomy and related host-pathogen interaction are associated with airway inflammation as characterized by tracheal aspirate analysis. Respir Med 2009;103(2):201-8. (PMID:18980836).
13. Reinbolt RE, Shenk AM, White PH, Navari RM. Symptomatic treatment of infections in patients with advanced cancer receiving hospice care. J Pain Symptom Manage 2005;30(2):175-82. (PMID:16125033).
14. Ribera Casado JM. Geriatrics and palliative care: some reflections. Rev Esp Geriatr Gerontol 2013;48(2):89-93. (PMID:23159775).
15. Rosenberg JH, Albrecht JS, Fromme EK, Noble BN, McGregor JC, Comer AC, et al. Antimicrobial use for symptom management in patients receiving hospice and palliative care: a systematic review. J Palliat Med 2013;16(12):1568-74. (PMID:24151960).
16. Schonenberger S, Al-Suwaidan F, Kieser M, Uhlmann L, Bosel J. The SETscore to predict tracheostomy need in cerebrovascular neurocritical care patients. Neurocrit Care 2016;25(1):94-104. (PMID:26842719).
17. Thomsen RW, Hundborg HH, Lervang HH, Johnsen SP, Schønheyder HC, Sørensen HT. Diabetes mellitus as a risk and prognostic factor for community-acquired bacteremia due to enterobacteria: a 10-year, population-based study among adults. Clin Infect Dis 2005;40(4):628-31. (PMID:15712091).
18. Unroe KT, Meier DE. Research priorities in geriatric palliative care: policy initiatives. J Palliat Med 2013;16(12):1503-8. (PMID:24147877).
19. Vitetta L, Kenner D, Sali A. Bacterial infections in terminally ill hospice patients. J Pain Symptom Manage 2000;20(5):326-34. (PMID:11068154).
20. White PH, Kuhlenschmidt HL, Vancura BG, Navari RM. Antimicrobial use in patients with advanced cancer receiving hospice care. J Pain Symptom Manage 2003;25(5):438-43. (PMID:12727041).
21. WHO definition of palliative care. [Internet] Available from: http://www.who.int/cancer/palliative/definition/en/. Accessed: 06.23.2018.
22. World Health Organization. Better Palliative Care for Older People. Copenhagen: WHO; 2004. [Internet] Available from: http://www.euro.who.int/__data/assets/pdf_file/0009/98235/E82933.pdf. Accessed: 07.06.2018.
23. World Health Organization. Planning and implementing palliative care services: a guide for programme managers. 2016. [Internet] Available from: http://apps.who.int/iris/bitstream/handle/10665/250584/9789241565417-eng.pdf?sequence=1. Accessed: 06.23.2018.
24. Yajima R, Ise Y, Wako T, et al. A retrospective study of risk factors for infection in cancer patients receiving specialist palliative care. J Nippon Med Sch 2013;80(6):481-5. (PMID:24419723).
25. Yamada K, Namikawa H, Fujimoto H, et al. Nakaie K, Takizawa E, Okada Y, et al. Clinical Characteristics of Methicillin-resistant Coagulase-negative Staphylococcal Bacteremia in a Tertiary Hospital. Intern Med 2017;56(7):781-5. (PMID:28381743).

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RESEARCH

# EVALUATION OF ADMISSION CAUSES AND MORTALITY RATES OF 65 YEARS OF AGE AND OLDER PATIENTS ADMITTED FROM THE EMERGENCY DEPARTMENT TO THE INTENSIVE CARE UNIT

## Abstract

***Introduction:*** With increasing life expectancy, admission of elderly patients to intensive care units is increasing. We aimed to determine profiles, admission causes and mortality rates of elderly patients who were admitted from the emergency department to the intensive care unit. Because the cost of intensive care hospitalisation is high, this data may be important when determining elderly patients health policies.

***Materials and Method:*** This retrospective study included elderly patients who were admitted from the emergency department to the intensive care unit. The patients' age, sex, chronic illnesses, date of admission, admission causes and mortality rates were recorded.

***Results:*** The mean age of the elderly patients was 76.19 years, 53.4% of the patients were males, and 70.3% of the total patients had ≥1 chronic diseases. The most frequent chronic disease was hypertension. The most common cause of admission was cardiovascular disease. The frequency of myocardial infarction was equally high in male and female patients. They were mostly admitted to the coronary intensive care unit. Intensive care unit admissions were mostly noted during winter. The mortality rate was 14.75%.

***Conclusion:*** With the increasing population of elderly people because of increased life expectancy, the admission of elderly patients to the intensive care units is gradually increasing. The intensive care unit hospitalisation cost and mortality rate of elderly patients' is high. Taking all of this into account, identifying admission causes and mortality rates of elderly patients will provide guidance for the approach used for their diagnosis and treatment and for determining medical policies.

***Keywords:*** Aged; Patient; Intensive care unit; Mortality; Emergency department

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ARAŞTIRMA

# ACİL SERVİSTEN YOĞUN BAKIM ÜNİTESİNE KABUL EDİLEN 65 YAŞ VE ÜZERİ HASTALARIN KABUL NEDENLERİ VE MORTALİTE DEĞERLERİNİN DEĞERLENDİRİLMESİ

## Öz

***Giriş:*** Yaşın ilerlemesi ile birlikte, yoğun bakım ünitelerine yaşlı hastaların kabulü de artmaktadır. Bu çalışmada, acil servisten yoğun bakım ünitelerine kabul edilen yaşlı hastaların profilleri, başvuru nedenleri ve mortalite oranlarının belirlenmesi amaçlanmıştır. Yoğun bakım yatışların maliyetlerinin yüksek olduğunu dikkate alındığında, bu verilerin yaşlı hastaların sağlık politakasını belirlemede önemli olabileceğini düşünmekteyiz.

***Gereç ve Yöntem:*** Bu retrospektif çalışma, acil servisten yoğun bakım ünitelerine kabul edilen yaşlı hastalarda yapıldı. Hastaların yaşı, cinsiyeti, kronik hastalıkları, başvuru tarihleri, ve mortalite oranları kaydedildi.

***Bulgular:*** Yaşlı hastaların yaş ortalaması 76.19 yıldı ve %53.4'ü erkekti. Bunların %70.3'ünde bir veya daha fazla kronik hastalık vardı. En sık görülen kronik hastalık hipertansiyondu. En sık başvuru nedeni kardiyovasküler hastalıklardı. Myokardiyal infaktüs sıklığı hem erkek hem de kadın hastalarda yüksekti. Hastalar sıklıkla koroner yoğun bakım ünitesine kabul edildi. Yoğun bakım ünitesine başvuru sıklıkla kış aylarındaydı. Mortalite oranı %14.75'di.

***Sonuç:*** Yaşlı nüfusun artışı ile birlikte, yaşlı hastaların yoğun bakım ünitelerini kullanım oranı her geçen gün artmaktadır. Yaşlı hastaların yoğun bakım maliyetleri ve mortalite oranları çok daha yüksektir. Tüm bunlar dikkate alındığında, yaşlı hastaların yoğun bakım ünitesine kabul nedenleri ve mortalite oranlarının belirlenmesi, bu hastaların tanı ve tedavi yaklaşımlarına ve sağlık politikalarının belirlenmesine rehberlik sağlayacaktır.

***Anahtar sözcükler:*** Yaşlı; Hasta; Yoğun bakım ünitesi; Mortalite; Acil servis

## INTRODUCTION

Old age and the ageing process, which are important in developed countries, have been gaining increasing importance in developing countries, such as Turkey (1). The elderly population is gradually increasing worldwide because of the increasing life expectancy and decreasing birth rate. According to data of 2016, 8.7% of the total world population is elderly (≥65 years old). In Turkey, according to data of the Turkey Statistics Institute reported in 2016, the number of elderly has increased by 17.1% in the last 5 years, and the proportion of the elderly has reached to 8.3% of the population by the end of 2016 (2). Consistent with this increase in the elderly population, the rate of admission of elderly patients to hospitals, particularly to emergency departments (EDs) and intensive care units (ICUs), is also gradually increasing (3-7). Admission rates of elderly patients are variable in different countries, cities and regions (4). In addition, the admission rates of elderly patients to EDs vary according to the population and socioeconomic status of the elderly in the city; location and total number of hospitals in the city and characteristics of the hospital, such as bed capacity (5,8). According to a study by Strange *et al.*, in a total of 70 hospitals in 25 states, elderly patients are 5.6 times more likely to be admitted to the hospital than younger patients and almost 15% of the patients admitted to EDs are elderly (9). As reported in the literature, the admission rates of elderly patients to EDs vary from 9% to 19% (3,9). Elderly patients are more likely to suffer from chronic diseases, multiple drug usage and more complex symptoms (7); they require more laboratory tests to confirm their diagnosis and longer stays in hospital and ICUs than non-elderly patients (10).

It has been observed that elderly patients are admitted to ICUs 2.5–4.6 times more frequently than younger patients (5). Approximately half of the patients admitted to ICUs in the United States are reported to be elderly (11).

In this study, it was aimed to determine profiles, admission causes and mortality rates of geriatric patients who were admitted from EDs to ICUs. Because the ICU hospitalisation cost of geriatric patients' is much higher, having information on their admission causes to ICUs and mortality rates can be of significant guidance when determining health policies.

## MATERIALS AND METHOD

This was a retrospective observational study of ≥65-year-old patients who were admitted from EDs to ICUs of the University of Health Sciences Antalya Education and Research Hospital between 1 January and 31 December 2015. The study was approved by the ethics committee of the hospital (76/15). Patients' age, sex, chronic illnesses, date of admission to EDs (day, season and year), causes of hospitalisation, ICU type (coronary, reanimation, neurology, etc.) and mortality rates in ICUs were recorded. In patients with recurrent ICU admission, the first admission of the patient was considered for analysis. Hospitalisation causes for admission of patients to ICUs were grouped according to ICD 10 codes in the 'SARUS' hospital information system used in our hospital. In this study, the seasons were defined as follows: spring: 1st March–31st May, summer: 1st June–31st August, autumn: 1st September–30th November and winter: 1st December–28th February.

Obtained data were analysed using Statistical Package for Social Sciences for Windows 23.0. Descriptive data are summarised in frequency (*n*), percentage (%) and mean±standard deviation. Continuous and categorical variables were compared using the chi-square test. p values of $<0.05$ were accepted as statistically significant.

## RESULTS

Between 1 January 2015 and 31 December 2015, 1.200 elderly patients were admitted from EDs to ICUs. The mean age of these patients was 76.19±7.4 (65–104) years, and 53.4% of them were males.

Further, 70.3% of the elderly patients had ≥1 chronic disease. Regardless of the chronic disease association, the six most frequent chronic diseases in elderly patients were hypertension (HT) (44.8%), coronary artery disease (CAD) (43.2%), hyperlipidaemia (31.1%), congestive heart failure (12.3%), diabetes mellitus (DM) (10.3%) and chronic obstructive pulmonary disease (COPD) (4.4%). The most common cause of admission to ICUs was myocardial infarction.

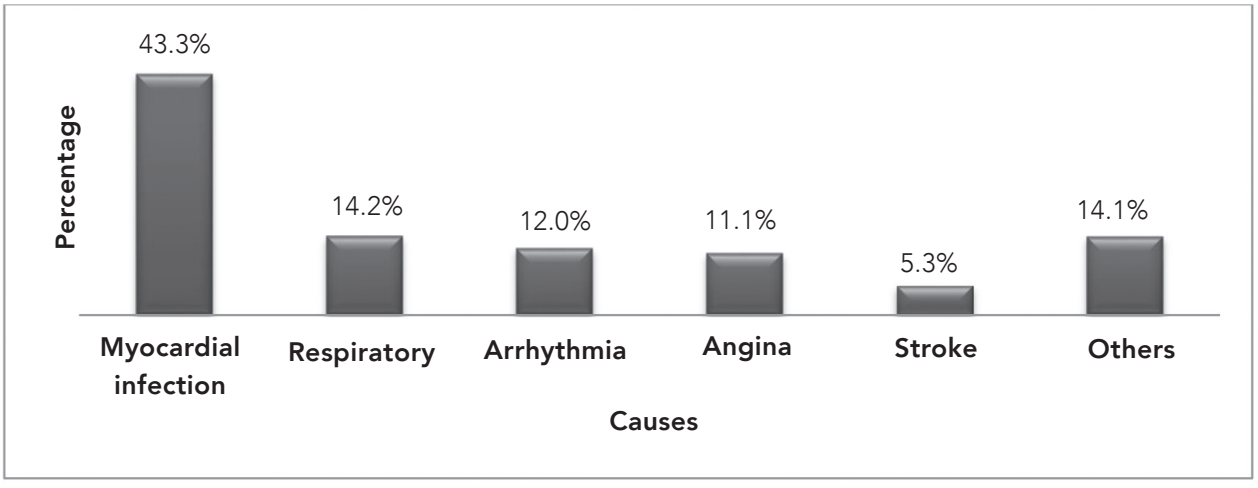


**Figure 1.** Causes of ICU hospitalisation.

The distribution of patients according to ICU admission causes is shown in Figure 1. When admission causes were analysed by gender, myocardial infarction was found to be the most frequent cause in male and female patients. The second most frequent cause was respiratory system disorders in males and arrhythmia in females ($p<0.05$).

When ICU admissions of elderly patients were evaluated in terms of the ICU type, the most frequent admission was in the coronary ICU (74.3%). The rates of patients admitted to each ICU type are shown in Figure 2.

ICU admissions were most frequently noted during winter (Figure 3). However, no statistically significant difference was observed between seasons and admission causes ($p>0.05$).

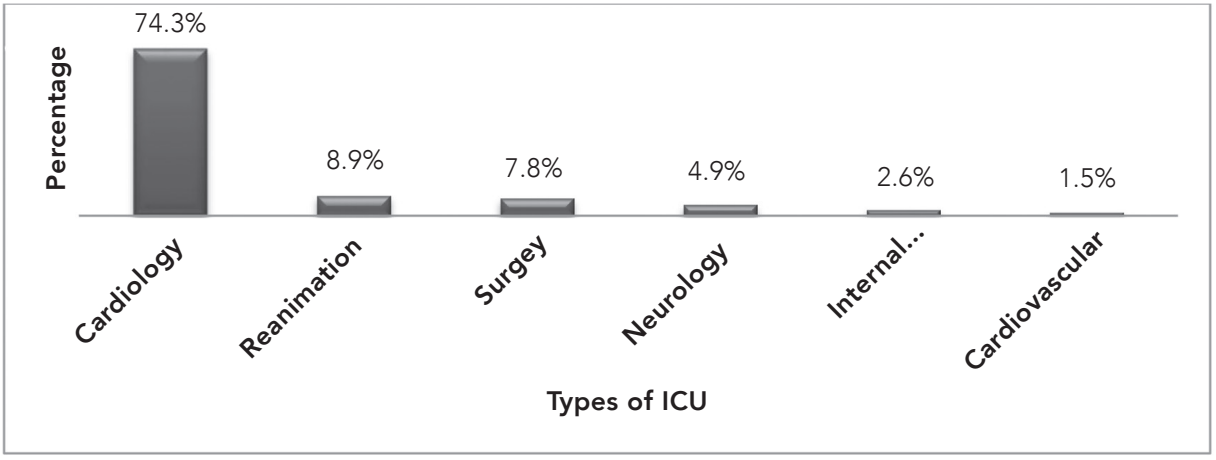


**Figure 2.** Admission rates of elderly patients from EDs to ICUs.

The most frequent admission causes to each ICU department were determined to be myocardial infarction to cardiology ICU, respiratory problems to reanimation and surgery ICUs, stroke to neurology ICU, other causes (such as gastric bleeding and electrolyte imbalance) to internal medicine ICU and aortic dissection to cardiovascular surgery ICU. The mortality rate in the ICU of the patients admitted from ED to ICU was 14.75%.

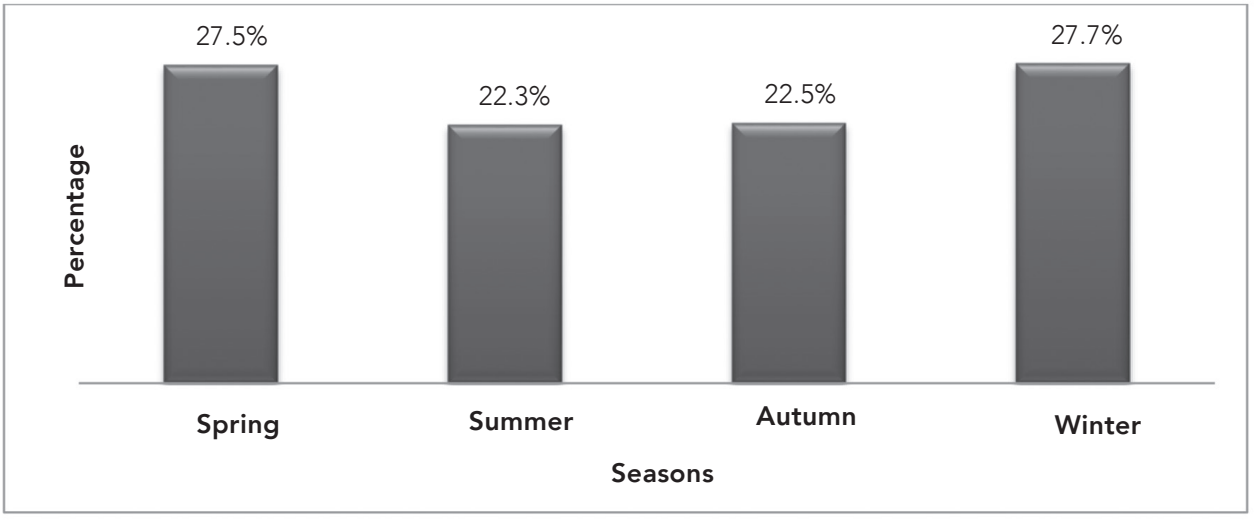


**Figure 3.** Seasonal changes in the admission rates of elderly patients.

## DISCUSSION

The elderly population requires more intensive care than the younger population because of physiological changes and chronic diseases that occur because of ageing (5). Ozdemir *et al*. evaluated the chronic disease prevalence and risk factors in the elderly and found that 78% of elderly patients (≥65 years old) have at least one chronic disease (12).

It is suggested that 90% of the elderly have at least one chronic disease, 35% have two chronic diseases 23% have three chronic diseases and 15% have ≥4 diseases (4). Consistent with these findings, we found that 70.3% of the elderly patients who were admitted from EDs to ICUs had at least one chronic disease, and regardless of the coexistence of chronic diseases, the most frequent chronic disease was cardiovascular disease, particularly HT. In a similar study, Laloglu *et al*. found that cardiovascular diseases, particularly HT and CAD, are the most frequently observed diseases in elderly patients, followed by DM and respiratory diseases, such as asthma/COPD (4). Consistent with our findings, one study conducted in Italy reported that HT and cardiovascular diseases are the most frequently occurring diseases in the geriatric population, but contrary to our findings, it also reported that anaemia and cerebrovascular diseases were the second and third most frequent diseases, respectively (13). Taymaz *et al*. showed that an average of 2.95±1.82 comorbidities occurred in elderly patients, and their evaluation revealed that cardiovascular diseases, particularly HT, were most commonly observed, followed by DM and respiratory diseases; this was consistent with our findings (14). According to the findings of the Turkish Hypertension Prevalence study in 2003, the prevalence of HT increases with age and reaches 70%–80% at ≥60 years of age (15).

Admission rates of elderly patients from EDs to ICUs may vary seasonally between countries, cities and even regions. A study evaluating the seasonal variations in admissions to EDs in Mersin, Turkey, found that the admission rates increased during summer (16). Another study conducted in Adana showed that admission rates to EDs increased during winter (8). Baz *et al*. found that the highest rate of admission in Mardin was during autumn (17). Literature states that hospital admissions of patients with cardiovascular diseases show seasonal variation (18). In the study by Satar *et al*., heart failure was more frequently observed during spring than during other seasons, whereas respiratory diseases were more frequent during winter (8). Another study found that respiratory system disorders and acute bronchitis were more frequent during winter and stroke was more frequent during autumn (17). In our study, although elderly patients were more likely to be admitted to ICUs than younger patients, significant seasonal changes were not observed. This may be due to different socio-cultural structures and locations of the hospitals. Our hospital serves as a reference hospital in the centre of Antalya.

In our study, 53.4% of the elderly patients who were admitted from EDs to ICUs were males. Conversely, literature states that the proportion of females in the population and their life expectancy are higher, which also results in higher admission rates for elderly females (3,17). However, considering that cardiovascular diseases, particularly ischaemic heart disease and heart failure, and hospitalisation because of cardiovascular diseases are more prevalent in males (19), the admission rates to ICUs may be higher in males than in females. In a study investigating intensive care experiences of elderly patients, more than half of the patients were males (6).

Many studies have been conducted on the causes of admission of elderly patients to EDs. Elderly patients were admitted most frequently because of HT and cardiac and pulmonary diseases in the study by Unsal *et al*. (3); because of stroke in the study by Satar *et al*. (8); because of metabolic/systemic diseases and cardiovascular and cerebrovascular problems in the study by Kekec *et al*. (20); because of cardiac problems, such as chest pain, HT and acute coronary syndrome, in the

study by Mert *et al*. (16); because of cardiovascular problems in the study by Baz *et al*. (17) and because of cardiovascular and respiratory problems in the study by Akpinar *et al*. (21). In our study, elderly patients were most frequently admitted because of cardiovascular diseases.

Differences among the studies may be due to different socio-cultural structures which each hospital serves, locations of the hospitals and characteristics of the hospital. Unlike other studies, in our study, causes of admission from EDs to ICUs were considered. In the study of Yu *et al*. on ICU uses and mortalities in the elderly, patients with cardiac diagnoses, such as congestive heart failure, myocardial infarction, angina pectoris and arrhythmia, were found to be frequently admitted to ICU (22). Most patients admitted to EDs and those hospitalised are most frequently followed up in a clinic. Depending on the severity of the underlying disease, only a small proportion of patients are admitted to ICUs after ED admission. Literature states that elderly patients are hospitalised 2.5–4.6 times more frequently and are admitted to ICUs 5.5 times more frequently than younger patients (9), indicating that elderly patients have higher admission rates to ICUs than younger patients (5). Laloglu *et al*. found that elderly patients who were admitted to the ED had a hospitalisation rate of 21.1% and that only 34.6% of them were subsequently admitted to the ICU (4). In one study, Kekec *et al*. found that the hospitalisation rate of elderly patients in the ED was 61.1% and that 38.1% of them were transferred to the ICU (20). In a study by Baz *et al*., the hospitalisation rate of elderly patients was 11.5%; 13.6% of these patients were monitored in the ICU (17). Further, the hospitalisation rate of elderly patients was 59.35% in a study by Satar *et al*.; 70.4% of these patients were admitted to the ICU (8). When considering the fact that the incidence of chronic diseases increased with age, cardiovascular and respiratory problems are more frequent and fatal in elderly patients and hospitalisation rates and durations are higher in elderly patients than in younger patients (14), we believed that elderly patients are more frequently admitted to ICUs with cardiovascular problems, such as MI; arrhythmia and respiratory problems, such as COPD.

The mortality rate of elderly patients is higher due to the severity of the underlying diseases (1). In our study, the mortality rate was 14.75% in elderly patients admitted from EDs to ICUs, and cardiac problems were the most frequent causes of mortality. In the study by Baz *et al*., the highest mortality rate was observed for elderly patients hospitalised to ICUs, and the most frequent causes of mortality were cardiac problems (17).

For patients aged between 18 and 70 years in the ICU, on an average, there is a 1% increase in the mortality for all patients. For those aged >70 years, the rate of increase in the mortality becomes 2% for all patients. The 6-month expected mortality rate is 44% for 55-year-old patients, 48% for 65-year-old patients, 53% for 75-year-old patients and 60% for 85-year-old patients (23). According to the study by Topeli *et al*., the hospital mortality rate of >65-year-old patients was much higher than that of <65-year-old patients (from 54.9% to 35.4%; $p<0.01$). This hospital mortality rate also continues to be high after the hospital term for the same age group (24).

Our study has some limitations. Our study was based on retrospective file scanning, involved a single centre and evaluated only the first admission of the elderly patients. Because the number of admissions and causes of hospitalisation may vary according to the characteristics of hospitals, seasons and regions, it is not possible to generalise our results.

In our study, we found that cardiac diseases were the most frequent admission and mortality causes in elderly patients who were admitted from EDs to ICUs. We also observed that elderly patients were most frequently admitted to the cardiology ICU. Chronic diseases in elderly patients, health spending and the problems faced in ICUs will provide opportunities for more rational use of

medical policies, which also includes end-of-life decisions and palliative treatment. We believe that the health policies of elderly patients should be re-determined based on this and similar study results.

**Conflict of interest**

The authors have no conflict of interest to declare.

## REFERENCES

1. Akpinar O, Turkdogan KA, Kapci M, Duman A. Use of emergency department by geriatric patients. J Clin Anal Med 2015;6:310-4.
2. Altun B, Arici M, Nergizoglu G, et al. Prevalence, awareness, treatment and control of hypertension in Turkey (the PatenT study) in 2003. J Hypertens 2005;23(10):1817-23. (PMID:16148604).
3. Baz U, Satar S, Kozaci N, Acikalin A, Gulen M, Karakurt U. Geriatric patient admissions to emergency service. JAEM 2014;13:53-7.
4. Demircan A, Bikmaz SGA, Kadi G, et al. Evaluation of the general characteristics of patients aged 85 years and above admitted to a university hospital emergency department. Turk J Med Sci 2017;47:1393-402. (PMID:29151309).
5. Hamel MB, Davis RB, Teno JM, et al. Older age, aggressiveness of care and survival for seriously ill, hospitalized adults. Ann Intern Med 1999;131(10):721-8. (PMID:10577294)
6. İsezuo SA. Seasonal variation in hospitalisation for hypertension related morbidities in Skoto, north-western Nigeria. Int J Circumpolar Health 2003;62(4):397-409. (PMID:14964766).
7. Kekec Z, Koc F, Buyuk S. Review of geriatric patients hospitalization in emergency department. JAEM 2009;8(3):21-4.
8. Laloglu A, Ayrik C, Kose A, et al. Analysis of non-traumatic elderly patient presentations to the emergency department. Tr J Emerg Med 2013;13(4):171-9.
9. Marengoni A. Patterns of chronic multimorbidity in the elderly population. J Am Geriatr Soc 2009;57:225-30. (PMID:19207138).
10. Mert E. Use of emergency departments by elderly patients. Turk J Geriatrics 2006;9(2):70-4. (in Turkish).
11. Ozdemir L, Koçoglu G, Sumer H, et al. Frequency of some chronic diseases and risk factors among the elderly people in Sivas, Turkey. Cumhuriyet Med J 2005;27:89-94.
12. Ozşaker E, Alcan OA, Korkmaz DF. Investigation of intensive care experiences of the elderly patients. Turk J Geriatrics 2013;16(4):408-13.
13. Republic of Turkey Ministry of Health. Turkish Public Health Institution. Turkey healthy ageing action plan and implementation program 2015-2020. [Internet] Available from: http://www.nationalplanningcycles.org/sites/default/files/planning_cycle_repository/turkey/turkey_health_ageing_action_plan_and_implementation_program_2015-2020.pdf. Accessed: 01.07.2018.
14. Samaras N, Chevalley T, Samaras D, Gold G. Older patients in the emergency department: a review. Ann Emerg Med 2010;56:261-9. (PMID:20619500).
15. Satar S, Sebe A, Avci A, Karakus A, İcme F. Emergency department and the elderly patient. Cukurova Med J 2004;29:43-50.
16. Strange GR, Chen EH, Sanders AB. Use of emergency departments by elder patients: Projections from a multicenter data base. Ann Emerg Med 1992;21:819-24. (PMID:1610039).
17. Taymaz T. Examination of geriatric patients hospitalised from the emergency department. Journal of Academic Geriatrics 2010;2(3):167-75. (in Turkish).
18. Topeli A. Elderly patient in the intensive care unit. Turk J Geriatrics 2000;3(4):151-4. (in Turkish).
19. Topeli A. The outcome of the geriatric patients in the ICU. Crit Care 2005;5(1):P249.
20. Turkish Statistical Institute. Elderly statistics, 2016. [Internet] Available from: http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=24644. Accessed: 01.07.2018.
21. Ulger Z, Cankurtaran M. Elderly patient in intensive care units. Turkish J Int Care Med 2006;6(2):94-100.
22. Unsal A, Cevik AA, Metintas S, Arslantas D, İnan OÇ. Emergency department visits by elder patients. Turk J Geriatrics 2003;6(3):83-8. (in Turkish).
23. Ye F, Piver WT, Ando M, Portier CJ. Effects of temperature and air pollutants on cardiovascular and respiratory diseases for males and females older than 65 years of age in Tokyo, July and August 1980-1995. Environ Health Perspect 2001;109:355-9. (PMID:11335183).
24. Yu W, Ash AS, Levinsky NG, Moskowitz MA. Intensive care unit and mortality in the elderly. J Gen Intern Med 2000;15:97-102. (PMID:10672112).

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RESEARCH

# ACCURACY AND PERFORMANCE ASSESSMENT OF APACHE IV AND SAPS 3 IN GERIATRIC PATIENTS ADMITTED TO THE INTENSIVE CARE UNIT

## Abstract

***Introduction:*** As the world's population is ageing, accurate prognostic prediction in critically ill elderly patients is becoming increasingly important. We aimed to assess the performance of the Acute Physiology and Chronic Health Evaluation IV and Simplified Acute Physiology Score 3 scores in predicting outcome in elderly patients admitted to the intensive care unit.

***Materials and Method:*** In this study, we retrospectively evaluated the patients over 65 years who were followed in the intensive care unit between 2016 and 2018. Acute Physiology and Chronic Health Evaluation IV, Simplified Acute Physiology Score 3 and predicted mortality rate were calculated using a web-based calculator and the predictive mortality performance of these scores were evaluated.

***Results:*** Total mortality was 37% (n=74). Mean Acute Physiology and Chronic Health Evaluation IV and Simplified Acute Physiology Score 3 scores were 87.73±41.24 and 54.87±25.44, respectively. Mean predicted mortality rate according to Acute Physiology and Chronic Health Evaluation IV and Simplified Acute Physiology Score 3 was 41.82±32.76 and 34.60±34.57, respectively. The area under the curve was 0.89 for Acute Physiology and Chronic Health Evaluation IV and 0.91 for Simplified Acute Physiology Score 3. The Hosmer–Lemeshow statistics showed poor calibration for Simplified Acute Physiology Score 3 ($p<0.01$) and strong calibration for Acute Physiology and Chronic Health Evaluation IV ($p> 0.05$).

***Conclusion:*** Simplified Acute Physiology Score 3 had better performance in predicting mortality than The Acute Physiology and Chronic Health Evaluation IV in the elderly population.

***Keywords:*** APACHE; Simplified Acute Physiology Score; Critical Care; Mortality

ARAŞTIRMA

# YOĞUN BAKIM ÜNİTESİNE BAŞVURAN GERİATRİK HASTALARDA APACHE IV VE SAPS 3'ÜN DOĞRULUK VE PERFORMANS DEĞERLENDİRMESİ

## Öz

***Giriş:*** Dünya populasyonu yaşlandıkça, yoğun bakımdaki yaşlı hastalarda prognozun doğruluğunu tahmin etmek daha önemli hale gelmektedir. Bu çalışmadaki amacımız, Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi IV ve Basitleştirilmiş Akut Fizyoloji Skoru 3 performansının, yoğun bakım ünitesine yatırılan yaşlı hastalarda sonuçları tahmin etmedeki performansını değerlendirmektir.

***Gereç ve Yöntem:*** Bu çalışmada 2016-2018 yılları arasında yoğun bakım ünitesinde takip edilen 65 yaş üstü hastalar retrospektif olarak inceledi. Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi IV, Basitleştirilmiş Akut Fizyoloji Skoru 3 ve tahmini mortalite oranı web tabanlı bir hesap makinesi kullanılarak hesaplanıp, bu skorların mortaliteyi öngörme performansı değerlendirildi.

***Bulgular:*** Toplam mortalite %37'dir (s=74). Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi IV ve Basitleştirilmiş Akut Fizyoloji Skoru 3 puan ortalaması sırasıyla 87.73±41.24 ve 54.87±25.44 idi. Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi IV ve Basitleştirilmiş Akut Fizyoloji Skoru 3'e göre ortalama tahmini mortalite oranı sırasıyla 41.82±32.76 ve 34.60±34.57 idi. Eğri altındaki alan Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi IV için 0.89 ve Basitleştirilmiş Akut Fizyoloji Skoru 3 için 0.91 idi. Hosmer – Lemeshow istatistikleri ve Basitleştirilmiş Akut Fizyoloji Skoru 3 için zayıf kalibrasyon gösterirken ($p<0.01$) Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi IV için güçlü kalibrasyon gösterdi ($p>0.05$).

***Sonuç:*** Basitleştirilmiş Akut Fizyoloji Skoru 3 yaşlı popülasyonda Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi IV'e göre mortaliteyi tahmin etmede daha iyi bir performansa sahiptir.

***Anahtar sözcükler:*** Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi; Basitleştirilmiş Akut Fizyoloji Skoru 3; Kritik bakım; Mortalite

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## INTRODUCTION

In clinical practice, age is a major barrier to standards of the intensive care unit (ICU). When admitted to ICU, old and very old patients often do not receive adequate diagnostic workup and treatment compared with younger patients. A study on triage decisions in European countries demonstrated that in the fact that elderly patients have more intensive care unit rejections than younger patients and have a higher mortality when admitted, the mortality rate appears reduced for the elderly (1).

The course of management in ICU in addition to the diagnosis and treatment offered must include a prognosis for mortality beginning at admission and during the stay in ICU.

As the world's population is ageing, accurate prognostic prediction in critically ill elderly patients is becoming increasingly important. Several scoring systems have been developed for critically ill patients. Acute Physiology and Chronic Health Evaluation (APACHE) scores and Simplified Acute Physiology Score (SAPS) models are widely used for assessing severity of illness and predicting outcome in critically ill patients. The recent ICU scoring systems SAPS 3 and APACHE IV are powerful revised models (2).

The objective of this study was to assess the performance of APACHE IV and SAPS 3 scores in predicting outcome in a small heterogeneous population of elderly patients admitted to ICU.

## MATERIALS AND METHOD

The study was approved by the Mugla Sıtkı Kocman University Medical Faculty institutional review board, and informed consent was obtained from the patients. This retrospective study was conducted in ICU of a 600-bed university teaching hospital. ICU, which had 10 beds, was managed by a closed system. Data from patients aged >65 years old and admitted to ICU between 2016 and 2018 were retrospectively evaluated. Data were collected on patients' age, sex, length of stay in ICU, ICU admission, and outcome. APACHE IV scores were obtained from the worst laboratory findings obtained within 24 h after admission, and SAPS 3 scores were obtained from worst laboratory findings obtained within 1 h after admission. APACHE IV and SAPS 3 scores were calculated using a web-based calculator "http://intensivecarenetwork.com/Calculators/Files/APACHE4.html" and "http://intensivecarenetwork.com/Calculators/Files/SAPS3.html," respectively. Predicted mortality rate (PMR) was calculated using the same web-based calculators. Patients aged <65 years, re-admitted to ICU, with burns, and with insufficient data were excluded. We also excluded patients with an ICU stay<24 h or hospital stay>365 days.

### Statistical analysis

The Number Cruncher Statistical System (NCSS) 2007 program (Kaysville, UT, USA) was used for statistical analysis. After evaluation of distribution with Shapiro-Wilk test, normally distributed data and non-normally data according to Shapiro-Wilk test were analyzed with independent t test and the Mann-Whitney U test respectively. Normally distributed data were detailed with mean (SD) and not normally distributed data with median [IQR]. A $p$ value <0.05 was considered statistically significant.

Assessment of the overall accuracy of mortality predictions was performed using the standardized mortality ratio (SMR), and calibration was assessed by the Hosmer–Lemeshow goodness-of-fit C statistic. Discrimination was evaluated using receiver operating characteristic

curves based on calculation of the area under the curve (AUC).

## RESULTS

The study was conducted among 200 geriatric patients who were admitted to ICU between January 2016 and February 2018. Of the 200 patients, 24.5% (*n*=49) were female and 75.5% (*n*=151) were male. The mean age was 75.22±7.35 years. Comorbidities were detected in 89.5% patients (*n*=179). Among the patients with comorbidities, 59.0% (*n*=118) had hypertension, 35.0% (*n*=70) had diabetes mellitus, 15.5% had chronic obstructive pulmonary disease, 16.5% (*n*=33) had coronary artery disease and KAH, and 22.5% (*n*=45) had other diseases. One hundred twenty patients (60%) were admitted to ICU from the operating theater, 52 patients (26%) from the emergency department, and 28 patients (14%) from the wards. Among the 120 postoperative patients, 38.5% (*n*=77) had undergone emergency surgery and 21.5% (*n*=43) had undergone elective surgery. Total mortality rate was 37% (*n*=74) WW(Table 1).

The mean APACHE IV and SAPS 3 scores were 87.73±41.24 and 54.87±25.44, respectively. The mean PMR was 41.82±32.76 according to APACHE IV and 34.60±34.57 according to SAPS 3 (Table 2).

Table 3 shows actual mortality and predicted mortality from the scoring systems. Mortality was correctly predicted with the SAPS 3 model.

The SAPS 3 and APACHE IV scores were significantly higher in patients who died ($p<0.001$). Predicted mortality rate according to SAPS 3 and APACHE IV scores was also significantly higher in patients who died ($p<0.001$).

Standardized mortality rate was 0.900 (95% CI, 0.713–1.127) according to APACHE IV scores and 1.042 (95% CI, 0.824–1.301) according to SAPS 3 scores. The Hosmer–Lemeshow statistic showed poor calibration for SAPS 3 ($p<0.01$) but strong calibration for APACHE IV ($p>0.05$) (Table 4).

There was a statistically significant difference between SAPS 3 and APACHE IV scores according to mortality ($p<0.001$). We, therefore, decided to calculate cut-off points for APACHE IV and SAPS 3 scores according to mortality by receiver operating characteristic analysis and diagnostic scanning tests. Results for APACHE IV score were cut-off point of 101, sensitivity of 86.49%, specificity of 80.95%, positive predictive value of 72.73, and negative predictive value of 91.07. Results for SAPS 3 score were cut-off point of 53, sensitivity of 89.19%, specificity of 76.19%, positive predictive value of 68.75, and negative predictive value of 92.31 (Table 5).

Area under curve was 88.7% with 2.4% standard deviation for APACHE IV and 90.7% with 2% standard deviation for SAPS 3.

The predicted level of mortality for SAPS 3 scores was higher than that for APACHE IV score, but the difference was not statistically significant ($p=0.280$ and $p>0.05$, respectively).

**Table 1.** Patient demographics and characteristics.

| **Descriptive characteristics** | | **n (%)** |
|---|---|---|
| Age (year) | Min–Max (Median) | 65–92 (75) |
| | Mean±SD | 75.22±7.35 |
| Gender | Female | 49 (24.5) |
| | Male | 151 (75.5) |
| Main comorbidities* | No | 21 (10.5) |
| | Yes | 179 (89.5) |
| | HT | 118 (59.0) |
| | DM | 70 (35.0) |
| | COPD | 31 (15.5) |
| | CAD | 33 (16.5) |
| | Other | 45 (22.5) |
| Route of admission | Emergency room | 52 (26.0) |
| | OR/recovery room | 120 (60.0) |
| | Ward | 28 (14.0) |
| Admission type | No surgery | 80 (40.0) |
| | Emergency surgery | 77 (38.5) |
| | Elective surgery | 43 (21.5) |
| Length of stay at ICU | Min–Max (Median) | 1–78 (4) |
| | Mean±sd | 7.88±13.92 |
| Patient prognosis | Transferred to ward | 126 (63.0) |
| | Exitus | 74 (37.0) |

*Multiple additional disease choices have been made
HT: Hypertension, DM: Diabetes Mellitus, COPD: Chronic Obstructive Pulmonary Disease, CAD: Coronary Artery Disease, OR: Operating Room

**Table 2.** Distribution according to APACHE IV scores and SAPS 3.

| | **Min–Max (Median)** | **Mean±sd** |
|---|---|---|
| APACHE IV | 21–173 (77) | 87.73±41.24 |
| APACHE IV PMR | 0.7–94.1 (35.6) | 41.82±32.76 |
| APACHE IV LOS | 0.9–12.3 (7.3) | 7.44±2.34 |
| SAPS 3 | 13–92 (51) | 54.87±25.44 |
| SAPS 3 PMR | 0–86 (17) | 34.60±34.57 |

APACHE: Acute Physiology and Chronic Health Evaluation, SAPS: Simplified Acute Physiology Score, PMR: Predicted Mortality Rate, LOS: Length of stay

**Table 3.** ICU mortalities predicted by the two models.

| Models | Actual Mortality | Predicted Mortality |
|---|---|---|
| APACHE IV | 0.37 | 0.42 |
| SAPS 3 | 0.37 | 0.35 |
| APACHE: Acute Physiology and Chronic Health Evaluation, SAPS: Simplified Acute Physiology Score | | |

**Table 4.** Hosmer–Lemeshow statistic results for APACHE IV and SAPS 3 according to mortality.

| | H-L statistics | p | SMR (95% CI) |
|---|---|---|---|
| **APACHE IV** | 7.981 | **0.334** | 0.900 (0.713–1.127) |
| **SAPS 3** | 25.254 | **0.001**** | 1.042 (0.824–1.301) |
| APACHE: Acute Physiology and Chronic Health Evaluation, SAPS: Simplified Acute Physiology Score, SMR: Standardized mortality rate | | | |

**Table 5.** Diagnostic scanning tests and receiver operating characteristic curve results for APACHE IV scores and SAPS 3.

| | Diagnostic Scan | | | | | ROC Curve | | p |
|---|---|---|---|---|---|---|---|---|
| | Cut-off | Sensitivity | Specifity | Positive Predictive Value | Negative Predictive Value | Area | 95% Confidence Interval | |
| **APACHE IV** | **≥101** | 86.49 | 80.95 | 72.73 | 91.07 | **0.887** | 0.839–0.935 | **<0.001**** |
| **SAPS 3** | **≥53** | 89.19 | 76.19 | 68.75 | 92.31 | **0.907** | 0.867–0.946 | **<0.001**** |
| APACHE: Acute Physiology and Chronic Health Evaluation, SAPS: Simplified Acute Physiology Score | | | | | | | | |

## DISCUSSION

Our study demonstrated that the APACHE IV model showed strong calibration whereas the SAPS 3 model showed poor calibration. Both models showed good discrimination. The APACHE IV model overestimated the observed mortality rate.

Results for the SAPS 3 model in our study were not totally unanticipated as many studies have reported results similar to those of as our study (3–5). Nassar et al. determined the performance of APACHE IV, SAPS 3, and Mortality Probability Model III (MPM0-III) in patients at three medical surgical ICUs in Brazil. In their study, all three models had poor calibration but very good discrimination (3). Although we found the same results, the patients were completely different from that in the study by Nassar et al. in which the three diagnostic models were assessed. Our study population mainly comprised surgical patients. Sixty percent were surgical patients admitted to ICU after

a surgery, and an additional 21.5% were patients undergoing elective surgery. Although postsurgical patients were generally at low risk, they admitted to ICU because of the absence of post anesthesia care unit in our hospital.

External validation is crucial for achieving definite evaluation of these prognostic models (6). To the best of our knowledge, this is the first study to validate the APACHE IV model and compare it with the SAPS 3 model among geriatric patients in ICU in Turkey. In a Dutch study, the APACHE IV model showed very good discrimination (AUC, 0.87) but poor calibration (Hosmer–Lemeshow statistic, 822.67) (7); in a US study, APACHE IV again showed very good discrimination (AUC, 0.86) (8). Our results are consistent with those of studies showing good discriminatory power of the APACHE IV model (AUC, 0.88). However, in our study, the APACHE IV model showed strong calibration (Hosmer–Lemeshow statistic, 7.981). The main goal in applying a scoring system at admission to ICU is to predict mortality of the patient and determine management; hence, it is always required to calibrate the scoring system before generating it conventional (9). Thus, strong calibration of the APACHE IV score in our study makes this score acceptable for geriatric patients admitted in our ICU.

The SAPS 3 admission score is based on records obtained within the 1st h after acceptance of a geriatric patient to ICU (2). Almost half of the predictive power of original SAPS 3 was generated by gathering trauma patients' data prior admission to ICU. Scores recorded after the first 24 h following ICU admission reflected standard care rather than actual clinical status. Because of this major advantage of SAPS 3, the predicted level of mortality of SAPS 3 was higher than that of APACHE IV scores. We observed a poor calibration for SAPS 3 (Hosmer–Lemeshow statistic, 25.254), whereas discrimination was very good (AUC, 0.91). This model was globally evaluated in ICUs; results showed poor calibration but good discrimination (10–14). These results can be explained by the higher proportion of surgical patients with worsened medical conditions. It is important to remember that surgical patients have different physiological and functional characteristics from medical patients and these may influence the prognosis (15).

Keegan et al. concluded from their study that the APACHE IV model had better discriminatory capability than the SAPS 3 model (8). On the other hand, studies in patients with acute kidney injury and acute coronary artery syndrome showed that the two models had similar discriminatory performance (10,16). Poor model calibration can also be correlated with a higher proportion of patients who are at low risk (17). These differences can be explained by discrepancies in study populations and territorial variation in do not resuscitate decisions.

Although the SAPS 3 model has better discriminative power and a tendency to estimate mortality more accurately, its lack in calibration makes it less suitable than the APACHE IV model. Aggarwal et al. suggested that lack of acceptable calibration, regardless of good discrimination power, should result in rejection of a scoring system (18).

The results of our survey should be carefully interpreted because of present limitations. Our study was conducted at a single-center, mixed surgical and medical ICU, which limits the capacity of our results to be generalized to other ICUs. Another limitation is associated with its retrospective design. Furthermore, customization might have supplied a better calibration for the SAPS 3 model, but we decided not to try this path because our objective was to evaluate original scores.

In conclusion, our study showed that APACHE IV and SAPS 3 models had very good discriminative power for predicting mortality in geriatric patients admitted to ICU. Although the SAPS 3 model had poor calibration, it had better performance in predicting mortality than the APACHE IV model.

## REFERENCES

1. Sprung CL, Artigas A, Kesecioglu J, et al. The Eldicus prospective, observational study of triage decision making in European intensive care units. Part II: intensive care benefit for the elderly. Crit Care Med 2012;40(1):132-8. (PMID:22001580).
2. Vincent JL, Moreno R. Clinical review: scoring systems in the critically ill. Critical Care 2010;14(2):207-9. (PMID:20392287).
3. Nassar AP Jr, Mocelin AO, Nunes ALB, et al. Caution when using prognostic models: A prospective comparison of 3 recent prognostic models. J Crit Care. 2012;27(4):423.e1-7. (PMID:22033059).
4. Beck DH, Smith GB, Pappachan JV, Millar B. External validation of the SAPS II, APACHE II and APACHE III prognostic models in South England: A multicentre study. Intensive Care Med 2003;29(2):249-56. (PMID:12536271).
5. Pappachan JV, Millar B, Bennett ED, Smith GB. Comparison of outcome from intensive care admission after adjustment for case mix by the APACHE III prognostic system. Chest 1999;115(3):802-10. (PMID:10084495).
6. Terrin N, Schmid CH, Griffith JL, D'Agostino RB, Selker HP. External validity of predictive models: A comparison of logistic regression, classification trees, and neural networks. J Clin Epidemiol 2003;56(8):721-9. (PMID:12954463).
7. Brinkman S, Bakhshi-Raiez F, Abu-Hanna A, et al. External validation of Acute Physiology and Chronic Health Evaluation IV in Dutch intensive care units and comparison with Acute Physiology and Chronic Health Evaluation II and Simplified Acute Physiology Score II. J Crit Care 2011;26(1):105.e11-8. (PMID:20869840).
8. Keegan MT, Gajic O, Afessa B. Comparison of APACHE III, APACHE IV, SAPS 3, and MPM0III and influence of resuscitation status on model performance. Chest 2012;142(4):851-8. (PMID:22499827).
9. Fadaizadeh L, Tamadon R, Saeedfar K, Jamaati HR. Performance assessment of Acute Physiology and Chronic Health Evaluation II and Simplified Acute Physiology Score II in a referral respiratory intensive care unit in Iran. Acta Anaesthesiol Taiwanica 2012;50(2):59-62. (PMID:22769859).
10. Silva VTCE, De Castro I, Liaño F, et al. Performance of the third-generation models of severity scoring systems (APACHE IV, SAPS 3 and MPM-III) in acute kidney injury critically ill patients. Nephrol Dial Transplant 2011;26(12):3894-901. (PMID:21505093).
11. Soares M, Silva UVA, Teles JMM, et al. Validation of four prognostic scores in patients with cancer admitted to Brazilian intensive care units: results from a prospective multicenter study. Intensive Care Med 2010;36(7):1188-95. (PMID:20221751).
12. Lee H, Shon YJ, Kim H, Paik H, Park HP. Validation of the APACHE IV model and its comparison with the APACHE II, SAPS 3, And Korean SAPS 3 models for the prediction of hospital mortality in a Korean surgical intensive care unit. Korean J Anesthesiol 2014;67(2):115-22. (PMID:25237448).
13. Khwannimit B, Bhurayanontachai R. The performance and customization of SAPS 3 admission score in a Thai medical intensive care unit. Intensive Care Med 2010;36(2):342-6. (PMID:19756506).
14. Sakr Y, Krauss C, Amaral ACKB, et al. Comparison of the performance of SAPS II, SAPS 3, APACHE II, and their customized prognostic models in a surgical intensive care unit. Br J Anaesth 2008;101(6):798-803. (PMID:18845649).
15. Sanchez-Hurtado LA, Angeles-Velez A, Tejeda-Huezo BC, Garcia-Cruz JC, Juarez-Cedillo T. Validation of a prognostic score for mortality in elderly patients admitted to Intensive Care Unit. Indian J Crit Care Med 2016;20(12):695-700. (PMID:28149026).
16. Nassar Junior AP, Mocelin AO, Andrade FM, et al. SAPS 3, APACHE IV or GRACE: Which score to choose for acute coronary syndrome patients in intensive care units? Sao Paulo Med J 2013;131(3):173-8. (PMID:23903266).
17. Beck DH, Smith GB, Taylor BL. The impact of low-risk intensive care unit admissions on mortality probabilities by SAPS II, APACHE II and APACHE III. Anaesthesia 2002;57(1):21-6. (PMID:11843737).
18. Aggarwal AN, Sarkar P, Gupta D, Jindal SK. Performance of standard severity scoring systems for outcome prediction in patients admitted to a respiratory intensive care unit in North India. Respirology 2006;11(2):196-204. (PMID:16548906).

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RESEARCH

# DO THE EFFECTS OF VITAMIN D SUPPLEMENTATION ON MUSCLE STRENGTH DIFFER ACCORDING TO AGE?

## Abstract

***Introduction:*** Vitamin D plays an important role in musculoskeletal health and its use improves muscle strength. However, the effect of vitamin D use on muscle strength in women of different ages is yet to be investigated. Therefore, in this study, we aimed to evaluate the effect of vitamin D use on muscle strength in women of different age groups and determine the differences of muscle strength gain between age groups.

***Materials and Method:*** Sixty-three women with calcidiol levels<30 ng/mL were randomly assigned and stratified by their age group as follows: Group I (aged 40–49 years), Group II (aged 50–59 years) and Group III (aged 60–69 years). Calcidiol levels, body mass index, fat free mass, percent fat, grip strength, arm curl, chair stand and isokinetic concentric flexor and extensor peak torque and power at 60°•s−1 and 180°•s−1 were assessed at baseline and six months after oral cholecalciferol supplementation.

***Results:*** Vitamin D supplementation caused significant improvement in body mass index, arm curl, grip strength and knee flexor and extensor peak torque and power at 60°•s−1 and 180°•s−1 in all groups ($p<0.05$). Knee flexor power at 60°•s−1 and extensor power at 180°•s−1 were significantly higher in group I than in group III ($p<0.025$).

***Conclusion:*** Muscle strength in response to vitamin D supplementation increased in all age groups, and isokinetic muscle power was the highest in the youngest age group studied.

***Keywords:*** Body composition; Muscle strength; Vitamin D; Women

ARAŞTIRMA

# D VİTAMİNİN KULLANIMININ KAS KUVVETİNE ETKİSİ YAŞA GÖRE DEĞİŞİR Mİ?

## Öz

***Giriş:*** D vitamininin muskuloskeletal sağlık için önemli olduğu ve D vitamin kullanımının kas kuvvetini arttırdığı bilinmektedir. Ancak, farklı yaşlardaki kadınlarda, D vitamin kullanımının kas kuvvetine etki farklılığını araştıran çalışma yoktur. Bu nedenle bu çalışmada, farklı yaş gruplarındaki kadınlarda D vitamin kullanımının kas kuvvetine etkisini değerlendirmek ve yaş grupları arasındaki kuvvet değişim farkını belirlemek amaçlanmıştır.

***Gereç ve Yöntem:*** Kalsidiol düzeyi <30ng/ml olan altmış üç kadın rasgele olarak yaş gruplarına göre sınıflandırıldı ve tabakalandı: Grup I (40-49 yaş arasında), Grup II (50-59 yaş arasında), ve Group III (60-69 yaş arasında). Kalsidiol düzeyi, beden kütle indeksi, yağsız kütle, yüzde yağ, kavrama kuvveti, kol bükme, otur kalk testleri ile 600.s-1 and 1800.s-1 hızlarda izokinetik konsantrik fleksör ve ekstensör zirve tork ve güç başlangıçta ve oral kolekalsifereol verildikten altı ay sonra değerlendirildi.

***Bulgular:*** D vitamin kullanımı tüm yaş gruplarında beden kütle indeksi, kol bükme, kavrama kuvveti, 600.s-1 and 1800.s-1 hızlarda diz fleksör ve ekstensör zirve tork ve güçte artışa neden oldu ($p<0.05$). Grup I'de, Grup III'e kıyasla 600.s-1 hızda fleksör güç ve 1800.s-1 hızda ekstensör güç daha büyüktü ($p<0.025$).

***Sonuç:*** D vitamin kullanımı sonucu tüm yaş gruplarında kas kuvveti arttı ve izokinetik kas gücü artışının genç yaş grubunda daha fazla olduğu belirlendi.

***Anahtar sözcükler:*** Beden kompozisyonu, Kas kuvveti, Vitamin D, Kadın

## INTRODUCTION

Muscle strength declines with age, and its loss is prominent in people over 40 years of age (1). Vitamin D has a small but positive effect on muscle strength (2), and the improvement of muscle strength with vitamin D supplementation can only be achieved in persons with vitamin D deficiency (3). On performing meta-analysis, no significant effect of vitamin D supplementation was noted on grip strength in adults with 25(OH)D levels>10 ng/mL, but a large effect was noted on hip muscle strength in adults with 25(OH)D levels<10ng/mL (4). Most of the improvement in lower extremity functions occurred in 25(OH)D concentrations between 9 and 16 ng/mL, while the change was not as noticeable in the range of 16–37.6 ng/mL in older adults (5). In adults aged 65–102 years, vitamin 25(OH)D levels<10 ng/mL were significantly associated with lower extremity performances, whereas serum 25(OH)D levels<20 ng/mL were significantly associated with grip strength (5,6). To the best of our knowledge, there is no study comparing the effects of serum 25(OH)D levels on muscle strength and that of vitamin D supplementation on muscle strength gain across different age groups of women.

Some studies suggest that vitamin D improves isometric (7-11) or isokinetic muscle strength (7,12,13), while other studies suggest that it has no effect on isometric (12,14-16) and isokinetic muscle strength (17). However, no study has yet investigated the differences in isometric or isokinetic strength gain on vitamin D supplementation in different age groups of women. Therefore, this study was designed to determine the effects of vitamin D supplementation on isometric and isokinetic muscle strength and to assess whether these effects differ according to the ages of women.

## MATERIALS AND METHOD

Sixty-three sedentary women (aged 40–69 years) with 25(OH)D levels<30 ng/mL and without a history of vitamin D use within the last six months participated in the study and provided written informed consent. Exclusion criteria included the presence of any of the following comorbidities that may affect vitamin D levels or physical performance: renal and liver diseases, endocrine and neurologic diseases, a history of myocardial disease within the last six months, gastrointestinal malabsorption, the use of medicines which may affect muscles and the history of trauma/surgery of related muscles. The patients were stratified into the following three age groups: Group I (40–49 years of age), Group II (50–59 years of age) and Group III (60–69 years of age).

Vitamin D supplementation with 300.000 IU oral cholecalciferol was administered to patients according to their vitamin D status in March 2013: three doses at 10-day intervals in patients with vitamin D levels ≤ 10 ng/mL, two doses at 15-day intervals in patients with vitamin D levels of 11–20 ng/mL and a single dose in patients with vitamin D levels of 21–30 ng/mL. Oral calcium supplementation was administered to patients with insufficient calcium intake to achieve a total daily calcium intake of 1000 mg. This study was approved by the Institutional Ethics Committee (decision no;date.4/5; 2012).

All the following outcome measures were assessed at baseline and on the sixth month following vitamin D supplementation.

Serum 25(OH)D (calcidiol) assays (DiaSorin, Stillwater, MN, USA) were performed using direct competitive chemiluminescence immunoassay. LIAISON assay is linear up to 125 ng/mL, the limit of detection is 3.5 ng/mL and the coefficient of variation ranges between 4.8% and 11.1%. Blood samples were obtained after overnight fasting. Serum samples were separated via centrifugation at 3000 rpm for 10 minutes, and serum portions were stored at −80°C and later used for analysing 25(OH) D levels.

Height was measured using a tape measure with the participant in standing position. Body Mass Index (BMI), fat free mass (FFM) and percentage

body fat were measured using Tanita Body Composition Analyzer (TANİTA MC-180MA).

The handgrip strength of the dominant limb was measured using a baseline hydraulic hand dynamometer in which the dynamometer was used with participants in seated positions, their elbow by their side and flexed to right angles and their wrists in neutral positions. For the analyses, the maximum force from the three trials was used.

The chair stand test assessed lower body strength. The score was the total number of stands correctly executed within 30 seconds. The dominant side of the arm curl test assessed upper body strength. The score was the total number of hand weight curls through the full range of motion in 30 seconds (18). Isokinetic concentric measurements of knee flexor/extensor muscles at $60°\cdot s^{-1}$ and $180°\cdot s^{-1}$ were evaluated using ISOMED2000 (model code 106-012, Hemau/Germany/2008). The test protocol included five maximal contractions at each speed with 1-minute intervals between each speed. The relative peak torque and power values were used in the analysis.

The study participants were assessed for any adverse reactions of vitamin D supplementation during and at the end of the study.

**Statistical analysis**

Data were analysed using the SPSS software (version 18.0). One-way ANOVA test was used for comparing baseline values and the post-hoc Tukey test was used. The level of significance was set at 0.05. Multiple 3×2 (group×time) repeated measures ANOVA were performed for identifying significant changes over time. When significant differences were observed between groups at the start of the study, analysis of covariance was performed on the outcome variables at the end of the study. The covariate was the baseline value of each participant for the particular outcome variable being analysed. Post-hoc analyses were conducted using the Bonferroni test for examining time and group effects. The level of significance was set at 0.025; that is, 0.05 divided by 2.

## RESULTS

In the present study, we included 20 patients in the group I, 24 patients in the group II and 19 patients in the group III. One patient was excluded after stratification because of a haemorrhagic stroke. Vitamin D treatment was not associated with any clinically adverse reactions. Laboratory results revealed that serum 25(OH)D levels were <10ng/mL in 95% of participants in groups I and III and in 92% of participants in the group II. At baseline, no significant difference was noted in serum vitamin D levels among the groups ($p>0.05$) (Table 1).

Baseline BMI, FFM and percent fat measurements did not significantly differ among the study groups, and no significant differences were noted between groups I and II regarding isokinetic measurements ($p>.05$). Chair stand and grip strength test scores were higher in group I than in groups II and III and arm curl test scores were higher in the group I when compared with those in group the III and in group the II when compared with those in the group III ($p<.05$). No significant differences were noted between groups II and III for the chair stand and grip strength tests or between groups I and II for the arm curl test ($p>.05$). Furthermore, extension torque and power at $60°\cdot s^{-1}$ and $180°\cdot s^{-1}$ and flexion torque at $60°\cdot s^{-1}$ were higher in the group I than in the group III ($p<.05$). The flexion torque and power at $60°\cdot s^{-1}$ and extension torque at $60°\cdot s^{-1}$ were higher in the group II than in the group III ($p<.05$) (Table 1).

According to the 25(OH)D blood concentrations at the end of the study, 70% and 71% of women in groups I and II, respectively, reached levels >30ng/mL, whereas only 37% of the women in group III reached these levels. Repeated measures of ANOVA revealed a significant time effect for 25(OH)D levels ($p<.025$), while no group effect was noted ($p>.025$) (Table 1).

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**Table 1.** Outcome measures at baseline and six months.

| | | | Group I, N=20 mean±sd | | Group II, N=24 mean±sd | | Group III, N=19 mean±sd | | Baseline difference | Time | Group |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pre- | Post- | Pre | Post- | Pre- | Post- | | | |
| **25 (OH)D,ng/mL** | | | 7.2±2 | 39.9±17.5 | 7.8±2.3 | 36.5±11.1 | 7.1±2.6 | 28.8±7.0 | *p=.580 | **p<.001 | **p=.027 |
| **Body Mass Index, kg/m²** | | | 31.4±5.3 | 30.9±5.1 | 30.9±3.4 | 30.2±3.8 | 34.2±6.2 | 33.4±5.8 | *p=.086 | **p<.001 | **p=.091 |
| **Fat free mass,kg** | | | 24.5±3.1 | 24.4±2.5 | 24.6±3.2 | 24.1±2.1 | 22.9±2.9 | 23.4±3.4 | *p=.171 | **p=.725 | **p=.248 |
| **% fat** | | | 43.9±7 | 43.1±5.9 | 43.3±6.2 | 43.8±4.6 | 47.1±6.4 | 46±7.2 | *p=.140 | **p=.456 | **p=.177 |
| **Chair stand,rep/30 s** | | | 8.9±1.6†‡ | 11.1 ±2.1 | 7.5±1.4 | 9.7±2.6 | 6.8±1.2 | 8.1±2.2 | *p< .001 | ††p=.470 | ††p=.301 |
| **Arm curl,rep/30s** | | | 11.1±2.3‡§ | 13.8±2.2 | 10.5±1.9 | 12.3±2.6 | 8.4±2.4 | 10.6±2 | *p=.001 | ††p<.001 | ††p=.046 |
| **Grip strength,kg** | | | 24.4±5.3†‡ | 27.9±4.8 | 20.4±4.8 | 26.7±9.6 | 17.7±5.4 | 19.9±5.9 | *p=.001 | ††p=.003 | ††p=.072 |
| **60⁰/s** | **Flex** | **Peak Torque,Nm/kg** | 0.47±0.17‡§ | 0.62±0.20 | 0.46±0.21 | 0.58±0.17 | 0.28±0.16 | 0.38±0.19 | *p=.002 | ††p<.001 | ††p=.106 |
| | | **Peak Power,W** | 21.6±10.1†§ | 29.3±10.8‡‡ | 22.3±11.7 | 26.5±9.8 | 13.6±8.9 | 16.6±9.1 | *p=.018 | ††p<.001 | ††p=.015 |
| | **Ext** | **Peak Torque, Nm/kg** | 0.89±0.30‡ | 1.10±0.33 | 0.83±0.32 | 0.97±0.31 | 0.55±0.32 | 0.66±0.28 | *p=.003 | ††p<.001 | ††p=.029 |
| | | **Peak Power W** | 38±15.5‡ | 44.8±15 | 35.9±16.7 | 40.1±12.7 | 25.2±14.5 | 29.2±13.7 | *p=.030 | ††p<.001 | ††p=.067 |
| **180⁰/s** | **Flex** | **Peak Torque, Nm/kg** | 0.29±0.14 | 0.45±0.15 | 0.30±0.16 | 0.46±0.19 | 0.19±0.11 | 0.27±0.16 | *p=.021 | ††p<.001 | ††p=.036 |
| | | **Peak Power,W** | 25.4±15.5 | 39.5±15.5 | 27.7±17.3 | 37±15.4 | 13.8±10.4 | 21.1±15 | *p=.010 | ††p<.001 | ††p=.029 |
| | **Ext** | **Peak Torque, Nm/kg** | 0.52±0.23‡§ | 0.70±0.23 | 0.46±0.21 | 0.61±0.23 | 0.33±0.16 | 0.42±0.20 | *p=.012 | ††p<.001 | ††p=.029 |
| | | **Peak Power,W** | 46.7±25.1†‡ | 65.1±20.3‡‡ | 41.6±23.8 | 50.3±21.8 | 26.3±16.6 | 35.4±18.4 | *p=.016 | ††p<.001 | ††p=.004 |

* One-way ANOVA; †Tukey difference between Group I and II; ‡Tukey, difference between Group I and III; §Tukey, difference between Group II and III , p<.05
**Repeated measures of ANOVA; ††Repeated measures of ANCOVA; ‡‡Bonferroni, difference between Group I and III, p <.025

There were no significant time effect for the FFM and percent fat values (p>.025) but did so for BMI (p<.025). No significant group effects were noted for BMI, FFM and percent fat values (p>.025) (Table 1).

There was no significant time effect for the chair stand test (p>.025), whereas significant time effects were noted for grip strength, arm curl, flexor and extensor torque and power at 60°·s$^{-1}$ and 180°·s$^{-1}$ for all groups (p<.025). The performance of flexor power at 60°·s$^{-1}$ and that for extensor power at 180°·s$^{-1}$ were higher in group I than in group III (p<.025) (Table 1).

## DISCUSSION

The results in this study demonstrated that vitamin D supplementation improved BMI, arm curl, grip strength as well as flexor, extensor torque, and power at 60°·s$^{-1}$ and 180°·s$^{-1}$ in all age groups. The effect sizes for flexion power at 60°·s$^{-1}$ and extension power at 180°·s$^{-1}$ were greater in group 1 than in the group 3.

At baseline, 25(OH)D levels were <15 ng/mL (range 4–14 ng/mL) in all groups without any significant differences. Chair stand and grip strength were higher in group I than in groups II and III, while arm curl was lower in group III than in groups I and II. Flexor and extensor torque at 60°·s$^{-1}$ were significantly lower in group III than in groups I and II. Extensor power at 60°·s$^{-1}$ and 180°·s$^{-1}$ and extensor torque at 180°·s$^{-1}$ were significantly lower in group III than in group I, while flexion power at 60°·s$^{-1}$ and 180°·s$^{-1}$ and also flexion torque at 180°·s$^{-1}$ were significantly lower in group III than in group II. These findings suggested that muscle strength and power correlated with age rather than with vitamin D levels.

Grip strength was lower than normative values in all groups at baseline (19). Conflicting results have been reported regarding the relation between vitamin D and grip strength, with some studies proposing the presence of such a relation (6,7,11) while others proposing the lack of a relation (12). A study reported that women with serum vitamin D levels <30ng/mL had lower grip strength (11), while another study reported that grip strength was lower when serum vitamin D levels were <20ng/mL in both sexes (6). In addition, various cut-off levels were defined for serum vitamin 25(OH)D levels in studies investigating the relation between the physical performance of lower extremities. In some studies, physical performance was reportedly lower at vitamin 25(OH)D levels <10ng/mL (6), while other studies proposed different levels such as <32 ng/mL (20) and <30ng/mL (11,13). In a study on individuals older than 60 years of age (51 women, 75% physically active), lower extremity performances were suggested to be worse when serum 25(OH)D concentrations were between 9 and 16ng/mL (5). In the present study, we could not determine whether group differences in muscle strength, muscle power and physical performances were associated with age or serum vitamin D levels because none of the participants had normal vitamin D levels.

Although it has been reported that there was no significant effect of vitamin D on muscle power (2,11,14), Bischoof et al.(20) stated that there was a significant, positive correlation between muscle power and 25(OH)D only in male participants between 65 and 95 years of age. In another study, vitamin D was positively associated with isometric flexion and extension average torque at the knee and isokinetic flexion strength at 60°·s$^{-1}$ and 180°·s$^{-1}$; there was no correlation between vitamin D and knee isokinetic extension strength at 60°·s$^{-1}$ and 180°·s$^{-1}$ (12). Previous studies have suggested that vitamin D affected isometric muscle strength (7-11) and isokinetic muscle strength (7,12,13), but other reports have proposed no effect (12,14-17). In this study, improvement was observed in the knee flexor as well as extensor torque and power at 60°·s$^{-1}$ and 180°·s$^{-1}$ in all assessed age groups, and the between-group effect sizes for flexion power at 60°·s$^{-1}$ and extension power at 180°·s$^{-1}$ after vitamin D supplementation suggested that vitamin D was more effective for muscle power in younger age groups than in older ones. This outcome suggested that the effect of vitamin D supplementation depends on age and also on increased 25(OH)D levels because 25(OH)D levels were >30 ng/mL in 70% of participants in the group I and in 37% of participants in group III. Serum 25(OH)

D level increment was 481% in group I, 404% in group II and 360% in group III. Grip strength increased from 15% at baseline to 50% in group I, from 13% to 35% in group II and from 11% to 21% in group III. The increase in grip strength was consistent with the increase in serum vitamin D levels. It has been demonstrated that the greatest improvement of muscle strength occurred from very low concentrations of serum 25(OH)D up to 16–20 ng/mL (5).

Even though vitamin D supplementation resulted in increased grip strength and isokinetic strength in our study, it had no effect on chair stand test performance. However, McCarthy et al.(21) stated that isokinetic knee extensor strength was an important but moderate predictor of chair stand test performance and additional independent variables such as leg power, leg endurance, posture, and psychological variables may have contributed to the variance in chair stand test performance.

Obesity is a major risk factor for vitamin D deficiency because of body fat absorption of vitamin D (11,22). BMI and higher body fat percentage are significantly associated with lower serum 25(OH) D levels, especially in older persons, and there is a relation between vitamin D levels and adipose tissue (23). On the basis of this evidence, obese individuals are expected to require higher doses of vitamin D supplementation (22). The smaller increment of serum 25(OH)D levels in the group III depended on the percentage of obese participants in this age group. BMI was >30 kg/m$^2$ in 54% of the group I, 60% of the group II and 79% of the group III in this study.

Although high doses of vitamin D were used in this study, there were no adverse reactions. In a previous review, it was suggested that doses <300.000 IU do not provide an adequate amount of vitamin D for restoring vitamin D status in most populations, and the increases in 25(OH)D concentration safely occur in a majority of individuals (24). Moreover, this review highlighted previous works wherein there were no adverse events when participants received up to 500.000 IU of vitamin D (24).

One of the limitations of the present study was its small sample size. In addition, there was a significant difference in muscle strength, especially for isokinetic muscle strength, between groups at baseline. Furthermore, the lack of a control group with different serum vitamin D levels is another study limitation. In addition, we did not have specific information regarding sunlight exposure. Lastly, we were unable to evaluate the response of muscle strength of different body regions to vitamin D supplementation. Randomised, controlled studies using a large sample of participants with different serum 25(OH)D levels are required for defining optimal treatment modalities, including the dose and mode of administration and duration. Future research may also identify factors such as age, sex, physical activity level, the number of concomitant medications and endogenous gonadal hormone levels that affect responses to vitamin D supplementation.

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## REFERENCES

1. Araghi SO, van Dijk SC, Ham AC, et al. BMI and body fat mass is inversely associated with vitamin D levels in older individuals. J Nutr Health Aging 2015;19(10):980-5. (PMID:26624208).
2. Beaudart C, Buckinx F, Rabenda V, et al. The effects of vitamin D on muscle strength, muscle mass and muscle power: a systematic review and meta-analysis of randomised controlled trials. J Clin Endocrinol Metab 2014;99(11):4335-45. (PMID:25033068).
3. Bischoff HA, Stahelin HB, Urscheler N, et al. Muscle strength in the elderly: its relation to vitamin D metabolites. Arch Phys Med Rehab 1999;80(1):54-8. (PMID:9915372).
4. Bischoff-Ferrari H, Dietrich T, Orav E, et al. Higher 25-hydroxyvitamin D concentration are associated with better lower-extremity function in both active and inactive persons aged>60y. Am J Clin Nutr 2004;80(3):752-8. (PMID:15321818).


5. Bohannon RW, Peolsson A, Westropp N, Desrosiers J, Bear-Lehman J. Reference values for adult grip strength measured with a Jamar dynamometer: a descriptive meta-analysis. Physiotherapy 2006;92(1):11–15.
6. Dhesi JK, Jackson SH, Bearne LM, et al. Vitamin D supplementation improves neuromuscular function in older people who fall. Age Ageing 2004;33(6):589-95. (PMID:15501836).
7. Grimaldi AS, Parker BA, Capizzi JA, et al. 25(OH) vitamin D is associated with greater muscle strength in healthy men and women. Med Sci Sports Exerc 2013;45(1):157-62. (PMID:28696084).
8. Grimnes G, Emaus N, Cashman KD, Jorde R. The effect of high-dose vitamin D supplementation on muscular function and quality of life in postmenopausal women–a randomized controlled trial. Clin Endocrinol (Oxf) 2017;87(1):20-8. (PMID:28423480).
9. Gupta R, Sharma U, Gupta N, et al. Effect of cholecalciferol and calcium supplementation on muscle strength and energy metabolism in vitamin D deficient Asian Indians: a randomized controlled trial. Clin Endocrinol 2010;73(4):445-51. (PMID:20455886).
10. Houston DK, Cesari M, Ferrucci L, et al. Association between vitamin D status and physical performance: the InCHIANTI study. J Gerontol A Biol Sci Med Sci 2007;62(4):440-6. (PMID:17452740).
11. Iolascon G, Mauro GL, Fiore P, et al. Can vitamin D deficiency influence muscle performance in post-menopausal women? A multicenter retrospective study. Eur J Phys Rehab Med 2018;54(5):676-82. (PMID:28696084).
12. Janssen HC, Samson MM, Verhaar HJ. Muscle strength and mobility in vitamin D-insufficient female geriatric patients: a randomized controlled trial on vitamin D and calcium supplementation. Aging Clin Exp Res 2010;22:78-84. (PMID:20305368).
13. Kara M, Ekiz T, Kara Ö, et al. does vitamin D affect muscle strength and archıtecture? An isokinetic and ultrasonographic study. Asia Pac J Clin Nutr 2017;26(1):85-8. (PMID:28049266).
14. Kearns M, Alvarez J, Tangpricha V. Large, single-dose, oral vitamin D supplementation in adult populations: a systematic review. Endocr Pract 2013;20(4):341-51. (PMID:24246341).
15. Keller K, Engelhardt M. Strength and muscle mass loss with aging process. Age and strength loss. Muscles Ligaments Tendons J 2014;3(4):346-50. (PMID:24596700).
16. McCarthy EK, Horvat MA, Holtsberg PA, Wisenbaker JM. Repeated chair stands as a measure of lower limb strength in sexagenarian women. J Gerontol A Biol Sci Med Sci 2004; 59(11):1207-12. (PMID:15602077).
17. Moreira-Pfrimer LD, Pedrosa MA, Teixeira L, Lazaretti-Castro M. Treatment of vitamin D deficiency increases lower limb muscle strength in institutionalized older people independently of regular physical activity: a randomized double-blind controlled trial. Ann Nutr Metab 2009;54(4):291-300. (PMID:19729890).
18. Pfeifer M, Begerow B, Minne HW, Suppan K, Fahrleitner-Pammer A, Dobnig H. Effects of a long-term vitamin D and calcium supplementation on falls and parameters of muscle function in community-dwelling older individuals. Osteoporos Int 2009;20:315-22. (PMID:18629569).
19. Pioli G, Giusti A. The inconsistent data on the effect of vitamin D on muscle function. J Spine 2012;1:e107.
20. Rikli RE, Jones CJ. Functional fitness normative scores for community-residing older adults, ages 60–94. J Aging Phys Activ 1999;7:162-81.
21. Smedshaug GB, Pedersen JI, Meyer HE. Can vitamin D supplementation improve grip strength in elderly nursing home residents? A double-blinded controlled trial. Scand J Food Nutr 2007;51:74-8. (PMCID:PMC2607001).
22. Stockton KA, Mengersen K, Paratz JD, Kandiah D, Bennell KL. Effect of vitamin D supplementation on muscle strength:a systematic review and meta-analysis. Osteoporos Int 2011;22(3):859-71. (PMID:20924748).
23. Wortsman J, Matsuoka LY, Chen TC, Lu Z, Holick MF. Decreased biovailability of vitamin D in obesity. Am J Clin Nutr 2000;72:690-3. (PMID:10966885).
24. Zhu K, Austin N, Devine A, Brcue D, Prince RL. A randomized controlled trial of the effects of vitamin D on muscle strength and mobility in older women with vitamin D insufficiency. J Am Geriatr Soc 2010;58:2063–8. (PMID:21054285).

RESEARCH

# ASSOCIATION BETWEEN VITAMIN D LEVEL AND TOTAL COMORBIDITY STATUS IN GERIATRIC PATIENTS


## Abstract

***Introduction:*** Vitamin D is known as an anti-inflammatory, antitumor, and immune-modulating hormone, which plays an important role in common diseases in the geriatric population, such as hypertension and cerebrovascular disorders. Vitamin D deficiency has been linked to various diseases in the literature. However, the association between vitamin D and multiple comorbidities remains unclear due to limited published data. The aim of the present study was to evaluate the association between vitamin D levels and multiple comorbidities in elderly patients.

***Materials and Method:*** The study design was cross-sectional. Geriatric patients (aged ≥65 years) who underwent serum 25(OH)D evaluation to determine the vitamin D status during the last 3 months were assessed for eligibility. Demographic data and 25(OH)D levels of patients were obtained from the electronic database of the hospital and a telephonic interview. In addition, a comorbidity questionnaire was completed via telephonic interviews. The correlation between comorbidity scores, demographic data, and vitamin D levels in elderly patients was analyzed.

***Results:*** Data on 25(OH)D levels in 685 geriatric patients was obtained. Among these patients, 211 (169 female, 42 male) who were contacted over telephone were enrolled. The mean values for age, vitamin D level, and comorbidity scores were 70.4±5.0 years, 16.8±9.2 ng/ml, and 11.3±4.7, respectively. A moderate-good negative correlation was found between 25(OH)D levels and comorbidity scores (r=−0.503).

***Conclusion:*** Low vitamin D levels were associated with total comorbidity status in geriatric patients. This result suggests that vitamin D deficiency may be a risk factor for comorbidities in geriatric patients.


***Keywords:*** Comorbidity; Geriatrics; Vitamin D

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ARAŞTIRMA

# GERİATRİ YAŞ GRUBUNDAKİ HASTALARDA D VİTAMİNİ DÜZEYİ İLE TOTAL KOMORBİDİTE DURUMU ARASINDAKİ İLİŞKİ


## Öz

***Giriş:*** Vitamin D, anti-inflamatuvar, anti-tümör ve immünmodulatuvar etkileri nedeniyle; hipertansiyon ve serebrovasküler hastalıklar gibi, geriatrik popülasyonda sık görülen bazı sağlık problemlerinde önemli role sahiptir. Literatürde farklı hastalıklarda vitamin D eksikliğinin rolü gösterilmiştir. Ancak, birden fazla sağlık probleminin olduğu ileri yaş grubunda, vitamin D seviyesi ile komorbidite arasındaki ilişki net değildir. Bu çalışmada, yaşlı hastalarda, vitamin D seviyesi ile komorbidite arasındaki ilişkinin saptanması amaçlanmıştır.

***Gereç ve Yöntem:*** Çalışma dizaynı kesitseldir. Son 3 ay içinde 25(OH)D seviyeleri bakılmış olan geriatrik hastalar (≥65 yaş) uygunluk açısından değerlendirildi. Hastane veri tabanından ve telefon görüşmesi ile, hastaların demografik verileri ve 25(OH)D seviyeleri kaydedildi. Ayrıca, telefon görüşmesi ile hastaların komorbidite anketi dolduruldu. Geriatrik hastaların, komorbidite skoru, demografik özellikleri ve serum 25(OH)D düzeyi arasındaki korelasyon değerlendirildi.

***Bulgular:*** Veri tabanında 65 yaş ve üzeri toplam 685 hastanın 25(OH)D seviyeleri mevcuttu. Bu hastalardan telefon aracılığıyla ulaşılabilen 211 hasta (169 kadın, 42 erkek) çalışmaya dahil edildi. Hastaların yaş, 25(OH)D düzeyi ve komorbidite skoru için ortalama değerleri sırasıyla; 70.4±5.0 yıl, 16.8±9.2 ng/ml ve 11.3±4.7 idi. Yapılan korelasyon analizinde, serum 25(OH) D seviyesinin, komorbidite skoru ile orta-iyi derecede negatif korele olduğu tespit edildi (r=−0.503).

***Sonuç:*** Geriatrik hastalarda düşük vitamin D düzeyleri total komorbidite durumu ile ilişkili bulunmuştur. Bu nedenle, vitamin D eksikliği yaşlı hastalarda komorbidite için bir risk faktörü olarak düşünülebilir.


***Anahtar sözcükler:*** Komorbidite; Geriatri; Vitamin D

## INTRODUCTION

Comorbidity is described as the occurrence of additional disorders in a patient who has an index disease at a given time point (1). An index disease is defined as a single disease of interest. Additional disorders are classified according to comorbidity as causality, complication, and coincidence. Causality is an abnormality linked with the pathophysiology of the index disease; complications are impairments due to the treatment of the index disease; and coincidence is the coexistence of any disease that is not related to the index disease (1). Multimorbidity is defined as the coexistence of two or more chronic diseases of equal importance in the same patient (1,2). In the literature, the impact of comorbidities on patients' health has been investigated and associated with poor outcomes, impaired mental functioning, increased percentages of disability and frailty, prolonged hospital stays, risk of adverse drug reactions related to polypharmacy, and higher mortality (1,3-5). The number of comorbidities increases with age, disease duration, and/or disease activity (1,6); thus, there is an increased prevalence of comorbidity in the geriatric population (6). This association has encouraged physicians to investigate contributors or exacerbators of comorbid conditions (3). The association between comorbidity and factors, including genes, environment, diet, and exercise, has been stated in the literature (7-9). Particularly, vitamin D is one of the most prominent factors accounting for disorders and impairments that contribute to comorbidity.

Vitamin D is a fat-soluble vitamin and hormone that affects not only the musculoskeletal system but also almost all the tissues with vitamin D receptors (10). Several studies have investigated the association between vitamin D and specific diseases. According to the literature, low vitamin D levels are suggested to be a fundamental risk factor for various disorders, including hypertension, cardiovascular disease, cerebrovascular disease, chronic musculoskeletal pain, decreased physical performance, increased fall risk, and some types of malignancies which are common in the geriatric population (3,11-13). However, studies showing an association between decreased vitamin D levels and comorbidity are very limited in the literature (3).

We hypothesized that low levels of vitamin D may contribute to comorbidities and hence evaluated the association between vitamin D levels and total comorbidity rather than one specific disease in geriatric patients.

## MATERIALS AND METHOD

### Study population

Geriatric patients (aged ≥65 years) who underwent serum 25(OH)D evaluation during the last 3 months were assessed for eligibility. Of these patients, those who agreed to participate in the study and who met none of the exclusion criteria were included. Exclusion criteria were deafness, cognitive impairment, and unavailability due to other reasons.

The Local Ethics Committee of the University approved the study protocol. All the patients included in the study gave verbal consent.

### Vitamin D evaluation

For each patient, serum 25(OH)D levels were tested by high performance liquid chromatography and categorized as sufficient (≥30 ng/ml), insufficient (21–29 ng/ml), and deficient (<20 ng/ml) according to the guidelines of the Endocrine Society (14).

### Comorbidity evaluation

Total comorbidity status was assessed using a self-administered comorbidity questionnaire (15), with 12 defined medical comorbidities and 3 optional conditions. The questionnaire was completed via a telephonic interview with each participant during a 6-week period. Each interview lasted approximately 10 min. The medical

conditions defined in the questionnaire included heart disease, high blood pressure, lung disease, diabetes, ulcer or stomach disease, kidney disease, liver disease, anemia or other blood disease, cancer, depression, osteoarthritis and rheumatoid arthritis, back pain, and other diseases (with 3 open-ended questions). The questionnaire asked not only about the presence of any comorbidity but also whether the patient sought any treatment for the present comorbidity and whether the comorbidity had any impact on the individual's physical function. Each separate comorbidity was scored as 1=present and 0=absent. If a comorbid condition required treatment, an additional point was added. If this comorbidity limited the activity of the patient, another point was added. Thus, each comorbidity could score between 0 and 3 points; the total score ranged between 0 and 36, without the optional conditions, and the maximum score was calculated as 45 points when the open-ended items were also included (15).

### Statistical analysis

SPSS statistical software version 20.0 was used for analysis. The normality of variables was checked using normality tests. Nonparametric tests (Mann–Whitney U and Kruskal–Wallis tests) were performed to analyze non-normally distributed continuous variables between the groups.

Demographic variables and comorbidity scores were analyzed according to vitamin D subgroups. The difference between the groups was examined using a *post-hoc* comparison test.

The results were expressed as the mean±standard deviation (SD). P values <0.05 were considered statistically significant. Correlations were tested with the Spearman correlation coefficient. The strength of the correlation was classified as none, very weak, weak–moderate, moderate–strong, and very strong when the correlation coefficient ($r_s$) values were 0–0.24, 0.25–0.49, 0.50–0.74, and 0.75–1.00, respectively.

## RESULTS

A total 211 patients (169 female, 42 male) were included in the study. The mean values for age, body mass index (BMI), and comorbidity scores were 70.5±5.0 years, 28.5±5.7 kg/m$^2$, and 11.3±4.7 points, respectively.

The mean 25(OH)D levels in our study group were 16.8±9.2 ng/ml. These levels were <20 ng/ml (vitamin D deficiency) in 139 (65.9%) patients and 20–29 ng/ml (vitamin D insufficiency) in 50 (23.7%). Vitamin D levels were sufficient in only 22 (10.4%) patients.

Approximately 3.8% (n=8), 31.3% (n=66), and 37.4% (n=79) of the patients were morbidly obese (BMI ≥40 kg/m$^2$), obese (BMI ≥30 kg/m$^2$), and overweight (BMI=25–29.9 kg/m$^2$), respectively. The descriptive data and 25(OH)D levels of the study population are shown in 1.

When the results were analyzed according to vitamin D subgroups (deficient, insufficient, and sufficient), comorbidity scores and BMI were statistically significant among the groups (p< 0.001, p=0.04, respectively) (Table 2; Figure 1).

The *post-hoc* analysis revealed that patients with vitamin D deficiency had higher comorbidity scores than those with insufficiency and sufficiency (p=0.001). The study population was analyzed according to BMI groups (morbidly obese, obese, overweight, normal weight, and underweight), and no significant difference was found in terms of comorbidity scores and vitamin D levels.

A moderate-good negative correlation was found between serum 25(OH)D levels and comorbidity scores (r=−0.503). No correlation was found among the other parameters (Table 3).

We hypothesized that the comorbidity score would increase as vitamin D levels decreased. Based on the findings of this study, a moderate-good correlation between comorbidity score and vitamin D level was found, which confirmed our hypothesis.

**Table 1.** Demographic variables and 25(OH)D level of study population.

| Characteristics | Mean±sd<br>Median (min-max)<br>Total (n=211) |
|---|---|
| **Age (year)** | 70.5±5.0<br>69 (65-89) |
| **BMI (kg/m²)** | 28.5±5.7<br>27.5 (15.6-49.6) |
| **Comorbidity score** | 11.3±4.7<br>11 (2-25) |
| **25-(OH)D (ng/ml)** | 16.8±9.2<br>15.2 (2.6-39.4) |

BMI: Body mass index; Values are given as mean±standard deviation and median (minimum-maximum).

**Table 2.** Comparison of comorbidity scores and body mass index according to vitamin D levels.

| Characteristics | Group 1 (n=139) | Group 2 (n=50) | Group 3 (n=22) | p | Comparison group | Post hoc p |
|---|---|---|---|---|---|---|
| **F/M** | 110/29 | 39/11 | 20/2 | | | |
| **Age (year)** | 70.5±5.0 | 70.0±4.5 | 70.8±6.4 | 0.93 | | |
| **BMI (kg/m²)** | 29.2±5.9 | 27.4±4.7 | 26.5±5.4 | **0.04*** | 1 Vs 2 | 0.166 |
| | | | | | 1 Vs 3 | 0.141 |
| | | | | | 2 Vs 3 | 1.000 |
| **Comorbidity score** | 12.6±4.6 | 8.9±4.1 | 8.7±3.6 | **<0.001¶** | 1 Vs 2 | **<0.001§** |
| | | | | | 1 Vs 3 | **0.001§** |
| | | | | | 2 Vs 3 | 1.000 |

Group 1: <20 ng/ml; Group 2: 21-29 ng/ml; Group 3: ≥30 ng/ml; F/M: Female/Male; BMI: Body mass index; Values are given as mean±standard deviation. The results were derived from the Kruskal-Wallis test (* p<0.05, ¶ p<0.01) and Post hoc p values were analyzed (§ p<0.0167).

**Table 3.** Correlation between vitamin D level and clinical variables.

| Characteristics | Age | BMI | Comorbidity Score | 25-(OH)D |
|---|---|---|---|---|
| **Age (year)** | 1 | -0.116 | 0.172* | 0.009 |
| **BMI (kg/m²)** | | 1 | 0.000 | -0.091 |
| **Comorbidity score** | | | 1 | **-0.503**§ |
| **25-(OH)D (ng/ml)** | | | | 1 |

Values represent the Spearman's correlation coefficient ($r_s$). BMI: Body Mass Index, p*<0.05, ¶p<0.01, §p<0.001

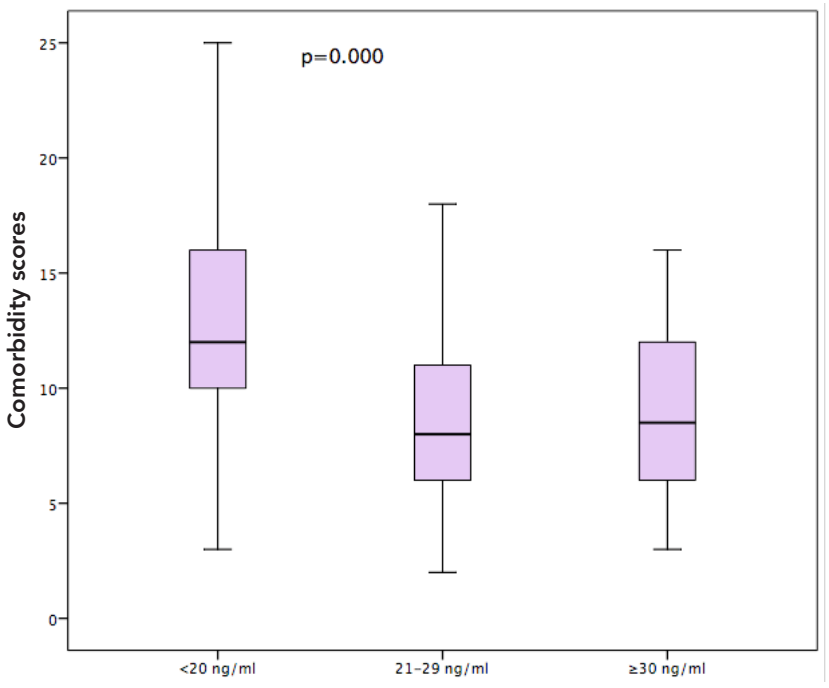


**Figure 1.** Comorbidity scores in the three groups of vitamin D level.

## DISCUSSION

In the present study, we assessed patients' comorbidities using a self-administered comorbidity questionnaire that not only evaluated the comorbid conditions and drugs administered for these conditions but also investigated the ongoing impact of disorders on patients' functionality. The goal of our study was to determine the association of vitamin D levels with multiple comorbidities rather than a single disease or comorbidity.

A negative correlation was found between 25(OH)D levels and comorbidity scores in geriatric patients. In other words, we established the fact that low vitamin D levels are associated with increased comorbid conditions. Vitamin D affects many tissues in the body via several molecular mechanisms. It may also affect the expression of various genes, including those involved in pathophysiological pathways of cell proliferation, differentiation, apoptosis, and angiogenesis, as well as inflammation via these molecular mechanisms. However, it is unclear whether vitamin D modulates the expression of a particular gene in a particular organ under a particular condition (16,17). Studies investigating its effects on genes have shown that low levels of vitamin D may be associated with a cause and/or exacerbation of the illnesses. Consequently, decreased vitamin D levels have been linked with several diseases, especially age-related disorders (3,11-13,16-19). Nevertheless, the role of vitamin D in diseases could be viewed as a "chicken or egg" issue; i.e., low vitamin D levels may be a cause of certain disorders or a consequence of disorders and aging (3,10). Autier et al. showed an inverse relationship between vitamin D levels and certain diseases, but the efficiency of vitamin D supplementation in diseases was not determined. They suggested that decreased vitamin D level is a marker for ill health rather than a cause or risk factor for certain diseases (3,20). Similarly, Meems et al. demonstrated that low levels of vitamin D were associated with a high prevalence of multimorbidity and proposed vitamin D deficiency as a marker for health status (3).

In the current study, we also evaluated the association between comorbidity and demographic variables, such as age and BMI. Comorbidity scores in our study group were not correlated with BMI and were very weakly correlated with age. In a cross-sectional study investigating obesity prevalence and health consequences, Eggers et al. showed a positive correlation between BMI and age. In addition, they found that the incidence of certain comorbidities, such as asthma, diabetes, and hypertension, increases with increasing BMI (21).

According to the literature, the proportion of individuals aged ≥60 years has steadily increased from 8.1% in 1960 to 12% in 2015. This percentage is expected to further increase in the next 30-year period (22,23). Comorbid health conditions, such as heart disease, pulmonary disease, diabetes, hypertension, and arthritis, are common in these geriatric patients (24). Therefore, chronic diseases related to aging have replaced infectious diseases as the main reason for seeking healthcare (22). Numerous studies have investigated the factors that contribute to disorders in the elderly population, and one of the most important factors believed to impact these diseases is the vitamin D level (11,16,25). However, most studies have only assessed a specific illness and its association with vitamin D levels. Therefore, in the current study, we specifically aimed to evaluate the impact of vitamin D level on patients with multiple comorbidities.

The limitations of the present study are as follows: (i) retrospective nature of our search to predict the target population; and (ii) lack of vitamin D supplementation assessment. The strength of the current study is the confirmation of an inverse association between vitamin D levels and total comorbidity status in geriatric patients. Also, our results provide attention into this association for physicians dealing with geriatric population.

In conclusion, a decreased vitamin D level is associated with increased comorbidity in geriatric patients. Our results suggested that vitamin D deficiency may be a risk factor for comorbidities, particularly in geriatric patients. However, the actual cause of this association remains unclear. Longitudinal studies are warranted to determine whether diseases trigger vitamin D deficiency or low levels of vitamin D cause or exacerbate these diseases.

**Conflicts of interest**

The authors declare that they have no conflicts of interest.

## REFERENCES


1. Alkan S, Sarsan A, Alkan H, Yıldız N, Topuz O, Ardıç F. Relationship between balance, physical performance and quality of life with vitamin D levels in the elderly. Turkish Journal of Geriatrics 2012;15(2):156-63.
2. Autier P, Boniol M, Pizot C, Mullie P. Vitamin D status and ill health: a systematic review. Lancet Diabetes Endocrinol 2014;2(1):76-89. (PMID:24622671).
3. Boeckxstaens P, Vaes B, Legrand D, Dalleur O, De Sutter A, Degryse JM. The relationship of multimorbidity with disability and frailty in the oldest patients: a cross-sectional analysis of three measures of multimorbidity in the BELFRAIL cohort. Eur J Gen Pract 2015;21(1):39-44. (PMID:24980394).
4. Chen LY, Liu LK, Hwang AC, et al. Impact of malnutrition on physical, cognitive function and mortality among older men living in veteran homes by minimum data set: A Prospective Cohort Study in Taiwan. J Nutr Health Aging 2016 Jan;20(1):41-7. (PMID:26728932).
5. de Borst MH, de Boer RA, Stolk RP, Slaets JP, Wolffenbuttel BH, Navis G. Vitamin D deficiency: universal risk factor for multifactorial diseases? Curr Drug Targets 2011;12(1):97-106. (PMID:20795934).
6. Dekker J, de Rooij M, van der Leeden M. Exercise and comorbidity: the i3-S strategy for developing comorbidity-related adaptations to exercise therapy. Disabil Rehabil 2016;38(9):905-9. (PMID:26176170).
7. Eggers S, Remington PL, Ryan K, Nieto J, Peppard P, Malecki K. Obesity prevalence and health consequences: Findings From the Survey of the Health of Wisconsin, 2008-2013. WMJ 2016;115(5):238-44. (PMID:29095585).
8. Güler H, Turhanoğlu A, Özer C. The effect of vitamin D supplementation on balance and quality of life in older women. Turkish Journal of Geriatrics 2008;11(2):57-61.
9. Gündüz E, Eskin F, Gündüz M, et al. Effects of sleep quality, income level and comorbid conditions on quality of life in a Turkish Elderly population: A multicenter study. Turkish Journal of Geriatrics 2015;18(2):136-42.
10. Holick MF, Binkley NC, Bischoff-Ferrari HA, et al. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab 2011;96(7):1911-30. (PMID:21646368).
11. Karlamangla A, Tinetti M, Guralnik J, Studenski S, Wetle T, Reuben D. Comorbidity in older adults: nosology of impairment, diseases, and conditions. J Gerontol A Biol Sci Med Sci 2007;62(3):296-300. (PMID:17389727).
12. Klimek P, Aichberger S, Thurner S. Disentangling genetic and environmental risk factors for individual diseases from multiplex comorbidity networks. Sci Rep 2016 Dec 23;6:39658. (PMID:28008973).
13. Liu GL, Pi HC, Hao L, Li DD, Wu YG, Dong J. Vitamin D status is an independent risk factor for global cognitive impairment in peritoneal dialysis patients. PLoS One 2015;10(12):e0143782. (PMID:26630385).
14. Marengoni A, Angleman S, Melis R, et al. Aging with multimorbidity: a systematic review of the literature. Ageing Res Rev 2011 Sep;10(4):430-9. (PMID:21402176).
15. Meems LM, de Borst MH, Postma DS, et al. Low levels of vitamin D are associated with multimorbidity: results from the LifeLines Cohort Study. Ann Med 2015;47(6):474-81. (PMID:26340085).
16. Muschitz C, Kocijan R, Stütz V, et al. Vitamin D levels and comorbidities in ambulatory and hospitalized patients in Austria. Wien Klin Wochenschr 2015;127(17-18):675-84. (PMID:26184408).
17. Piccirillo JF, Vlahiotis A, Barrett LB, Flood KL, Spitznagel EL, Steyerberg EW. The changing prevalence of comorbidity across the age spectrum. Crit Rev Oncol Hematol 2008;67(2):124-32. (PMID:18375141).
18. Radner H, Yoshida K, Smolen JS, Solomon DH. Multimorbidity and rheumatic conditions enhancing the concept of comorbidity. Nat Rev Rheumatol 2014;10(4):252-6. (PMID:24418765).
19. Rodríguez-Pérez A, Alfaro-Lara ER, Albiñana-Perez S, et al. Novel tool for deprescribing in chronic patients with multimorbidity: List of Evidence-Based Deprescribing for Chronic Patients criteria. Geriatr Gerontol Int 2017;17(11):2200-07. (PMID:28544188).
20. Sangha O, Stucki G, Liang MH, Fossel AH, Katz JN. The self-administered comorbidity questionnaire: a new method to assess comorbidity for clinical and health services research. Arthritis and Rheumatism 2003;49(2):156-63. (PMID:12687505).

21. Sogomonian R, Alkhawam H, Jolly J, et al. Serum vitamin D levels correlate to coronary artery disease severity: a retrospective chart analysis. Expert Rev Cardiovasc Ther 2016;14(8):977-82. (PMID:27187061).

22. Timpini A, Pini L, Tantucci C, Cossi S, Grassi V. Vitamin D and health status in elderly. Intern Emerg Med 2011;6(1):11-21. (PMID:20517656).

23. Toscano Guzmán MD, Galván Banqueri M, Otero MJ, Alfaro Lara ER, Casajus Lagranja P, Santos Ramos B. Development of a trigger tool to identify adverse drug events in elderly patients with multimorbidity. J Patient Saf 2017 Jun 14. (PMID:28617720).

24. United Nations. World Population Aging: The 2015 Report: 27. [Internet] Available from: http://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2015_Report.pdf. Accessed: 01.12.2017

25. Vimaleswaran KS, Cavadino A, Berry DJ, et al. Association of vitamin D status with arterial blood pressure and hypertension risk: a mendelian randomisation study. Lancet Diabetes Endocrinol 2014;2(9):719-29. (PMID:24974252).

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RESEARCH

# SAFETY AND COMPLICATION OF PERCUTANEOUS ENDOSCOPIC GASTROSTOMY BY AGE GROUPS: A RETROSPECTIVE CLINICAL TRIAL

## Abstract

***Introduction:*** This study aimed at conducting comparisons across age groups on the safety of Percutaneous Endoscopic Gastrostomy (PEG) procedure and the rates of complications when used to resolve dysphagia and other oral intake problems which are increasing in prevalence in line with population ageing.

***Materials and Method:*** Data from patients aged 65 years and over, who underwent a PEG procedure in our clinic between 2012-2017 were retrospectively reviewed. Age and sex of study subjects and the reason for performing PEG procedure and complications were assessed. Patients were assigned into two age groups: Group1 included patients aged from 65 to 85 years and Group2 aged 85 years and over.

***Results:*** 76 out of 182 patients were in group1and 106 were in group 2. There were 139 female, 43 male patients. 21(11.2%) patients developed PEG related-complications and there was PEG revision in seven (3.8%) patients. The most common complications were peristomal infections in the Group 1 and peristomal infections and formulation leakage around the PEG tube site, in the Group 2. No statistically significant intergroup differences were found in complication rates and PEG revision rates (p=0.349 and p=0.701, respectively). Mortality occurred in none of the groups 2 at the end 30-day follow up during the study.

***Conclusion:*** In patients who underwent a PEG procedure, no differences were found between patients aged 65 to 85 years and patients aged 86 years and over in terms of complication rates and PEG revision rates. We believe that PEG is a safe procedure with low complication rates, when performed following a detailed assessment and thorough preparations.

***Keywords:*** Gastrostomy; Deglutition disorders; Aged; Malnutrition

ARAŞTIRMA

# PERKÜTAN ENDOSKOPİK GASTROSTOMİ UYGULAMASININ GÜVENİLİRLİĞİ VE KOMPLİKASYONLARININ YAŞ GRUPLARINA GÖRE KARŞILAŞTIRILMASI: RETROSPEKTİF KLİNİK ÇALIŞMA

## Öz

***Giriş:*** Yaşlı nüfusun artmasıyla sıkça görülmeye başlanan yutma güçlüğü ve diğer oral beslenme problemlerinin çözümünde Perkütan Endoskopik Gastrostomi (PEG) işleminin güvenirliliği ve komplikasyon yüzdelerinin yaş gruplarına göre karşılaştırılması amaçlanmıştır.

***Gereç ve Yöntem:*** 2012 ile 2017 tarihleri arasında PEG uygulanan 65 yaş ve üstü hastaların verileri retrospektif olarak incelendi. Hastaların yaş, cinsiyet, PEG açılması nedeni ve komplikasyonları değerlendirildi. Hastalar Grup 1; 65-85 yaş, Grup 2; 86 ve üzeri yaş olmak üzere ikiye ayrıldı.

***Bulgular:*** Çalışmaya alınan 182 hastanın 76 sı grup 1, 106 sı grup 2 idi. Hastaların 139'u kadın 43'ü erkekti. Toplam 21 hastada (%11.2) komplikasyon görüldü ve 7 hastada (%3.8) PEG değişimi yapıldı. En sık saptanan komplikasyon grup 1 de peristomal enfeksiyon, grup 2 de ise peristomal enfeksiyon ve PEG tüpünün yanından mama kaçağıydı. İki grup arasında komplikasyon görülmesi ve PEG revizyonu açısından istatistiksel fark saptanmadı (sırasıyla p=0.349, p=0.701). Çalışmada iki grupta da 30 gün sonunda mortalite görülmedi.

***Sonuç:*** 65-85 yaş arası ve 86 yaş üzeri PEG uygulanan olgularda komplikasyon ve PEG revizyonu açısından fark saptanmadı. Geriatrik hasta grubunda detaylı değerlendirme ve hazırlık yapıldıktan sonra PEG uygulaması yapılmasının düşük komplikasyon oranı ile güvenle uygulanabilecek bir işlem olduğunu düşünmekteyiz.

***Anahtar sözcükler:*** Gastrostomi; Disfaji; Geriatri; Malnutrisyon

## INTRODUCTION

For patients requiring long-term tube feeding, enteral nutrition has several advantages over parenteral nutrition, including lower cost, easier and comfortable administration, intestinal flora protection and mucosal atrophy prevention as well as lower rates of bacterial translocation. The long-term use of nasogastric, nasoduodenal or nasojejunal tubes in patients requiring enteral nutrition can cause nasopharyngeal discomfort, nasal erosion, acute otitis media, acute sinusitis, pharyngeal ulceration, esophagitis, esophageal ulceration, oesophageal varice rupture and gastric erosion and ulceration (1). Therefore, if long-term enteral tube nutrition is planned, clinicians should consider switching to percutaneous endoscopic gastrostomy (PEG) feeding at an early stage. PEG, first described by Gauder et al. in 1980, is a technique for delivering nutrition, fluids and/or medications directly into the stomach, bypassing the mouth and esophagus, in patients who have impaired oral intake due to various reasons but have an intact gastrointestinal tract (2). PEG is often used in place of conventional gastrostomy since it is simple, has a low complication rate and is relatively inexpensive (3,4). Three techniques are commonly used for PEG tube placement: the pull technique, push technique and introducer technique. The pull technique is the first choice (5).

A literature review revealed that neurogenic dysphagia was the most common indication for placing a feeding tube using PEG (6,7). In addition, PEG is indicated in patients with conditions leading to malnutrition, such as metabolic diseases, cardiac disease, cystic fibrosis, trauma, malignancies and oropharyngeal anatomical abnormalities (4,8). PEG tube placement is contraindicated in patients with severe esophageal strictures or diffuse ascites accumulation in the abdominal cavity, morbid obesity, uncontrollable coagulation disorders, previous stomach surgeries, severe hiatal hernia and advanced cancers (9).

In this study, we aimed at conducting comparisons across geriatric age groups on the safety of Percutaneous Endoscopic Gastrostomy (PEG) procedures and the rates of complications associated with Percutaneous Endoscopic Gastrostomy (PEG) used to resolve dysphagia and other oral intake problems which are increasing in prevalence in line with population ageing.

## MATERIALS AND METHOD

The present study was conducted according to the recommendations of the Declaration of Helsinki on Biomedical Research Involving Human Subjects. This retrospective clinical study was performed at our hospital, Department of General Surgery after obtaining approval of the Local Ethics Committee (KAEK-50-1269). Patients' relatives provided informed consents. We retrospectively reviewed the medical records of elderly patients who underwent PEG at our hospital between 2012 and 2017. The inclusion criterion was to be aged 65 years and over. Age and sex of study subjects and the reason for performing a PEG procedure, complications associated with PEG and time to death were recorded. Patients were divided into two groups, the Group I included patients aged between 65 and 85 years and the Group 2 included patients aged 86 years and older. The two groups were compared to each other in complication rates.

### Procedure

The PEG procedures were performed by two endoscopists (AHG, FG) using the same commercial PEG kit. Each patient received antibiotic prophylaxis with cefazolin sodium 1 h before the procedure, and a $H_2$ receptor blocker was intravenously administered for the first 3 days later. Patients were given water and formula through the PEG tube 24 h and 48 h after the procedure, respectively. In this study, the pull technique was used for PEG tube placement in all patients.

### Statistical analysis

Data were analyzed using the SPSS (Statistical Package for Social Sciences, Windows Version 22.0) software. In addition to descriptive statistics (mean, standard deviation), one-way analysis of variance was used for intergroup comparisons and the chi-square test was used for the comparisons of quantitative data. A p value of $<0.05$ was considered significant.

## RESULTS

From 2012 to 2017, 191 patients underwent PEG. Of these patients, 107 had dementia, 44 had cerebrovascular disorders, 26 had hypoxic brain damage, six had head or neck cancers and eight had other disorders. Nine patients who not meet the eligibility criterion of age≥65 years were excluded. Of 182 study patients 139 (76.4%) were female and 43 (23.6%) were male. None of the study subjects died within 30 days after PEG placement. No PEG-related mortality occurred during 3-month and 12-month follow-up.

In this study, 76 patients aged from 65 to 85 years were included in the Group 1 and 106 patients aged 86 years and over were included in the Group 2. 21 (11.2%) patients developed either major or minor complications. 13 out of 76 (%17.1) patients from the Group 1 and 8 out of 106 (7.5%) patients from the Group 2 developed PEG-related complications. No statistically significant intergroup difference was observed in the rate of total complications associated with PEG (p=0.06).

The most common complication was peristomal infection, which occurred in 11 patients. 7 out of these 11 patients were from the Group 1 and 4 patients were from the Group 2. No statistically significant difference was found between two groups in the incidence of peristomal infections (p=0.206). The earliest peristomal infection occurred at day 7 postoperatively and the latest occurred at day 112 postoperatively and the mean time to the occurrence of infection was 27±31.1 days. PEG tube feeding was discontinued in these patients, wound cultures were made and intravenous antimicrobial therapy was initiated. These patients were started on empirical antimicrobial therapy with ceftriaxone 1000 mg b.i.d and ornidazole 500 mg t.i.d given intravenously until susceptibility test results were available. Antimicrobial therapy regimens might be changed based on susceptibility test results. Antimicrobial therapy regimens might also be changed in refractory cases based on repeat wound cultures, if required. Ten of these 11 patients responded to treatment. Only one patient from the Group 2 experienced a treatment-refractory peristomal infection and underwent revision surgery.

Only one patient from the Group 1 developed gastrointestinal bleeding on the day of the PEG tube placement; PEG tube feeding was discontinued and the PEG tube was left in place for free drainage and this patient was started on proton pump inhibitor therapy. The bleeding stopped, and PEG tube feeding was resumed 48 h later.

Buried bumper syndrome (migration of the PEG tube from the stomach into the abdominal wall) was observed in two group1 patients. These two complications occurred 35 days and 120 days after the PEG tube placement, respectively and were corrected by revision surgery.

Formula leakage around the PEG tube site was observed in seven patients. 3 out of these 7 patients were from the Group 1 and 4 patients were from the Group 2. No statistically significant difference was found between two groups in the incidence of formula leakage around the PEG tube site (p=1). The earliest formula leakage occurred at day 16 postoperatively and the latest occurred at day 154 postoperatively and the mean time to the occurrence of this complication was 73.5±49.9 days. Thus, PEG tube feeding was discontinued and intravenous antimicrobial therapy was initiated with methylene blue through the PEG tube 72 h later. No formula leakage was observed after treatment

in three of the seven patients, whereas leakage persisted in four. These four group 2 patients also underwent revision surgery due to persistent formula leakage from the PEG tube site. Thus, seven patients developed complications requiring PEG tube replacement.

Two patients from the Group 1 and 5 patients from the Group 2 underwent a PEG revision procedure. No statistically significant difference was found between two groups in the rates of patients who underwent revision surgery (p=0.701) (Table 1).

**Table 1.** Percutaneous endoscopic gastrostomy tube complications and tube revision number of patients and rates in the Group 1 and Group 2.

| COMPLICATIONS | Group 1 n=76 | Group 2 n=106 | p |
|---|---|---|---|
| Peristomal infection | 7 (9.2%) | 4 (3.7%) | $\chi^2$:2.304; p=0.206 |
| Gastrointestinal bleeding | 1 (1.3%) | - | $\chi^2$:1.402; p=0.418 |
| PEG tube feeding was discontinued | 3 (3.9%) | 4 (3.7%) | $\chi^2$:0.004; p=1 |
| The Buried Bumper Syndrome | 2 (2.6%) | - | $\chi^2$:2.82; p=0.173 |
| Total complications | 13 (17.1%) | 8 (7.5%) | $\chi^2$:3.962; p=0.06 |
| PEG Revision | 2 (2.6%) | 5 (4.7%) | $\chi^2$:0.521; p=0.701 |

## DISCUSSION

PEG is a common procedure indicated if enteral feeding is likely to be needed for a prolonged period of time in patients with a normal gastrointestinal function. However, the prevalence of chronic diseases is usually high among patients who require a PEG tube placement and these patients are usually in a poor health condition. Although standardized criteria have not been established yet, guidelines published by the American Gastroenterological Association recommend that PEG should be performed only in patients who are expected to survive for more than 30 days after the procedure. Despite ongoing efforts to determine risk factors for PEG-related complications and mortality, risk factors reported by several studies have been conflicting. In addition, although PEG has been shown to be a safer approach than percutaneous radiological and endoscopic surgical tube placement, complication rates associated with PEG have been reported to vary in a range between 13.2 and 42.9% (10)

There are publications indicating associations between PEG placement and higher mortality rates and a reduced quality of life (11). On the contrary, reduced PEG-related mortality rates have been reported from studies in patients experiencing dysphagia as a result of amyotrophic lateral sclerosis or stroke (12). In a publication, Young et al. reported lower 30-day mortality rates in patients who underwent a PEG tube placement procedure due to dysphagia associated with neurological disorders, including Parkinson's disease and stroke (13). In our study, no death occured within 30 days after the procedure. No PEG-related mortality occurred during 3-month and 12-month follow-up. As stated above, we believe that these lower rates were associated with a careful patient selection before planning a PEG procedure. PEG tube placements were not performed patients in a

poor health condition and in conditions which were expected to have a fatale course.

In another study, significant correlations were found between serious complications requiring a PEG tube change and mortality rates (13). Unlike this publication, no significant correlations were found between complications rates and mortality rates in this study.

In addition, several studies have investigated the safety of PEG. In a study of 314 patients, Larson et al. reported a minor complication rate of 33% and a major complication rate of 3%. Major complications included gastric perforation, gastric bleeding and buried bumper syndrome (14). In our study, the rates of major and minor complications were 1.5% and 9.8%, respectively. In addition, the rate of major complications was 2.6% in the Group 1 and 0% in the Group 2, while the rate of minor complications was 14.5% in the Group 1and 7.5% in the Group 2. Major and minor complication rates detected in our study were found to be lower than those reported in the literature . Furthermore, no death occurred within 30 days after the procedures. We believe that these lower rates are associated with the compliance of our study patients with the eligibility criteria for PEG placement and clinical experience of the practitioners who performed the procedure. (AHG and FG have performed this procedure since 14 years ago). In another study of 161 elderly patients, peristomal infection was the most common complication (15). In line with the literature, peristomal infection was the most common complication in our study. The incidence of PEG complications can increase if PEG tube placement is not truly indicated or contraindicated (16). Although, there are studies reporting a positive correlation between complication rates and age (10), overall complication rate was 17.1% in the Group 1 and 7.5% in the Group 2 and the rate of complications was not statistically significantly higher in the group of patients aged 86 years and older, indicating that complication rates did not increase with age. In our study, 2 patients from the Group 1 and 5 patients from the Group 2 underwent a PEG revision procedure. No association was found between the age and the need for revision surgery in the group of geriatric patients.

Our literature search revealed another study analyzing complications by age, in a similar way to our study. This study used age of 100 years as the cutoff and the rate of minor complications was reported to be higher in those aged over the age of 100 years than the study subjects younger than100 years of age. However, mortality and major complication rates in the group of patients aged 100 years and over were similar to the rates in the younger groups, in line with our study (17).

For most patients with dysphagia, PEG procedures are not performed on time typically because of the indecisiveness of relatives until the terminal stages of disease due to their prejudice and fear regarding PEG. Malnutrition and associated health problems are less common in patients who are fed through a PEG tube than in those patients who are not. Any delay in PEG tube insertion may harm patients who require feeding through a PEG tube. Practitioners should explain the procedure and benefits associated with the insertion of a PEG tube in detail to patients and their relatives to overcome their prejudice and fear regarding the procedure.

In conclusion, PEG appears to be associated with a low complication rate in geriatric patients when performed by experienced, accomplished practitioners. Our belief is further strengthened by the complication and revision rates which were not increased in the geriatric patient group in our study. We believe that more comprehensive preoperative assessments and preparations are needed before planning a PEG procedure in elderly patients aged 65 years and over.

**Conflict of interest**

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

## REFERENCES


1. Cortez-Pinto H, Correia AP, Camilo ME, Tavares L, De Moura MC. Long-term management of percutaneous endoscopic gastrostomy by a nutritional support team. Clin Nutr 2002;21(1):27-31. (PMID:11884009).
2. Fortunato JE, Cuffari C. Outcomes of percutaneous endoscopic gastrostomy in children. Curr Gastroenterol Rep 2011;13(3):293-9. (PMID:21409518).
3. Fröhlich T, Richter M, Carbon R, Barth B, Köhler H. Review article; percutaneous endoscopic gastrostomy in infants and children. Aliment Pharmacol Ther 2010;31(8):788-801. (PMID:20102353).
4. Gauderer MW, Ponsky JL, Izant RJ Jr . Gastrostomy without laparotomy; a percutaneous endoscopic technique. J Pediatr Surg 1980;15(6):872-5. (PMID:6780678).
5. Hiki N, Maetani I, Suzuki Y, et al. Reduced risk of peristomal infection of direct percutaneous endoscopic gastrostomy in cancer patients; comparison with the pull percutaneous endoscopic gastrostomy procedure. J Am Coll Surg 2008;207(5):737-44. (PMID:18954787).
6. Laasch HU , Wilbraham L , Bullen K , et al. Gastrostomy insertion; comparing the options- PEG, RIG or PIG ? Clin Radiol 2003;58(5):398-405 . (PMID:12727170).
7. Larson DE, Burton DD, Schroeder KW, DiMagno EP. Percutaneous endoscopic gastrostomy. Indications, success, complications, and mortality in 314 consecutive patients. Gastroenterology 1987;93(1):48-52. (PMID:3108063).
8. Löser C, Aschl G, Hebuterne X, et al. ESPEN guidelines on artificial enteral nutrition percutaneous endoscopic gastrostomy (PEG). Clin Nutr 2005;24(5):848-61. (PMID:16261664).
9. Marik PE, Zaloga GP. Early enteral nutrition in acutely ill patients; a systematic review. Crit Care Med 2001;29(12):2264-70. (PMID:11801821).
10. Mendiratta P, Tilford JM, Prodhan P, et al. Trends in percutaneous endoscopic gastrostomy placement in the elderly from 1993 to 2003. Am J Alzheimers Dis Other Demen 2012;27(8):609-13. (PMID:23038714).
11. Pih GY, Na HK, Ahn JY, et al. Risk factors for complications and mortality of percutaneous endoscopic gastrostomy insertion. BMC Gastroenterol 2018;18(1):101. (PMID:29954339).
12. Raha SK, Woodhouse K. The use of percutaneous endoscopic gastrostomy (PEG) in 161 consecutive elderly patients. Age Ageing 1994;23(2):162-3. (PMID:8023728).
13. Sobani ZA, Tin K, Guttmann S, Abbasi AA, Mayer I, Tsirlin Y. Safety of percutaneous endoscopic gastrostomy tubes in centenarian patients. Clin Endosc 2018;51(1):56-60. (PMID:28728345).
14. Tham TC, Taitelbaum G, Carr-Locke DL. Percutaneous endoscopic gastrostomies; are they being done for the right reasons? QJM 1997;90(8):495-6. (PMID:9327026).
15. Toporowska-Kowalska E, Gębora-Kowalska B, Jabłoński J, Fendler W, Wąsowska-Królikowska K. Influence of percutaneous endoscopic gastrostomy on gastro-oesophageal reflux evaluated by multiple intraluminal impedance in children with neurological impairment. Dev Med Child Neurol. 2011;53(10):938-43. (PMID:21752017).
16. Wirth R, Voss C, Smoliner C, et al. Complications and mortality after percutaneous endoscopic gastrostomy in geriatrics: a prospective multicenter observational trial. JAMDA 2012;13(3):228-33. (PMID:21872536).
17. Young G, Kyong H , Yong J , et al. Risk factors for complications and mortality of percutaneous endoscopic gastrostomy insertion. BMC Gastroenterology 2018;18(1):101. (PMID:29954339).

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RESEARCH

# FREQUENCY OF POLYPHARMACY AND RISK FACTORS IN THE ELDERLYIN BURDUR

## Abstract

***Introduction:*** Polypharmacy is common among the elderly. This study aimed to determine the frequency of polypharmacy and the risk factors in the elderly.

***Materials and Method:*** This cross-sectional study will be analysed in three stages (polypharmacy, drug characteristics and drug interaction). Herein, the first stage (polypharmacy) was conducted at Burdur city centre and the connected villages. A total of 400 of 11,360 subjects aged ≥65 years who were registered with family physicians in Burdur city centre were selected using a systematic sampling method. A questionnaire of 30 questions about socio-demographic variables and rational drug use was distributed among the subjects. Subsequently, the subjects were asked to bring their own drugs from home that they were actively using or not currently using, and their drug-using behaviour was analysed via specific questions.

***Results:*** The average number of different drugs possessed by the subjects at home was approximately 6 (5.95±4.30). A total of 64.9% of the drugs were used regularly, 21.3% were used occasionally and 13.8% were previously used but not currently used. The median number±standard deviation of the drugs that were used regularly, used occasionally and previously used but not currently used was 3.86±3.36, 1.27±1.75 and 0.82±1.82, respectively. According to the results of multivariate analysis, the presence of diabetes, hypertension, respiratory system or cardiovascular (except hypertension) diseases, visual impairment or hearing disorders significantly increased the total drug use ($p<0.05$).

***Conclusion:*** Chronic diseases and living in the city centre are the main risk factors leading to polypharmacy. Therefore, interventions must be undertaken by monitoring and reducing chronic diseases and providing training on rational drug use in the provincial centres.

***Key words:*** Polypharmacy; Aged; Chronic disease

ARAŞTIRMA

# BURDUR İLİNDE YAŞAYAN YAŞLILARDA POLİFARMASİ SIKLIĞI VE POLİFARMASİYİ ETKİLEYEN ETMENLER

## Öz

***Giriş:*** Polifarmasi yaşlılıkta çok sık görülür. Bu araştırmada Burdur ilinde yaşayan yaşlı bireylerde polifarmasi sıklığı ve neden olan risk faktörlerinin incelenmesi amaçlanmıştır.

***Gereç ve Yöntem:*** Kesitsel tipte planlanan polifarmasi, ilaçların özellikleri, ilaç etkileşimi aşamalı bir çalışmanın birinci aşamasının (polifarmasi) yer aldığı bu araştırma, Burdur ili merkezi ve merkeze bağlı köylerde gerçekleştirildi. Burdur ili merkezde aile hekimlerine kayıtlı 65 yaş ve üzeri 11360 kişiden 400'ü sistematik örneklem yöntemiyle seçilmiştir. Kişilere sosyodemografik değişkenler ve akılcı ilaç tutumuna yönelik 30 soruluk anket uygulandı ve ikinci aşamada kişilerin evlerinde bulunan ve kendilerine ait olan kullandıkları veya şu an kullanmadıkları ilaçları getirmeleri talep edildi ve ilaçları kullanma ile ilgili davranışları belirli sorularla irdelendi.

***Bulgular:*** Kişilerin evlerinde kendilerine ait yaklaşık olarak ortalama 6 farklı etken maddeli ilaç (5.95±4.30) olduğu belirlendi. İlaçların %64,9'unu düzenli olarak, %21.3'ünü ara sıra kullanılmakta ve %13.8'ini ise önceden kullanmış ancak şu anda kullanılmamakta olduğu saptandı. Düzenli olarak kullanılan, ara sıra kullanılan ve önceden kullanılmış olup şimdi kullanılmayan ilaç sayısı ortalaması ve standart sapması sırasıyla; 3.86±3.36, 1.27±1.75, 0.82±1.82'dir. Polifarmasi (5 ve üzeri aktif olarak ilaç kullanma) sıklığı %36.5'dir. Multivariate analiz sonuçlarına göre, kişide diyabet, hipertansiyon, solunum sistemi veya kardiyovasküler sistem (hipertansiyon dışı) hastalığı bulunması, görme bozukluğu yaşaması veya işitme rahatsızlığı bulunması toplam ilaç kullanımını anlamlı şekilde arttırmıştır ($p<0.05$).

***Sonuç:*** Polifarmasiye yol açan asıl etkenin kronik hastalıklar ve kent merkezinde yaşam olduğu saptanmıştır; dolayısıyla kronik hastalıkların takibi ve azaltılmasına yönelik uygulamalar ve il merkezlerine akılcı ilaç kullanımı konusunda eğitim verilerek müdahale edilmesi gerekmektedir.

***Anahtar sözcükler:*** Polifarmasi; Yaşlı; Kronik hastalık

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## INTRODUCTION

The population over the age of 65 years has been growing rapidly as a result of the demographic transformation of the world and Turkey. The global elderly population, which was approximately 534 million in 2010, is estimated to be approximately 1.5 billion (mostly in developing countries) in 2050 (1).

In Turkey, the elderly population (age≥65 years) was 5,891,694 in 2013. In the last 5 years, it increased by 17% and reached 6,895,385 in 2017. The ratio between the elderly population and the total population was 7.7% in 2013 and increased to 8.5% in 2017. Based on future population estimates by the Turkish Statistical Institute, the ratio of elderly population is expected to be 10.2% in 2023, 12.9% in 2030, 16.3% in 2040, 22.6% in 2060 and 25.6% in 2080 (2).

Along with increase in the life expectancy, there have been changes in the causes of diseases and deaths. At the dawn of the 20th century, the major health threats were infectious and parasitic diseases that most often claimed the lives of infants and children. Currently, non-communicable diseases that more commonly affect adults and older people impose the greatest burden on global health. As a result, elderly people refer more to physicians due to increase in the number of elderly people with prolonged life expectancy, the multiplicity of comorbid diseases and increase in the need for health care. This may cause the elderly population to be in the forefront of drug consumption. The need for long-term use of drugs due to chronic diseases leads to concomitant use of certain drugs. Besides, undesirable side effects of drugs can easily occur owing to long-term use, drug-drug interactions and age-related changes in metabolic processes. For these reasons, the use of multiple drugs leads to a vicious circle that is difficult to break, if not prevented, in the elderly (3).

Polypharmacy (multi-drug use) has different definitions and can be expressed as the use of ≥4–5 drugs per day, the use of drugs more than those that are clinically indicated and the use of at least one unnecessary drug (4). The incidence of polypharmacy increases with age and also varies among countries. Study in the United States of America (USA) report that 23% of women aged over 65 years living in the community and 35%–40% of those aged 75–85 years have been shown to use ≥5 drugs (5). In the United Kingdom, 36% of individuals aged over 75 years have been shown to use ≥4 drugs per day (6). In Turkey, although there are no comprehensive data concerning the elderly living in the community, in studies among patients admitted to polyclinics, the rate of using ≥5 drugs was found to be 63.2% for women and 55.3% for men aged over 65 years. According to this study, the average number of drugs used per person was 4.5 and the use of ≥10 drugs was 7.9% (7).

The present study aimed to determine the frequency of polypharmacy and the risk factors in the elderly (aged ≥65 years).

## MATERIALS AND METHOD

This cross-sectional study will be analysed in three stages (polypharmacy, drug characteristics and drug interaction). Herein, the first stage (polypharmacy) was conducted at Burdur city centre and the connected villages. The study population comprised 11,360 subjects, after excluding individuals who are in prison (12 individuals) and those whose residence is outside the city centre (519 individuals) from 11,900 subjects aged ≥65 years who were registered with 28 family physicians in Burdur city centre. Considering the population of 11,360 individuals, prevalence of 50%, sampling error rate of 0.05 and confidence interval of 95.0%, the minimum sample size, which represents the population in the Epi info programme, was calculated to be 378. A total of 400 subjects were decided to be included in the study. The subjects to be sampled were selected by listing them as those who are registered with 1st family physicians to those who are registered with 28th family physicians (to protect regional factors as much as possible) using a systematic sampling method. A backup for each person was also identified. Because 13 individuals could not be reached, predefined back-ups were contacted. A pre-test was performed on 10 subjects (aged >65 years), who dropped out from the selected samples and back-ups selected before the research, and the questions were revised. The dependent variable of the study included

the total number of different drugs used by the subjects, whereas the independent variables included the rational drug use, attitudes and behaviours of the elderly and the general socio-demographic variables. First, a questionnaire of 30 questions about socio-demographic variables and rational drug use was distributed among the subjects. Second, the subjects were asked to bring their own drugs from home that they were actively using or not currently using. Their drug-using behaviour was then analysed via specific questions. Before data collection, training was provided to midwives and nurses who would collect the data to fill the questionnaire in order to ensure standardisation. Home visits were conducted by community health centre midwives and nurses who had previously received training and had field experience, and face-to-face interviews and questionnaires were conducted for subjects who provided consent to participate in the survey. Survey forms were filled by midwives and nurses. Data were collected between May 2016 and June 2016, and the obtained data were recorded electronically for statistical analysis using SPSS 22.0 statistical analysis software (SPSS Inc. Chicago, IL, USA). Quantitative data were represented as arithmetic average and standard deviation, and count data were represented as number (percentage). The chi-square test and Student's *t*-test were used for the analysis of variables, and logistic regression (backward LR) was used for multivariate analysis. The results were evaluated using a 95% confidence interval, and $p<0.05$ was considered statistically significant. Medical ethics committee approval was obtained from Başkent University Medical and Health Sciences (date: 17 May 2016, protocol number: KA16/215). After obtaining the necessary permits, the permission of Burdur Governorship Public Health Directorate was also obtained (date: 20 May 2016 and number of the permission file: 13124672/663.08), and the implementation of the research was started.

## RESULTS

This study included a total of 400 subjects aged ≥65 years, among which 64.0% lived in the city centre, 57.0% were women and 45.2% were aged ≥75 years. Furthermore, 64.2% of the subjects were married and 25.2% had no social security. Only 9.7% of the subjects graduated from secondary school and higher education institutions. During the study, subjects aged >65 years were asked to bring all their medications from home, and the medications were recorded according to their different types. A total of 2,378 different drugs were found to be possessed by the 400 subjects. The average number of different drugs possessed by the subjects at home was approximately 6 (5.95±4.30). A total of 64.9% of the drugs were used regularly, 21.3% were used occasionally and 13.8% were previously used but not currently used. The median number±standard deviation of the drugs that were used regularly, occasionally used and previously used but not currently used was 3.86±3.36, 1.27±1.75 0.82±1.82, respectively. *The frequency of polypharmacy (active use of ≥5 drugs) was 36.5%.*

The results of univariate analysis performed to evaluate factors affecting polypharmacy in the elderly showed that the following were statistically significant risk factors responsible for increasing the frequency of polypharmacy: *decreased number of people living in the house; female sex; age>75 years; those living in city centres; those who are widowed, single or separated; those living in nursing homes; diabetes; hypertension; heart problems; hearing problems; visual problems; chronic respiratory disorders; history of urinary incontinence and falling in the last 6 months and total number of illnesses and findings observed in the subject*. The following factors did not have a statistically significant effect on polypharmacy in this age group: education status, presence of social security and income status, making the doctor prescribe medication without being sick, rheumatism, hernia, osteoarthritis and osteoporosis, gastrointestinal disorders, history of faecal incontinence, presence of disability report and nervous system disorders (Alzheimer, parkinson, vertigo, paralysis, etc.) (Table 1).

According to the results of multivariate analysis, the presence of diabetes, hypertension, respiratory system or cardiovascular system (except hypertension) diseases; visual impairment or hearing disorder significantly increased the total drug use ($p<0.05$) (Table 2).

**Table 1.** Effect of descriptive factors on polypharmacy.

| Characteristics | Total (n=400, \|%100.0\|) | Polypharmacy is absent (0–4 medications) (n=254\|%63.5\|) | Polypharmacy is present (≥5 medications) (n=146 \|%36.5\|) | p |
|---|---|---|---|---|
| **Sex (Female)** | 228 (57.0) | 132 (52.0) | 96 (65.8) | 0.007 |
| **Age (years \| mean±sd)** | 74.5±6.8 | 73.9±6.8 | 75.6±6.7 | 0.017 |
| **Living place (city centre)** | 256 (64.0) | 150 (59.1) | 106 (72.6) | 0.007 |
| **Marital status (married)** | 257 (64.3) | 177 (69.7) | 80 (54.8) | 0.003 |
| **Education status**<br>**Illiterate**<br>**Literate**<br>**Primary school graduate**<br>**Secondary school graduate and higher** | 78 (19.5)<br>49 (12.3)<br>234 (58.5)<br>39 (9.7) | 44 (17.3)<br>29 (11.4)<br>158 (62.2)<br>23 (9.1) | 34 (23.3)<br>20 (13.7)<br>76 (52.1)<br>16 (11.0) | 0.255 |
| **Has social security** | 299 (74.8) | 194 (76.4) | 105 (71,9) | 0.323 |
| **Income status**<br>**Not enough**<br>**Barely enough**<br>**Easily earn a livelihood** | 89 (22.3)<br>187 (46.8)<br>124 (31.0) | 52 (20.5)<br>120 (47.2)<br>82 (32.3) | 37 (25.3)<br>67 (45.9)<br>42 (28.8) | 0.498 |
| **Lives at home with**<br>**Only partner**<br>**Partner and relatives***<br>**Only relatives**<br>**Alone**<br>**Nursing home** | 206 (51.5)<br>51 (12.8)<br>54 (13.5)<br>72 (18.0)<br>17 (4.2) | 142 (55.9)<br>35 (13.8)<br>32 (12.6)<br>38 (15.0)<br>7 (2.8) | 64 (43.8)<br>16 (11.0)<br>22 (15.1)<br>34 (23.3)<br>10 (6.8) | 0.028 |
| **The number of people living at home (mean±sd)** | 2.2±1.2 | 2.3±1.2 | 2.1±1.1 | 0.044 |
| **Making the doctor prescribe medication without being sick** | 174 (43,5) | 114 (44.9) | 60 (41.1) | 0.462 |
| **Diabetes** | 82 (20.5) | 30 (11.8) | 52 (35.6) | <0.001 |
| **Hypertension** | 201 (50.3) | 97 (38.2) | 104 (71.2) | <0.001 |
| **Cardiovascular disease (except hypertension)** | 123 (30.8) | 42 (16.5) | 81 (55.5) | 0.000 |
| **Cancer** | 7 (1.8) | 3 (1.2) | 4 (2.7) | 0.264 |
| **Vision impairment** | 305 (76.2) | 188 (74.0) | 117 (80.1) | <0.001 |
| **Hearing problem** | 166 (41.5) | 87 (34.3) | 79 (54.1) | <0.001 |
| **Respiratory tract disorders** | 46 (11.5) | 19 (7.5) | 27 (18.5) | 0.001 |
| **Rheumatism, herniated disc, osteoarthritis and osteoporosis** | 122 (20.5) | 82 (32.3) | 40(27.4) | 0.307 |
| **Gastrointestinal tract disorders** | 46 (11.5) | 27 (10.6) | 19 (13.0) | 0.472 |
| **Nervous system disorders (Alzheimer, Parkinson, vertigo, paralysis, etc.)** | 47 (11.8) | 28 (11.0) | 19 (13.0) | 0.552 |
| **Stroke history** | 56 (14.0) | 28 (11.0) | 28 (19.2) | 0.024 |
| **Stress incontinence** | 155 (38.8) | 81 (31.9) | 74 (50.7) | <0.001 |
| **Urge incontinence** | 168 (42.0) | 93 (36.6) | 75 (51.4) | 0.004 |
| **Faecal incontinence** | 27 (6.8) | 16 (6.3) | 11 (7.5) | 0.636 |
| **Fall in last 6 months** | 95 (23.8) | 52 (20.5) | 43 (29.5) | 0.042 |
| **Disability reports** | 5 (1.2) | 1 (0.4) | 4 (2.7) | 0.062 |
| **Total number of illnesses and findings in the person (mean±sd)** | 3.8±1.9 | 3.2±1.8 | 4.9±1.5 | <0.001 |

*** Do you ask your doctor to prescribe medication without being sick or do you buy it and keep it at home thinking it might be necessary?
* Relatives: children, grandchildren and other people.

**Table 2.** Factors affecting polypharmacy.

| Factor | OR (95%, CI) | p |
|---|---|---|
| **Living place (province centre, village ref.)** | 1.816 (1.054–3.130) | 0.032 |
| **Diabetes (present, absent ref.)** | 3.239 (1.800–5.828) | <0.001 |
| **Hypertension (present, absent ref.)** | 2.689 (1.621–4.460) | <0.001 |
| **Cardiovascular (except hypertension) diseases (present, absent ref.)** | 4.923 (2.928–8.277) | <0.001 |
| **Hearing problem (present, absent ref.)** | 2.226 (1.409–3.873) | 0.001 |
| **Chronic respiratory disorder (present, absent ref.)** | 2.934 (1.407–6.120) | 0.004 |

Backward LR logistic regression, −2Log likelihood: 370.543, Nagelkerke R Square: 0.438, variables in the equation: p=0.000, wald: 28.426.
OR: odds ratio; CI: confidence interval

## DISCUSSION

In our study group, the frequency of polypharmacy (active use of ≥5 drugs) was 36.5%, which was considered as a significant problem. The incidence of polypharmacy increases with age and varies between countries, and it is reported to be approximately 35%–40% in the elderly aged >75 years (8,9). The frequency of polypharmacy also varies between the elderly living in the community and the elderly living in the nursing home. Among the patients living in the community, the incidence rates of 41%, 43.4%, 35.8% and 46.8% were reported from Iceland, USA, Australia and Italy, respectively (10-12). In a recent study conducted among nursing homes as a report of shelter work in eight European countries, the incidence rate was reported to be 49.7% (13). In the study conducted by Arslan et al., it was found that 28.2% of the participants were using one drug, 24.3% two drugs, 18.5% three drugs, 11.7% four drugs and 17.3% five or more drugs (14). Gurol Arslan et al. revealed that 35% of the elderly were using 5–6 drugs and the number of drugs used by them was 4.5±1.8 (15). In the study conducted by Kutsal et al. in 2006 on multiple drug use by interviewing 1,433 elderly aged ≥65 years, 84.7% of the elderly who participated in the survey had at least one drug that was regularly used and 15.3% did not have any; furthermore, 23.2% of the subjects stated that they were using only one drug, 17% two drugs, 19.2% three drugs and 38.2% four and more drugs (16). In the study by Arslan et al. (15) evaluating drug use in patients aged ≥65 years, there was no significant difference between male and female patients in terms of the amount of drugs used; 11.7% of the elderly were using four drugs and 17.3% were using five or more drugs. The results of univariate analysis showed that polypharmacy was more common in women. Based on the results of multivariate analysis, it was found that the presence of chronic diseases in general was the main risk factor. Longer life expectancy and higher frequency of chronic illness in women, especially those aged >65 years, were risk factors for using multiple drugs. There are many factors driving polypharmacy. Some studies have shown a relationship between polypharmacy and both female sex and age>80 years (17,18). In our study, there was no relationship between socio-demographic factors and polypharmacy. This may have been due to the characteristics of the study group.

As a general outcome of the study, the presence of chronic diseases that increase with age leads to polypharmacy. Because chronic diseases,

especially hypertension, is both frequent and leads to the use of multiple drugs in the relevant age group, it is considered an important problem that needs to be addressed. Approximately half of those participating in the study and 71.2% of those with polypharmacy have hypertension. In the study by Ozturk et al. evaluating the drug use in patients aged >65 years, the amount of subjects using four and more drugs was 46.7% and similarly the frequency of hypertension was 48.1% (19). In the study conducted by Iscigil et al., in which the elderly living in nursing homes and patients who applied to university polyclinics were studied and compared based on their drug use, antihypertensives were reported as the most commonly used drugs (20). Ozturk et al. also found that the frequency of hypertension was high (approximately 50%) in the elderly, and it was one of the significant risk factors of polypharmacy (21). Diabetes, one of the chronic diseases, also emerged as a significant public health problem with a frequency of 20.5% in the study group. In addition, approximately 35% of those who used multiple drugs and 11.8% of those who did not use any drugs had diabetes. In our study, diabetes was considered to be another significant risk factor of polypharmacy. Similarly, in the study by Ozturk et al., the frequency of diabetes was found to be 23.2% in the elderly (19). Arslan et al. found that the frequency of diabetes was 10.2% in the elderly living in the nursing home (15). In the study by Oztürk et al. examining the factors affecting polypharmacy in the elderly, the frequency of diabetes was found to be 39.0% in the study group, 49.0% in the polypharmacy group and 24.0% in the non-polypharmacy group (21). It is understood that diabetes is one of the major disease groups, which requires intervention, in terms of rational drug use. In other foreign studies, similarly to our study, it has been found that diabetes and hypertension lead to polypharmacy (22-23). In our study, the number of elderly people with hearing impairment, which was diagnosed based on the Problems and Expectations of People with Disabilities study (2010), was found to be significantly higher than that of people aged ≥65 years (7.7%) (24). This difference is considered to be attributed to the fact that those with mild hearing loss, who do not require hearing aids, were also included in our study as those with hearing problems. Hearing problems can also trigger polypharmacy as it appears with other chronic diseases. Another factor affecting polypharmacy was chronic respiratory diseases; 11.5% of the study group and 18.5% of those with polypharmacy had chronic respiratory disease. In patients with such chronic conditions, the problem of multiple and long-term drug use is prevalent.

In our study, polypharmacy was found to be higher in subjects who live in the city centre. Studies have shown that elderly people living in urban areas have more tendency toward polypharmacy due to the following: the ease of access to health services, the tendency of patients to visit different doctors and take many prescriptions, the presence of excess drug expectations, the use of medication for symptoms rather than diagnosis, the tendency of doctors to terminate current medication and start a new one, the large number of non-prescription drug sales without awareness of the physicians and the tendency of elderly patients to use medications taken from family members or surroundings (25). Doctor or Physicians; which one?

In conclusion, the prevention of chronic diseases, which is considered as the main cause of polypharmacy in the elderly, the adaptation of a rational drug use approach by physicians and the follow-up and regulation of drugs by family physicians, especially for the elderly with chronic diseases, are shown to be necessary to maintain multiple drug use at a certain level. We recommend trainings on rational drug use in city centres and then in rural areas and preventing patients from taking drugs from pharmacies in an uncontrolled manner.

## REFERENCES


1. Arslan S, Atalay A, Gokce Kutsal Y. Drug use in older people. J Am Geriatr Soc 2002;50(6):1163-4. (PMID:12110084).
2. Badedi M, Solan Y, Darraj H, et al. Factors associated with long-term control of type 2 diabetes mellitus. J Diabetes Res 2016;2109542. (PMID:28090538).
3. Bahat G, Tufan F, Bahat Z, et al. Comorbidities, polypharmacy, functionality and nutritional status in Turkish community-dwelling female elderly. Aging Clin Exp Res 2014;26:255-9. (PMID:24781830).
4. Ballentine HN. Polypharmacy in the elderly. Critical Care Nursing Quarterly 2008; 31: 4. (PMID:18316935).
5. Beer C, Hyde Z, Almeida OP, et al. Quality use of medicines and health outcomes among a cohort of community dwelling older men. J Clin Pharmacol 2011;71:592-9. (PMID:21395652).
6. Discigil G, Tekinc N, Anadol Z, Bozkaya AO. Polypharmacy in nursing home and community-dwelling elderly. Turk J Geriatrics 2006;9:117-21. (in Turkish).
7. Gokce Kutsal Y, Barak A, Atalay A, et al. Polypharmacy in the elderly: A multicenter study". J Am Med Dir 2009;1(7):486-90. (PMID:19716065).
8. Gürol AG, Eşer İ. Self-medication compliance in elderly and nurses role. Journal of Ege University Nursing Faculty 2005;21:147-57. (in Turkish).
9. Heuberger RA, Caudell K. Polypharmacy and nutritional status in older adults. Drugs Aging 2011;28:315-23. (PMID:21428466).
10. Kaufman DW, Kelly JP, Rosenberg L, Anderson TE, Mitchell AA. Recent patterns of medication use in the ambulatory adult population of the United States: The Slone Survey. JAMA 2002;287:337- 44. (PMID:11790213).
11. Mamun K, Lien CTC, Goh-Tan CYE. Polypharmacy and inappropriate medication use in Singapore nursing homes. Ann Acad Med Singapore 2004; 33:49-52. (PMID:15008562).
12. McCracken R, McCormack J, McGregor MJ, Wong ST, Garrison S. Associations between polypharmacy and treatment intensity for hypertension and diabetes: a cross-sectional study of nursing home patients in British Columbia, Canada. BMJ Open 2017;7(8):7-8. (PMID:28801438).
13. Morin L, Johnell K, Laroche ML, Fastbom J, Wastesson JV. The epidemiology of polypharmacy in older adults: register-based prospective cohort study. Clin Epidemiol 2018;10:289-98. (PMID:29559811).
14. Onder G, Liperoti R, Fialova D, et al. Polypharmacy in nursing home in Europe: results from the Shelter study. J Gerontol A Biol Sci Med Sci 2012;67(6):698-704. (PMID:22219520).
15. Ozturk Z, Ugras KG. Drug use and polypharmacy in elderly patients. The Journal of Tepecik Education and Research Hospital 2017;27(2):103-08.
16. Ozturk ZG, Ardıc C, Toprak D. Frequency of polypharmacy and use of potentially inappropriate Medications in the elderly. Turk J Geriatrics 2017;20(4):296-305. (PMID:127620431).
17. Pereira KG, Peres MA, Iop D, et al. Rev Bras Epidemiol 2017;20(2):335-44. (PMID:28832855).
18. Prescribing and Medicines Team Health and Social Care Information Centre. Prescriptions dispensed in community statistics for 1989–1999: England. Statistical Bulletin 2014. [Internet] Available from: https://digital.nhs.uk/data-and-information/publications/statistical/prescriptions-dispensed-in-the-community. Accessed: 05.02.2018.
19. Qato DM, Alexander GC, Conti RM, et al. Use of prescription and over-the-counter medications and dietary supplements among older adults in the United States. JAMA 2008;300:2867-78. (PMID:19109115).
20. Rochon PA, Schmader KE, Sokol HN. Drug prescribing for older adults. [Internet] Available from: https://www.uptodate.com/contents/drug-prescribing-for-older-adults. Accessed: 14.04.2018.
21. Santos TRA, Lima DM, Nakatani AYK, et al. Medicine use by the elderly in Goiania. Midwestern Brazil 2013;47(1):94-103. (PMID:23703135).
22. Sigurdardottir AK, Arnadottir SA, Gunnarsdottir ED. Medication use among community-dwelling older Icelanders. Laeknabladid 2011;97:675-80. (PMID:22133526).
23. TurkStat, Statistics by the Aged 2017, Number: 27595, [Internet] Available from: http://www.tuik.gov.tr/PreHaberBultenleri.do?id=27595, Accessed: 15.03.2018.
24. TurkStat, Survey on Problems and Expectations of Disabled People, 2010 [Internet] Available from: www.tuik.gov.tr/IcerikGetir.do?istab_id=244. Accessed: 26.6.2018.
25. United Nations. World Population Prospects: The 2010 Revision. [Internet] Available from: http://esa.un.org/unpd/wpp. Accessed: 26.7.2018.

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RESEARCH

# EFFICACY OF PULSED ELECTROMAGNETIC FIELD THERAPY IN PATIENTS WITH LUMBAR SPINAL STENOSIS: A RANDOMISED CONTROLLED STUDY

## Abstract

***Introduction:*** Lumbar spinal stenosis is a disorder that may cause low back and/or leg pain. This study aimed to evaluate the efficacy of pulsed electromagnetic field therapy in lomber spinal stenosis.

***Materials and method:*** This study is single-blind randomised controlled study. Fifty patients diagnosed with lomber spinal stenosis were randomised into two groups. Patients in the first group [median age 61 (51-84) years] underwent 10 sessions of active pulsed electromagnetic field therapy (25 Hz, 80 gauss) for 15 minutes a day, whereas those in the second group [median age 64 (55-77) years] were controls and underwent 10 sessions of placebo pulsed electromagnetic field therapy. The patients were assessed with VAS, the Timed Up and Go test, Oswestry Disability Index and EQ5D-VAS. All tests were completed at baseline, after treatment and at a 3-week follow-up.

***Results:*** Forty-nine patients completed the study. The pulsed electromagnetic field therapy group significantly improved VAS score, Oswestry Disability Index and EQ5D-VAS ($p<0.05$) after treatment. Significant improvement was sustained after 3-week follow up. In the placebo group, there was no significant change in VAS score, Oswestry Disability Index or EQ5D-VAS ($p>0.05$) after treatment. Pulsed electromagnetic field therapy group showed significant improvement than plasebo group in terms of pain severity, Oswestry Disability Index, EQ5D-VAS and Timed Up and Go after treatment and at follow-up ($p<0.05$).

***Conclusion:*** Pulsed electromagnetic field therapy appears to be useful in terms of back and/or leg pain, functional mobility, physical disability and general health-related quality of life in lumbar spinal stenosis patients.

***Keywords:*** Spinal stenosis; Magnetic fields; Back pain; Quality of life

ARAŞTIRMA

# LOMBER SPİNAL STENOZLU HASTALARDA PULSE ELEKTROMANYETİK ALAN TERAPİSİNİN ETKİNLİĞİ: RANDOMİZE KONTROLLÜ ÇALIŞMA

## Öz

***Giriş:*** Lomber spinal stenoz bel ve/veya bacak ağrısına neden olabilen bir rahatsızlıktır. Bu çalışma lomber spinal stenozda pulse elektromanyetik alan terapisinin etkinliğini değerlendirmeyi amaçladı.

***Gereç ve Yöntem:*** Bu çalışma tek kör randomize kontrollü bir çalışmadır. Lomber spinal stenoz tanısı konulan 50 hasta 2 gruba randomize edildi. 1. gruptaki hastalar [ortanca yaş 61 (51-84) yıl] 10 seans, günde 15 dakika pulse elektromanyetik alan terapisi (25 Hz, 80 gauss) aldı, 2. grup kontrol grubuydu [ortanca yaş 64 (55-77) yıl] ve 10 seans plasebo pulse elektromanyetik alan terapisi aldı. Hastalar VAS, Süreli Kalk ve Yürü testi, Oswestry Disabilite İndeksi ve EQ5D-VAS skalası ile değerlendirildi. Tüm değerlendirmeler başlangıçta, tedavi sonrası ve tedaviden 3 hafta sonra tamamlandı.

***Bulgular:*** 49 hasta çalışmayı tamamladı. Pulse elektromanyetik alan terapisi grubunda tedavi sonrası VAS skoru, Oswestry Disabilite İndeksi'de ve EQ5D-VAS anlamlı olarak iyileşmişti ($p<0.05$). Anlamlı iyileşme tedaviden 3 hafta sonrada sürdürüldü. Kontrol grubunda tedavi sonrası VAS, Oswestry Disabilite İndeksi veya EQ5D-VAS'da anlamlı değişim olmadı ($p>0.05$). Pulse elektromanyetik alan terapisi grubunda plasebo gruba göre ağrı şiddeti, Oswestry Disabilite İndeksi, EQ5D-VAS, Süreli Kalk ve Yürü testi tedavi sonrası ve kontrolde anlamlı gelişim gösterdi ($p<0.05$).

***Sonuç:*** Pulse elektromanyetik alan terapisi uygulaması lomber spinal stenozlu hastalarda bel/bacak ağrısı, fonksiyonel mobilite, fiziksel dizabilite ve genel yaşam kalitesi açısından yararlı olduğu ortaya çıkmıştır.

***Anahtar sözcükler:*** Spinal stenoz; Manyetik alanlar; Bel ağrısı; Yaşam kalitesi

## INTRODUCTION

Lumbar spinal stenosis (LSS) is one of the major causes of back pain, ranging in incidence between 1.7%–8% (1). The diagnosis of LSS is usually made with history and clinical findings. Magnetic resonance imaging (MRI) provides information about the level and severity of stenosis (2). Although measuring spinal canal diameter is advantageous for diagnosis, the severity of symptoms is not necessarily always proportional to the canal diameter (2).

Due to the increase in the elderly population, diagnosis and treatment of LSS has become even more important today. In patients with mild to moderate symptoms, conservative treatment methods are preferred initially (3). Physiotherapy modalities are commonly used as non-pharmacological treatments are less likely to have systemic side effects (4). However, treatment of pain associated with spinal stenosis is challenging, and therefore, new treatment methods are needed.

Pulsed electromagnetic field therapy (PEMF) has been used and found to be useful in the treatment of pain due to different causes such as degenerative arthritis, lateral epicondylitis, and fibromyalgia (5-8). To our knowledge, there is no previous study on PEMF in cases with LSS. The magnetic field treatment created by passing a continuous current through a coil has analgesic and anti-inflammatory effects. Macrophage stimulation provides an anti-inflammatory effect by changing enzyme activation and pH. It creates an analgesic effect by depolarising the nociceptive C-fibres. Moreover, the high level of anti-inflammatory cytokines due to increased blood flow because of vasodilatation may also play a role in the analgesic effect (9). It is possible to avoid undesirable side effects, such as heating in pulsed magnetic fields created by conducting discrete electrical currents through the coil (5). Different devices for magnetic field treatment have been developed for this purpose. The strongest magnetic fields are the spiral electrodes surrounding the body (10).

The aim of this study was to investigate the efficacy of PEMF in patients with back and/or leg pain associated with LSS.

## MATERIALS AND METHOD

This study is single-blind randomised controlled study. Fifty patients who were admitted to hospital outpatient clinic presenting with complaints of back and/or leg pain between 15 November, 2015 and 15 November, 2016 and diagnosed with LSS based on clinical findings and lumbar MRI were included in this study. A diagnosis of the clinical syndrome of LSS requires both the presence of characteristic symptoms (low back pain, neurogenic claudication, lower extremity pain, numbness) and signs and radiographic or anatomic confirmation of narrowing or stenosis (central canal<10mm, lateral recess<3mm) of the lumbar spinal canal (11).

The inclusion criteria were: Patients aged>50 years, having chronic back pain, capable of independent ambulation, absence of visual disturbances and hearing impairments, good mental and cognitive health, having central and/or lateral recess stenosis on spinal stenosis on MRI and not having a physical therapy programme in the last 3 months. The exclusion criteria were: back pain for<3 weeks, inconsistent clinic findings although the detection of LSS on MRI, presence of progressive neurological deficit, primary or metastatic spinal malignancy or history, infectious spondylodiscitis such as tuberculosis, brucellosis, inflammatory spondylitis, uncontrolled systemic disease, history of lumbar surgery, the presence of acute lumbar trauma, lower limb operation

or unhealed fracture, pregnancy, epilepsy and implanted medical devices, such as pacemaker, insulin pump or hepatic artery infusion pump.

The history of physiotherapy in the last year, walking distance , duration of low back pain, number of sessions, and the use of analgesics braces and canes were noted. In MRI, the level of lumbar central stenosis of all patients was determined, and central canal and lateral recess diameters were measured. Central canal measured distance between middle of vertebral body and middle of basis processus spinosus at border of dural sac. Lateral recess measured distance between superior articular facet and the top part of the pedicle. Measures were recorded in milimetres (12). All patients were examined by the same physician, and all of them experienced an increased pain with back extension. Patients were randomly assigned to each group. The treatment group received PEMF for 15 minutes in each session. Patients in the placebo group were laid on PEMF table for 15 minutes, but did not receive treatement; they received magnetic field therapy for 2 weeks. Patients in both groups were trained in lumbar flexion exercises, and advised to do these exercises every day for 10 times, twice a day throughout the study. Patients in both groups were allowed to use paracetamol for pain if needed. Physical examination was performed in the patients in both groups before therapy, at the end of 10 sessions of therapy and 3 weeks after therapy.

Visual analogue scale (VAS: 0–10cm) was used to assess the severity of resting low back pain or leg pain with 0 (no pain) to 10 (worst pain ever). Timed Up and Go (TUG) test was used for functional mobility. The TUG uses the time that a person takes to rise from a standard 45 cm chair, walk 3 m, turn around, walk back to the chair, and sit down (13). Two trials performed and the faster of the two is recorded. The Oswestry Disability Index (ODI; range 0-100) was used for physical disability. It is a self-administered questionnaire divided into ten sections designed to assess limitations of various activities of daily living. Each section is scored on a 0–5 scale, 5 representing the greatest disability. The index is calculated by dividing the summed score by the total possible score, which is then multiplied by 100 and expressed as a percentage (14). The overall quality of life was assessed using the EuroQol-5D VAS (EQ5D-VAS) index scale. EQ5D-VAS was presented as a vertical line, marked from 100 (best imaginable health state) to 0 (worst imaginable health state) in the centre of page. Respondents were asked to draw a line to the EQ5D-VAS to indicate how good or bad health state.

MAG-Expert with coil Ø 60 cm (Physiomed, Germany, AC input 230V/1-100Hz, intensity 1-100 gauss, input power 400VA) magnetotherapy unit was used for PEMF administration in the study. PEMF for a total of 10 sessions was administered to the lumbar region for two weeks, 15 minutes per day and five sessions per week.

Patients were treated at the same specific time each day. All applications were carried out by the same person during the therapy. Patients were laid in a comfortable supine position on the treatment table. Channel 1 was selected from the device touch screen, and the frequency was set manually to 25 Hz and intensity to 80 gauss.

Patients in both the PEMF and placebo groups received therapy (or sham) in the same manner for the same amount of time. Patients in the placebo group were placed in supine position into the solenoid coil. The written consents of all the patients enrolled in the study were obtained after they were informed of the study and relevant general information about their disease. This study was approved by the hospital ethics committee on 08.04.2016. (Number:2016-202)

### Statistical analysis

The mean, standard deviation, median lowest, highest, frequency and ratio values were used in the descriptive statistics of the data. The distribution of the variables was measured by the Kolmogorov-Simirnov test. Mann–Whitney U test and independent samples t test were used in the analysis of quantitative data. Chi-square test was used in the analysis of qualitative data. The SPSS 22.0 software package was used in the analyses, and a P value of<0.05 was considered statistically significant. Clinical parameter values (VAS, ODI, TUG, EQ5D-VAS) were assessed at baseline, posttherapy, and at the 3 weeks follow-up period in PEMF and placebo groups (Table 2). Posttherapy and control period clinical parameter values were compared to pretreatment (Table 3). Differences were calculated and the group comparison was made (Table 3).

**Table 1.** Demographic characteristics, duration of low back pain, walking distance and MRI findings related with LSS.

| Characteristics | | PEMF Group | | | Placebo Group | | | p |
|---|---|---|---|---|---|---|---|---|
| | | Mean±sd | Median | (min-max) | Mean±sd | Median | (min-max) | |
| **Age (years)** § | | 61.6±8.6 | 61 | (50-84) | 64.6±5.0 | 64 | (55-77) | 0.061 |
| **Sex (F/M)**** | | 18/7 | | | 17/7 | | | 0.928 |
| **BMI (kg/m²)*** | | 28.2±4.1 | 28.3 | (22-38) | 29.2±3.9 | 29 | (19-36) | 0.327 |
| **Profession**** | Housewife | 10 | | | 8 | | | 0.151 |
| | Retired | 12 | | | 16 | | | |
| | Working | 3 | | | | | | |
| **Walking Distance (m)*** | | 1802±2110 | 500 | (100-5000) | 1092±708 | 1000 | (100-2000) | 0.936 |
| **Duration of low back pain* (Year)** | | 4.9±3.1 | 5 | (1-10) | 7.3±1.9 | 7 | (3-11) | 0.003‡ |
| **Level of stenosis** | L1-2 | 2 (8%) | | | 5 (20.8%) | | | |
| | L2-3 | 2 (8%) | | | 12(50%) | | | |
| | L3-4 | 8 (32%) | | | 3 (12.5%) | | | |
| | L4-5 | 7 (28%) | | | 3 (12.5%) | | | |
| | L5-S1 | 6 (24%) | | | 1 (4.5%) | | | |
| **Central canal diameter (mm)*** | | 8.9±0.6 | 9 | (8-9.8) | 8.8±0.6 | 9 | (8-9.8) | 0.847 |
| **Lateral recess diameter (mm)*** | | 2.5±0.2 | 2.5 | (2.1-2.9) | 2.4±0.3 | 2.5 | (1.8-2.8) | 0.245 |

Abbereviations: BMI,body mass index; F, female; M, male; SD,Standard Deviation

*Mann–Whitney U test **Chi-square test § t test ‡P value of<0.05 statistically significant

**Table 2.** Change in Clinical parameters at the end of therapy and at 3 weeks of control period.

| Characteristics | | PEMF Group Mean±sd | Median | (min-max) | Placebo Group Mean±sd | Median | (min-max) | p |
|---|---|---|---|---|---|---|---|---|
| VAS* | Baseline | 6.1±1.8 | 6 | (3-9) | 6.2±1.6 | 6 | (3-8) | 0.878 |
| | Posttherapy | 4.5±2.5 | 4 | (0-9) | 6±1.6 | 6 | (3-8) | 0.024‡ |
| | Control | 4.5±2.5 | 4 | (0-9) | 6±1.6 | 5 | (3-8) | 0.032‡ |
| ODI* | Baseline | 46.2±17.2 | 44 | (2-68) | 47±17.5 | 45 | (26-82) | 0.857 |
| | Posttherapy | 40.8±19.3 | 42 | (0-68) | 46.9±17.5 | 44 | (24-82) | 0.028‡ |
| | Control | 39.5±19.4 | 36 | (0-68) | 46.3±17.4 | 45 | (24-82) | 0.018‡ |
| TUG* | Baseline | 13.8±3.4 | 14 | (8-21) | 14.5±3.2 | 14 | (10-21) | 0.747 |
| | Posttherapy | 13.1±3.6 | 13 | (8-21) | 14.6±3.2 | 14 | (10-21) | 0.141 |
| | Control | 12.8±4.3 | 13 | (7-21) | 14.6±3.0 | 15 | (10-21) | 0.155 |
| EQ5D-VAS* | Baseline | 57.4±14.7 | 60 | (30-90) | 52.7±15.9 | 55 | (30-80) | 0.280 |
| | Posttherapy | 63.4±15.9 | 70 | (30-95) | 52.9±15.9 | 55 | (30-80) | 0.029‡ |
| | Control | 64±16.3 | 70 | (30-95) | 52.9±15.9 | 55 | (30-80) | 0.023‡ |

Abbereviations: VAS, visual analogue scale; ODI, oswestry disabilite indeksi; TUG, timed up and go test;EQ5D-VAS, EuroQol-5D visual analogue scale;SD,Standard Deviation *Mann–Whitney U test ‡P value of<0.05 statistically significant

**Table 3.** Change in clinical parameters at the end of therapy and at 3 weeks of control period.

| Change Compare to Baseline | | PEMF Group Mean±sd | Median | (min-max) | Placebo Group Mean±sd | Median | (min-max) | p |
|---|---|---|---|---|---|---|---|---|
| VAS* | Posttherapy | −1.6±1.3 | -2 | (-4-0) | −0.2±0.4 | 0 | (-1-0) | 0.001‡ |
| | Control | −1.6±1.3 | -2 | (-4-0) | −0.5±0.8 | 0 | (-2-0) | 0.0004‡ |
| ODI* | Posttherapy | −5.4±8.4 | -2 | (-26- -6) | −0.1±1.4 | 0 | (-2- -4) | 0.011‡ |
| | Control | −6.8±7.8 | -2 | (-26-0) | −0.7±2.3 | 0 | (-6- -5) | 0.004‡ |
| TUG* | Posttherapy | −0.7±1.1 | -0,4 | (-2,5- +1,5) | 0.1±0.8 | 0 | (-1-+3) | 0.001‡ |
| | Control | −1±2.1 | -0,4 | (-2,5- +1.3) | 0.2±1.0 | 0 | (-2-+3) | 0.002‡ |
| EQ5D-VAS* | Posttherapy | 6±7.6 | 5 | (0- +30) | 0.2±2.3 | 0 | (-5- -10) | 0.001‡ |
| | Control | 6.6±8.1 | 5 | (0- +30) | 0.2±2.3 | 0 | (-5- -10) | 0.001‡ |

Abbereviations: VAS, visual analogue scale; ODI, oswestry disabilite indeksi; TUG, timed up and go test;EQ5D-VAS, EuroQol-5D visual analogue scale; SD,Standard Deviation * Mann–Whitney U test ‡P value of<0.05 statistically significant.

## RESULTS

Forty nine patients who were clinically diagnosed with LSS and confirmed by MRI completed this single-blind, prospective placebo randomised controlled study. One patient in the placebo group discontinued the treatment because of moving to another city. The demographic characteristics of the patient and walking distances are summarised in Table 1. There was no statistically significant difference between the age and gender distribution and body mass index (BMI) values of the treatment and placebo groups ($p>0.05$). Antihypertensives were the most commonly used drug in both groups. 14 patients in the PEMF group (56%) and 17 in the placebo group (70.8%) were using antihypertensive drugs.

There was no statistically significant difference between the walking distances in PEMF and placebo groups ($p>0.05$).

The spinal canal diameter measurements of patients in the PEMF and placebo groups are summarised in Table 1. In the PEMF group, the most frequent level of absolute central stenosis was L3-4 by 32%, whereas the most common level involved in the placebo group was L2-3 by 50%. There was no significant difference between the diameters of antero–posterior central canal and lateral reces in PEMF and placebo groups ($p>0.05$). Mean duration of low back pain was shorter in the PEMF group than that in control ($p<0.05$).

Pain intensity measured by VAS before therapy, ODI scores, duration of TUG test and EQ5D-VAS are summarised in Table 2. There was no significant difference between PEMF and placebo groups in terms of pretreatment VAS, ODI, EQ5D-VAS and TUG scores ($p>0.05$). In the PEMF group, improvement in VAS, ODI, EQ5D-VAS and TUG values after treatment and after 3 weeks compared to the placebo group ($p<0.05$). The improvement in VAS, ODI and EQ5D-VAS values after treatment and 3 weeks control in the PEMF group was significantly better according to the baseline values ($p<0.05$). In the placebo group, VAS, ODI, TUG and EQ5D-VAS scores did not show any change after treatment ($p>0.05$). There was no significant difference in term of baseline TUG values between the groups ($p>0.05$). However, the decrease in TUG values was significantly higher in PEMF group than that of controls' immediately after treatment and after 3 weeks later ($p<0.05$).

## DISCUSSION

In this study, our treatment intervention (10 sessions of 15-minute PEMF) improved low back and leg pain, disability, functional mobility and general health condition in LSS patients, which was sustained even after 3 weeks. No significant improvements were noted in the placebo group.

Chronic pain is related to depression, disability and reduced quality of life (15). We believe that PEMF has positive effects on disability and quality of life parameters due to decreased back pain. In this study, there was significant relief in low back and leg pain after treatment in the PEMF group with LSS. The magnetic field affects cell membrane potential causing depolarisation in the nociceptive C-fibres, resulting in an analgesic effect (9). In a plethysmographic study, blood flow in the applied magnetic field region is increased by 45% and oxygenation is increased by 25%. Increased blood flow in the tissues creates an anti-inflammatory effect (16).

Khoromi et al., assessed the pain relieving efficacy of low indensity permenant magnets in a double-blind, randomized study in patients with lumbar radicular pain. They concluded that relative treatment effect of the 200 G magnets appeared to increase throughout the 5-week period and for this reason this type of therapy may be considered in patients with lumbar radicular pain (17).

In a randomised controlled study in patients with discogenic lomber radiculopathy by Omar et al., severity of low back pain was reduced with 3 weeks of PEMF (18), as well as improvements in hypoesthesia, achilles reflex, and straight leg raise tests.

In current study, there was a significant increase in functional mobility after treatment in the PEMF group compared to control. The increase in mobility was sustained after three weeks. In the placebo group, there was no change in mobility after treatment or after three weeks.

An important finding of this study was that the improvement in the physical disability measured by ODI in the PEMF group was significantly better after treatment and at 3 weeks of control. However, there was a significant decrease in physical disability after treatment in both PEMF and placebo groups, and was sustained for the 3-week post-treatment period. This suggests that PEMF treatment in patients with lumbar radiculopathy provides a significant improvement in the disability scores measured by modified ODI (18).

In our study, the improvement in health condition as measured by EQ5D-VAS after treatment in the PEMF group was significantly better than placebo. This situation also continued after the 3-week control period. There was an insignificant improvement in the placebo group after treatment and 3 weeks follow-up period.

Chao et al., suggested that cervical and lumbar radicular pain decreased by 53.6% and 50.8%, respectively, after one week of PEMF treatment. In the same study, the relief of pain was reported in 55% and 45.8% of patients with cervical and lumbar radiculopathy after 3 months of treatment, respectively (19). Also, in a randomised double-blind controlled study in patients with knee osteoarthritis by Bognatove et al., 12-hour therapy sessions of PEMF a significant improvement in the placebo group was reported in terms of VAS and WOMAC values in the 12-hour therapy in PEMF group per day for 30 days. It was also reported that 26% of the patients in the PEMF group had discontinued the analgesic medication (20). In a study conducted by Harper et al., PEMF administered twice daily in patients with failed back surgery syndrome, reduced back and leg pain by 44% and 55%, respectively, by the third week of treatment. Those improvements in pain were maintained during 45 days of treatment. In the same study, analgesic use was decreased in 22 patients, and 50% of patients had a significant improvement in physical function (21). In a prospective, randomised controlled study by Nayback-Beebe et al., PEMF three times a week for a month reduced chronic low back pain in US army workers, and also significantly improved health-related quality of life immediately after treatment and one month post-treatment (22).

This study has some strengths and some limitations. One of the strength is being the first study to examine the effects of PEMF in LSS patients as our knowledge. The other strengths are its prospective design, radiographic assessments of all patients were carried out by the same physician, low experimental mortality in the PEMF group, and only one patient drop out in placebo the group. The limitation of this study was being single blind with a relatively short follow-up period. However, the duration of low back pain due to LSS was shorter in the PEMF group, all the patients had chronic low back pain more than a year.

In conclusion, there was a significant improvement in back and leg pain, functional mobility, disability and general state of health in patients with LSS compared with the placebo group. There is a need for additional studies to with varying numbers of sessions and different treatment durations.

**Conflict of interest**

None.

## REFERENCES


1. A Mehra, D Baker, S Disney, and PB Pynsent. Oswestry Disability Index Scoring Made Easy. Ann R Coll Surg Engl 2008; 90(6): 497-9. (PMID:18598595).
2. Ammendolia C, Stuber KJ, Rok E, et al. Nonoperative treatment for lumbar spinal stenosis with neurogenic claudication. Cochrane Database Syst Rev 2013;8;CD010712. (PMID:23996271).
3. Bachl N, Ruoff G, Wessner B, Tschan H. Electromagnetic interventions in musculoskeletal disorders. Clin Sports Med 2008;27(1):87-105. (PMID:18206570).
4. Bagnato GL, Miceli G, Marino N, Sciortino D, Bagnato GF. Pulsed electromagnetic fields in knee osteoarthritis: a double blind, placebo-controlled, randomized clinical trial. Rheumatology 2015;55(4):755-62. (PMID:26705327).
5. Chao SC, Lee HT, Kao TH, et al. Percutaneous pulsed radio frequency in the treatment of cervical and lumbar radicular pain. Surg Neurol 2008;70(1):59-65. (PMID:18207554).
6. Fraser JF, Huang RC, Girardi FP, Cammisa FP. Pathogenesis, presentation and treatment of lumbar spinal stenosis associated with coronal or sagittal spinal deformities. Neurosurg Focus 2003;14(1):e6. (PMID:15766223).
7. Harper WL, Schmidt WK, Kubat NJ, Isenberg RA. An open-label pilot study of pulsed electromagnetic field therapy in the treatment of failed back surgery syndrome pain. Int Med Case Rep J 2015;8:13-22. (PMID:25678825).
8. Hughes A, Makirov SK, Osadchiy V. Measuring spinal canal size in lumbar spinal stenosis: description of method and preliminary results. Int J Spine Surg 2015;9:3. (PMID:25834777).
9. Katz JN, Harris MB. Clinical practice: lumbar spinal stenosis. N Engl J Med 2008;358(8):818-25. (PMID:18287604).
10. Khoromi S, Blackman MR, Kingman A, et al. Low intensity permanent magnets in the treatment of chronic lumbar radicular pain. J Pain Symptom Manage 2007;34(4):434-45. (PMID:17618081).
11. Markov MS. Expanding use of pulsed electromagnetic field therapies. Electromagn Biol Med 2007;26(3):257-74. (PMID:17886012).
12. Meyer T, Cooper J, Raspe H. Disabling low back pain and depressive symptoms in the community-dwelling elderly: a prospective study. Spine 2007;32(21):2380-6. (PMID:17906583).
13. Multanen J, Häkkinen A, Heikkinen P, Kautiainen H, Mustalampi S, Ylinen J. Pulsed electromagnetic field therapy in the treatment of pain and other symptoms in fibromyalgia: a randomized controlled study. Bioelectromagnetics 2018;39(5):405-13. (PMID:29709070).
14. Nayback-Beebe AM, Yoder LH, Goff BJ, Arzola S, Weidlich C. The effect of pulsed electromagnetic frequency therapy on health-related quality of life in military service members with chronic low back pain. Nurs Outlook 2017;65(5S):S26-33. (PMID:28893387).
15. Omar AS, Awadalla MA, El-Latif MA. Evaluation of pulsed electromagnetic field therapy in the management of patients with discogenic lumbar radiculopathy. Int J Rheum Dis 2012;15(5):e101-8. (PMID:23083041).
16. Pilla AA. Mechanisms and therapeutic applications of time-varying and static magnetic fields, In: Barnes F, GreenebaumB (Eds). Biological and medical aspects of electromagnetic fields. CRC Press, Boca Raton, 2006, pp 351-411.
17. Podsiadlo D, Richardson S. The timed "Up & Go": A test of basic functional mobility for the frail elderly persons. J Am Geriatr Soc 1991;39(2):142-8. (PMID:1991946).
18. Suri P, Rainville J, Kalichman L, Katz N. Does this older adult with lower extremity pain have the clinical syndrome of lumbar spinal stenosis? JAMA 2010;304:2628-36. (PMID:21156951).
19. Sütbeyaz ST, Sezer N, Köseoğlu BF. The effect of pulsed electromagnetic fields in the treatment of cervical osteoarthritis : a randomized, double-blind, sham-controlled trial. Rheumatol Int 2006;26:320-4. (PMID:15986086).
20. Tepper OM, Callaghan MJ, Chang EI, et al. Electromagnetic fields increase in vitro and in vivo angiogenesis through endothelial release of FGF-2. FASEB J 2004;18(11):1231-3. (PMID:15208265).
21. Tomkins CC, Dimoff KH, Forman HS, et al. Physical therapy treatment options for lumbar spinal stenosis. J Back Musculoskelet Rehabil 2010;23:31-7. (PMID:20231787).
22. Uzunca K, Birtane M, Taştekin N. Effectiveness of pulsed electromagnetic field therapy in lateral epicondylitis. Clin Rheumatol 2007;26(1):69-74. (PMID:16633709).

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RESEARCH

# PROGNOSIS AFTER EARLY HYPERBARIC OXYGEN THERAPY IN GERIATRIC PATIENTS WITH CENTRAL RETINAL ARTERY OCCLUSION

## Abstract

***Introduction:*** This study was conducted to evaluate the results of early hyperbaric oxygen therapy (HBOT) in patients 65 years and older with Central retinal artery occlusion (CRAO).

***Materials and Method:*** The files of patients who presented with CRAO between February 2010-June 2016 were retrospectively analyzed. Age, gender, time between symptom onset-first HBOT session, other treatments, follow-up period, intraocular pressure(IOP), visual acuity(VA) were reported. Color fundus photography, fundus fluorescein angiography, optic coherence tomography (OCT) were done. HBOT was initiated in the first 8 hours after visual symptom onset. Wilcoxon test was used in statistical analysis, P<0.05 accepted as statistically significant.

***Results:*** 20 eyes of 20 patients with CRAO were included to the study. Thirteen (65%) of the patients were male, 7(35%) female; mean age was 65-87(76.3±9.6) years. Ocular massage, antiglaucomatous drops, acetylsalicylic acid, oral acetazolamide, mannitol (i.v) treatments were applied. Anterior chamber paracentesis was performed. All patients had HBOT within the first 8 hours, 20 sessions of HBOT (2.4atm, 120min) were applied. Time between symptom onset-first HBOT session was 5.3 hours. Follow-up time was 16.3 months. IOP was 12.23±3.41mmHg before treatment, 12.97±5.58mmHg after treatment. VA was 1.92±3.26 (logMAR) at presentation, 1.1±7.80 after treatment (p<0.01). VA improved in 13 eyes (65%), unchanged in 6 eyes(30%), decreased in 1 eye(5%). In OCT examination, mean macular thickness was 358 µm at presentation, 177 µm at 6 months after treatment (p<0.01).

***Conclusion:*** In patients 65 years of age and older with SRAT; HBOT results are quite satisfactory if it is initiated within the first 8 hours.

***Keywords:*** Retinal artery occlusion; hyperbaric oxygenation; Aged

ARAŞTIRMA

# SANTRAL RETİNAL ARTER TIKANIKLIĞI GEÇİREN GERİATRİK YAŞ GRUBUNDAKİ HASTALARDA ERKEN UYGULANAN HİPERBARİK OKSİJEN TEDAVİSİNİN PROGNOZU

## Öz

***Giriş:*** Bu çalışma santral retinal arter tıkanıklığı (SRAT) geçiren 65 yaş ve üzerindeki hastalarda erken uygulanan hiperbarik oksijen tedavisinin (HBOT) sonuçlarının değerlendirilmesi amacıyla yapılmıştır.

***Gereç ve Yöntem:*** Şubat 2010-Haziran 2016 tarihleri arasında SRAT nedeniyle başvuran hastaların dosyaları retrospektif olarak incelendi. Yaş, cinsiyet, semptom başlangıcı ile ilk HBOT seansı arasındaki süre, diğer tedaviler, takip süresi, göz içi basıncı (GİB), görme keskinliği (GK) kaydedildi. İlk muayenelerde ve kontrollerde; renkli fundus fotoğrafı, fundus floresein anjiografi, optik koherens tomografi (OCT) çekildi. Tüm hastalara görsel semptomların başlamasından itibaren ilk 8 saat içerisinde HBOT başlandı. İstatistiksel analizlerde Wilcoxon testi kullanıldı, p<0.05 olması anlamlı kabul edildi.

***Bulgular:*** Çalışmaya SRAT geçiren 20 hastanın 20 gözü dahil edildi. Hastaların 13'ü (%65) erkek, 7'si (%35) kadın, yaşları 65-87 (76.3±9.6) idi. Oküler masaj, antiglokomatöz damla, asetilsalisilik asit, oral asetazolamid, mannitol (i.v) tedavisi uygulandı. Ön kamara parasentezi yapıldı. Tüm hastalara HBOT ilk 8 saat içerisinde başlandı ve toplam 20 seans HBOT (2.4atm, 120min) uygulandı. Şikayetler ile ilk HBOT arasındaki süre ortalama 5.3 saat idi. Ortalama takip süresi 16.3 aydı. Tedavi öncesi GİB 12.23±3.41mmHg, tedavi sonrası 12.97±5.58mmHg idi. Başvuru anında GK ortalama 1.92±3.26 (logMAR), tedavi sonrasında 1.1±7.80 (p<0.01) idi. GK 13 (%65) gözde arttı, 6 (%30) gözde değişmedi, 1(%5) gözde azaldı. OCT incelemesinde olguların ortalama makula kalınlığı başvuru anında 358µm, tedavi sonrası 6. ayda 177µm (p<0.01) idi.

***Sonuç:*** SRAT geçiren 65 yaş ve üzerindeki hastalarda; ilk 8 saat içerisinde başlandığı takdirde, HBOT sonuçları oldukça tatminkardır.

***Anahtar sözcükler:*** Retinal arter tıkanıklığı; Hiperbarik oksijenasyon; Yaşlı

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## INTRODUCTION

Central retinal artery occlusion (CRAO) accounts for the majority of retinal artery occlusion cases and generally reduces vision to the level of light perception or hand movements. The diagnosis is established by medical history and ophthalmoscopic examination. Relative afferent pupillary defect is an important clinical finding suggestive of CRAO in the early phase, when fundus findings are not yet prominent. In the first week, cherry-red spot (90%), retinal opacities (58%), pallor (39%), arterial attenuation (32%), and optic disc oedema (22%) may be seen in the posterior pole, while optic atrophy (58%), arterial attenuation (58%), cilioretinal collaterals (18%), and macular retinal pigment epithelial changes (18%) occur in the late phase (1). The 'cherry-red spot' sign frequently seen in ophthalmoscopic examination in the first week refers to the red appearance of the macula, which continues to be perfused by the choroid, surrounded by the pale fundus resulting from retinal ischaemia and oedema. This sign disappears after about 4 to 6 weeks when the oedema resolves (2).

The risk factors for CRAO include male sex, age 65 and older, hypertension, diabetes, hyperlipidaemia, obesity, smoking and alcohol use, sedentary lifestyle, haematological disorders, systemic vasculitis, oncologic diseases, local eye trauma, retinal surgeries causing sudden increase in intraocular pressure (IOP), retrobulbar injections, prepapillary arterial loop, and optic disc drusen (3).

Fundus fluorescein angiography (FFA), optical coherence tomography (OCT), electroretinography (ERG), automated visual field (AVF) examination, and colour Doppler ultrasound (CDUS) are important in the diagnosis of CRAO. In FFA, the retinal artery filling time and arteriovenous transit time are prolonged. Leakage is observed from the perfused capillaries within the first week of obstruction. In the late phase, there is no leakage, but vascular changes are evident and the optic disc remains hypofluorescent (4). Findings on OCT include thickening of the retinal layers, oedema of the retina and optic nerve head. The electroretinogram (ERG) shows a normal a-wave, which represents the photoreceptor response, while the b-wave showing Müller and bipolar cell responses is reduced or absent (5). AVF reveals visual field defects proportional to the extent of neurosensory layer damage. Limited temporal and peripheral vision is often preserved. CDUS provides information about reduced or absent flow in the central retinal artery (6).

Treatment of CRAO is urgent, because animal studies have shown that irreversible damage occurs in the neurosensory layer when retinal occlusion lasts more than 240 minutes (7). The aim of treatment is to rapidly reduce IOP and dislodge the embolus with the help of intravenous perfusion pressure. This is currently done using methods; such as ocular massage, anterior chamber paracentesis, systemic acetazolamide and mannitol therapy (8). Various treatment methods with unproven efficacy are also used to restore retinal circulation; such as aspirin, calcium channel blockers, systemic vasodilators, intravenous bolus methylprednisolone, and isovolumic hemodilution. Systemic antifibrinolytic agents, such as streptokinase, urokinase, and tissue plasminogen activators, must be used carefully because of possible adverse effects. However; many studies have demonstrated the efficacy of fibrinolytic therapy in the first 6.5 hours (9).

Hyperbaric oxygen therapy (HBOT) is another method used to treat patients with CRAO. In HBOT, 95% (carbogen) or 100% oxygen is applied at pressures of 2 atmospheres (atm), 2.4 atm, or

2.8 atm in order to increase oxygenation of the retina (10). In our study; we aimed to evaluate the results of early HBOT in patients 65 years and older with CRAO.

## MATERIALS AND METHOD

The medical records of patients who presented to The Atatürk University Faculty of Medicine, Department of Ophthalmology with CRAO, between February 2010 and June 2016 were analysed retrospectively. The study adhered to the principles of the Declaration of Helsinki. The patients age and sex, time from symptom onset to first HBOT session, other treatments, follow-up time, pretreatment and posttreatment IOP (Canon TX 20p noncontact tonometer), and best corrected visual acuity (BCVA) were recorded. All patients underwent a full ophthalmologic examination, including colour fundus photography, FFA (Kowa VX-10a), and OCT (Optovue RTvue RT-100) imaging. HBOT was initiated within the first 8 hours after the onset of visual symptoms in all cases.

### Statistical analysis

Descriptive and statistical analyses of the data were performed using SPSS version 21.0 software. The Wilcoxon signed rank test was used to compare pre- and posttreatment values. A p value<0.05 was considered to indicate statistical significance.

### Ethical considerations

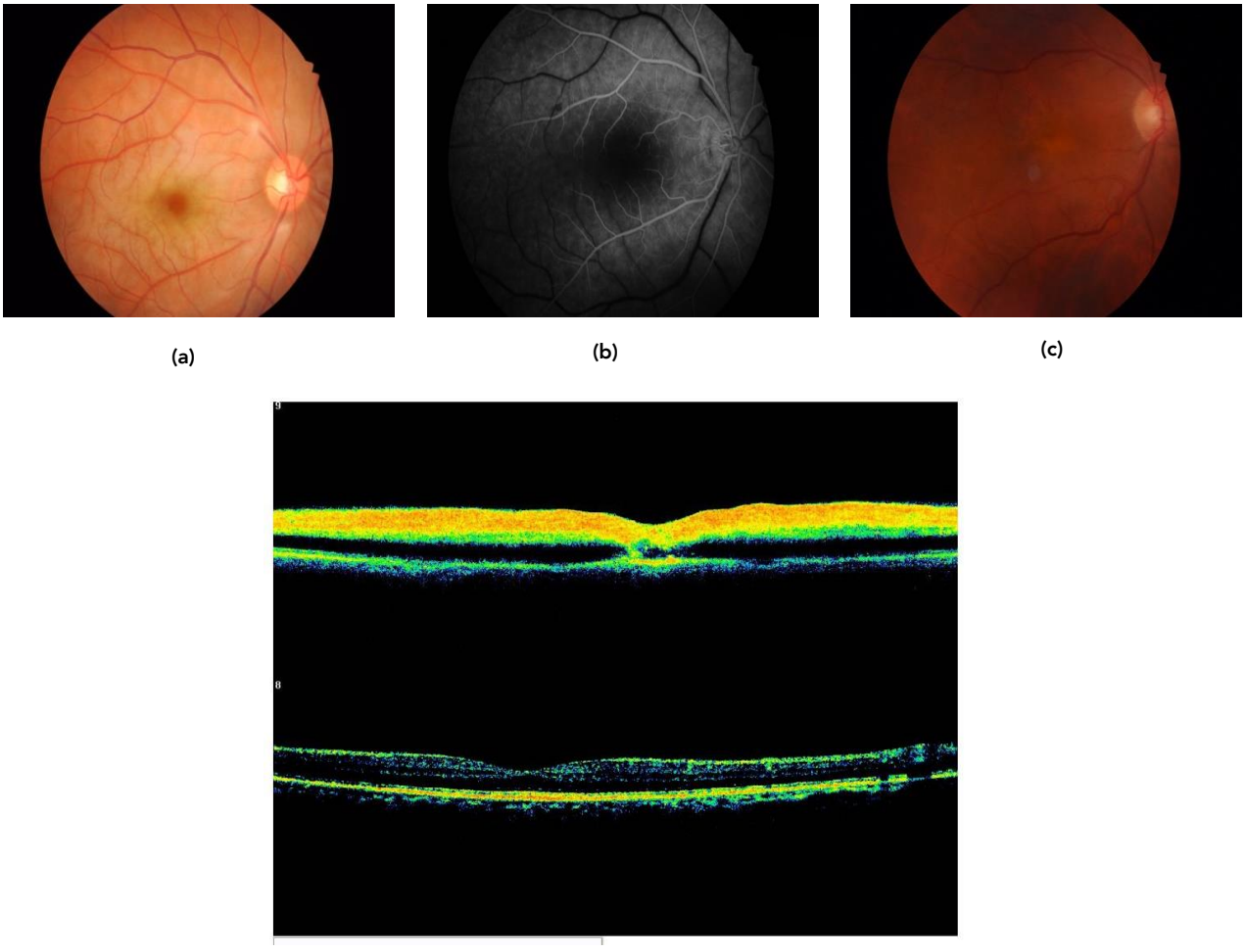
The local ethic committee approval was obtained (2018/13-136).

## RESULTS

Twenty eyes of 20 patients with CRAO were included in the study. Thirteen (65%) of the patients were male and 7 (35%) were female; the mean age was 76.3±9.6 (range, 65–87) years. All patients were administered topical antiglaucomatous drops (dorzolamide-timolol, brimonidine tartrate, latanoprost), 250 mg oral acetazolamide, and 1.5–2 g/kg intravenous 20% mannitol to reduce IOP. Intermittent ocular massage (10–15 seconds with sudden release) was applied, and 0.1–0.4 mL anterior chamber paracentesis was performed under sterile conditions.

All patients underwent a total of 20 HBOT sessions of 2.4 atm for 120 minutes, starting within 8 hours after the onset of visual symptoms. The mean time between symptom onset and first HBOT was 5.3 hours. The mean follow-up time was 16.3 months. The mean IOP was 12.23±3.41 mmHg before treatment and 12.97±5.58 mmHg after treatment.

VA was 1.92±3.26 2.0–1.6) (logMAR) at presentation, 1.1±7.80 (1.52–0.92) after treatment (p<0.01). BCVA increased in 13 eyes (65%), remained unchanged in 6 eyes (30%), and decreased in 1 eye (5%). All patients underwent colour fundus photography and FFA examination at the time of application and in the sixth month; images were recorded (Figures 1, 2). On OCT examination performed at presentation and 6 months after treatment, the mean macular thickness was 358 and 177 µm, respectively (p<0.01) (Figures 1, 2).



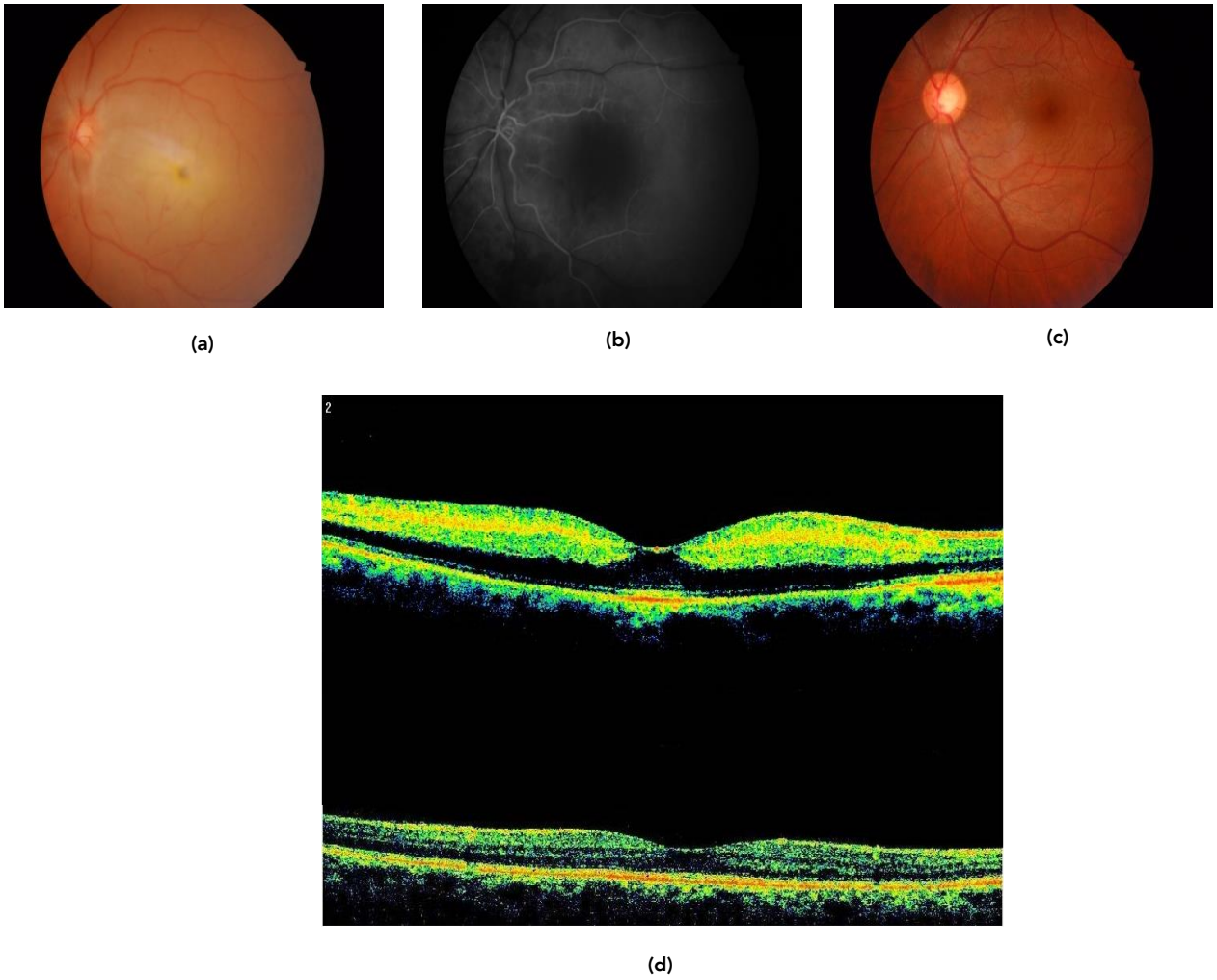
**(a)** Colour fundus photograph of the right eye showing CRAO with cherry-red spot, common paleness and oedema in retina

**(b)** Corresponding FFA showing filling defect in retinal arterioles

**(c)** 6 month fundus photograph shows recovery of the retinal paleness**.**

**(d)** OCT examination performed at first visit showing increased reflectivity in inner retinal layers, reduced reflectivity in the area of perifoveal retinal pigment epithelium (central macular thickness: 357 *μm*) (above). In the sixth month OCT examination showing; atrophy in neurosensory retina, decrased reflectivity, flattening in foveal contour (central macular thickness: 231 *μm*) (bottom).

**Figure 1.** 77-year-old male patient.



**(a)** Colour fundus photograph of the left eye reveals CRAO with significant retinal oedema and pallor

**(b)** Corresponding FFA shows filling defect in retinal arterioles and infarcted retina

**(c)** 6 month fundus photograph shows recovery of the retinal paleness.

**(d)** OCT examination performed at first visit showing; increased reflectivity in inner retinal layers, reduced reflectivity in the area of perifoveal retinal pigment epithelium (central macular thickness: 385 *μm*) (above). In the sixth month OCT examination showing; atrophy in neurosensory retina, decrased reflectivity, flattening in foveal contour (central macular thickness: 273 *μm*) (bottom).

**Figure 2.** 68-year-old female patient.

## DISCUSSION

CRAO is an emergency condition, the equivalent of an ocular stroke, and occurs at a rate of about 1/10,000 (11). There are four types of CRAO (12). Nonarteritic permanent CRAO; Accounts for two-thirds of all CRAO cases; occurs due to thromboembolism from atherosclerotic vessels. Nonarteritic transient CRAO; Comprises 15% to 17% of all CRAO cases; has the best visual prognosis. Nonarteritic CRAO with cilioretinal sparing; Central vision may be preserved in CRAO patients with perfusing cilioretinal artery due to continued supply to the macula. Arteritic CRAO; Occurs due to giant cell arthritis; accounts for 4.5% of all CRAO cases.

A prospective study of 260 eyes with CRAO showed that people suffer profound monocular visual loss, with 80% of patients having a visual acuity (VA) of 20/400 or worse (12). In four types; nonarteritic transient CRAO has the best visual prognosis after the treatment. Our cases were nonarteritic permanent CRAO in our study. Case presentations in all studies do not differentiate the degree of CRAO severity; therefore, it is impossible to compare the data. In the reports presenting successful treatment, the patients had not been divided into groups according to their CRAO stage.

Many treatments have been used for CRAO. Although ocular massage and anterior chamber paracentesis have been practised for 130 years, some studies have indicated that these measures can cause extreme IOP fluctuations and thus have an adverse effect on ischaemic retinal neurons if performed incorrectly (13). Intravenous fibrinolysis therapy has been shown to be effective if initiated within 4.5 hours after symptom onset (14). However, due to the high risk of cardiac and cerebrovascular disease in patients with CRAO, the use of thrombolytic agents and surgical embolectomy has not been widely accepted because of the high risk of haemorrhage (15).

While the inner two-thirds of the retina is fed by the central retinal artery, the outer third is fed by diffusion from the choroid; therefore, choroidal circulation is important in patients with CRAO. Oxygen dissolved at high concentration in the plasma may perfuse from the choroidal circulation into the inner retinal layers until reperfusion can be achieved. In HBOT, 100% oxygen applied at 2.4 atm increases plasma oxygen concentration by 17-fold, from 0.32 to 6 mL/100 mL, allowing more oxygen to reach the retina (16). For this purpose, we subjected 20 CRAO patients to 20 HBOT sessions, each lasting 120 minutes. We then evaluated whether there were changes in BCVA, IOP, and OCT measurements of macular thickness after treatment.

HBOT has been used in the treatment of many diseases since the 1600s. Clinical studies were first published in 1956 by Ite Boerema, the chair of the Department of Surgery at the University of Amsterdam. HBOT administered intraperitoneally during cardiac surgery has been shown to extend safe surgery time, and HBOT was shown to be effective in necrotising infected tissues and nonhealing ulcers (17).

Several studies have demonstrated that HBOT exhibits anti-inflammatory effects by reducing inflammatory agents such as interleukin (IL)-1, IL-6, IL-8, IL-10, and tumour necrosis factor alpha (TNF-$\alpha$) and reduces tissue oedema by vasoconstriction (18). Weiss et al. emphasised that HBOT reduces macular oedema and should be a part of CRAO treatment (19). In the present study, we observed a significant decrease in macular thickness measured on OCT after HBOT ($p<0.01$).

Murphy et al. showed that HBOT reduced damage in the ischaemic area by increasing oxygenation of the inner and outer retinal layers via the choroidal circulation (11). There are many studies in the literature concerning visual improvement with HBOT (11,20). In our study, there was significant improvement in visual prognosis in 13 eyes of 20 patients.

Hayreh et al. showed that HBOT after CRAO reduced apoptotic cell loss from 58% to 30% in a

study of rhesus monkeys (7). In addition, studies on ischaemic rat models demonstrated that HBOT exerted an anti-apoptotic effect by reducing caspase-3 secretion (21). In animal studies of diabetic retinopathy, HBOT has been shown to reduce disruption of the blood–retinal barrier and facilitate repair of retinal damage (22).

Although numerous studies have shown the value of HBOT in the treatment of CRAO, there is no consensus as to when HBOT should be initiated or for how long it should be given. Butler et al. reported achieving good visual outcomes in a patient group who received HBOT within 12 hours after symptom onset (23). Beiran et al. emphasised the need to start HBOT within the first 8 hours after vision loss (24). The Undersea and Hyperbaric Medical Society reported that HBOT should be initiated in the first 24 hours after symptom onset, but better outcomes are achieved when it is initiated within 12 hours (25). In our study, patients given HBOT at a mean of 5.3 hours after symptom onset experienced significant improvement in visual prognosis.

In addition to the requisite medical interventions, HBOT is a safe adjunctive therapy for patients aged 65 and older with CRAO and yields favourable outcomes when initiated within the first 8 hours after occlusion.

Patients with CRAO should undergo HBOT within the first 8 hours as a reliable noninvasive treatment method.

**Conflicts of interest**

The authors declare no conflict of interest.

## REFERENCES


1. Beatty S, Eong KGA. Acute occlusion of the retinal arteries: current concepts and recent advances in diagnosis and management. J Accid Emerg Med 2000;17:324-9. (PMID:11005400).
2. Beiran I, Goldenberg I, Adir Y, et al. Early hyperbaric oxygen therapy for retinal artery occlusion. Eur J Ophthalmol 2001;11(4):345-50. (PMID:11820305).
3. Butler FK, Hagan C, Murphy-Lavoie H. Hyperbaric oxygen therapy and the eye. Undersea Hyperb Med 2008;35:333-85. (PMID:19024664).
4. Callizo J, Feltgen N, Pantenburg S et al. Cardiovascular risk factors in central retinal artery occlusion: results of a prospective and standardized medical examination. Ophthalmology 2015;122:1881-8. (PMID:26231133).
5. Chang YH, Chen PL, Tai MC, et al. Hyperbaric oxygen therapy ameliorates the blood–retinal barrier breakdown in diabetic retinopathy. Clinical and Experimental Ophthalmology 2006;34:584-9. (PMID:16925707).
6. Chen X, Duan XS, Xu LJ, et al. Interleukin-10 mediates the neuroprotection of hyperbaric oxygen therapy against traumatic brain injury in mice. Neuroscience 2014;266:235-43. (PMID:24291771).
7. Cope A, Eggert J, O'Brien E. Retinal artery occlusion: visual outcome after treatment with hyperbaric oxygen. Diving Hyperb Med Journal 2011;41:135-9. (PMID:21948498).
8. Dattilo M, Biousse V, Newman NJ. Update on the management of central retinal artery occlusion. Neurol clin 2017;35(1):83-100. (PMID:27886897).
9. Feiss A, Cal O, Kehrein S, et al. Anterior chamber paracentesis after central retinal artery occlusion: a tenable therapy. BMC Ophthalmol 2014;14:28. (PMID:24612658).
10. Fraser SG, Adams W. Interventions for acute non-arteritic central retinal artery occlusion. Cochrane Database Syst Rev 2009;1:1989. (PMID:19160204).
11. Hattenbach LO, Kuhli-Hattenbach C, Scharrer I, Baatz H. Intravenous thrombolysis with low-dose recombinant tissue plasminogen activator in central retinal artery occlusion. Am J Ophthalmol 2008;146:700-6. (PMID:18718570).
12. Hayreh S, Jonas JB. Optic disk and retinal nerve fiber layer damage after transient central retinal artery occlusion: an experimental study in rhesus monkeys. Am J Ophthalmol 2000;129:786-95. (PMID:10926989).

13. Hayreh SS, Podhajsky PA, Zimmerman MB. Retinal artery occlusion: associated systemic and ophthalmic abnormalities. Ophthalmology 2009;16:1928-36. (PMID:19577305).

14. Hayreh SS, Zimmerman MB. Central retinal artery occlusion: visual outcome. Am J Ophthalmol 2005;140(3):376-91. (PMID:16138997).

15. Hayreh SS, Zimmerman MB. Fundus changes in central retinal artery occlusion. Retina 2007;27:276-89. (PMID:17460582).

16. Kranke P, Bennett MH, Martyn-St James M, et al. Hyperbaric oxygen therapy for chronic wounds. Cochrane Database of Syst Rev 2015;24:6. (PMID:26106870).

17. Liu XH, Yan H, Xu M, et al. Hyperbaric oxygenation reduces long-term brain injury and ameliorates behavioral function by suppression of apoptosis in a rat model of neonatal hypoxia-ischemia. Neurochem Int 2013;62(7):922–30. (PMID:23499794).

18. Menzel-Severing J, Siekmann U, Weinberger A, et al. Early hyperbaric oxygen treatment for nonarteritic central retinal artery obstruction. Am J Ophthalmol 2012;153:454-9. (PMID:21996308).

19. Murphy-Lavoie H, Butler F, Hagan C. Central retinal artery occlusion treated with oxygen: a literature review and treatment algorithm. Undersea Hyperb Med 2012;39(5):943-53. (PMID:23045923).

20. Nedelmann M, Graef M, Weinand F, et al. Retrobulbar spot sign predicts thrombolytic treatment effects and etiology in central retinal artery occlusion. Stroke 2015;46:2322-4. (PMID:26111890).

21. Olson EA, Lentz K. Central retinal artery occlusion: a literature review and the rationale for hyperbaric oxygen therapy. Mo Med 2016;113:53-7. (PMID:27039492).

22. Olson EA, Lentz K. Central retinal artery occlusion: a literature review and the rationale for hyperbaric oxygen therapy. Mo Med 2016;113:53-7. (PMID:27039492).

23. Schrag M, Youn T, Schindler J, Kirshner H, Greer D. Intravenous fibrinolytic therapy in central retinal artery occlusion: a patient-level meta-analysis. JAMA Neurol 2015;72:1148-54. (PMID:26258861).

24. Shinoda K, Yamada K, Matsumoto CS, Kimoto K, Nakatsuka K. Changes in retinal thickness are correlated with alterations of electroretinogram in eyes with central retinal artery occlusion. Graefes Arch Clin Exp Ophthalmol 2008;246:949-54. (PMID:18425524).

25. Weiss JN. Hyperbaric oxygen treatment of nonacute central retinal artery occlusion. Undersea Hyperb Med 2009;36:401-5. (PMID:20112531).

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RESEARCH

# EVALUATION OF GERIATRIC DEATHS CAUSED BY TRAFFIC ACCIDENTS: AN AUTOPSY SERIES

## Abstract

***Introduction:*** Increase in elderly population has been accompanied by traffic accident-related geriatric deaths. The aim of the present study was to evaluate the epidemiology and injury patterns of the victims.

***Materials and Method:*** A retrospective analysis of autopsies performed by the Forensic Medicine Department of Firat University in 2008-2017 was conducted. The statements of relatives of the deceased, hospital records and autopsy reports were examined. The study included 206 patients aged >65 years and who died in traffic accidents.

***Results:*** The victims comprised 75.2% males and 24.8% females (mean age 75.5±6.6 years), among which 67% were pedestrians. In 68.4% of the victims, fatal accident occurred in residential areas, among which 83.7% were pedestrians. Accidents most frequently occurred on Friday (n=54, 26.2%). In 144 (69.9%) victims, death occurred in the hospital, and the mean hospitalization length was 69.6±183.9 h. Intracranial traumatic changes were observed in 74.7% of the victims.

***Conclusion:*** Traffic accident-related geriatric deaths were more frequent in pedestrians on specific days. Therefore, city planning should be implemented for the safety of pedestrians, with increased traffic control on busy days. Trainings should be conducted among drivers to raise the awareness of restricted mobility of the elderly.

***Keywords:*** Geriatrics; Accidents, Traffic; Autopsy; Forensic medicine

ARAŞTIRMA

# TRAFİK KAZASINA BAĞLI GERİATRİK ÖLÜMLERİN DEĞERLENDİRİLMESİ: OTOPSİ SERİSİ

## Öz

***Giriş:*** Toplum içindeki yaşlı nüfusun artması trafik kazalarına bağlı geriatrik ölümleri arttırmaktadır. Çalışmamızda; geriatrik ölümlerin epidemiyolojik özelliklerinin ve yaralanma paternlerinin incelenmesi amaçlandı.

***Gereç ve Yöntem:*** Fırat Üniversitesi Adli Tıp Anabilim Dalı tarafından 2008-2017 yılları arasında yapılan otopsiler retrospektif olarak incelendi. Ölenlerin yakınlarının ifadeleri, hastane kayıtları ve otopsi tutanakları incelendi. Trafik kazası nedeniyle ölen 65 yaş ve üstündeki 206 olgu çalışmaya alındı.

***Bulgular:*** Olguların %75.2'si erkek, %24.8'i kadındı. Olguların yaş ortalaması 75.5±6.6 yıl idi. Olguların %67.0'ı yaya idi, kazaların %68.4'i yerleşim yerinde meydana geldiği belirlendi. Yerleşim yerindeki kazaların %83.7'si yaya kazaları olduğu belirlendi. Kazaların en sık %26.2 (54) Cuma günü olduğu belirlendi. Olguların %69.9'u (144) hastanede öldü, ortalama yatış süreleri 69.6±183.9 saat idi. Olguların %74.7'sinde kafa içi travmatik değişim görüldü.

***Sonuç:*** Geriatrik olgularda trafik kazalarına bağlı ölümler daha çok yaya konumunda ve belirli günlerde olmaktadır. Bu nedenle yaya güvenliğini sağlayacak şehir planlamaları oluşturulmalı, özellikle yaşlıların trafikte yoğun olduğu günlerde trafik denetimleri arttırılmalı, yaşlıların hareket kısıtlılığı konusunda sürücülere yönelik eğitimler verilmelidir.

***Anahtar sözcükler:*** Geriatri; Kazalar; Trafik; Otopsi; Adli tıp

## INTRODUCTION

The global population is ageing at a disproportionately increasing rate (1). For example, in the United States, the population of elderly persons increased by 80% from 1920 to 2000, and it has been predicted that by 2030, 20% of the population of the United States will be aged >65 years (2). Particularly in developed countries, the percentage of the elderly is causing certain problems. Although most elderly die from natural causes, deaths from accidents, murders and suicides are not insignificant (3). For example, traffic accidents account for most of the non-natural geriatric deaths (4). Despite several precautions taken to prevent traffic accidents, which represent a significant public health problem, the elderly are considered at a higher risk because of their reduced physical abilities, such as restricted mobility, poor hearing and distracted attention. Therefore, further precautions must be introduced to protect the elderly from a premature death. Deaths due to traffic accidents are most often caused by intracranial traumatic changes (5). However, there is no study on geriatric traffic accidents.

The aim of the present study, therefore, was to evaluate the epidemiology and injury patterns of traffic accident-related geriatric deaths to establish new precautions that can prevent traffic accidents.

## MATERIALS AND METHOD

Autopsy records of 206 individuals aged >65 years who died in traffic accidents in Elazig. Province were analysed. The autopsies were conducted at the Firat University Department of Forensic Medicine between 01 January, 2008 and 01 December, 2017. Following data were available: age and sex of the victim, date of the accident, role the victim (driver, passenger, or pedestrian), and site of death, hospitalization length and location of fatal injuries in the victim. Descriptive statistics are presented as mean±standard deviation, numbers or percentages. The data collected were analysed using the SPSS 17.0 (Statistical Package for Social Science) for Windows software program. Pearson's Chi-squared and Fisher's exact tests were used for statistical analysis. The differences were considered significant if the p-value was<0.05.

The study was approved by the Firat University Ethics Committee. (01 February, 2018, Meeting No. 03, Decision No. 10).

## RESULTS

The deceased comprised 155 (75.2%) males and 51 (24.8%) females (mean age 75.5±6.6: range, 65-92 years).

The deaths were associated with traffic accidents: pedestrians struck by a vehicle [n=138 (67.0%)] and driver or passenger within the vehicle [n=66 (33.0%)] (Table 1).

The accidents occurred within [n=141 (68.4%)] or outside [n=65 (31.6%)] residential areas. Pedestrian accidents accounted for significantly more deaths [n=118 (83.7%, p<0.05)] (Table 2).

The circumstances of the deaths were as follows: during hospitalization [n=71 (74.0%)]; at the site of accident [n=17 (17.7%)] or during transport to the hospital [n=8 (8.3%)] (Table 3). The mean hospitalization length among those who died in hospital was 69.6±183.9 h.

The traffic accidents most often occurred on Friday (n=54, 18.5%). The distribution of the accidents according to the day is presented in Figure 1.

More than one cause of death was determined in 166 cases. The most frequent cause of death was intracranial traumatic changes (74.7%), including skull fractures, inter-membrane bleeding in the brain, and brain contusion-oedema.

**Table 1.** Distribution of the traffic positions of the victims by gender.

| Sex | Position in Traffic | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Pedestrian | | Driver | | Passenger | | | |
| | Number | % | Number | % | Number | % | Number | % |
| **Male** | 106 | 76.8 | 18 | 81.8 | 31 | 67.4 | 155 | 75.2 |
| **Female** | 32 | 23.2 | 4 | 18.2 | 15 | 32.6 | 51 | 24.8 |
| **Total** | **138** | **67.0** | **22** | **10.7** | **46** | **22.3** | **206** | **100.0** |

**Table 2.** Distribution of accident sites according to accident type.

| Accident Types | Accident Site | | | | Total | |
|---|---|---|---|---|---|---|
| | Residential Area | | Outside Residential Area | | | |
| | Number | % | Number | % | Number | % |
| **In-vehicle accidents** | 23 | 16.3 | 45 | 69.2 | 68 | **67.0** |
| **Out of vehicle accidents** | 118 | 83.7 | 20 | 30.8 | 138 | **33.0** |
| **Total** | **141** | **68.4** | **65** | **31.6** | **206** | **100.0** |

$X^2$: 56.402, $p < 0.001$

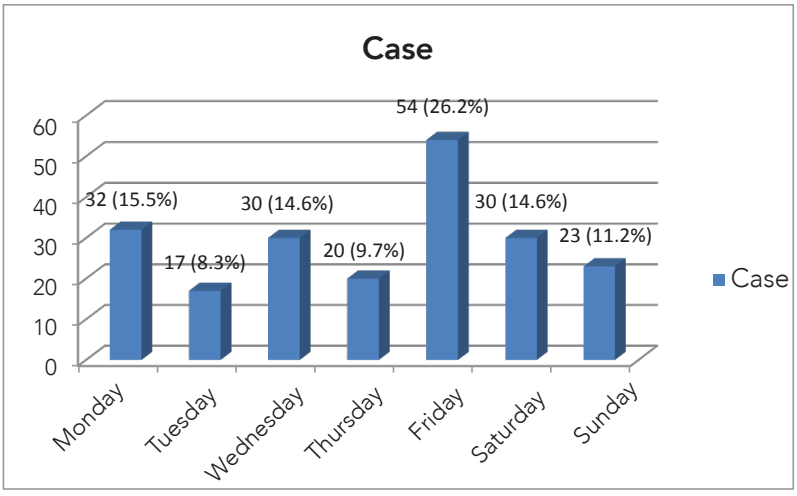
**Table 3.** Distribution of accident sites according to the place of death.

| Location of Death | Accident Site | | | | Total | |
|---|---|---|---|---|---|---|
| | Residential Area | | Outside Residential Area | | | |
| | Number | % | Number | % | Number | % |
| **At accident site** | 27 | 19.1 | 19 | 29.2 | 46 | 22.3 |
| **During hospital transfer** | 10 | 7.1 | 6 | 9.2 | 16 | 7.8 |
| **In hospital** | 104 | 73.8 | 40 | 61.5 | 144 | 69.9 |
| **Total** | **141** | **68.4** | **65** | **31.6** | **206** | **100.0** |

**Table 4.** Cause of death.*

| Cause | Number | % |
|---|---|---|
| Skull fractures | 84 | 40.8 |
| Bleeding between brain membranes | 150 | 72.8 |
| Brain contusion and oedema | 148 | 71.8 |
| Internal organ injury | 130 | 63.1 |
| Internal bleeding | 130 | 63.1 |
| Collapsed chest | 22 | 10.7 |
| Critical vascular injury | 26 | 12.6 |
| Critical nerve injury | 15 | 7.3 |
| Hospital complications | 7 | 3.4 |

* Among 166 subjects, there was more than one cause of death




**Graph 1.** Distribution of cases according to the day of the week.

## DISCUSSION

Two studies among elderly patients admitted to the Emergency Departments because of traffic accidents have found respectively 66.4% (6), and 62.7% (7) of the victims to be males. In the present study, 75.2% of the victims were males, which is consistent with the reported percentages. The higher percentage of males can be attributed to their more active social life in Turkey.

Old age create a significant risk to pedestrian injuries (8). Pedestrian accidents accounted for 50% of deaths of people aged>54 years in

Japan (9), and most pedestrian deaths occurred among individuals aged >75 years in the United States (10). In the current study, 67.0% of the victims were pedestrians. The high rate of traffic accident related mortality among the elderly can be attributed to the higher frequency of elderly pedestrians and the limited use of sidewalk, footbridges or underpasses by the pedestrians. Further, drivers are not sufficiently aware of the restricted mobility of the elderly.

We found that 141 (68.4%) and 65 (31.6%) accidents occurred within and outside residential areas, respectively. Of the accidents occurring in residential areas, 83.7% involved pedestrian accidents, whereas of the accidents outside residential areas, 69.2% occurred within-the-vehicle. The elderly are more frequently present in traffic as pedestrians, and because there is more traffic in residential areas, more pedestrian deaths occur. The accidents outside residential areas occurred at higher vehicle speeds. Therefore, the associated injuries were more severe, and deaths occurred more frequently at the accident site. When the types of accidents were evaluated according to the accident site, significantly higher deaths occurred among pedestrians ($p<0.05$).

In the current study, 144 (69.9%) deaths occurred in the hospital, 46 (22.3%) at the accident site and 16 (7.8%) during transport to the hospital. Previous studies includes all age groups have reported more frequent traffic accident-related deaths at the accident site (11). However, the mortality rate at the accident site in the current study was lower than the rates reported in other studies. This can be attributed to the relatively less severe accidents experienced by elderly pedestrians and their deaths during hospitalization. Further, the university hospital that serves our province, also receives victims of traffic accidents from surrounding areas. As the local forensic authorities performed the autopsies of transferred patients who died in the hospital, the number of deaths in the hospital was high.

Traffic accidents occur more often during weekends (12). According to TÜİK data, mortal and injured traffic accidents are most common on Saturdays (13). In the current study, there were 54 (26.2%) traffic accident-related deaths on Friday. This can be explained by the participation of the elderly population in Turkey in their Islamic religious obligations of Friday prayers at the mosque. Furthermore, Friday is the last working day of the week, and drivers may be more tired than usual, causing them to drive less carefully and to ignore the traffic rules.

Head injuries in within-vehicle and pedestrian accidents are the most common fatal injuries, and head trauma is the most common cause of traffic accident-related death (14). Ndiaye et a. have found that intracranial haemorrhage occurred most often, followed by skull fractures caused by head injuries suffered during traffic accidents (15). Toro et al. have found that when the majority of victims were pedestrians or passengers in a vehicle, skull fractures occurred in 55.4%, intracranial haemorrhage in 42.3% and brain contusion in 53.9% (14). Consistent with the literature, in the current study, intracranial haemorrhage occurred in 72.8% brain contusion and oedema in 71.8% and internal haemorrhage and internal organ injury in 63.1% of the victims.

The results of the present study indicate that a significant proportion of traffic accidents-related geriatric deaths occurred in pedestrians within residential areas on specific days. City planners must, therefore, consider the safety of elderly pedestrians through the greater provision of sidewalk, increased supervision of the elderly on heavy traffic days, restrictions on vehicles in areas with a heavy concentration of pedestrians or placement of speed-limiting structures. Further, trainings should be conducted among drives to increase awareness the restricted mobility of the elderly.

## REFERENCES

1. Adam SH, Eid HO, Barss P, et al. Epidemiology of geriatric trauma in United Arab Emirates. Arch Gerontol Geriatr 2008;47:377-82. (PMID:17936381).
2. Cantürk N, Cantürk G, Özdeş T, Dağalp R. Autopsies of elderly people performed between 2004 and 2006 in Ankara. Turkish Journal of Geriatrics 2009;12(4):165-70. (in Turkish).
3. Centers for Disease Control and Prevention (editorial). Motor Vehicle Traffic Related Pedestrian Deaths, United States 2001-2010. MMWR 2013;62:277-282.
4. Clarke DD, Ward P, BartlE C, Truman W. Killer crashes: fatal road traffic accidents in the UK. Accid Anal Prev 2010;42(2):764-770. (PMID:20159105).
5. Collins KA, Presnell SE. Elder homocide: a 20 year study. Am. J. Forensic Med Pathol 2006;27(2):183-7. (PMID:16738443).
6. Eser M, Keten A, İçme F, Kılınç İ, Keten HS. Investigation of traffic accidents in geriatric age group. Turkish Journal of Geriatrics 2013;16(3):277-80. (in Turkish).
7. Hayakawa H, Fischbeck PS, Fischhoff B. Traffic accident statistics and risk perceptions in Japan and the United States. Accid Anal Prev 2000;32(6):827-35. (PMID:10994610).
8. Kandiş H, Karakuş A, Katırcı Y, Karapolat S, Kara İH. Geriatric population and forensic traumas. Turkish Journal of Geriatrics 2011;14(3):193-8. (in Turkish).
9. Karbeyaz K, Balcı Y, Çolak E, Gündüz T. Charateristics of the traffic accidents in Eskişehir between the years 2002 and 2007. Turkiye Klinikleri J Foren Med 2009;6(2):65-73. [Internet] Available from: http://www.turkiyeklinikleri.com/journal/adli-tip-ve-adli-bilimler-dergisi/2619-9459/issue/2009/6/2-0//tr-index.html Accessed: 16.04.2018. (in Turkish).
10. Massie DL, Campbell KC, Williams AF. Traffic accident involvement rates by driver age and gender. Accid Anal Prev 1995;27(1):73-87. (PMID:7718080).
11. Ndiaye A, Chambost M, Chiron M. The fatal injuries of car drivers. Forensic Sci Int 2009;184:21-7. (PMID:19111410).
12. Sardon JP. Recent demographic trends in the developed countries. Population 2006;61:197-266.
13. Towner EM. Assessment of geriatric knowledge: an online tool for appraising entering APN students. J Prof Nurs 2006;22(2):112-5. (PMID:16564477).
14. Töro K, Hubay MP. Sotonyi P, Keller E. Fatal traffic injuries among pedestrian, bicyclists and motor vehicle occupants. Forensic Sci Int 2005;151:151-6. (PMID:15939146).
15. Turkish Statistical Institute. Traffic accidents statistics. [Internet] Available from: http://www.tuik.gov.tr/PreTablo.do?alt_id=1051 Accessed: 02.07.2018. (in Turkish).

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RESEARCH

# PREVALENCE OF DEPRESSION IN THE ELDERLY POPULATION OF MANİSA AND RELATED RISK FACTORS

## Abstract

***Introduction:*** The present study aimed to determine the prevalence of depressive symptoms in elderly people living in Manisa and to reveal the possible risk factors.

***Materials and Method:*** The population of this cross-sectional study included 17760 elderly people living in the Manisa Celal Bayar University Health Education and Research District in 2017. The sample size of the study was calculated as 546 using Epi Info 7.0 software. Sample selection was performed by a simple random sampling method of the records of Manisa Provincial Public Health Directorate. The data were collected by authors, and the participation ratio was 97.8% (n=534). The Katz Index of Independence in Activities of Daily Living and Geriatric Depression Scale were used as data collection tools, in addition to a sociodemographic form. The data were analyzed by using descriptive statistics, univariate and multivariate Odds ratios (with logistic regression analysis).

***Results:*** The mean age of the participants was 72.70±6.35 years. Of note, 56.3% of the elderly participants were women, 44.3% were primary school graduates and 19.6% were living alone. Moreover, 78.6% of them had at least one chronic disease requiring continuous medication. The prevalence of depressive symptoms was 32.8%.

***Conclusion:*** Multivariate analyses indicated that the prevalence of depressive symptoms is more likely higher in individuals living alone and in those who are dependent on others for daily life activities. Additionally, negative expenditure income balance, perceived annual change in health status, history of previous psychiatric disease and history of abuse significantly increase the prevalence of depressive symptoms.

***Keywords:*** Aged; Depression; Prevalence

ARAŞTIRMA

# MANİSA'DA YAŞLILARDA DEPRESİF BELİRTİ PREVALANSI VE İLİŞKİLİ RİSK FAKTÖRLERİ

## Öz

***Giriş:*** Bu çalışmada Manisa'da yaşayan yaşlılarda depresif belirti sıklığını saptamak ve olası risk faktörlerini ortaya çıkarmak amaçlanmıştır.

***Gereç ve Yöntem:*** Kesitsel tipteki çalışmanın evreni Mart-Nisan 2017'de Manisa Celal Bayar Üniversitesi Sağlık Eğitim Araştırma Bölgesi Toplum Sağlığı Merkezi bölgesinde yaşayan 17760 yaşlıdan oluşmuştur. Araştırmanın örneklem büyüklüğü Epi info 7.0 programı kullanılarak hesaplanmış ve 546 yaşlı olarak belirlenmiştir. Çalışmaya alınacak yaşlılar Manisa İl Halk Sağlığı Müdürlüğü kayıtlarından basit rastgele örnekleme yöntemi ile seçilmiştir. Veriler yüz yüze görüşülerek toplanmıştır. Katılım oranı %97.8 (n=534) olarak gerçekleşmiştir. Katılımcılara sosyodemografik veri formu, Katz Günlük Yaşam Aktiviteleri Ölçeği ve Geriatrik Depresyon Ölçeği (GDS-30) veri toplama aracı olarak uygulanmıştır. Elde edilen veriler betimleyici istatistikler, tek değişkenli ve çok değişkenli (lojistik regresyon analizleri ile) Odds Oranları hesaplanarak değerlendirilmiştir.

***Bulgular:*** Araştırmaya katılanların yaş ortalaması 72.70±6.35'dir. Araştırmaya katılan yaşlıların %56.3'ü kadın, %44.3'ü ilkokul mezunu ve %19.6'sı yalnız yaşamaktadır. %78.6'sında sürekli ilaç kullanmayı gerektiren en az bir kronik hastalık vardır. Depresif belirti sıklığı ise %32.8'dir.

***Sonuç:*** Çok değişkenli analizlerde, yalnız yaşayan, günlük yaşam aktivitelerinde başkasına bağımlı olan; bir önceki yıla göre sağlık durumunun daha olumsuz olduğunu belirten; son bir yılda kötü muameleye maruz kalan; geliri giderine göre daha az olan ve daha önce geçirilmiş psikiyatrik hastalık öyküsü olanlarda, depresif belirti sıklığının daha fazla olduğu saptanmıştır.

***Anahtar sözcükler:*** Yaşlı; Depresyon; Prevalans

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## INTRODUCTION

Life expectancy has increased due to advances in medicine and improvements in living conditions, leading to growth of the elderly population, from 5.6% in 2005 to 8.7% in 2018. According to population projections, the proportion of the elderly population is estimated to reach 16.3% in 2040 and 22.6% in 2060 (1). Mental health and well-being are as important in old age as at any other time of life. Depression in the elderly has become an important public health problem as the elderly population has grown in Turkey (2).

Older adult's biological structure, life experiences and coping with problems, physical health conditions, economic conditions, status in society and living alone affect the psychological health condition and so depression may occur more frequently in the elderly (3).

The World Health Organization (WHO) has reported that the most common mental disorder in older adults is depression, which affects approximately 7% of the world's elderly population, and clinically significant depressive symptoms have been reported in 15% of older adults (4). Depression prevalence rates differ among countries: a recent population-based study found that 41.8% of the elderly had depressive symptoms in Ethiopia (5), 40.0% in South Africa (6) and 42.7% in India (7). Globally, clinically significant depressive symptoms exist in one in every eight elderly individuals living in the community; however, the depression rate is higher in inpatient older adults and in those who reside in nursing homes (8,9). In a study conducted in Turkey, 68.9% of individuals living in nursing homes and 27.9% of those living at home were found to have depression (10). Another study conducted in a nursing home reported that 47.4% of the elderly had depressive symptoms and 39% had diagnosed depression (11). Although studies have shown that the depression rate is high in individuals living in nursing homes, depression is observed frequently in the elderly living in the community as well. Additionally, depression in old age may decrease individual physical abilities and quality of life and increase the risk of suicide and premature death, unless it is diagnosed and treated early (9).

Many factors play a role in the emergence of depression in the elderly, including female sex; low socioeconomic status; living alone; presence of chronic disease; physical, verbal and economical abuse and needing assistance in activities of daily living (ADL) (5-7,10-12). Therefore, the early recognition of depressive symptoms and the determination of risk factors are important in the elderly. The aim of this study was to determine the prevalence and risk factors of depressive symptoms in elderly people living in Manisa, Turkey.

## MATERIALS AND METHOD

This is a cross-sectional study conducted in individuals aged 65 years and older living in the Manisa Celal Bayar University (CBU) Health Education and Research District in March–April 2017. The elderly population (aged 65 years and over) living in this district included 17760 individuals, as recorded in the health district registry. The minimum sample size was calculated as 546 with 95% confidence rate, 5% maximum type 1 error and 50% event prevalence using Epi Info 7.0 software. Elderly individuals were randomly selected from the records of the health district registry of Manisa Provincial Public Health Directorate. Data were collected by a battery of questionnaires by interviewer administration at the respondents' homes. On the planned date of the visits, the older adults who could not be contacted at home were re-visited the next day at a different time. Individuals with cognitive

dysfunctions, such as pre-diagnosed dementia, were excluded from the study. Additionally, adequacy of cognitive skills of the older adults was evaluated using a simple memory test based on word list recall at the beginning and middle of the interview. Five elderly individuals could not be contacted at home and seven declined to participate in the study. The overall rate of participation was 97.8% (n=534).

The existence of depressive symptoms was the dependent variable, whereas sociodemographic characteristics such as age, sex, educational status, marital status, income perception and migration status; verbal and physical abuse; self and family history of any psychiatric diagnosis; presence of any comorbid chronic illness and ADL measured by the Katz Index of Independence were predictor (independent) variables in this study.

### Data collection

Data were collected via face-to-face interviews (interviewer administration) in the homes of the elderly during March-April 2017. The person closest to the working time at birth (in months/days) was included in the study when there was more than one person aged ≥65 in the home. Ethical approval was obtained from Manisa CBU Health Sciences Ethics Committee and Manisa Public Health Directorate. The study data were collected using the Katz Index of Independence in ADL and Geriatric Depression Scale (GDS) in addition to a sociodemographic questionnaire.

### Katz Index of Independence in ADL

The Katz Index of Independence in ADL measures the level of dependence of the elderly in performing daily activities. The Katz Index comprises movement, excretion, washing, dressing, toilet needs and nutritional activities (13,14). Each activity level is categorised as totally dependent (0–6 points), partially dependent (7–12 points) or independent (13-18 points).

### Geriatric Depression Scale

The GDS measures the level of depressive symptoms and severity changes in individuals over 60 years of age with no apparent hearing difficulties and no moderate-to-severe dementia. However, it excludes somatic complaints and sexual function related to depression, as well as expectations for the future. The GDS is a screening tool for depressive mood that evaluates patients for depression in the prior week and comprises 30 questions (15). It can be filled in either by self-application or by interviewer assistance and administration. The overall possible score ranges from 0 to 30 points. The cut-off point of the scale is 13/14, and there is a high likelihood of depression in individuals who score above this cut-off point. Turkish validity results were published by Sagduyu A. et al (16).

### Statistical analysis

The statistical analyses were comprised of descriptive statistics (number, percentage distribution, mean and standard deviation) and logistic regression analyses (Backward Wald model) in order to investigate the relationships between depression and the predictor variables.

## RESULTS

The mean age of the older adults was 72.70±6.35 years. Of note, 56.4% of the elderly participants were women, 44.4% were primary school graduates, 60.9% were married, 32.4% had greater expenses than their income and 36.1% had immigrated into the district (Table 1).

Thirty-two percent of the elderly participants had depressive symptoms based on a score of 14 or above in the GDS (mean GDS score, 12.15±6.86). Overall, 8.4% of the participants stated that they had previously been diagnosed with a mental illness and 13.9% of them stated that they had a family history of mental illness in first-degree relatives (Table 2).

**Table 1.** Distribution by sociodemographic characteristics.

| Variables | n | % |
|---|---|---|
| **Age** | | |
| 65-69 | 202 | 37.8 |
| 70-74 | 156 | 29.2 |
| 75-79 | 96 | 18.0 |
| 80+ | 80 | 15.0 |
| **Gender** | | |
| Male | 233 | 43.6 |
| Female | 301 | 56.4 |
| **Education** | | |
| Illiteracy | 87 | 16.3 |
| Literacy | 110 | 20.6 |
| Primary school | 237 | 44.4 |
| Secondary school | 38 | 7.1 |
| High school | 44 | 8.2 |
| University | 18 | 3.4 |
| **Marital status** | | |
| Married | 325 | 60.9 |
| Single | 13 | 2.4 |
| Widow | 185 | 34.6 |
| Divorced | 11 | 2.1 |
| **Income** | | |
| Low | 173 | 32.4 |
| Middle | 289 | 54.1 |
| High | 72 | 13.5 |
| **Immigration** | | |
| No | 341 | 63.9 |
| Yes | 193 | 36.1 |

Table 3 shows the factors associated with the presence of depressive symptoms. Living in rural and semi-urban areas, female sex, having no formal education, living alone, not being married, not having income, having chronic disease, a history of psychiatric disease and having poor health perceptions were risk factors of depression. The risk of depressive symptoms was high in the elderly

who had been subjected to maltreatment (abuse) in the last year and was found to be dependent on the ADL according to Katz Index. These differences were statistically significant (p<0.05).

**Table 2.** Distribution of participants by depressive symptoms and psychiatric disorders.

| Variable | n | % |
|---|---|---|
| **Presence of depressive symptoms** | | |
| Yes * | 175 | 32.8 |
| No | 359 | 67.2 |
| **Previously diagnosed mental illness** | | |
| Yes | 44 | 8.4 |
| No | 480 | 91.6 |
| **Family history of mental illness** | | |
| Yes | 73 | 13.9 |
| No | 451 | 86.1 |

* The Geriatric Depression Scale (GDS) point 14 and over

There was a weak positive correlation between age and GDS score (r=0.13, p=0.01) and a moderate positive correlation between age and Katz Index score (r=0.41, p<0.001).

A logistic regression model was developed to evaluate the independent risks of the different variables affecting depressive symptoms. Correlations between the variables found to be effective alone were evaluated, and it was decided to include those variables with a higher correlation and greater effect on depressive symptoms. The region where they lived, sex, income status, with whom they were living, addiction status, presence of chronic disease, health status compared with the previous year, ill treatment in the last year and history of psychiatric disease were entered into the model. In the model, the prevalence of depressive symptoms was 3.06 times greater (95% CI 1.54–6.09) in those living alone, 2.75 times (95% CI 1.71–4.43) greater in those who stated that their health status was worse than the previous year and 4.58 times (95% CI 2.06–10.16) greater in those who had been subjected to neglect–abuse in the last year. A 2.89-fold risk (95% CI 1.02–8.21) of depression was found in patients with a history of psychiatric disease (Table 4).

**Table 3.** Univariate analysis between depression and sociodemographic-economic characteristics.

| Variables | Presence of depressive symptoms % | OR (%95 CI)** | p |
|---|---|---|---|
| **Region** (Ref: Urban)*** | | | |
| Rural (n=232) | 36.2 | 1.91 (1.25-2.92) | <0.001 |
| Semi-urban (n=101) | 44.6 | 2.70 (1.62-4.51) | |
| **Age** (Ref: 65 –74) | | | |
| 75 and over (n=176) | 37.5 | 1.37 (0.93-2.00) | 0.103 |
| **Gender** (Ref: Male) | | | |
| Female (n=301) | 38.5 | 1.84 (1.27-2.69) | 0.001 |
| **Marital status** (Ref: Married) | | | |
| Other (n=209) | 45.5 | 2.55 (1.76-3.69) | <0.001 |
| **Education** (Ref: Primary school and over) | | | |
| Illetaracy/Literacy (n=197) | 47.2 | 2.78 (1.91-4.04) | <0.001 |
| **People alive** (Ref: It lives with someone) | | | |
| Alone (n=105) | 43.8 | 1.76 (1.13-2.73) | 0.010 |
| **Income** (Ref: Good ) | | | |
| Bad (n=173) | 49.7 | 3.02 (2.06-4.42) | <0.001 |
| **Health status according to previous year** (Ref: Good) | | | |
| Same (n=231) | 20.3 | 1.06 (0.51-2.22) | <0.001 |
| Bad (n=238) | 49.2 | 4.04 (1.99-8.18) | |
| **Chronic illness** (Ref: No ) | | | |
| Yes (n=420) | 36.0 | 1.91 (1.16-3.15) | 0.009 |
| **History of psychiatric disease** (Ref: No ) | | | |
| Yes (n=44) | 70.4 | 4.23 (1.79-9.98) | <0.001 |
| **Maltreatment (abuse) in the last year** (Ref: No) | | | |
| Yes (n=71) | 60.6 | 3.75 (2.24-6.30) | <0.001 |
| **According to ADL** (Ref: Independent) | | | |
| Dependent (n=145) | 58.6 | 4.58 (3.05-6.87) | <0.001 |

* The Geriatric Depression Scale (GDS) point 14 and over ; **OR: Odds Ratio, ***Ref: Reference

**Table 4.** Factors associated with the presence of depressive symptom according to the last model of reduced logistic regression.*

| Variable | Multivariate analysis OR value (95% CI) |
|---|---|
| Living alone | 3.06 (1.54-6.09) |
| Being dependent on others in daily living activities | 4.18 (2.39-7.31) |
| Poorer health compared to the previous year | 2.75 (1.71-4.43) |
| Less than the amount of income from expenses | 2.54 (1.45-4.43) |
| Abuse in the last year | 4.58 (2.06-10.16) |
| A history of previous psychiatric illness | 2.89 (1.02-8.21) |

* Model variables; Changes in the region, gender, lifestyle, addiction status, presence of chronic diseases, health status compared to the previous year, income-expenditure situation, last year ill-treatment, history of psychiatric disease

## DISCUSSION

The prevalence and risk factors of depression in the elderly vary in different studies in Turkey (10-12,17,18). In addition, studies vary in terms of the setting, for example, in the community or in a nursing home (8-11). Population-based representative recent studies are rather scarce in Turkey. This study shows the prevalence of depressive symptoms in a community-based investigation.

In the present study, the prevalence of depressive symptoms was 32.8% in the elderly. The prevalence of depression varies greatly among studies conducted with geriatric depression screening scales. The frequency of depressive symptoms in previous studies was 18.5%–56.6% in community-based investigations, in Turkey (11,12,17,18). A community-based study conducted in South Africa using the GDS found depressive symptoms in 40% of the elderly (6). In contrary, depression prevalence in the elderly population is lower (range 9.0% - 11.0%) in developed countries than underdeveloped countries (19, 20). This higher depression rate seen in the underdeveloped countries may be attributed to the economic deprivation that might affect older adults more than the young adults. The rate of depressive symptoms (i.e. 32.8%) in older adults in our study is a consistent figure that falls between the rates of economically developed and under-developed communities.

Our study results showed that, depressive symptoms were higher in the elderly who were socioeconomically disadvantaged and who had a lack of social support. Consistent with our findings, it was observed in the literature that depressive symptoms were more common in elderly women who did not have education, who had low socioeconomic status and who were living alone (8-12). Our results also indicated that having any disability, previous depression, poor health status, poor self-perception of health status and female gender are directly related to depressive mood in older adults, hence these findings were supported by a meta-analysis (21). On the other hand, we found that depressive symptoms were three times higher [3.06 (CI 95%:1.54-6.09)] in the elderly who were living alone. In a recent longitudinal study conducted in Netherlands it was concluded that the loneliness negatively affected the prognosis of depression (22).

We found that the frequency of depressive symptoms was four times higher in elderly patients who had any chronic illness and who were physically

dependent on others. Although the prevalence of depressive symptoms in the general population is 15%, this rate rises to 25% in the elderly with chronic disease (9,23). Physical health deterioration and having chronic disease limits the daily living activities of the elderly, making them dependent on others. This would negatively affect their self-role and dignity in life, leading to an increase in depressive symptoms (9,23).

History of maltreatment (4.58 times risk of depression) affected the frequency of depressive symptoms the most. Abuse of the elderly, which is a preventable problem, hurts the elderly and leads to psychosocial problems (24). There is a strong relationship between depression and abuse of the elderly; therefore, both problems are considered risk factors for each other (24,25).

**Limitations**

The limitations of the present study naturally include those related with the cross-sectional design of this study. First of all, interviews were done at day time which may restrict the participation rate of the study. A second limitation of this cross sectional design is the difficulty to infer the temporal association between risk factors and the outcomes. Therefore, only an association, and not causation, can be inferred in this study. In addition to these restrictions, the type of the interviews might have biased the results more or less. Firstly, depression symptoms were measured with only a self-rated scale and no psychiatric interview was performed. Depression in elderly individuals may differ from the classical symptoms of depression and therefore depression may not be detected. Secondly an evaluation of the cognitive functions could not be performed in this study.

To conclude, depressive symptoms are seen more frequently among elderly with a lower economic status, with a history of abuse and female gender. For this reason, priority should be given to these people in order to identify and screen depression. Proper training of primary health care personnel to detect elderly depression early should be provided during health-care planning. Education about the different symptoms of elder depression, communication and interview skills with elderly and use of geriatric depression scales are important parts of this training. Thus, we consider that the growing elderly population in the community in Turkey provides an opportunity to increase the quality and efficiency of health services provided to the elderly.

## REFERENCES

1. Aksüllü N, Doğan S. Relationship of social support and depression in institutionalized and non-institutionalized elderly. Anatolian J of Psychiatry 2004;5:76-84. (in Turkish).
2. Alexopoulos GS. Depression in the elderly. Lancet 2005;365:1961-70. (PMID:15936426).
3. Aylaz R, Akturk U, Erci B, Ozturk H, Aslan H. Relationship between depression and loneliness in elderly and examination of influential factors. Arch Gerontol Geriatr 2012;55(3):548-54. (PMID:22487148).
4. Blazer DG. Depression in late life: review and commentary. J Gerontol A Biol Sci Med Sci 2003;58:249-65. (PMID:12634292).
5. Cole MG, Dendukuri N. Risk factors for depression among elderly community subjects: a systematic review and meta-analysis. Am J Psychiatry 2003;160:1147-56. (PMID:12777274).
6. de Sousa RD, Rodrigues AM, Gregório MJ, et al. Anxiety and depression in the portuguese older adults: prevalence and associated factors. Front Med 2017;20(4):196. (PMID:29209612).
7. Dişçigil G, Gemalmaz A, Başak F, Gürel S, Tekin N. Signs of depression in the elderly relationship between depression and sociodemographic characteristics TAF Prev Med Bull 2008;7(5):399-404. (in Turkish).

8. Dong X, Simon MA, Odwazny R, Gorbien M. Depression and elder abuse and neglect among a community-dwelling Chinese elderly population. J Elder Abuse Negl 2008;20:25-41. (PMID:18551905).
9. Eker E, Utucu N. Physical disorders and depression in the elderly population. Akademik Geriatri Dergisi 2009;1:90-97. (in Turkish).
10. Ellison JM, Kyomen HH, Harper DG. Depression in later life: an overview with treatment recommendations. Psychiatr Clin North Am 2012;35:203-29. (PMID:22370499).
11. Gul HL, Evcili G, Karadas O, Gül ES. Geriatric depression and associated risk factors: the level of depression symptom at elderly living in nursing home. J Clin Anal Med 2012;3:308-10. (in Turkish).
12. Güz H, Çolak EG. Psychiatric illnesses found in old age. T Klin J Psychiatry 2002;3:63-74. (in Turkish).
13. Holvast F, Burger H, de Waal MM, van Marwijk HW, Comijs HC, Verhaak PF. Loneliness is associated with poor prognosis in late-life depression: longitudinal analysis of the Netherlands study of depression in older persons. J Affect Disord 2015;185:1-7. (PMID:26142687).
14. Katz S, Ford AB, Maskowitz RW, Jackson BA, Jaffe MW. Studies of illness in the aged: the index of ADL: a standardized measure of biological and psychosocial function. JAMA 1963;185:914-9. (PMID:14044222).
15. Lok N. Elder abuse and neglect in Turkey: a systematic review. Current Approaches in Psychiatry 2015;7(2):149-156. (in Turkish).
16. Mirkena Y, Reta MM, Haile K, Nassir Z, Sisay MM. Prevalence of depression and associated factors among older adults at ambo town, Oromia region, Ethiopia. BMC Psychiatry 2018;18(1):1-7. (PMID:30336773).
17. Padayacheya U, Ramlalla S, Chipps J. Depression in older adults: prevalence and risk factors in a primary health care sample. S Afr Fam Pract 2017;59(2):61–6.
18. Sagduyu A. The geriatric depression scale: a reliability and validity study in comparison with hamilton rating scale for depression. Turk Psikiyatri Derg 1997;8(1):3-8. (in Turkish).
19. Sinha SP, Shrivastava SR, Ramasamy J. Depression in an older adult rural population in India. MEDICC Rev 2013 Oct;15(4):41-4.
20. Sjöberg L, Karlsson B, Atti AR, Skoog I, Fratiglioni L, Wang HX. Prevalence of depression: Comparisons of different depression definitions in population-based samples of older adults. J Affect Disord 2017;221:123-31. (PMID:28645024).
21. Tel H, Tel H, Sabancıoğulları S. Status of maintenance of activities of daily living and experience of loneliness in elder than 60 years old living at home and in institutions. Turk J Geriatrics 2006;9:34-40. (in Turkish).
22. TUIK 2017 Elderly statistics. [Internet] Available from: http://www.tuik.gov.tr/PreHaberBultenleri.do?id=24644. Accessed: 13.10.2018.
23. WHO. Mental health of older adults. [Internet] Available from: http://www.who.int/news-room/fact-sheets/detail/mental-health-of-older-adults Accessed: 30.10.2018.
24. Yaka E, Keskinoğlu P, Uçku R, Yener GG, Tunca Z. Prevalance and risk factors of depression among community dwelling elderly. Arch Gerontol Geriatr 2014;59:150-4. (PMID:24767692).
25. Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr Res 1983;17(1):37-49. (PMID:7183759).

RESEARCH

# PHYSICAL RESTRAINT USE IN ELDERLY PATIENTS: PERCEPTIONS OF NURSES IN UNIVERSITY HOSPITALS

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## Abstract

***Introduction:*** Nurses are primarily responsible for patient care and safety. Identification of nurses perceptions about restraint practices is thus important for raising awareness on this issue. This study aimed to identify perceptions about physical restraint use among nurses working in wards and intensive care units (ICUs) in three university hospitals.

***Materials and Method:*** The study was conducted in three university hospitals with 298 nurses who completed the Perceptions of Restraint Use Questionnaire (PRUQ) to evaluate their perceptions of the use of restraint in the care of older patients. Higher values indicated that the situations described were considered an important justification for using physical restraints.

***Results:*** The overall mean score for the PRUQ was 4.14. Nurses identified "Falling out of bed" as the most important reason for restraining a patient and "Substituting for staff observation"as the least important reason. In addition, there was a significant relationship between the perception of using restraints in wards and ICUs. It was noted that the nurses reported that using restraints in ICUs was more common than in wards.

***Conclusion:*** The nurses' perceptions on the practice of physical restraint were high. According to these result, the nurses need to learn alternative practices for decreasing use of restraints and consider it important to plan individualized nursing care for older patients who need to be restrained and to provide sufficient information to them and their families about the safety charestics of the practice.

***Keyword:*** Restraint, Physical; Aged; Nurses

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ARAŞTIRMA

# YAŞLI HASTALARDA FİZİKSEL TESPİT KULLANIMI: ÜNİVERSİTE HASTANELERİNDE ÇALIŞAN HEMŞİRELERİN FİZİKSEL TESPİT KULLANIM ALGILARI

## Öz

***Giriş:*** Hemşirelerin temel sorumluluklarından biri de bakım sürecinde hastaların kendilerine ve başkalarına zarar vermesini engellemektir. Hemşirelerin tespit uygulamalarındaki algı düzeylerinin tanımlanması bu konuda farkındalık oluşturmak açısından önemlidir. Bu çalışmada üç üniversite hastanesinde çalışan hemşirelerin genel servisler ile yoğun bakımlarda fiziksel tespit kullanımına ilişkin algılarının incelenmesi amaçlanmıştır.

***Gereç ve Yöntem:*** Bu çalışma, hemşirelerin yaşlı hastaların bakımında tespit kullanımı hakkındaki görüşlerini değerlendirmek amacıyla üç üniversite hastanesinde Tespit Kullanımı Algı Anketini (PRUQ-T) tamamlayan 298 hemşire ile yürütülmüştür. Anketten elde edilen puanların yükselmesi hemşirelerin fiziksel tespiti kullanım algılarının yüksek olduğunu göstermektedir.

***Bulgular:*** PRUQ-T puan ortalaması 4.14 olarak bulunmuştur. Hemşireler, hastalara tespit kullanımının en önemli nedenini "Hastanın yataktan düşmesini engellemek", en az önemli nedenini ise "Personelin gözetimi için yaşlının yerinde kalmasını sağlama" olarak belirtmişlerdir. Ayrıca, genel servislerde tespit kullanımı algısı ile yoğun bakım ünitelerinde lerinde tespit kullanımı algısı arasında istatistiksel olarak anlamlı bir fark bulunmuştur. Hemşireler yoğun bakım ünitelerinde servislere göre daha fazla tespit kullanıldığını belirtmişlerdir.

***Sonuç:*** Çalışmamızda hemşirelerin tespit kullanım algılarının yüksek olduğu saptanmıştır. Bu sonuca göre, hemşirelerin yaşlılarda tespit kullanımının azaltılması için tespit kullanımına alternatif yöntemler uygulaması, tespit kullanılması gereken durumlarda ise bireyselleştirilmiş hemşirelik bakım planı yapması ve güvenlik uygulamalarına ilişkin hastalara ve ailelerine yeterli bilgi verilmesi önerilerilmektedir.

***Anahtar sözcükler:*** Fiziksel tespit; Yaşlı; Hemşire

## INTRODUCTION

One of the fundamental responsibilities of nurses is to prevent patients from harming themselves and others in the care process (1). Nurses may have to make the decision themselves to use restraints to protect patients and others. Physical restraints are defined as the use of physical and mechanic tools or chemical agents that limit movements of some parts of the body for the control of physical activities with a view to prevent individuals from harming themselves or others (2-4). Another definition includes restricting or preventing patient movements by use of physical or mechanical devices or using bodily force of a health professional for a short time (5-7).

Although restraints inevitably limit individuals' movements, they prevent them from harming themselves or others. Beside the existing physiopathological problems of elderly people in nursing homes and wards for the elderly, a large number of them experience various changes in their cognitive levels and behaviors. These eldery patients might poorly adjust to treatment processes, leading them to harm themselves (1). A study on this issue reports that 80% of the elderly people in the ICUs experience cognitive and behavioral agitation at various levels and harm themselves by removing endotracheal or tracheostomy tubes or dressings (8). In another study that investigated restraint use in an education and research hospital in Australia, Irving et al. reported the prevalence of restraint use as 9.4%, with 62% of these involving confinement to the bed, 17% involved chemical restrainment, and 3.9% involved the use of a restraint vest. The same study revealed that more than one restraint method was used for 25% of the patients and restraint use increased with the increase in age. The prevalence of restraint use was 31% in patients aged over 85 years but only 14.1% in patients aged between 75 and 85 years (9). In these cases, limiting movements and using restraint could become a part of the treatment. In cases where patients harm themselves or others, nurses see limiting movements and using restraints as part of care.

Nurses are primarily responsible for patient care and safety. Identification of their perceptions about restraint practices is thus important for raising awareness on this issue and protecting eldery people from unnecessary damage of using physical restraint. This study aimed to identify perceptions about physical restraint use among nurses who work in university hospitals and to investigate whether there are differences between wards and ICUs in terms of the perceptions of restraint use.

### Background

Review of the related literature indicates that individuals' perceptions about restraint use in the elderly are identified via the Perceptions of Restraint Use Questionnaire (PRUQ) developed by Strumpf and Evans (1993) (10). One of the pioneer studies that utilized the PRUQ included 18 nurses providing care for 20 patients. The most important reason for restraint use by nurses in that study was found to be the protection of patients' and others' safety (11). An analysis of the studies conducted in different clinics that utilized the PRUQ tool indicate that some facts in physical restraint use were found to be more important and acceptable than others for enhancing patient safety (12,13). In a study with 52 nurses in three different clinics (Internal Diseases, Orthopedics, and Cardiovascular Surgery), Helmuth found that patient safety was the most important reason for using restraint and achievement of quiet time was the least important (12). Myers reported that the most important reason for physical restraint use in their environment was preventing patients from falling and the least important was the need for quiet time (13).

In their study conducted with 94 nurses, McGabe et al. utilized the PRUQ and found the mean score was 2.8 out of 5 and that treatment interference was reported to be the most important restraint reason (14). Similarly, nurses' physical restraint perception mean score was found to be 2.8 in a study conducted by Matsui in Japan (15). In this study conducted with a sample of 205 nurses, perceptions' mean score for physical restraint use in surgery wards were found to

be significantly higher than in other wards, and the most important reason was stated as preventing patients from breaking open sutures.

A study that utilized the PRUQ conducted by Lopez et al. with 19 Spanish nurses working in nursing homes found the general mean scores to be 3.4 out of 5. In addition, no significant differences were found between nurses' perceptions of restraint use and demographic charestics of the working units (16).

A study that utilized the PRUQ to investigate nursing students' restraint use perceptions found that the students initially had negative attitudes about restraint use. However, they were found to adjust this to positive attitudes as they observed the clinic nurses' need for the use of restraint (17).

This review of the studies on this subject conducted in various countries and various clinics led to the conclusion that perceptions of and primary reasons for restraint use vary. The common opinion held by the workers in the field is that restraint should be used primarily for patient safety. We could not find other studies in our country that have aimed to identify nurses' perceptions about restraint use. Therefore, the purpose of the present study was two-fold: to examine nurses' perceptions about restraint use and to identify the relationship between wards and intensive care nurses' perception about restraints. It was anticipated that the results would provide an evaluation of the current situation, identify the needs in this field, and make a contribution to the literature.

## MATERIALS AND METHOD

### Sample selection

This cross-sectional study was conducted between September and October, 2017. The target population of the study was nurses working in three university hospitals located in the south eastern part of Turkey who provided care for the elderly in internal and surgery wards and ICUs. Five hundred nurses (except pediatric, emergency and policlinic nurses) in these three university hospitals were the target population for the study. The number of participants was identified using power analysis in the 3.1.7 version of the G-Power program, in which the confidence interval was taken as 95%, the error margin as 5%, the effect size as 0.20, and the power of research as 80% (18). The result of this analysis, the number of participants was identified as 262. The number of ward nurses (Internal Diseases, Neurosurgery, Thoracic diseases, Neurology), and intensive care nurses (Palliative care, Reanimation IC, Cardiology IC, Neurosurgery IC, Internal Diseases IC) who participated in the study were 148 and 150 respectively (Total 298).

### Data collection instruments

The data were collected using the Descriptive Characteristics Form and the PRUQ.

**Descriptive characteristics form.** For the purpose of this study, this form was prepared to obtain the subjects' age, gender, number of years of working experience, number of years in the current work unit, identity of the current work unit, and education in geriatrics nursing.

**The Perceptions of Restraint Use Questionnaire (PRUQ)** A Turkish form of Strumpf and Evans's PRUQ tool was developed to collect study data (11). The tool consists of 17 items, each with a 5-point Likert response scale and each consisting of a reason for physical restraint. Participants scale their perception of the importance of physical restraint use for each itemized purpose. The total score for each subject ranging from 17 to 85 is reduced to an average score between 1 and 5, in which a higher average indicates a more favorable overall perception towards physical restraint use with older adults.

The Cronbach's Alpha Reliability Coefficient value analysis for the original questionnaire was 0.93. When the Turkish form of the 17-item PRUQ was developed, the Cronbach alpha reliability coefficient was 0.92 (19).

### Ethical considerations

Prior to the study, ethics committee approval was obtained from the Biomedical Research Ethics

Committee of the university (permission no: 2017-6-17) and the institutions where the study was conducted. After the nurses who participated in the study were informed about the purpose of the study, they were informed that the decision to participate in the study belonged only to them, that they should not write their name on the questionnaire, that the data to be collected would be used only within the scope of the study, and that confidentiality would be strictly maintained. Once their consent was obtained, the personal data form and the PRUQ were distributed for completion.

### Data analysis

The data obtained from the study were analyzed in SPSS 16.00 package programme, and their normality was tested using Kolmogorov–Smirnov and Shapiro–Wilk tests. Parametric tests were used because the PRUQ scale displayed normal distribution. The data were displayed in tables as means (±), standard deviations (SDs), and numbers and percentages of the individuals. Data were assessed by descriptive statistics, t-tests and One way Anova. A p value <0.05 was considered statistically significant.

## RESULTS

Of all the nurses participating in the study, 215 (72.1%) were female and 83 (27.9%) were male. The average age of the participants was 30.48±5.55 years (youngest 20 years, oldest 47 years), and the total number of years of experience was 8.20±5.65 years (least 1 year, most 27 years). There were 45.8% (136) nurses who stated that they had received education in geriatric nursing.

The nurses' perception of the use of restraint displayed similar distribution between the groups in terms of variables such as gender, age group, years of experience, and receiving geriatrics education or not. There is a statistically significant difference between PRUQ mean score of the nurses according to their gender, age and their years of experience ($p<0.05$). There is no significant difference between PRUQ mean score of the nurses according to receiving geriatrics education status ($p>0.05$) (Table 1).

**Table 1.** Distribution of the PRUQ mean scores for descriptive characteristics.

| Descriptive characteristics | n (%) | PRUQ Mean±sd |
|---|---|---|
| **Gender (298)** | | |
| Female | 215 (72.1) | 4.18±0.60 |
| Male | 83 (27.9) | 4.03±0.57 |
| **Statistics*** | | **t=-2.034, p=0.040** |
| **Age (298)** | | |
| 20–29 | 156 (52.3) | 4.06±0.64 |
| 30–39 | 121 (40.6) | 4.18±0.54 |
| ≥40 years old | 21 (7.0) | 4.48±0.40 |
| **Statistics**** | | **F=5.064, p=0.007** |
| **Years of experience (295)** | | |
| 1–5 years | 126 (42.3) | 4.05±0.69 |
| 6–10 years | 95 (31.9) | 4.16±0.51 |
| >10 years | 74 (24.8) | 4.26±0.50 |
| **Statistics**** | | **F=3.069, p=0.048** |
| **Geriatrics education (298)** | | |
| Yes | 136 (45.8) | 4.07±0.63 |
| No | 162 (54.4) | 4.20±0.56 |
| **Statistics*** | | t=-1.847 p=0.066 |

* Independent sample t test; **One way Anova

**Table 2.** Distribution of PRUQ mean scores for restraint reasons.

| PRUQ | Mean | sd |
|---|---|---|
| 1- Protecting an older person from: | | |
| a- Falling out of bed | 4.55 | 0.60 |
| b- Falling out of a chair | 4.37 | 0.83 |
| c- Unsafe ambulation | 4.37 | 0.82 |
| 2- Preventing an older person from wandering | 3.75 | 1.01 |
| 3- Preventing an older person from taking things from others | 3.37 | 1.37 |
| 4- Preventing an older person from getting into dangerous places or supplies | 4.36 | 0.75 |
| 5- Keeping a confused older person from bothering others | 3.94 | 1.01 |
| 6- Preventing an older person from: | | |
| a- Pulling out a catheter | 4.45 | 0.75 |
| b- Pulling out a feeding tube | 4.43 | 0.75 |
| c- Pulling out an IV | 4.26 | 0.83 |
| d- Breaking open sutures | 4.31 | 0.80 |
| e- Removing a dressing | 4.28 | 0.77 |
| 7- Providing quiet time or rest for an overactive older person | 3.75 | 1.06 |
| 8- Providing for safety when judgment is impaired | 4.20 | 0.88 |
| 9- Substituting for staff observation | 3.54 | 1.20 |
| 10- Protecting staff or other patients from physical abusiveness/combativeness | 4.21 | 0.89 |
| 11- Managing agitation | 4.23 | 0.85 |
| **Total PRUQ score** | **4.14** | **0.60** |

**Table 3.** Distribution of the PRUQ mean scores for subjects in wards and ICUs.

| PRUQ | Wards Mean±sd | ICUs Mean±sd | p value* |
|---|---|---|---|
| 1- Protecting an older person from: | | | |
| a- Falling out of bed | 4.51±0.69 | 4.59±0.49 | 0.211 |
| b- Falling out of a chair | 4.28±0.94 | 4.45±0.70 | 0.078 |
| c- Unsafe ambulation | 4.30±0.82 | 4.43±0.82 | 0.176 |
| 2- Preventing an older person from wandering | 3.63±0.94 | 3.87±1.07 | **0.042** |
| 3- Preventing an older person from taking things from others | 3.05±1.43 | 3.68±1.28 | **0.001** |
| 4- Preventing an older person from getting into dangerous places or supplies | 4.28±0.82 | 4.43±0.67 | 0.085 |
| 5- Keeping a confused older person from bothering others | 3.66±1.10 | 4.21±0.83 | **0.001** |
| 6- Preventing an older person from: | | | |
| a- Pulling out a catheter | 4.32±0.91 | 4.58±0.52 | **0.003** |
| b- Pulling out a feeding tube | 4.38±0.77 | 4.48±0.72 | 0.240 |
| c- Pulling out an IV | 4.13±0.92 | 4.38±0.71 | **0.009** |
| d- Breaking open sutures | 4.28±0.83 | 4.34±0.76 | 0.543 |
| e- Removing a dressing | 4.20±0.82 | 4.36±0.72 | 0.067 |
| 7- Providing quiet time or rest for an overactive older person | 3.58±1.08 | 3.91±1.01 | **0.008** |
| 8- Providing for safety when judgment is impaired | 3.99±1.01 | 4.41±0.68 | **0.001** |
| 9- Substituting for staff observation | 3.46±1.16 | 3.62±1.24 | 0.249 |
| 10- Protecting staff or other patients from physical abusiveness/ combativeness | 4.08±0.99 | 4.34±0.78 | **0.012** |
| 11- Managing agitation | 4.14±0.92 | 4.33±0.76 | 0.051 |
| **Total PRUQ score** | **4.02**±0.61 | **4.26**±0.56 | **0.001** |

* Independent sample t test

The overall average PRUQ score for this study was found to be 4.14 out of a total of 5 points. The most important reasons for restraint use indicated by nurses included protecting an older person from falling out of bed, preventing an older person from breaking open sutures, and pulling out a catheter and/or a feeding tube. Relatively less important reasons for nurses included preventing an older person from taking others' goods, acting as a substitution for staff observation, and providing quiet time in the ward or ICU (Table 2).

There was a significantly difference between the average scores of ward nurses' perceptions (4.02) and those of ICU nurses (4.26) ($p<0.05$) In addition to this result, the PRUQ mean scores of nurses working in ICUs were found to be higher for all reasons (Table 3).

## DISCUSSION

Use of restraint on eldery patients is one of the important cases that causes ethical dilemma because it limits the individual's autonomy and independence. Routine care practices should be regulated in a way restraint would be needed at minimum level. However, its indications, expected benefits, risks and potential complications should be considered well in cases when restraint needs to be used. Nurses use physical restraints as useful and simple solutions to prevent treatment interference. However, the use of restraints that violate physical, psychological, legal, ethical, and/or moral boundaries are considered intrusive and risky and are only legally permitted in very specific circumstances.

Our study showed that there was a significant relationship between the perception of using restraints in wards and ICUs. According to the results, using restraints in ICUs was more common than in wards, despite the reported potential harm to the eldery patients and the controversy concerning the effectiveness of physical restraints (18).

The mean scores that the nurses obtained from the perceptions of the restraint use questionnaire suggest that nurses currently hold a very strong belief that restraints should be used with older people for the reasons given in the scale. However, it is important to consider whether understanding the dangers of restraint as well as learning how to "make sense" of the patients' behaviors as a communication of distress or unmet need would significantly decrease their mean scores. Results similar to ours were found in a study that also aimed to identify - ward and ICU nurses' restraint perceptions. The reason given for this was that ICUs are more complicated than other wards, and more emergency cases are managed there (20). It could also be due to the fact that as intensive care nurses spend more time with their ICU patients than the practice in other nursing situations, these nurses could be more worried about patient safety and thus tend to use more restraints.

Nurses who work in wards and in ICUs considered the use of physical restraints more important in some circumstances: both groups supported its use for protecting an older person from falling out of bed. Other studies that utilized the PRUQ also identified patient safety as the primary reason (12,13,16). However, studies have shown that no evidential information has been reported that restraint use provides patient safety (20,21).

The other reasons for which our subjects considered the use of restraint to be important (preventing an older person from breaking sutures open and pulling out a catheter or a feeding tube) were confirmed by several studies (15,16,20,22,23). In routine patient care, restraint use should be one of the least frequently applied practices by nurses. For instance, restraint use should be avoided in a patient who constantly removes the dressing, and the case should be managed using alternative methods. Various studies posit that restraint

should be used only in terminally ill patients to protect dressings and prevent from the removal of tubes (24,25).

The findings about the use of physical restraint for preventing an older person from taking things from others, substituting for staff observation, and providing quiet time were also reported in other studies (16,20).

There is a statistically significant difference between PRUQ mean score of the nurses according to their gender, age and their years of experience ($p<0.05$). There is no significant difference between PRUQ mean score of the nurses according to receiving geriatrics education status ($p>0.05$). Some other studies investigating this issue provided similar findings (13,16). Other investigations concerning nurses' and nursing assistants' restraint use perceptions reported significant differences according to variables such as receiving postgraduate education and the wards in which they work (16).

We consider it important to design postgraduate education programs that cover reasons for restraint use, its ethical and legal aspects, and alternative substitute methods to raise nurses' awareness on the issue. The perception of restraint use does not appear to be affected by education in geriatric nursing. As our study did not provide any information about the nature or degree of the extra knowledge of general nursing practice, this issue is open to research.

In conclusion, this study provided the clinical outcomes of nurses' perceptions on the practice of physical restraint in Turkey. The overall PRUQ score of the sample was found to be 4.14. There was a statistically significant difference between the scores of the perceptions of the wards and ICU nurses. The most important reasons for the participants to use restraint were found to be protection of an older person from falling out of bed, preventing an older person from breaking open sutures, and pulling out a catheter and/or a feeding tube. Reasons that are less important, according to the subjects, included preventing an older person from taking things from others, substituting for staff observation, and providing quiet time.

Although restraint use is a practice applied for patient safety, it should be considered that this procedure can limit patient freedom and have effects that may even lead to death. Decision about restraint use should involve the evaluation of the expected benefits or risks as well as potential side effects. It is important to plan individualized nursing care for the patient who is restrained and to provide him and his family with the opportunity to participate in achieving the safety of the patient. In cases where the decision to use restraint has been made, the reasons for restraint use should be clarified, the application period should be limited, and the reasons, efficacy, and side effects of the practice should be reported for each patient. Prior to restraint use, the relatives of the agitated, aggressive, or dementia patient should be informed and consent should be obtained.

**Limitations of the study**

The data in this study were obtained from nurses recruited from one hospital in Turkey, which limits the generalizability of the findings. Future research requires larger samples to ensure representativeness.

**Conflict of interest**

The authors declare that there is no conflict of interest.

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## REFERENCES


1. Allen D, Lowe K, Brophy S, Moore K. Predictors of restrictive reactive strategy use in people with challenging behaviour. JARID 2009;22(2):159-68.
2. Arai F, Leibowitz SY. Nurses' perceptions of restraint. The Japan Society of Nursing Research 2014; 5:39-46.
3. Bray K, Hill K, Robson W, et al. British association of critical care nurses position statement on the use of restraint in adult critical care units. Nurs Crit Care 2004;9(5):199-212. (PMID:15462118).
4. Chang LY, Wang KW, Chao YF. Influence of physical restraint on unplanned extubation of adult intensive care parents: a case control study. Am J Crit Care 2008;17(5):408-15. (PMID:18775996).
5. Cotter VT. Restraint free care in older adults with dementia. Keio J Med 2005;54(2):80-4. (PMID:16077257).
6. Evans LK, Strumpf NE. Frailty and physical restraint. In: Perry HM, Morley JE, Coe RM.(Eds). Aging and musculoskeletal disorders. Springer, New York 1993, pp 324-33.
7. Fariña-López E, Estévez-Guerra GJ, Gandoy-Crego M, Polo-Luque LM, Gómez-Cantorna C, Capezuti EA. Perception of spanish nursing staff on the use of physical restraints. J Nurs Scholarsh 2014;46(5):322-30. (PMID:24754778).
8. Fradkin M, Kidron D, Hendel T. Israeli student nurses' attitudes about physical restraints in acute care settings. Geriatr Nurs 1999;20(2):101-5. (PMID:10382427).
9. Gallinagh R, Slevin E, Mccormack B. Side rails as physical restraints in the care of older people: a management issue. J Nurs Manag 2002;10(5):299-306. (PMID:12191076).
10. Hamers JP, Meyer G, Köpke S, Lindenmann R, Groven R, Huizing AR. Attitudes of Dutch, German and Swiss nursing staff towards physical restraint use in nursing home residents, a cross-sectional study. Int J Nurs Stud 2009;46(2):248-55. (PMID:18656876).
11. Helmuth AM. Nurses' Attitudes toward older persons on their use of physical restraints. Orthop Nurs 1995;14(2):43-51. (PMID:7761132).
12. Huang HC, Huang YT, Lin KC, Kuo YF. Risk factors associated with physical restraints in residential aged care facilities: a community-based epidemiological survey in Taiwan. J Adv Nurs 2013;70(1):130-43. (PMID:23734585).
13. Irving, K. Inappropriate restraint practices in Australian teaching hospitals. Aust J Adv Nurs. 2004;21(4):23-7. (PMID:18646650).
14. Jiang H, Li C, Gu Y, He Y. Nurses' perceptions and practice of physical restraint in China. Nurs Ethics 2015:22(6):652-60. (PMID:25488757).
15. Kapo J, Morrison LJ, Liao S. Palliative care for the older adult. J Palliat Med 2007;10(1):185-209. (PMID:17298269).
16. Koczy P, Becker C, Rapp K, et al. Effectiveness of a multifactorial intervention to reduce physical restraints in nursing home residents. J Am Geriatr Soc 2011;59(2):333-9. (PMID:21314651).
17. Luiselli JK. Physical restraint of people with intellectual disability: a review of implementation reduction and elimination procedures. JARID 2009;22(2):126-34.
18. McGabe DE, Alvarez CD, Mcnulty SR, Fitzpatrick JJ. Perceptions of physical restraints use in the elderly among registered nurses and nurse assistants in a single acute care hospital. Geriatr Nurs 2011;32(1):39-45. (PMID:21146901).
19. Myers H, Nikoletti S, Hill A. Nurses' use of restraints and their attitudes toward restraint use and the elderly in an acute care setting. Nurs Health Sci 2001;3(1):29-34. (PMID:11882175).
20. Ozkan SA, Karaca T, Ister ED. Validity and reliability of the "perceptions of restraint use questionnaire" for use in Turkey. Journal of Turkish Geriatrics 2017;20(1):30-7.
21. Shorr RI, Guillen MK, Rosenblatt LC, Walker K, Caudle CE, Kritchevsky SB. Restraint use, restraint orders, and the risk of falls in hospitalized patients. J Am Geriatr Soc 2002;50(3):526-9. (PMID:11943051).
22. Sloane PD, Zimmerman S, Williams CS, Hanson LC. Dying with dementia in long-term care. Gerontologist 2008;48(6):741-51. (PMID:19139248).
23. Strumpf NE, Evans LK. Physical Restraint of the Hospitalized Elderly. Nurs Res 1988;37(3):132-7. (PMID:3368353).
24. Sturmey P. It is time to reduce and safely eliminate restrictive behavioural practices. JARID 2009;22(2):105-10.
25. Vassallo M, Wilkinson C, Stockdale R, Malik N, Baker R, Allen S. Attitudes to restraint for the prevention of falls in hospital. Gerontology 2004;51(1):66-70. (PMID:15591759).

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RESEARCH

# RELATIONS AMONG EMOTIONAL MOOD STATE, PERSONALITY DIMENSIONS AND SOCIAL DESIRABILITY IN OLDER ADULTS

## Abstract

***Introduction:*** Previous studies have shown that older adults report higher levels of positive affect (PA). Studies in the context of the five-factor model of personality have also noted the age-related changes in personality. However, the possible influence of personality on emotional state needs further investigation in older adulthood. This study examines relations among personality traits, social desirability, and positive/negative affectivity in conjunction with aging.

***Materials and Method:*** A total of 123 volunteers (62 young and 61 older adults) was participated in the study. A cross-design was used with consecutive sampling. All participants had higher education. Participants completed the Positive and Negative Affect Schedule as a measure of emotional state. Thereafter, they rated the degree to which each item described themselves on the Five-Factor Personality Inventory, which measures personality dimensions and social desirability.

***Results:*** Independent t-tests were conducted to compare young and older adults in terms of affectivity and personality. Findings revealed that older adults reported less negative affect (NA) compared with young adults. Older adults scored higher on agreeableness, conscientiousness, and social desirability, whereas young adults scored higher on extraversion and neuroticism. Based on correlational results, neuroticism was negatively correlated with extraversion, social desirability, and PA in older adults. Analyses of variance showed that conscientiousness, neuroticism, and social desirability impacted positive/negative affectivity.

***Conclusion:*** The results indicated that neuroticism proved to be the most important factor on emotional well-being. Older adults low on neuroticism experienced less NA. Furthermore, conscientiousness and social desirability had strong effects on PA indicating that the age-related differences found in affectivity might not only be attributable to age-related changes in personality, but also partly attributable to age-related increases in social desirability.

***Keywords:*** Aging; Personality; Affect; Emotions; Social desirability

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ARAŞTIRMA

# YAŞLI YETİŞKİNLERDE DUYGUDURUM, KİŞİLİK BOYUTLARI VE SOSYAL İSTENİRLİK ARASINDAKİ İLİŞKİLER

## Öz

***Giriş:*** Önceki çalışmalar yaşlıların daha yüksek olumlu duygudurum bildirdiklerini göstermektedir. Beş faktör kişilik modeli bağlamındaki çalışmalar, ayrıca, kişilikte yaşlanmaya bağlı değişiklikleri göstermiştir. Ancak, yaşlılarda kişiliğin duygudurumu olası etkisi hakkında daha fazla araştırmaya ihtiyaç vardır. Mevcut araştırmada, kişilik özellikleri, sosyal istenirlik boyutu ve olumlu/olumsuz duygulanım arasındaki ilişkiler yaşlanmayla birlikte incelenmiştir.

***Gereç ve Yöntem:*** Çalışmaya, 62 genç ve 61 yaşlı olmak üzere 123 gönüllü katılmıştır. Ardışık örneklemle enlemesine desen kullanılmıştır. Tüm katılımcılar yüksek öğrenim düzeyine sahiptir. Katılımcılar duygudurum ölçümleri için Pozitif ve Negatif Duygu Ölçeği'ni doldurmuştur. Sonra, kişilik özelliklerinin ve sosyal istenirlik boyutunun ölçümü için Beş Faktör Kişilik Envanteri'ndeki her maddenin kendilerini ne derece tanımladıklarını derecelendirmişlerdir.

***Bulgular:*** Genç ve yaşlıları olumlu/olumsuz duygulanım ve kişilik açısından karşılaştırmak için bağımsız örneklem t-testleri kullanılmıştır. Yaşlılar gençlere göre daha az olumsuz duygulanım rapor etmiştir. Yaşlılar yumuşakbaşlılık, özdenetim ve sosyal istenirlik boyutlarında daha yüksek puan alırken, gençler dışadönüklük ve duygusal tutarsızlık boyutlarında daha yüksek puan almıştır. Korelasyon sonuçlarına göre, yaşlılarda duygusal tutarsızlık; dışadönüklük, sosyal istenirlik ve olumlu duygudurumla negatif ilişkilidir. Olumlu duygudurumsa, dışadönüklük, deneyime açıklık ve sosyal istenirlikle pozitif ilişkilidir. Olumlu/olumsuz duygulanım puanları üzerinde yürütülen varyans analizleri; özdenetim, duygusal tutarsızlık ve sosyal istenirlik boyutlarının olumlu/olumsuz duygulanıma etkilerini göstermiştir.

***Sonuç:*** Bulgular, duygusal tutarsızlık boyutunun duygusal iyi oluş üzerinde önemli etken olduğunu göstermiştir. Duygusal tutarsızlık boyutunda düşük puan alan yaşlılar daha az olumsuz duygudurum deneyimlemiştir. Ayrıca, özdenetim ve sosyal istenirlik boyutlarının olumlu duygudurum üzerindeki güçlü etkisi, duygudurumdaki yaşla ilişkili farkların, yalnızca kişilikteki değişikliklere atfedilemeyeceğini, aynı zamanda sosyal istenirlik boyutundaki artışa kısmen atfedilebileceğini göstermiştir.

***Anahtar sözcükler:*** Yaşlanma; Kişilik; Duygulanım; Duygular; Sosyal İstenirlik

## INTRODUCTION

### Personality traits, emotional well-being and aging

Personality is composed of patterns of thoughts, feelings, behaviors, and moods characteristic of an individual (1). The five-factor model of personality (composed of the Big Five components: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience) is regarded as a useful and meaningful taxonomy for organizing personality traits (2). These personality traits are captured attention in aging studies (3,4,5). Although personality is generally considered to be stable over time (6), studies have found that age-related changes do occur in the Big Five dimensions of personality mentioned previously. For instance, openness to experience declines with aging (4,5,7). Older adults prefer to spend their time with close relatives and friends and are less interested in novel opportunities. In contrast, young adults are more open to meeting new people, seeing new places, and learning new information. In a study, when participants were given a hypothetical choice to either spend time with a family member or meet someone new such as a famous author (8), older adults were more likely to select the emotionally close social partner, whereas young adults were more likely to select the social partner who could provide new information. Moreover, due to the absence of work-related social interactions, older adults experience less social stimulation, which impacts their extraversion scores (5). Agreeableness and conscientiousness increase with age (5), whereas neuroticism declines (3,5).

The age-related changes in personality might influence emotional well-being in older adulthood because personality is also an important predictor of emotional well-being (9). It is the emotional dimensions of which are described as positive affect (PA) and negative affect (NA). PA reflects the extent to which a person feels enthusiastic, alert, and active; conversely, NA reflects the degree to which a person experiences contempt, disgust, fear, anger, and guilt (10). In this sense, personality traits may considerably impact people's emotional state because they influence people's sense of their own satisfaction (9).

The subjective evaluation of satisfaction increases across the life span. In a study of participants aged 18 to 94 years, PA appeared to remain constant (11) or increase (12) with increasing age. In contrast, the frequency and duration of NA experienced in daily life decreased with age (8,11). Thus, young adults are more likely to be in a negative mood, whereas older adults appear to experience fewer negative emotions. Similarly, the literature on developmental depression has indicated that older adults are at a lower risk for depression compared with young adults (13).

The age-related changes in affectivity might be evaluated in term of changes in personality. Among the five personality traits, extraversion and neuroticism have the strongest and the most consistent associations with positive (14) and negative affectivity (15), respectively. Individuals who score high on extraversion are usually affectionate, talkative, fun-loving, and passionate (2). Those scoring low on this trait are usually passive and lonely and lack the ability to express their feelings. In line with such reasoning, the correlation between extraversion and positive affectivity becomes especially important among older adults, who may have fewer social opportunities. Researchers have observed that individuals high on extraversion especially experience high levels of positive emotion when socializing with other people (16,17). McCrae and Costa (2) suggested that extraversion leads to PA, agreeableness and conscientiousness results in increased emotional well-being. On the other hand, neuroticism leads to NA (2). Specifically, higher scores on extraversion and agreeableness render people more likely to experience PA, whereas higher neuroticism scores are associated with greater likelihood of experiencing NA (3,5). Hence, it can be concluded that emotional states and personality traits interact with one another.

### Social desirability and aging

Personality assessments rely on self-reported data. One of the issues with self-reports is the tendency to answer questions in a socially desirable way (18). This type of response bias refers to social desirability and can be provided in specially designed personality inventories as scores, independently from personality dimension scores. Social desirability can also influence measures of individuals' emotional states. It seems that older adults have a tendency to self-report of more satisfaction and happiness (19). Most studies on emotional states have neglected social desirability; however, this factor also plays an important role in explaining personality changes (18) and subjective emotional states in older adults. Although age-related changes in social desirability are important in explaining emotional well-being, to the best of our knowledge, the current study is among the few ones including a measure of social desirability in aging studies and the only one conducted in the Turkey's aging population.

Although personality provides explanation to the changes in affectivity in older adults, this might be the only one part of the story. For example, since older adults are not usually high on extraversion (5), this trait does not seem to be the main factor of PA. On the other hand, age-related increases in social desirability could provide additional explanation why older adults specifically attain or maintain their positive affectivity. In other words, social desirability which is affected by aging could be another variable and explains why older adults experience positive rather than negative affectivity and maintain high levels of emotional well-being and social harmony. In this regard, the relations between personality dimensions and social desirability need further investigation. In a study (19), when researchers analyzed the effects of age-related social desirability changes on age-related personality changes, they found that there were no significant relationships between age and neuroticism, consciousness and agreeableness, when social desirability was controlled. Thus, although personality seems to be a cause of one's emotional state, social desirability could explain the positive affectivity in older adults. These associations again highlight the importance of considering the manner in which aging and changes in personality and social desirability interactively influence the emotional state.

### The present study

Taking all these into account the present study was designed to examine whether the participants' personality traits, social desirability, and current emotional state are a function of age. First, age-related changes in affectivity and personality were investigated separately. Secondly, significant correlations were analyzed between personality dimensions, social desirability dimension, and affectivity among older participants, so the present research was extended by also examining the social desirability variable as a function of age. Last, further analysis was intended to assess the effects of age, personality traits, and social desirability on emotional state and determine the dimensions, if any, that play a crucial role in older adults' emotional states.

It was hypothesized that age would be associated with less negative affect, and higher positive affect. It was also predicted that there would be age-related decreases in extraversion, openness to experience, and neuroticism, whereas age would be associated with higher scores on agreeableness, conscientiousness, and social desirability. With regard to the relations between personality and affect, positive affectivity was expected to be associated with extraversion, agreeableness, conscientiousness, and social desirability; on the other hand, negative affectivity was expected to be associated with neuroticism. It was further predicted that older adults high on agreeableness, conscientiousness would experience higher positive affectivity. On the other hand, older adults high on social desirability were expected to be less likely to experience negative affect. Higher neuroticism

scorers were predicted to experience greater negative affect in older participants.

## MATERIALS AND METHOD

### Participants

The sample consisted of 123 volunteers; 62 young adults [mean age, 20.77 (range 18-24) years, 32 F, 30 M] and 61 older adults [mean age, 77.62 (range 65-89) years, 36 F, 25 M]. Undergraduate students at Çankaya University and Middle East Technical University (METU) received course credits for participating in the study. The older adult participants were chosen from among the residents of Ankara Nursing Home of Social Security Institution for Civil Servants, and were recruited from social centers and cultural centers for the elderly and mostly from the visitors of Ankara Metropolitan Municipality Women Services. Consecutive sampling method was used to recruit these participants. The two groups were significantly different only in age; no other differences were observed in terms of demographic characteristics such as years of education. The demographical information of the participants is shown in Table 1. All participants gave informed consent to their participation in a method approved by the Çankaya University Ethics Committee.

**Table 1.** The demographical information of the participants.

| | | | |
|---|---|---|---|
| **Age** | **Young** | M=20.77<br>sd=1.56 | |
| | **Older** | M=77.62<br>sd=6.72 | |
| **Years of education** | **Young** | M=13.31<br>sd=1.21 | |
| | **Older** | M=13.12<br>sd=2.12 | |
| **Gender** | **Young** | Female=32<br>Male=30 | (52%)<br>(48%) |
| | **Older** | Female=36<br>Male=25 | (59%)<br>(41%) |
| **Marital status** | **Young** | Married=0<br>Single=62<br>Widowed/Divorced=0 | <br>(100%)<br> |
| | **Older** | Married=15<br>Single=5<br>Widowed/Divorced=41 | (25%)<br>(8%)<br>(67%) |
| **Occupation** | **Young** | State=0<br>Private=0<br>Self-employed=0<br>Nonworking/Student=60 | <br><br><br>(100%) |
| | **Older** | State=2<br>Private=6<br>Self-employed=2<br>Nonworking/Retired=51 | (3%)<br>(10%)<br>(3%)<br>(84%) |

[a] Notes: M=Mean; sd=Standard deviation

### Materials

#### Positive and Negative Affect Schedule

Participants were asked to complete the Positive and Negative Affect Schedule (PANAS) to assess their current emotional state (10,20). The PANAS is a reliable, valid, and efficient assessment commonly used to measure both the positive and negative affectivity related to emotional well-being. Positive affect and negative affect have emerged as two independent dimensions on this scale in both the United States and various other countries. Watson, Clark, and Tellegen (10) developed the two 10-item mood scales that comprise the PANAS. The version for Turkish culture was developed by Gençöz (20). The 10 positive (e.g., "interested") and 10 negative (e.g., "guilty") emotional states are mixed together and rated on five-point Likert-type scales. Participants rate their "last week" state on a scale from 1 (very slightly or not at all) to 5 (extremely). Thus, the total score for each affect can range from 10 to 50.

#### Five-Factor Personality Inventory

The Big Five personality variables were assessed using the Five-Factor Personality Inventory (5FPI) (2,21). 5FPI is the most widely used personality test across different cultures and languages (21). The inventory is organized into the Big Five personality dimensions of extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (2). A version of the inventory suitable for Turkish culture was developed by Somer, Korkmaz, and Tatar (21). The Turkish 5FPI is an 85-item questionnaire that assesses five domains of normal personality functioning and also social desirability dimension. Items are answered on a five-point Likert scale ranging from "completely agreeable" to "not at all agreeable."

#### Procedure

The participants first completed the informed consent form. Participants then completed the self-report questionnaires on demographic characteristics. Next, they completed PANAS; the average time for completion was approximately 5 minutes for young adults and 10 minutes for older adults. Finally, they completed 5FPI (average time: approximately 15 minutes for young adults and 30 minutes for older adults). After a debriefing, they were thanked and dismissed.

## RESULTS

### Relation between PANAS scores and age

Independent *t*-tests were performed to examine how PANAS scores of the young and older participants differed from each other (Figure 1). The PA scores of young and older participants did not differ significantly, $t(121)=.70$, $p>.05$. In contrast, young participants experienced greater NA than older participants; this difference was significant, $t(121)=4.03$, $p=.000$.

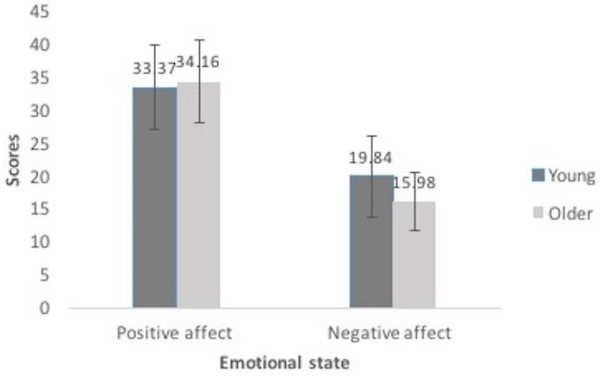


**Figure 1.** PANAS scores. Error bars represent standard error.

**Relation between personality scores and age**

Independent *t*-tests were conducted to determine the difference between age groups in terms of the Big Five personality dimensions (Figure 2). Young participants had significantly higher scores on extraversion compared with older participants, $t(121)=2.86$, $p<.05$. Older participants had significantly higher scores on agreeableness than young participants, $t(121)=2.52$, $p<.05$. Similarly, older participants had significantly higher scores on conscientiousness compared with young participants, $t(121)=4.60$, $p<.05$. Young participants scored significantly higher on neuroticism than older participants, $t(121)=2.56$, $p<.05$. Young participants had higher scores on openness to experience than older participants. However, this difference was not significant $t(121)=1.58$, $p>.05$. Finally, older participants had significantly higher scores on social desirability than young participants, $t(121)=3.94$, $p<.05$.

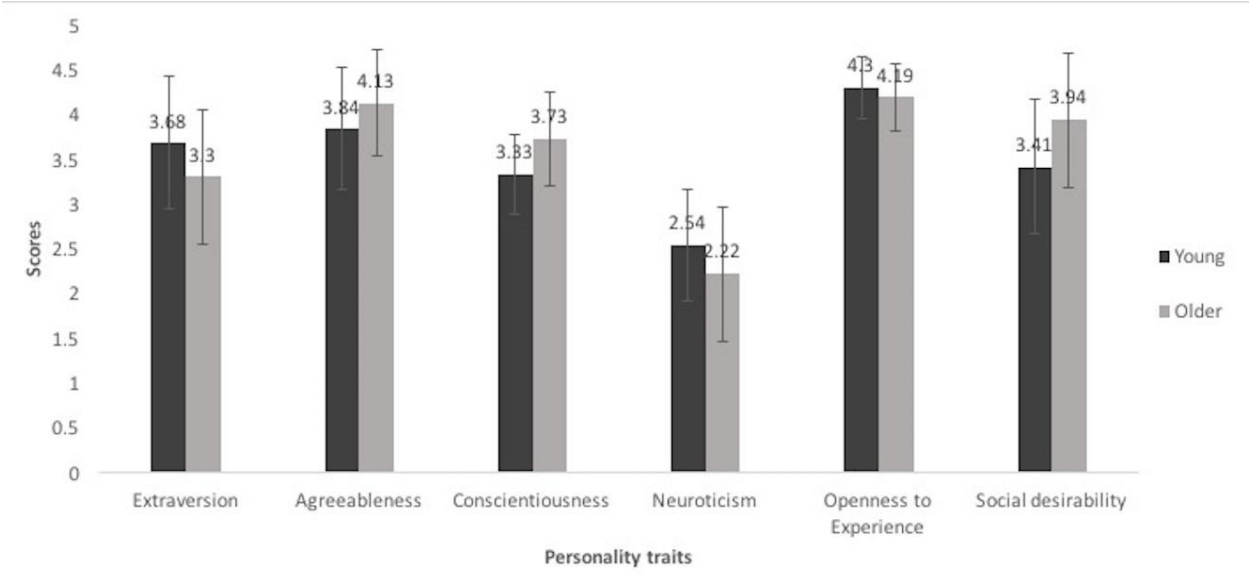


**Figure 2.** 5FPI and social desirability scores. Error bars represent standard error.

**Relations among personality characteristics, social desirability, and PANAS scores**

Pearson correlations were calculated for the personality dimensions, social desirability, and positive and negative affect separately for age groups. Table 2 indicates the correlation matrix among the variables of interest for young participants. Higher scores on neuroticism were associated with lower scores on extraversion ($r=-.34$, $p<.01$), conscientiousness ($r=-.22$, $p<.05$), and PA ($r=-.49$, $p<.01$). The correlation between neuroticism and NA was significant ($r=.40$, $p<.01$). Agreeableness was positively correlated with openness to experience ($r=.33$, $p<.01$) and social desirability ($r=.39$, $p<.01$). PA was positively correlated with conscientiousness ($r=.25$, $p<.05$). No other significant correlations between other dimensions of 5FPI and PANAS were noted among young participants.

**Table 2.** Correlations among personality dimensions, social desirability, and positive-negative affect in young and older adults.

| Correlation matrix Young | E | C | A | N | OE | SO | PA | NA |
|---|---|---|---|---|---|---|---|---|
| **Extraversion** | 1 | -,134 | ,011 | **-,341**** | ,188 | -,053 | ,167 | -,043 |
| **Conscientiousness** | | 1 | ,003 | **-,222*** | ,061 | **,276*** | **,251*** | ,020 |
| **Agreeableness** | | | 1 | -,107 | **,332**** | **,388**** | -,044 | -,102 |
| **Neuroticism** | | | | 1 | -,180 | -,210 | **-,493**** | **,400**** |
| **Openness to experience** | | | | | 1 | -,024 | ,063 | -,026 |
| **Social desirability** | | | | | | 1 | ,103 | -,145 |
| **Positive affect** | | | | | | | 1 | -,192 |
| **Negative affect** | | | | | | | | 1 |
| **Correlation matrix Older** | **E** | **C** | **A** | **N** | **OE** | **SO** | **PA** | **NA** |
| **Extraversion** | 1 | ,019 | -,120 | **-,213*** | ,124 | -,026 | **,398**** | ,019 |
| **Conscientiousness** | | 1 | **,430**** | -,068 | **,234*** | **,227*** | ,200 | ,020 |
| **Agreeableness** | | | 1 | -,183 | ,098 | **,260*** | ,161 | -,170 |
| **Neuroticism** | | | | 1 | -,207 | **-,376**** | **-,375**** | **,479**** |
| **Openness to experience** | | | | | 1 | ,014 | **,330**** | -,143 |
| **Social desirability** | | | | | | 1 | **,230*** | -,211 |
| **Positive affect** | | | | | | | 1 | -,075 |
| **Negative affect** | | | | | | | | 1 |

[a] Notes: One-tailed; *$p$<.05; **$p$<.01.

For older participants (Table 2), neuroticism was negatively correlated with extraversion ($r$=–.21, $p$<.05), social desirability ($r$=–.38, $p$<.01), and PA ($r$=-.38, $p$<.01). In contrast, neuroticism was positively correlated with NA ($r$=.48, $p$<.01). Higher scores on conscientiousness were associated with higher scores on agreeableness ($r$=.43, $p$<.01), openness to experience ($r$=.23, $p$<.05), and social desirability ($r$=.23, $p$<.05). Social desirability was positively correlated with agreeableness ($r$=.26, $p$<.05). PA was positively correlated with extraversion ($r$=.40, $p$<.01), openness to experience ($r$=.33, $p$<.01), and social desirability ($r$=.23, $p$<.05). No significant correlations were observed between other dimensions of 5FPI and PANAS among older participants.

### Effects of age and personality on PANAS scores

All participants were grouped as either "low" or "high" on each of the five personality dimensions and on social desirability, splitting the groups at the median. Medians were separately computed for each age group to eliminate the age effect. For example, the 31 young participants scoring 3.75 or above on extraversion were included in the "high extraversion" group, and 31 participants scoring below 3.75 were included in "low extraversion" group.

As preliminary analyses revealed no effects for gender, it was not included as a factor in the analyses reported below. Table 3 summarizes the results of a 2 (age: young and older) × 2 (personality dimensions: high and low) univariate analysis of variance (ANOVA), and of a 2 (age) × 2 (Social desirability) univariate ANOVA with PA and NA scores as the dependent measures.

**Table 3.** Summary of ANOVA Results on PA and NA scores.

| | PA scores | | | NA Scores | | |
|---|---|---|---|---|---|---|
| **Source** | ***F*(1,119)** | ***p*** | $\eta\rho^2$ | ***F*(1,119)** | ***p*** | $\eta\rho^2$ |
| **Age** | .26 | .61 | .00 | **16.32** | **.000** | **.12** |
| **Extraversion** | 2.50 | .12 | .02 | .36 | .55 | .00 |
| **Age×E** | .19 | .69 | .00 | .02 | .89 | .00 |
| **Age** | .47 | .49 | .00 | **16.03** | **.000** | **.12** |
| **Conscientiousness** | **6.11** | **.02** | **.05** | .00 | .94 | .00 |
| **Age×C** | .04 | .84 | .00 | .58 | .45 | .01 |
| **Age** | .37 | .54 | .00 | **16.17** | **.000** | **.12** |
| **Agreeableness** | 2.77 | .09 | .02 | 2.06 | .11 | .02 |
| **Age×A** | .65 | .42 | .01 | .17 | 69 | .00 |
| **Age** | .67 | .42 | .01 | **17.43** | **.000** | **.13** |
| **Neuroticism** | **15.68** | **.000** | **.12** | **8.95** | **.003** | **.07** |
| **Age×N** | .29 | .59 | .00 | .12 | .74 | .00 |
| **Age** | .50 | .48 | .00 | **15.98** | **.000** | **.12** |
| **Openness to experience** | 1.51 | .22 | .01 | .20 | .65 | .00 |
| **Age×OE** | 2.59 | .11 | .02 | 2.70 | .10 | .02 |
| **Age** | .42 | .52 | .00 | **16.72** | **.000** | **.12** |
| **Social desirability** | **4.33** | **.04** | **.04** | 2.94 | .09 | .02 |
| **Age×SO** | 1.52 | .22 | .01 | .26 | .61 | .00 |

[a] Notes: Effect size = partial $\eta\rho^2$
E=Extraversion; C=Conscientiousness; A=Agreeableness; N=Neuroticism; OE=Openness to experience; SO=Social desirability.

### Analyses of PA

The results indicated the main effects of conscientiousness ($F_{(1, 119)}$=6.11, $p$<.05, $\eta\rho^2$=.05), neuroticism ($F_{(1, 119)}$=15.68, $p$=.000, $\eta\rho^2$=.12), and social desirability ($F_{(1, 119)}$=4.33, $p$<.05, $\eta\rho^2$=.04) on PA. The main effects of extraversion, agreeableness and openness to experience were not significant. Furthermore, no main effect of age on PA was observed. Two-way interactions on PA did not reach conventional levels of significance; however, PA scores of older participants high on social desirability were marginally ($p$=.09) higher than those of participants low on social desirability.

### Analyses of NA

The results indicated the main effects of neuroticism ($F_{(1, 119)}$=8.95, $p$<.01, $\eta\rho^2$=.07) on NA. The main effects of extraversion, agreeableness, conscientiousness, openness to experience, and social desirability were not significant. The main effect of age ($F_{(1, 119)}$=16.32, $p$=.000, $\eta\rho^2$=.12) on NA was observed, indicating that older participants experienced less NA than young participants. Two-way interactions on NA did not reach conventional levels of significance.

## DISCUSSION

This study considered whether the major personality dimensions and social desirability are associated with the emotional state of older adults. We expected specific personality traits (such as neuroticism, agreeableness, conscientiousness) and social desirability scores to be the potentially important causes of emotional well-being in older adults. The findings were partially consistent with these expectations.

First, it was examined whether there is an age-related difference in affectivity, which was assessed by measuring the positive and negative affect. As in prior studies (11,13), the results showed older adults were less likely to report NA. Although older adults reported higher PA on the PANAS, the age groups did not differ significantly with respect to PA scores. Since advancing age is often associated with increasing satisfaction (12), findings of this study did not provide support for such positive affectivity. Rather, it has been showed that older adults did not feel happier than young adults, but they experienced less NA compared with young adults. Alternatively, it could simply mean that that older adults increase their daily satisfaction level by reducing their NA.

Secondly, it was investigated how the personality changes with aging. In the present study, the personality trait scores showed a noticeable difference between age groups. Older adults' agreeableness and conscientiousness scores were significantly higher than those of young adults. As hypothesized, older adults had lower scores on extraversion and neuroticism. On the other hand, age was not found to be a cause of openness to experience. Although there was no significant difference between young and older adults in terms of openness to experience scores, older adults scored less on this dimension. These findings are consistent with research suggesting that personality is not stable over time but changes as a function of age (3,5,7).

Thirdly, the present findings revealed strong relations overall between personality, social desirability, and affect in older adults. In this sense, results supported previous findings that personality is an important correlate of emotional state. In general, older adults' PA scores exhibited strong correlations with most of the personality dimensions. Extraversion and openness to experience were associated with increased levels of PA. It is not surprising that the active and exciting life of extroverts is reflected emotionally in the experience of positive emotions (2,3). The positive relationship detected between openness to experience and PA among the elderly is also reasonable because high scorers on openness to experience are more likely to experience a diversity of emotions and prefer variety (2,7). While PA was negatively correlated with neuroticism, NA was found to be positively correlated with neuroticism. Since neuroticism is highly correlated with anxiety, highly neurotic individuals are easily worried, they are more likely to experience negative affect (2). Moreover, the significant correlations between the dimensions of the 5FPI and PANAS showed that these two scales were strongly interrelated. Another variable assessed in the personality inventory was social desirability. There is a consensus in studies on aging that older adults are more likely to present themselves overly favorably (18). Consistent with some previous findings (18,19), the results showed that older adults' social desirability scores were significantly higher than those of young adults. Results of correlation analyses also revealed that social desirability was positively correlated with agreeableness, conscientiousness, and positive affect; whereas social desirability was negatively correlated with neuroticism.

Last, it was also investigated how age and personality traits impacted emotional states, which are PA and NA. Results showed that older adults scoring highly on neuroticism were more prone to experiencing high NA. Lower scorers of neuroticism were more prone to be experiencing greater PA. Results supported the McCrae and Costa's (2) description of neuroticism, that is the proneness of the individual to experience unpleasant and disturbing emotions. In the present study among five personality traits, neuroticism was found to be the most significant cause of emotional well-being by having influence on both negative and positive affectivity. In addition to neuroticism, conscientiousness has found to influence emotional state. That is, participants scoring highly on conscientiousness were more likely to report PA. Since individuals high on conscientiousness have the tendency to maintain stability within themselves, this tendency could be reflected in the emotional state. Contrary to the findings of Terracciano et al.'s study (5), we did not find a significant effect of agreeableness on positive affectivity although the participants high on agreeableness did report marginally higher PA than the participants low on agreeableness.

In addition to personality dimensions, social desirability was one of the potential variables which could affect emotional state. It was found that participants scoring highly on social desirability were more prone to experiencing high PA. Since social desirability was also found to be associated with increased levels of PA in the previous correlational analyses, such response bias seemed to enhance emotional well-being in older adults.

Overall, even though we did not replicate the previously reported the positive affectivity in older adults, the findings have suggested that older adults do not have significantly higher levels of positive affect than young adults; indeed, they have reliably lower levels of negative effect. Furthermore, another important finding is that conscientiousness and social desirability had strong effects on PA indicating that the age-related differences found in affectivity might not only be attributable to age-related changes in personality, but also partly attributable to age-related increases in social desirability.

One limitation is that reliability and validity studies concerning the PANAS have been conducted only with younger populations. Clearly, this confirmation of the PANAS should be extended to older adulthood. Furthermore, the study's findings regarding interactions among age, personality traits, and positive/negative affect were cross-sectional. Future research should also consider longitudinal work. The findings of age-related differences in personality, social desirability and affect could be attributable to the emotional regulation strategies which are used by older adults with conscious effort. It was stated that they have greater capacity for emotion regulation, which gives them the ability and motivation to seek positive emotional experiences more effectively and avoid negative experiences (22). Thus, in further studies, it seems to be important to add emotional regulation as a variable for disentangling age-related factors in personality and positive/negative affectivity. Nevertheless, the present findings provide a solid justification for examining how the relations between personality and emotional affect may vary between young and older adults.

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## REFERENCES


1. Charles S, Carstensen LL. Social and emotional aging. Annu Rev Psychol 2010;61:383-409. (PMID:19575618).
2. Funder DC. Personality. Annu Rev Psychol 2001;52:197-221. (PMID:11148304).
3. Fung HH, Carstensen LL, Lutz AM. Influence of time on social preferences: implications for life-span development. Psychol Aging 1999;14(4):595-604. (PMID:10632147).
4. G Matthews, IJ Deary, MC Whiteman. Personality Across the Life Span, In:Gerald Matthews, Ian J Deary, Martha C Whiteman (Eds). Personality Traits. 3rd edition, Cambridge University Press, Cambridge 2009, pp 63-84.
5. Gençöz T. Positive and negative affect schedule: a study of validity and reliability. Turk J Psychol 2000;15(46):19-28. (in Turkish).
6. Haigh EAP, Bogucki OE, Sigmon ST, Blazer DG. Depression among older adults: a 20-year update on five common myths and misconceptions. Am J Geriatr Psychiatry 2018;26(1):107-22. (PMID:28735658).
7. Lucas RE, Baird BM. Extraversion and emotional reactivity. J Pers Soc Psychol 2004;86(3):473-85. (PMID:15008650).
8. Lucas RE, Fujita F. Factors influencing the relation between extraversion and pleasant affect. J Pers Soc Psychol 2000;79(6):1039-56. (PMID:11138753).
9. McCrae RR, Costa PT Jr. The structure of interpersonal traits: Wiggins's circumplex and the five-factor model. J Pers Soc Psychol 1989;56(4):586-95. (PMID:2709308).
10. Mroczek DK. Age and emotion in adulthood. Curr Dir Psychol Sci 2001;10:87-90. [Internet] Available from: https://www.jstor.org/stable/20182706. Accessed: 25.6.2018.
11. Munoz E, Stawski RS, Sliwinski MJ, Smyth JM, MacDonald SWS. The ups and downs of cognitive function: neuroticism and negative affect drive performance inconsistency. J Gerontol B Psychol Sci Soc Sci 2018;gby032. (PMID:29590450).
12. O Somer, M Korkmaz, A Tatar. Development of Five Factor Personality Inventory, In:Oya Somer, Mediha Korkmaz, Arkun Tatar (Eds). From Theory to Practice Five-Factor Personality Model and Five-Factor Personality Inventory. Ege University, İzmir 2004, pp 45-66. (in Turkish).
13. Roberts BW, DelVecchio WF. The rank-order consistency of personality traits from childhood to old age: a quantitative review of longitudinal studies. Psychol Bull 2000;126(1):3-25. (PMID:10668348).
14. Schwaba T, Luhmann M, Denissen JJA, Chung JM, Bleidorn W. Openness to experience and culture-openness transactions across the lifespan. J Pers Soc Psychol 2018;115(1);118-36. (PMID:28557472).
15. Şimşek, ÖF. Higher order structure of personality and mental health: does general affectivity matter? J Pers Assess 2014;96(2):226-36. (PMID:24066739).
16. Smillie LD, DeYoung CG, Hall PJ. Clarifying the relation between extraversion and positive affect. J Pers 2015;83(5):564-74. (PMID:25234441).
17. Soubelet A, Salthouse, TA. Influence of social desirability on age differences in self-reports of mood and personality. J Pers 2011;79(4):741-62. (PMID:21682727).
18. Terracciano A, McCrae RR, Brant, LJ, Costa PT Jr. Hierarchical linear modeling analyses of the NEO-PI-R scales in the Baltimore Longitudinal Study of Aging. Psychol Aging 2005;20(3):493-506. (PMID:16248708).
19. Vigil-Colet A, Morales-Vives F, Lorenzo-Seva U. How social desirability and acquiescence affect the age-personality relationship. Psicothema. 2013;25(3):342-8. (PMID:23910749).
20. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. J Pers Soc Psychol 1988;54(6):1063-70. (PMID:3397865).
21. Williams LM, Brown KJ, Palmer D, et al. The mellow years? Neural basis of improving emotional stability over age. J Neurosci 2006;26(24):6422-30. (PMID:16775129).
22. Wortman J, Lucas RE, Donnellan MB. Stability and change in the big five personality domains: evidence from a longitudinal study of australians. Psychol Aging 2012;27(4):867-74. (PMID:22775362).

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RESEARCH

# DEVELOPMENT OF THE PHYSICAL ACTIVITY BARRIERS SCALE FOR ELDERLY INDIVIDUALS

## Abstract

***Introduction:*** The aim of this study was to develop the Physical Activity Barriers Scale for the Elderly.

***Materials and Method:*** We developed the Physical Activity Barriers Scale for the Elderly. Fifteen elderly individuals participated in pilot testing to determine the intelligibility of the remaining 30 items after content validity assessment. After confirming the appropriateness of the scale, we administered it to 214 individuals aged >65 years (mean age: 73.9±7.7 years). We applied the scale again 3-7 days later to determine test–retest reliability using the correlation coefficient. Exploratory and confirmatory factor analysis was used to determine the factor structure. Internal consistency was determined with Cronbach's alpha. The correlation with the International Physical Activity Questionnaire and the Nottingham Health Profile was assessed for construct validity.

***Results:*** Exploratory factor analysis revealed three scale factors: personal, environmental factors and daily routines. Test–retest reliability and internal consistency of the scale was good (r=0.869, Cronbach's alpha=0.918). Negative correlation was found between the Scale and International Physical Activity Questionnaire (r=–0.340, p<0.001) and a positive correlation between the Scale and Nottingham Health Profile (r=0.693, p<0.001).

***Conclusion:*** The Physical Activity Barriers Scale for the Elderly is a valid and reliable measurement that can be used to determine the factors that prevent seniors from engaging in physical activity. With this scale, physical activity barriers can be identified, and arrangements can be made to help improve the level of physical activity among elderly individuals.

***Keywords:*** Aged; Exercise; Questionnaire

ARAŞTIRMA

# YAŞLI BİREYLER İÇİN FİZİKSEL AKTİVİTE BARİYERLERİ ÖLÇEĞİNİN GELİŞTİRİLMESİ

## Öz

***Giriş:*** Bu çalışmanın amacı Yaşlılar İçin Fiziksel Aktivite Bariyerleri Ölçeği'nin geliştirilmesiydi.

***Gereç ve Yöntem:*** Yaşlılar İçin Fiziksel Aktivite Bariyerleri Ölçeği'ni geliştirdik. Kapsam geçerliliği değerlendirmesinden sonra kalan 30 maddenin anlaşılabilirliğini belirlemek için on beş yaşlı birey pilot teste katıldı. Ölçek uygunluğunu doğruladıktan sonra 65 yaş üzeri 214 bireye (yaş ortalaması:73.9±7.7 yıl) uyguladık. Korelasyon katsayısını kullanarak test-tekrar test güvenilirliğini belirlemek için ölçeği tekrar 3-7 gün sonra uyguladık. Faktör yapısını belirlemek için açıklayıcı ve doğrulayıcı faktör analizi kullanıldı. İç tutarlılık Cronbach alpha katsayısı kullanılarak belirlendi. Yapı geçerliliği için Uluslararası Fiziksel Aktivite Anketi ve Nottingham Sağlık Profili ile ilişki değerlendirildi.

***Bulgular:*** Açıklayıcı faktör analizi üç ölçek faktörü ortaya çıkardı: kişisel, çevresel faktörler ve günlük rutinler. Ölçeğin test- tekrar test güvenirliği ve iç tutarlılığı iyi bulundu (r:0,869; Cronbach alpha:0.918). Ölçek ile Uluslararası Fiziksel Aktivite Anketi arasında negatif ilişki (r=-0.340; p<0.001); Nottingham Sağlık Profili skoru arasında pozitif ilişki (r=0.693; p<0.001) bulundu.

***Sonuç:*** Yaşlılar İçin Fiziksel Aktivite Bariyerleri Ölçeği, yaşlıların fiziksel aktivite yapmalarına engel olan faktörlerin belirlenmesinde kullanılabilecek geçerli ve güvenilir bir ölçektir. Bu ölçekle, fiziksel aktivite engelleri tanımlanabilir ve yaşlı bireyler arasında fiziksel aktivite düzeyinin geliştirilmesine yardımcı olmak için düzenlemeler yapılabilir.

***Anahtar sözcükler:*** Yaşlı; Egzersiz; Anket

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## INTRODUCTION

Regular physical activity (PA) is important for maintaining general health in later life. At advanced ages, functional capacity decreases, and muscle atrophy, muscle weakness, loss of aerobic capacity occur. These conditions are increased with sedentary lifestyles. Therefore, regular PA is necessary for maintaining physical independence (1). In elderly individuals, regular PA is associated with higher self-esteem, improved quality of life (QoL) and reduced physical constraints and depressive symptoms (2,3). Although PA is well-known to be beneficial for health, inactivity is common among elderly individuals (4).

Participation in PA is a dynamic and complex process, influenced by individual and environmental factors (1,5). According to the International Classification of Functioning, Disability and Health (ICF) developed by the World Health Organization (WHO), personal and environmental factors affect PA behaviours (6). Poor health, poor balance, lack of role models, lack of motivation, lack of time, bad weather, lack of walking roads are examples of perceived PA barriers for elderly individuals (1,5,7).

Recent studies have emphasised the importance of PA. Evidence suggests that PA is associated with increased life expectancy, years without impairment in daily living activities, increased longevity and prevention of chronic illness (8,9). Physical activity is important for the health and quality of life of the elderly (10). To increase elderly individuals' physical independence levels, we need to determine PA barriers by means of an age-specific evaluation method. When the scales used to determine physical activity barriers in elderly people are examined, it is seen that subdivisions of some questionnaires which are non-specific for elderly are used (11,12). Qualitative studies in the elderly do not provide comprehensive data on physical activity barriers. In qualitative and quantitative studies, it is seen that the physical activities only performed on the outside, elderly people with some diseases and living in a certain living area, physical activity barriers in a particular category or barriers of a certain type of physical activity were evaluated (1,5). A structured scale assessing the physical activity barriers of the elderly living in various living areas was not found. Therefore, the aim of this study was to develop the Physical Activity Barriers Scale for the Elderly (PABS-E) and to investigate its reliability, internal consistency and validity.

## MATERIALS AND METHOD

This study consisted of two phases. We determined content validity, item development and item refinement during the first phase. During the second phase, we measured criterion validity, internal consistency and test–retest reliability. The study included 214 voluntary elderly individuals who were living in the nursing home or in the community. Inclusion criteria were a) age ≥65 years, b) literate. Exclusion criteria were a) dementia or cognitive disorders, b) bedridden, c) acute illness. Individuals living in nursing homes were evaluated by visiting nursing homes. The elderly living in the community were evaluated by visiting their homes or a senior club that people can meet and socialise to build up relationships. This study was approved by the Hacettepe University Ethical Committee. Informed written consent was obtained from all participants.

### Item generation

We conducted a literature review to identify qualitative and quantitative studies that employed questionnaires to identify PA barriers for elderly individuals. The item pool was formed based on questionnaires previously used in the literature. After consultation with geriatric rehabilitation experts, 84 items were generated.

### Content validity

After generating the items, we sent measurements to panellists consisting of five

experienced people in the field of geriatric rehabilitation. The content validity ratio (CVR) for individual scale items was calculated as CVR=(Ne – N/2)/(N/2), where Ne is the proportion of experts who rated the item as 1 on a 3-point scale, and N is the total number of experts. For the five panellists, the cut off point for excellent CVR was set at ≥0.99. Of the 84 items, 30 proved valid. The content validity index (CVI) was calculated as the mean of CVR. The CVI for the entire scale was calculated as the proportion of the number of items deemed content valid. CVI of the scale was calculated as 0.775, and CVI≥0.67 was considered excellent.

### Pilot study

After content validity assessment was completed, we reviewed each item for structure and clarity, eliminated redundant inquiries and modified ambiguous wording. To test user perceptions, a pilot study was completed with 15 elderly individuals. Items were scored using a 5-point Likert scale (1-strongly disagree, 2-disagree, 3-undecided, 4-agree and 5-strongly agree). Elderly individuals who participated in the pilot study did not discriminate between 1-2 points and between 3-4 points, so the scoring was changed to a 3-point Likert-type scale (1-disagree, 2-undecided and 3-agree).

Participants completed the PABS-E, International Physical Activity Questionnaire (IPAQ) and Nottingham Health Profile (NHP). The following demographic data were collected. Participants completed the PABS-E again 3–7 days later.

To determine participants' QoL, we used the Turkish version of the NHP, a generic QoL measurement. The measurement consists of six subheadings that tested PA, energy level (EL), pain (P), social isolation (SI), sleep (S) and emotional reactions (ER) using a "yes" or "no" response. Each subheading is assessed using a score ranging between 0 and 100. Low scores indicate good QoL (13).

We determined PA level using the Turkish version of the IPAQ-SF (14). The IPAQ-SF assesses PA over the preceding 7 days (15) and is a useful measure of PA in elderly individuals (16). The short form records four activity intensities; vigorous intensity, moderate intensity, walking and sitting (17). Total daily PA [Metabolic Equivalent of Task (MET, min/day)] was obtained by summing the product of duration within each item by a MET value (MET is metabolic equivalent; 1 MET=resting energy expenditure). Vigorous intensity of PA was assumed to be 8 METs; moderate intensity, 4 METs; and walking, 3.3 METs (18).

### Statistical analysis

Data obtained were analysed using IBM SPSS (version 22, SPSS Inc., Chicago, IL, USA) and AMOS 20.0. Construct validity of the scale was verified via exploratory and confirmatory factor analyses. The number of factors was determined based on the eigenvalue-greater-than-one rule. Principal component factor analysis was used for factor extraction. Varimax rotation was performed to maintain proper factorisation. Internal consistency of the whole scale, as well as of each subscale, which was formed by factor analysis, was presented with Cronbach's alpha. Item distinctiveness was evaluated by independent samples t-test. The reliability of the scale is presented as test–retest correlation coefficient, and Spearman's correlation coefficient was used. Correlations between the PABS-E and other scales were determined via Spearman's correlation coefficient. We calculated floor and ceiling effects on score distribution. The significance level for all analyses was set at $p<0.05$.

## RESULTS

The demographic characteristics are presented in Table 1. Comorbidities included diabetes mellitus (21.5%), hypertension (50.9%), heart disease (23.8%) and others including rheumatic

diseases, vision problems and orthopaedic disorders (52.7%). Only 1.4% reported workplace employment. Individuals' IPAQ score and NHP score with subscores are presented in Table 2.

According to item statistics, there were three items (13, 19 and 28) with item–total correlations of <0.3. Nevertheless, Cronbach's alpha did not decrease when these items were deleted (Table 3).

Item distinctiveness was detected by comparing the lower and upper 27% groups, according to total score. Since all differences were significant, all items were distinctive ($p<0.05$).

Before performing factor analysis, we determined sampling adequacy using the Kaiser–Meier Olkin measure to be 0.8834. Therefore, the sample was adequate for factor analysis. The Bartlett test indicated that the scale was factorable ($p<0.001$).

Based on the factor analysis results, items attending to similar parameters were observed to be clustered around three factors, which explained 84.53% of the variance. The factor clusters and weights are presented in Table 4.

Confirmatory factor analysis was applied by changing the factor of four items (items 15, 8, 27 and 28). Item 15 moved from environmental factors to personal factors. Because in item 15, the PA barrier is 'not feeling good psychologically'. Items 8 and 28 moved from personal factors to environmental factors. In item 8, the PA barrier was 'there are many stairs in the neighbourhood' and it is related to environment. In item 28, health care workers are included in social environment. We moved item 27 from daily routines to environmental factors. Since this item relates to rugged-ramp roads, it was appropriate as an environmental factor. Specifically, we expected a best-fit model with the following indices: a Satorra–Bentler scaled chi-square (S-B$\chi$2)/ degrees of freedom ratio (CMIN/DF) of ≤2.0; a Trucker Lewis index (TLI) of ≥0.90; a comparative fit index (CFI) of ≥0.90; a goodness-of-fit index (GFI) of ≥0.90; an Incremental Fit Index (IFI) of ≥0.90 and a low Root Mean Square Error of Approximation (RMSEA) of ≤0.08. These values were calculated as CMIN/DF: 1.659, RMSEA: 0.056, GFI: 0.839, IFI: 0.905, CFI: 0.903 and TLI: 0.891. Accordingly, this factor structure was found appropriate: personal factors subscale: 1, 2, 3, 10, 11, 12, 15, 21, 22, 24, 25, 26; environmental factors subscale: 4, 5, 6, 7, 8, 16, 17, 20, 23, 27, 28, 29, 30 and daily routines subscale: 9, 13, 14, 18, 19. Scores from the scale range from 30 to 90. Higher scores indicate more PA barriers. The personal factors subscale can be scored between 12 and 36. The environmental factors subscale can be scored between 13 and 39. The daily routines subscale can be scored between 5 and 15.

The PABS-E is completed in about 5-10 minutes. The mean PABS-E total score was 49.6±14.3. The subscale scores for personal factors, environmental factors and daily routines were 21.6±7.8, 20.9±7.0, 7.1±2.4 respectively. The PABS-E test–retest correlation was 0.869 ($p<0.001$). The test–retest correlation scores for the personal factors, environmental factors and daily routines subscales were 0.833, 0.866 and 0.538, respectively ($p<0.001$).

Cronbach's alpha coefficients for the PABS-E, personal factors, environmental factors and daily routines subscales were 0.918, 0.906, 0.863 and 0.655, respectively. Floor and ceiling effects were acceptable (floor effect: 9.1%; ceiling effect: 0.5%). A statistically significant, negative correlation was found between the PABS-E and IPAQ, and a positive correlation was found between the PABS-E and NHP scores (Table 5).

**Table 1.** Demographic data (N=214).

| **Demographic data** | | **X±sd** | **Min-Max** |
|---|---|---|---|
| **Age (years)** | | 73.9±7.7 | 65–105 |
| **Height (cm)** | | 161.1±9.7 | 110–190 |
| **Weight (kg)** | | 72.6±14.2 | 40–140 |
| **Body mass index (kg/m²)** | | 28.1±5.7 | 14,9–56,1 |
| | | **N** | **%** |
| **Gender** | Male | 95 | 44.4 |
| | Female | 119 | 55.6 |
| **Life setting** | Nursing home/ retirement village | 92 | 43.0 |
| | At home with partner or family | 91 | 42.5 |
| | At home alone | 31 | 14.5 |
| **Education level (years)** | Literate (<5 years) | 52 | 24.3 |
| | 5 | 86 | 40.2 |
| | 8 | 18 | 8.4 |
| | 11 | 33 | 15.4 |
| | 15 | 21 | 9.8 |
| | >15 | 4 | 1.9 |
| **Marital status** | Married | 74 | 34.6 |
| | Single | 22 | 10.3 |
| | Widow | 118 | 55.1 |
| **The number of people using mobility aid** | | 50 | 23.4 |

**Table 2.** Data on physical activity level and quality of life.

| **Variable** | **X±sd** | **Median** | **Min-Max** |
|---|---|---|---|
| **IPAQ[a] score** | 794.4±1066.9 | 462 | 0–8424 |
| **NHP[b] score** | 204.8±154.5 | 178.0 | 0–600 |
| **Energy level** | 45.5±40.4 | 39.2 | 0–100 |
| **Pain** | 31.3±35.5 | 12.9 | 0–100 |
| **Emotional reactions** | 31.2±32.8 | 19.8 | 0–100 |
| **Social isolation** | 29.0±31.9 | 22.0 | 0–100 |
| **Sleep** | 35.6±31.8 | 28.7 | 0–100 |
| **Physical activity** | 32.0±27.1 | 31.3 | 0–100 |

[a] IPAQ: International Physical Activity Questionnaire, [b]NHP: Nottingham Health Profile

**Table 3.** Item analysis of the physical activity barriers scale for the elderly.

| Physical activity barriers | X±sd | Item-Total correlation | Cronbach alpha when item is deleted |
|---|---|---|---|
| Item 1 | 1.90±0.96 | 0.561 | 0.915 |
| Item 2 | 1.44±0.78 | 0.448 | 0.917 |
| Item 3 | 1.64±0.89 | 0.595 | 0.914 |
| Item 4 | 1.62±0.89 | 0.576 | 0.915 |
| Item 5 | 1.60±0.89 | 0.493 | 0.916 |
| Item 6 | 1.54±0.86 | 0.477 | 0.916 |
| Item 7 | 1.42±0.78 | 0.484 | 0.916 |
| Item 8 | 1.51±0.84 | 0.483 | 0.916 |
| Item 9 | 1.75±0.93 | 0.340 | 0.918 |
| Item 10 | 1.82±0.94 | 0.634 | 0.914 |
| Item 11 | 1.87±0.94 | 0.615 | 0.914 |
| Item 12 | 1.90±0.96 | 0.665 | 0.913 |
| Item 13 | 1.21±0.56 | 0.200 | 0.919 |
| Item 14 | 1.33±0.72 | 0.311 | 0.918 |
| Item 15 | 1.53±0.86 | 0.520 | 0.916 |
| Item 16 | 1.55±0.87 | 0.501 | 0.916 |
| Item 17 | 1.72±0.94 | 0.552 | 0.915 |
| Item 18 | 1.61±0.89 | 0.394 | 0.917 |
| Item 19 | 1.21±0.59 | 0.115 | 0.920 |
| Item 20 | 1.86±0.95 | 0.556 | 0.915 |
| Item 21 | 1.80±0.92 | 0.517 | 0.916 |
| Item 22 | 1.78±0.95 | 0.452 | 0.917 |
| Item 23 | 1.72±0.92 | 0.552 | 0.915 |
| Item 24 | 2.09±0.96 | 0.611 | 0.914 |
| Item 25 | 1.90±0.95 | 0.661 | 0.913 |
| Item 26 | 1.93±0.97 | 0.629 | 0.914 |
| Item 27 | 1.89±0.97 | 0.561 | 0.915 |
| Item 28 | 1.19±0.56 | 0.149 | 0.920 |
| Item 29 | 1.71±0.92 | 0.589 | 0.914 |
| Item 30 | 1.60±0.89 | 0.455 | 0.917 |

**Table 4.** Results of explanatory factor analysis.

| Physical activity barriers | Factor 1 | Factor 2 | Factor 3 |
|---|---|---|---|
| 1 | 0.6731 | | |
| 2 | 0.4831 | | |
| 3 | 0.6169 | | |
| 8 | 0.4174 | | |
| 10 | 0.6620 | | |
| 11 | 0.7476 | | |
| 12 | 0.8146 | | |
| 21 | 0.6186 | | |
| 22 | 0.4680 | | |
| 24 | 0.6433 | | |
| 25 | 0.8244 | | |
| 26 | 0.8170 | | |
| 27 | 0.4392 | | |
| 4 | | 0.5397 | |
| 5 | | 0.6651 | |
| 6 | | 0.6508 | |
| 7 | | 0.5345 | |
| 15 | | 0.4951 | |
| 16 | | 0.6180 | |
| 17 | | 0.6649 | |
| 20 | | 0.4867 | |
| 23 | | 0.6187 | |
| 29 | | 0.4619 | |
| 30 | | 0.5627 | |
| 9 | | | 0.4780 |
| 13 | | | 0.5722 |
| 14 | | | 0.3048 |
| 18 | | | 0.6219 |
| 19 | | | 0.5802 |
| 28 | | | 0.4118 |
| **Eigenvalues** | 8.839 | 2.446 | 1.340 |
| **Described variance** | %59.21 | %16.39 | %8.98 |

KMO: 0.8834
Bartlett p: <0.001

**Table 5.** Correlation of the Physical Activity Barriers Scale for the Elderly with International Physical Activity Questionnaire and Nottingham Health Profile.

| | Total Score | | Personal Factors | | Environmental Factors | | Daily routine | |
|---|---|---|---|---|---|---|---|---|
| | r | p | r | p | r | p | r | p |
| **IPAQ[a] score** | -0.340 | <0.001 | -0.434 | <0.001 | -0.252 | <0.001 | 0.069 | 0.312 |
| **NHP[b] score** | 0.693 | <0.001 | 0.731 | <0.001 | 0.511 | <0.001 | 0.278 | <0.001 |
| **Energy level** | 0.644 | <0.001 | 0.685 | <0.001 | 0.446 | <0.001 | 0.294 | <0.001 |
| **Pain** | 0.557 | <0.001 | 0.635 | <0.001 | 0.346 | <0.001 | 0.251 | <0.001 |
| **Emotional Reactions** | 0.584 | <0.001 | 0.568 | <0.001 | 0.482 | <0.001 | 0.253 | <0.001 |
| **Social Isolation** | 0.480 | <0.001 | 0.460 | <0.001 | 0.409 | <0.001 | 0.166 | 0.015 |
| **Sleep** | 0.441 | <0.001 | 0.418 | <0.001 | 0.379 | <0.001 | 0.205 | <0.001 |
| **Physical Activity** | 0.548 | <0.001 | 0.653 | <0.001 | 0.350 | <0.001 | 0.154 | 0.024 |

[a]IPAQ: International Physical Activity Questionnaire, [b]NHP: Nottingham Health Profile

## DISCUSSION

The PABS-E is a valid and reliable scale that can be used to determine PA barriers in elderly individuals.

The scale appears appropriate for use in elderly individuals with different characteristics because our study cohort included participants of both sexes with different barriers, living environments, education levels and PA levels. Rantakokko et al. examined only environmental barriers, Rasinaho et al. evaluated only older people with mobility limitations, Eronen et al. examined only barriers to outdoor physical activity, Lin et al. examined only older women's physical activity barriers (5,12,19,20). PABS-E is advantageous because it evaluates physical activity barriers multidimensionally and is suitable for elderly people with different characteristics.

Item–total correlations of most items were >0.3, with the exception of items 13, 19 and 28. Because the Cronbach's alpha of these items did not decrease when the items were deleted, and according to the authors who developed the scale, these items should remain because they represent potential important PA barriers in elderly individuals.

The higher scores were taken from item 24 (tiring quickly), item 26 (fear of falling), item 12 (inadequate physical condition) and item 1 (difficulty in walking). These barriers to elderly individuals are frequently reported in the literature (1). The most common barriers were among the personal factors. Similarly, Rasinaho et al. found that the barrier categories pertaining to exercise were poor health, fear, negative experiences, lack of knowledge, lack of time and interest, lack of company and unsuitable environment for elderly individuals with mobility limitations (5).

We performed the test–retest correlation analyses to verify the test–retest reliability of the scale and found the reliability of the PABS-E to be good. Only the daily routines subscale's test–retest correlation was moderate. During test–retest, the respondent may have different perceptions of these

items. Because items on the daily routines subscale contain low intensity PAs (like praying, caring for grandchildren or daily jobs), they may represent activities that require body movements but are inadequate for PA, as proposed by the WHO, which recommends at least 150 min of moderate intensity PA or 75 min vigorous intensity during the week, in sessions lasting at least 10 min for individuals aged ≥65 years (8). We added a description to the items in the daily routines so they could be better understood: "Do these daily activities prevent you from participating in activities such as fast walking, gardening, housework and sports where you would expect to spend at least 150 minutes a week doing moderate intensity activities that increase your heart rate?"

The PABS-E Cronbach's alpha indicates that the internal consistency of the scale is very good. Vasudevan et al. found that the Cronbach's alpha of the Physical Activity Barriers Questionnaire for People with Mobility Impairments was 0.792–0.935 (21). Since the difference between the upper and lower 27% groups and the average of the scores of each item was significant, the distinction of each item has been shown.

A negative correlation between the PA level and PABS-E score is expected. Individuals who have more PA barriers are expected to perform less PA. Similarly, there was a negative relationship between PA barriers and PA levels in other studies (6,22).

We found a positive correlation between QoL and the PABS-E score. In particular, the correlation coefficient between personal factors and NHP score was high. This suggests that excessive PA barriers exert greater effects on QoL. Actions directed at increasing QoL should focus on personal barriers. There was no significant correlation between the IPAQ score and daily routines score. This shows that barriers that concern daily routines may require PA; however, there was a low correlation between daily routines and NHP subscores. The presence of daily routines may therefore prevent adequate PA, while not adversely affecting QoL.

The PABS-E contains 30 questions and it can be completed quickly. Elderly participants were able to successfully use a 3-point Likert-type scale to respond to the PABS-E questions. In addition to assessing the personal and environmental factors that are important in ICF, assessment of daily routines also allows for multidimensional evaluation of PA barriers. It is common for Turkish people to care for their grandchildren and perform low level PAs for worship five times per day. Importantly, the PABS-E enables the evaluation of these cultural habits within the context of daily routines.

One strength of our study was the inclusion of elderly participants with different life settings. The ability to evaluate different societal groups suggests that all elderly individuals can be represented using this tool.

One of the limitations of our study was our inability to include an adequate number of people using wheelchairs. There is a need for more comprehensive studies, including elderly individuals who use wheelchairs, as these individuals may face considerable environmental PA barriers.

Approaches that increase PA are important for reducing morbidity and mortality rates, increasing independence in everyday life and QoL (8, 9). We must determine the factors that impede PA to increase PA in elderly individuals and better understand the effectiveness of interventions that target PA. Although there are semi-structured and qualitative studies that identify PA barriers in elderly individuals, the number of quantitative studies is low (1, 7). The PABS-E is the first measure to assess PA barriers for Turkish elderly individuals, which was developed considering Turkish culture. The findings of this study may serve as a useful tool for developing community-based PA interventions for older adults.

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## REFERENCES

1. Autenrieth CS, Kirchberger I, Heier M, Zimmermann AK, Peters A, Doring A, et al. Physical activity is inversely associated with multimorbidity in elderly men: results from the KORA-Age Augsburg Study. Prev Med 2013;57(1):17-9. (PMID:23485795).
2. Baert V, Gorus E, Mets T, Geerts C, Bautmans I. Motivators and barriers for physical activity in the oldest old: a systematic review. Ageing Res Rev 2011;10(4):464-74. (PMID:21570493)
3. Casado-Perez C, Hernandez-Barrera V, Jimenez-Garcia R, Fernandez-de-las-Penas C, Carrasco-Garrido P, Lopez-de-Andres A, et al. Time trends in leisure time physical activity and physical fitness in the elderly: five-year follow-up of the Spanish National Health Survey (2006-2011). Maturitas 2015;80(4):391-8. (PMID:25604526).
4. Cho J, Jin Y, Kang H. Weight status, physical activity, and depression in Korean older adults. J Epidemiol 2018;28(6):292-9. (PMID:29353866).
5. Dergance JM, Calmbach WL, Dhanda R, Miles TP, Hazuda HP, Mouton CP. Barriers to and benefits of leisure time physical activity in the elderly: differences across cultures. J Am Geriatr Soc 2003;51(6):863-8. (PMID:12757577).
6. Ekelund U, Sepp H, Brage S, Becker W, Jakes R, Hennings M, et al. Criterion-related validity of the last 7-day, short form of the International Physical Activity Questionnaire in Swedish adults. Public Health Nutr 2006;9(2):258-65. (PMID:16571181).
7. Eronen J, von Bonsdorff MB, Tormakangas T, Rantakokko M, Portegijs E, Viljanen A, et al. Barriers to outdoor physical activity and unmet physical activity need in older adults. Prev Med 2014;67:106-11. (PMID:25045839).
8. Heath JM, Stuart MR. Prescribing exercise for frail elders. J Am Board Fam Pract 2002;15(3):218-28. (PMID:12038729).
9. Horne M, Tierney S. What are the barriers and facilitators to exercise and physical activity uptake and adherence among South Asian older adults: a systematic review of qualitative studies. Prev Med 2012;55(4):276-84. (PMID:22846506).
10. Joussain C, Joubert J, Laroche D, D'antono B, Juneau M, Gremeaux V. Barriers to physical activity in coronary artery disease patients: Development and validation of a new scale. Ann Phys Rehabil Med 2017;60(5):289-98. (PMID:28216414).
11. Kendrick D, Orton E, Lafond N, et al. Keeping active: maintenance of physical activity after exercise programmes for older adults. Public Health 2018;164:118-27. (PMID:30286342).
12. Kucukdeveci AA, McKenna SP, Kutlay S, Gursel Y, Whalley D, Arasil T. The development and psychometric assessment of the Turkish version of the Nottingham Health Profile. Int J Rehabil Res 2000;23(1):31-8. (PMID:10826123).
13. Lee M, Zhu W, Ackley-Holbrook E, Brower DG, McMurray B. Calibration and validation of the Physical Activity Barrier Scale for persons who are blind or visually impaired. Disabil Health J 2014;7(3):309-17. (PMID:24947572).
14. Lee PH, Macfarlane DJ, Lam TH, Stewart SM. Validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF): a systematic review. Int J Behav Nutr Phys Act 2011;8:115. (PMID:22018588).
15. Lin CH, Chiang SL, Yates P, Tzeng WC, Lee MS, Chiang LC. Influence of Socioeconomic status and perceived barriers on physical activity among Taiwanese middle-aged and older women. The J Cardiovasc Nurs 2017;32(4):321-30. (PMID:27281056).
16. Rantakokko M, Iwarsson S, Vahaluoto S, Portegijs E, Viljanen A, Rantanen T. Perceived environmental barriers to outdoor mobility and feelings of loneliness among community-dwelling older people. J Gerontol A Biol Sci Med Sci 2014;69(12):1562-8. (PMID:24864307).
17. Rasinaho M, Hirvensalo M, Leinonen R, Lintunen T, Rantanen T. Motives for and barriers to physical activity among older adults with mobility limitations. J Aging Phys Act 2007;15(1):90-102. (PMID:17387231).
18. Saglam M, Arikan H, Savci S, et al. International physical activity questionnaire: reliability and validity of the Turkish version. Percept Mot Skills 2010;111(1):278-84. (PMID:21058606).
19. Samra PK, Parkinson L, van Uffelen JG, Schoeppe S, Power, D, Schneiders A, Alley SJ. Physical Activity Attitudes, Preferences, and Experiences of Regionally-Based Australia Adults 65+ Years. J Aging Phys Act 2018;1-21 (PMID:30299206).
20. Tierney M, Fraser A, Kennedy N. Criterion validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF) for use in patients with rheumatoid arthritis: comparison with the SenseWear Armband. Physiotherapy 2015;101(2):193-7. (PMID:25442297).
21. Tomioka K, Iwamoto J, Saeki K, Okamoto N. Reliability and validity of the International Physical Activity Questionnaire (IPAQ) in elderly adults: the Fujiwara-kyo Study. J Epidemiol 2011;21(6):459-65. (PMID:21946625).
22. Vasudevan V, Rimmer JH, Kviz F. Development of the Barriers to Physical Activity Questionnaire for People with Mobility Impairments. Disabil Health J 2015;8(4):547-56. (PMID:26087721).

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RESEARCH

# THE EFFECT OF DUAL TASK TRAINING ON STATIC AND DYNAMIC BALANCE OF OLDER ADULTS HAVING INSTITUTIONAL LIVING: RANDOMIZED TRIAL

## Abstract

***Introduction:*** In the presented study it was aimed to observe the effects of dual-task on static and dynamic balance and to present if static and dynamic balance training under dual-task performance effect the static and dynamic balance ability positively among the older adults having an institutional living.

***Materials and Method:*** Fifty volunteer individuals (72.02±6.60 years of age, ranging between 64 and 91; 12% women, n=6,88% men, n=44) took part in this study. Evaluations as Barthel Activity of Daily Living Index, Berg Balance Scale and Berg Balance Scale Under Dual-Task Performance were performed both before and after trainings. The participants were divided into two groups by computer-generated randomization table: Group A (n=26, number of sessions=5) and Group B (n=24, number of sessions=7).

***Results:*** Balance score was not affected by dual-task performance, and no differences were found between groups (p>0.05). For groups, balance score both with and without dual-task performance showed positive improvement after training (p=0.00).

***Conclusion:*** Training had positive effects for both group's balance with and without dual-task performance, but not affected by the session numbers. Physiotherapists should prefer 5 training instead of 6,7 or 8. Yet it could be cost-effective by providing important health benefits, time gains, labor force at relatively low cost. Besides, the study offers standardized flow for both assessment and training on balance under dual-task performance for the older adult population.

***Keywords:*** Task Performance and Analysis; Activities, Daily Living; Aged

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ARAŞTIRMA

# ÇİFT GÖREV EĞİTİMİNİN KURUMDA YAŞAYAN YAŞLI BİREYLERDE STATİK VE DİNAMİK DENGEYE ETKİLERİ: RANDOMİZE ARAŞTIRMA

## Öz

***Giriş:*** Bu çalışmada çift görevin statik ve dinamik denge üzerindeki etkilerini gözlemleyerek etkilerini ortaya koymak amaçlanmıştır.

***Gereç ve Yöntem:*** Amaç doğrultusunda; 50 gönüllü bireyin (72.02±6.60, 64 – 91; 12% kadın n=6, 88% erkek n=44) fonksiyonel durumu (Barthel Günlük Yaşam Aktivite İndeksi), statik ve dinamik dengesi (Berg Balans Skalası) ve çift görev altında statik ve dinamik dengesi (Çift Görev altında Berg Balance Skalası) değerlendirildi. Tüm gönüllüler Türkiye Cumhuriyeti Darülaceze Müdürlüğü'nde yaşayan ve 65 yaş üstü bireylerdi. Bilgisayar tabanlı randomizasyon tekniği ile iki grup oluşturuldu: Grup A (n=26, 5 seans) ve Grup B (n=24, 5 seans üstü). Çift görev performansı altında verilen statik ve dinamik denge eğitimlerinden sonra iki grubun dengeleri Berg Balans Skalası ve Çift Görev altında Berg Balance Skalası ile değerlendirildi. Elde edilen veriler grup içi ve gruplar arası istatistiksel analizlerle karşılaştırıldı.

***Bulgular:*** Katılımcıların sosyo-demografik özellikleri ile fonksiyonel bağımsızlıkları arasında anlamlı bir fark bulunmadı (p>0.00). Sonuçlara göre, denge puanı çift görev performansından etkilenmemiştir ve gruplar arasında fark bulunmamıştır (p>0.05). Hem denge hem de çift görev performansı altında denge skorlarında, eğitimler sonrasında anlamlı gelişmeler görüldü (p=0.00).

***Sonuç:*** Eğitimler, iki grupta da denge ve çift görev altında denge performanslarını olumlu etkiledi, ancak eğitimlerin seans sayısı bir fark yaratmadı. Bu nedenle eğitim planlamasında; 6,7 veya 8 seans yerine 5 seans tercih edebilir. Böylelikle; beklenen yarar sağlanarak, vakitten iş gücünden kazanç sağlayarak ve nispeten daha az sağlık harcaması yaparak maliyet – yarar ilişkisinde kar elde edilebilir. Bunun yanı sıra çalışmamızda çift görev performansı altında denge değerlendirmesi ve eğitimi adına standardize edilmiş bir akış önerilmektedir.

***Anahtar sözcükler:*** Görev Performansı; Denge; Eğitim; Yaşlı

## INTRODUCTION

The elderly population is substantially increasing in the 21st century. Between 2000 and 2015, it increased from 11% to 22%. The Turkish elderly population also proportionally increases. According to the population projections reported by the Turkish General Directorate of Population and Citizenship Affairs, the total percentage of individuals higher then 65-year-old in Turkey is currently 8.3%; it is projected to reach 10.2% in 2023, 20.8% in 2050, and 27.7% in 2075 (1). Therefore, the globally increasing percent of older adult population, the literature is mostly focusing on their physical and cognitive performances that are having liability to decrease due to aging (1-3).

Falls and loss of balance are the most common physical problems faced by older adults usually occur while standing and performing one task or a complex task at the same time (4), which is called dual-tasking. Dual-tasking involves complex, strenuous, and advanced neurophysiological processes of the brain and body that require highly cognitive function (5). As the level of activity increases, the higher level of attention for performing the tasks, which may be physical, cognitive or combined tasks are required. Such as monitoring a phone call while walking or attempting to remember someone's name while running, carrying a filled cup of water while walking (6,7), may reduce attentional processing capacity and limit postural control abilities of older adults (4). This may result with limitations in their balance and postural control (8). However, these may also be affected negatively with the verbal tasks (5); such as counting backward from hundred, sorting the vegetables according to their colors while performing physical tasks.

Thus, the recent approaches in walking and balance trainings have included dual-and multitasking activities to improve both balance and cognitive performances of older adults (6-9).

The systematic review of Gobbo et al. (10) reached to the outcome that there is a lack of evidence reporting the exercise protocol and number of sessions on balance in healthy older adults during dual-task performance. Additionally, various numbers of training sessions as 5 to 25 were found for dual-task training in the literature (5-11). Yet, there are controversial results of the studies searching effectiveness of dual-task training on static and dynamic balance of older adults. Therefore, the aim of this study is to observe the effectiveness of dual-task training on static and dynamic balance performance of older adults as well as the number of sessions efficient to improve the balance under dual-task performance. In the light of this knowledge, we hypothesized that the balance and walking training under dual-task performance improves the static and dynamic balance of older adults having institutionalized living.

## MATERIALS AND METHOD

The study presented is a randomized controlled clinical study conducted with older adults living in the institutional setting of Darulaceze Presidency, which was first established in 1863 for those having no financial or family support. The study was designed to observe the effects of dual task training on static and dynamic balance of older adults as well as to state the minimum number of sessions required to reach positive effects on balance and dual tasks among the participants. The study was approved by the Ethics Committee of Bahçeşehir University (Turkey) (4/1/2017 date, 2017-01/05 numbered decision) and the written consent was received from participants prior to the evaluation in accordance with the principles of the Helsinki Declaration.

### Participants

The fifty (n=50) participants out of 152 were included according to the criteria of the study as shown in the flow chart (Figure 1). The participants assigned into two groups by using the computer generated randomization table of numbers created prior to the beginning of the study as

Group A (n=26) having 5 sessions of trainings and Group B (n=24) having more than 5 sessions of trainings (9 participants had 6 sessions; 6 participants had 7 sessions; 9 participants had 8 sessions; mean session number:7.00) (Table 1). A brief explanation to participants about assessments and trainings were conducted by the same physical therapist.

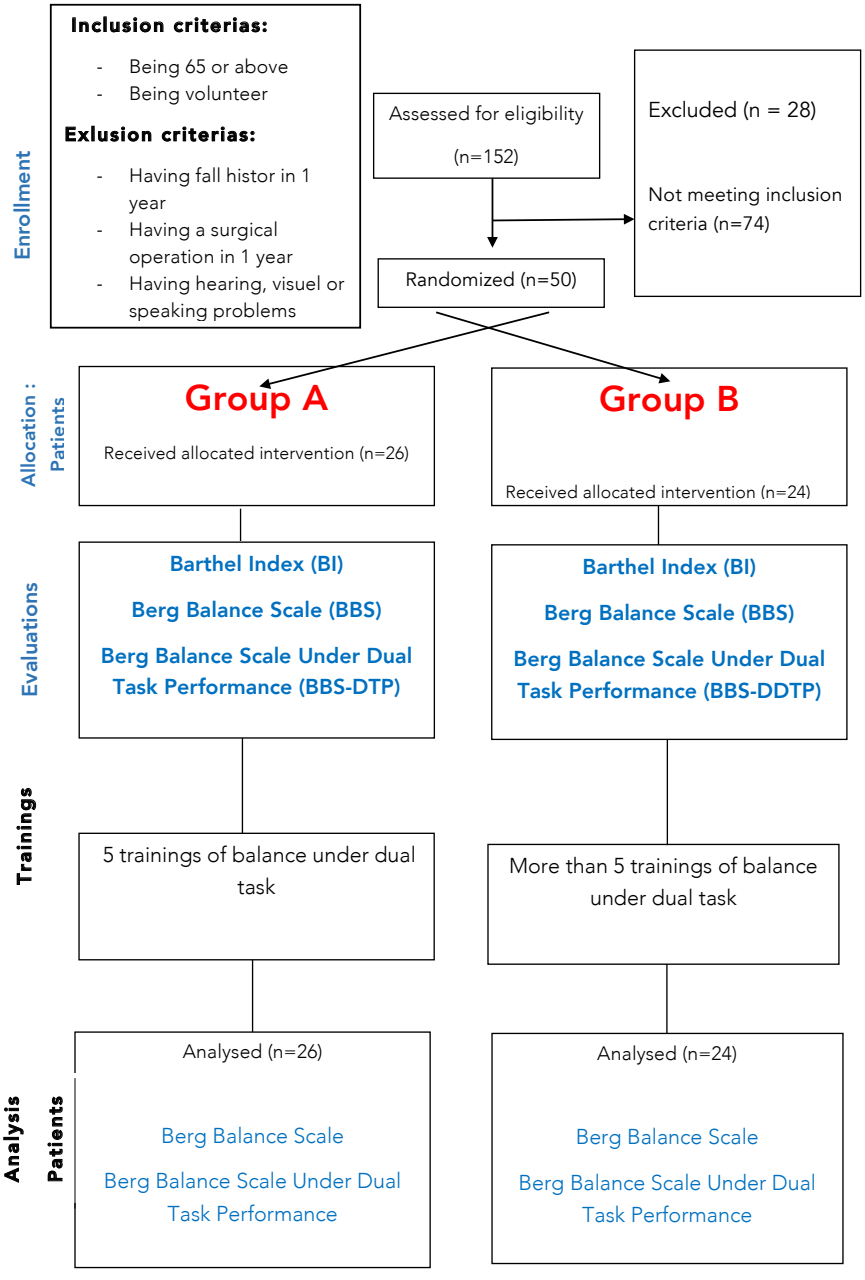


**Figure 1.** Flow Chart of the study.

**Table 1.** The socio-demographic features of the participants.

| | Participants (n=50) | | Frequency | Ratio (%) | X±sd | p |
|---|---|---|---|---|---|---|
| Group A | Gender | F | 4 | 15,4 | 24.17±14.52 | 0,01[a] |
| | | M | 22 | 84,6 | 37.82±11.22 | |
| | Age (years) | 64 – 91 (71.31±5.58) | 26 | | | |
| | Education | No education | 6 | 23,1 | 36.33±12.22 | |
| | | Primary school | 18 | 69,2 | 37.60±12.12 | 0.70[b] |
| | | High school | 2 | 7,7 | 32.83±13.75 | |
| | | University | 0 | 0 | - | |
| Group B | Gender | F | 2 | 8,3 | 25.83±15.29 | 0.01[a] |
| | | M | 22 | 91,7 | 39.61±11.04 | |
| | Age | 64–91 (72.79±7.61) | 24 | | | |
| | Education | No education | 12 | 50,0 | 38.94±12.21 | |
| | | Primary school | 7 | 29,2 | 38.64±12.01 | 0.65[b] |
| | | High school | 4 | 16,7 | 35.67±13.54 | |
| | | University | 1 | 4,2 | 33.17±10.88 | |

a: Mann Witney U Test;
b: Kruskal Wallis H Test

All participants were evaluated at the beginning of the study for functional independence (Barthel Activity of Daily Living Index-Barthel ADL Index) (12,13). Than both of the groups were evaluated at the beginning and end of the trainings (Group A at the end of 5$^{th}$ training; Group B at the end of the trainings following weeks after the 5$^{th}$ week, as 6$^{th}$ ,7$^{th}$, and 8$^{th}$ as they required) for balance (Berg Balance Scale-BBS) (14,15) and balance under dual-task (Berg Balance Scale under Dual Task Performance-BBS-DTP).

**Instruments**

*Bathel Activity of Daily Living Index (Barthel ADL Index)*

Barthel Activity of Daily Living Index is a 10-item daily life inventory scored between 0 and 100; 0–20 indicates fully dependence, 21–61 high level dependent, 62–90 moderately dependent, 91–99 low level dependent and 100 indicates independence in daily living activities. Intraclass Correlation Coefficiency (ICC) of Barthel Index was reported as 0.88 (12,13).

*Berg Balance Scale (BBS)*

The Berg Balance Scale is an objective balance scale that measures static and dynamic balance capabilities that has 14 functional tasks and daily living activities. It is scored from 0-56 points on sitting, standing, changing positions while sitting and standing, standing with eyes closed, reaching forward in standing, taking an object from floor standing on one leg or on both

while they are together, turning, stepping forward. The first five activities in the test were formed to measure simple balance movements and the last nine activities to measure high level of balance movements. Each activity was scored from 0-4, and a score less then 45 points indicates the elderly may be at greater risk of falling (14).

The Turkish reliability and validity study of the Berg Balance Scale has been conducted by Sahin et al and proven effective in determining balance and postural control of individuals over 65 years of age. Intraclass Correlation Coefficiency of the Turkish version of the BBS was determined as 0.98 for the total score (15).

*Berg Balance Scale under Dual Task Performance (BBS-DTP)*

Fourteen dual-tasks consisting of verbal fluency, visual search and calculation tasks were defined for each sub-parameter of Berg Balance Scale for the participants to perform their balance under dual-tasks (Tablo 4) (10). The participants were expected to perform the sub-parameters of Berg Balance Scale, while doing the defined physical tasks at the same time, and their performances were recorded as BBS-DTP score. Berg Balance Scale provides motor task and additional dual-tasks selected as verbal, visual or calculation task from the cognitive tasks.

**Trainings**

The standardized static and dynamic balance training under dual-task performance (10,14,15) in the concept of Berg Balance Scale items were given once a week for 45 minutes as a face-to-face session for each group (Figure 2) (Tablo 4). The training program was specifically designed by combining the sub-parameters of Berg Balance Scale with the tasks requiring verbal (10 items), visual (2 items) and calculation (2 items) assignments.

**Statistical analysis**

For statistical analysis, SPSS Statistics 22.0 was used. Distribution was determined by the Shapiro–Wilk and Kolmogorov–Smirnov tests. For normally distributed and non-normally distributed data, parametric tests and non-parametric tests were used, respectively. Variables were defined with mean and standard deviation values. The data within group were assessed with Paired Sample t Test and between the groups with the Independent Sample t- and a Kruskal–Wallis H Tests. The difference between the groups we analyzed by a 95% confidence level and $p<0.05$ value were considered as statistically significant.

## RESULTS

According to the outcomes of the study, there were no significant difference among the socio-demographic features of the participants in both group (Table 1; $p>0,05$). There were also no difference in the level of the daily living activities of both of the groups. Group A, who had 5 sessions of trainings (78.84±14.16) and Group B who had more than 5 sessions of trainings (78.54±17.59), were moderately dependent according to the Barthel Acitivites of Daily Living Index (Table 2).

According to the Berg Balance Scale with and without under dual task, both of the groups benefited from the training program given in the sessions ($p<0.05$). However, we have not found any difference between the outcomes of the groups (Table 3). Thus, we found that 5 sessions of balance or balance under dual task training designed in the concept of Berg Balance Scale was effective to improve the balance of the participants. This points out that five sessions of balance training program under dual task can be suggestible.

**Table 2.** The comparison of the outcomes of the both groups in relation to functional independence assed by Bathel Activity of Daily Living Index (Group A n=26; Group B n=24).

| Parameter (min – max values) | Group | $\bar{X}$ | sd | t | p[a] |
|---|---|---|---|---|---|
| **Feeding (0-10)** | A | 9.615 | 1.359 | -.515 | .609 |
| | B | 9.792 | 1.021 | | |
| **Transfer (0-5)** | A | 12.308 | 3.234 | 1.480 | .146 |
| | B | 10.833 | 3.807 | | |
| **Grooming (0-5)** | A | 3.269 | 2.426 | -.730 | .469 |
| | B | 3.750 | 2.212 | | |
| **Toilet use (0-10)** | A | 8.077 | 2.481 | .857 | .396 |
| | B | 7.292 | 3.895 | | |
| **Bathing (0-5)** | A | 2.308 | 2.542 | -1.151 | .256 |
| | B | 3.125 | 2.473 | | |
| **Mobility (0-15)** | A | 12.692 | 3.530 | -.223 | .825 |
| | B | 12.917 | 3.586 | | |
| **Stairs (0-10)** | A | 5.769 | 2.717 | 1.184 | .242 |
| | B | 4.792 | 3.120 | | |
| **Dressing (0-10)** | A | 7.115 | 2.519 | -1.745 | .087 |
| | B | 8.333 | 2.408 | | |
| **Bowel (0-10)** | A | 9.423 | 1.629 | .102 | .919 |
| | B | 9.375 | 1.689 | | |
| **Bladder (0-10)** | A | 7.885 | 3.217 | -.278 | .783 |
| | B | 8.125 | 2.879 | | |
| **Total score (0-100)** | A | 78.846 | 14.164 | .068 | .946 |
| | B | 78.542 | 17.599 | | |

a: Independent T Test

**Table 3.** Comparison of the outcomes of both groups balance scores with and without Dual Task Performance (BBS and BBS-DTP) both before and after trainings.

| Before training | | | | After training | | | | Difference between groups | |
|---|---|---|---|---|---|---|---|---|---|
| Group | $\bar{X}$±sd | t | P[a] | Group | $\bar{X}$±sd | t | p[a] | t | p[b] |
| **A (BBS)** | 35.8112.47 | -0.220 | 0.83 | **A (BBS)** | 37.1512.40 | -0.478 | 0.63 | -3.505 | **0.00** |
| **B (BBS)** | 36.5812.44 | | | **B (BBS)** | 38.8312.40 | | | -6.608 | **0.00** |
| **A (BBS-DTP)** | 33.0411.42 | -0.143 | 0.89 | **A (BBS-DTP)** | 34.9212.09 | -0.270 | 0.79 | -3.767 | **0.00** |
| **B (BBS-DTP)** | 33.5011.43 | | | **B (BBS-DTP)** | 35.8311.74 | | | -6.402 | **0.00** |

[a]: Paired Sample t Test; [b]: Independent T Test; BBS score min-mix values: 0-56

**Figure 2.** Balance trainings under dual task performance of one of the participants.

**Table 4.** Specified Dual Tasks given during balance training and Berg Balance Test interventions (BBS-DTP).

| No | Type of task | BBS Sub-parameters | Specified Dual Tasks |
|---|---|---|---|
| 1 | VFT | Sitting to stand | Give some example to green vegetables |
| 2 | VFT | Standing unsupported | Give some example to sports done with a ball |
| 3 | VFT | Sitting unsported | Named the geographic areas of Turkey |
| 4 | VST | Standing to sitting | Named the colours of rainbow |
| 5 | VFT | Transfers | Name the days of week |
| 6 | VFT | Standing with eyes closed | Give example to cities starting with the capital letter "K". |
| 7 | CT | Standing with feet together | Count backwards from 100 |
| 8 | CT | Reaching forward with outstretched arm | Count 5 from 50 |
| 9 | VFT | Retrieving object from floor | Give some examples to most watched TV channels |
| 10 | VST | Turning to look behind | Name the showed colour and object behind you |
| 11 | VFT | Turning 360 degrees | Give some examples to fruits grown on trees |
| 12 | VFT | Placing alternate foot on stool | Give some example to furnitures from house. |
| 13 | VFT | Standing with one foot in front | Name the months in order |
| 14 | VFT | Standing on one foot | Give some examples to organs |

BBS: Berg Balance Scale; BBS-DTP: Berg Balance Scale under Dual Task Performance; VFT: Verbal Fluency Task; VST: Visual Search Task; CT: Calculation Task

## DISCUSSION

We aimed to observe the effectiveness of the dual-task training on balance for the elderly having institutionalized living. The training program was specifically designed by combining the sub-parameters of Berg Balance Scale with the tasks requiring verbal (10 items), visual (2 items) and calculation (2 items) assignments. We have found that minimum 5 sessions of balance or balance under dual task training designed in the concept of Berg Balance Scale was effective to improve the balance of the participants. Colcombe et al. (16) stated physical activity had positive effects on cognition and also stated that cognitive performance improves executive functioning to coordinate and control the behaviors. Strobach et al. (17) and Li et al. (5) targeted to improve motor performance with a cognitive dual task training protocol but as Li et al. announced at the end of the study, they do not claim cognitive trainings can substitute physical improvements. Therefore, in this study we focused on two functions by giving hybrid instruction, to achieve simultaneous motor and cognitive training to improve both motor and cognitive performance.

Mengi et al. (18) who studied on people above (n=18) and below (n=18) 65 years of age both with and without a history of falls by giving a dual task as walking while holding a filled cup of water as a dual-task (two physical tasks), found no significant difference between the fallers and non-fallers. They claimed that walking or holding a filled cup does not require a cognitive process and can be simultaneously done by automatic responses. However, in contrary, in this study we considered dual-tasks as a physical and cognitive assignment, combined with activities including static and dynamic balance not as automatic response. For this purpose, since it is known that a fall history is one of the risk factors for re-falling (19), we included fall history in the last one-year into the exclusion criteria of the study.

Besides the design of the dual-task training program the number of sessions are also important. Kimura et al. (11) reported that a dual-task training intervention to improve motor task performance for eight 15-minute sessions (totaling 120 minutes) improved motor task performance. In this research, as it was aimed to put forth the minimum training number that improves balance of elderly, we may state that 5 sessions for 45 minutes each (totally 225 minutes) is the minimum intervention duration. However, the greater the duration the greater the positive effects. On the other hand, the interest and motivation of the elderly to the sessions (11) as well as the cost effectiveness of the treatment programs may also be the other issues directing the rehabilitation team.

On contrary to these outcomes, there are studies showing the influence of one-session interventions with balance or dual-task training. Hamacher et al. (20) aimed to display the acute effects of single motor training and combined motor-cognitive training by assigning the exercise and dance groups, and reported the marked improvements in dynamic stability after one session of motor-cognitive training. This may be due to the increased awareness of the motor-cognitive function. Since they also studied with elderly, further studies are needed to come up with effective outcomes on dual-task performances.

The statistical power of the study is 53% according to Raosoft power analysis program. Since we used the cognitive tasks as for training and testing that combined with a well-known balance test, this may be suggestible as a new intervention for institutionalised elderly.

In conclusion, we may state that trainings of static and dynamic balance under Dual Task Performance are effective in institutionalized older adults. Therefore, it can be suggested that physiotherapists should plan balance training programs combined with cognitive skills, as physical and verbal, visual or calculation dual tasks together for older population at least 5 sessions. Preferring 5 sessions of trainings instead of 6,7 or 8 could also be cost-effective by providing important health benefits, time saving, labor force at relatively low cost (21).

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### Conflict of interest

We have no conflict of interest to declare.

## REFERENCES


1. Berg KO, Wood-Dauphinee S, Williams JI, Gayton D. Measuring balance in elderly: preliminary development of an instrument. Physiother Can 1989;41(6):304-311.
2. Colcombe S, Erickson K, Scalf P, et al. Aerobic exercise training increases brain volume in aging humans. The Journals Of Gerontology. Series A, Biological Sciences And Medical Sciences 2006;61(11):1166-1170. (PMID:17167157).
3. Gobbo S, Bergamin M, Sieverdes JC et al. Effects os exercise on dual-task ability and balance in older adults: a systematic review. Archieves of Gerontology and Geriatrics 2014;58(2):177-87. (PMID:24188735).
4. Gürkan A, Demirel H, Demir M, Atmaca E, Bozöyük G, Dane S. Effects of long-term training program on static and dynamic balance in young subjects. Clinical and Investigative Medicine 2016;39(6):31-3. (PMID:27917788).
5. Hamacher D, Hamacher D, Rehfeld K, & Schega L. Motor-cognitive dual-task training improves local dynamic stability of normal walking in older individuals. Clinical Biomechanics 2016;32:138-141. (PMID:26682629).
6. Haripriya S, Anjana BS, George S, Babu Roshan PS. The influence of body mass index on functional mobility and balance in elderly individuals. Indian Journal of Physiotherapy & Occupational Therapy 2017;11(1):6-10.
7. Kimura T, Kaneko F, Nagahata K, Shibata E, Aoki N. Working memory training ımproves dual-task performance on motor tasks. Journal of Motor Behavior 2017;49(4):388-97. (PMID:27726513).
8. Konak H, Kibar S, Ergin E. The effect of single-task and dual-task balance exercise programs on balance performance in adults with osteoporosis: a randomized controlled preliminary trial. Osteoporosis International 2016;27(11):3271-8. (PMID:27234670).
9. Kucukdeveci AA, Yavuzer G, Tennant A, Suldur N, Sonel B, Arasil T. Adaptation of the modified Barthel Index for use in physical medicine and rehabilitation in Turkey. Scandinavian Journal of Rehabilitation Medicine 2000;32(2):87-92. (PMID:10853723).
10. Li KZH, Roudaia E, Lussier M, Bherer L, Leroux A, McKinley PA. Benefits of cognitive dual-task training on balance performance in healthy older adults. J Gerontol A Biol Sci Med Sci 2010;65(12):1344-52. (PMID:20837662).
11. Little CE, Woollacott M. Effect of attentional interference on balance recovery in older adults. Experimental Brain Research 2014;232(7):2049-60. (PMID:24639065).
12. Mahoney FI, Barthel DW. Functional evaluation: the barthel index, Maryland State. Med J 1965;(14):61-5. (PMID:14258950).
13. Manor B, Zhou J, Jorðdan A, et al. Reduction of dual-task costs by noninvasive modulation of prefrontal activity in healthy elders. Journal of Cognitive Neuroscience 2016;28(2):275-81. (PMID:26488591).
14. Mengi GT, Özyemişçi-Taşkıran ÖT, Taş NT. Balance, muscle strength and dual tasking ın the elderly. Turkish Journal of Geriatrics 2010;13(3):178-84. (in Turkish).
15. Mengi GT, Özyemişçi-Taşkıran ÖT, Taş NT. Balance, muscle strength and dual tasking ın the elderly. Turkish Journal of Geriatrics 2010;13(3):178. (in Turkish).
16. Munro J, Brazier J, Davey R, Nicholl J. Physical activity for the over-65s: could it be a cost-effective exercise for the NHS?. Journal of Public Health 1997;19(4):397-402. (PMID:9467144).
17. Padala K, Padala P, Lensing S, et al. Efficacy of wii-fit on static and dynamic balance in community dwelling older veterans: a randomized controlled pilot trial. Journal Of Aging Research 2017;1-9. (PMID:28261500).
18. Sahin F, Yilmaz F, Ozmaden A, Kotevoglu N, Sahin T, Kuran B. Reliability and validity of the Turkish version of the Berg Balance Scale. Journal of Geriatric Physical Therapy 2008;31(1):32-37. (PMID:18489806)
19. Strobach T, Salminen T, Karbach J, Schubert T. Practice-related optimization and transfer of executive functions: a general review and a specific realization of their mechanisms in dual tasks. Psychological Research 2014;78(6):836-51. (PMID:24668506).
20. Yang YR, Chen YC, Lee CS et al. Dual-task-related gait changes in individuals with stroke. Gait & Posture 2007;25(2):185-90. (PMID:16650766).
21. Zoghi M, Kış M. The studies and results of elderly patients in Turkey. Archives of the Turkish Society of Cardiology 2017;45(5):143-6. (PMID:28976403). (in Turkish).

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