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Relationship Between Physical Activity Levels and Cognitive Functions in Alzheimer Patients

Fatma ERDEO[1] Figen GÜNEY[2] Neslihan ALTUNTAŞ YILMAZ[3]

[1] Necmettin Erbakan Üniversitesi Nezahat Keleşoğlu Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü, ferdeo@erbakan.edu.tr, https://orcid.org/0000-0002-0266-229X

[2] Necmettin Erbakan Üniversitesi Tıp Fakültesi Nöroloji Anabilim Dalı, fguney@erbakan.edu.tr, https://orcid.org/0000-0002-8572-8919

[3] Necmettin Erbakan Üniversitesi Nezahat Keleşoğlu Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü, yilmaz.altuntas.neslihan@gmail.com, https://orcid.org/0000-0003-0116-9089

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ABSTRACT

Alzheimer's disease causes cognitive and physical problems. The observational and cross-sectional study. There were 20 elders in the alzheimer's disease group (mean age = 72 ± 5.34 years) and 15 elders in the control group (no dementia). The reported values in the alzheimer's disease group were then compared with those in the control group. The mini mental status examination scores and median step number of those in the alzheimer's disease group were lower than those in the control group (p1 = 0.000 and p2 = 0.006).This study showed that the physical activity level of individuals with alzheimer's disease was decreased.

Alzheimer Hastalarında Fiziksel Aktivite Düzeyleri ile Bilişsel İşlevler Arasındaki İlişki

Makale Bilgileri

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ÖZ

Alzheimer hastalığı bilişsel ve fiziksel sorunlara neden olur. Gözlemsel ve kesitsel çalışma. Alzheimer hastalığı grubunda 20 (ortalama yaş = 72 ± 5,34 yıl) ve kontrol grubunda (demans yok) 15 yaşlı birey vardı. Alzheimer hastalığı grubunda bildirilen değerler daha sonra kontrol grubundaki değerlerle karşılaştırıldı. Alzheimer grubundakilerin mini mental durum muayene puanları ve ortanca adım sayısı kontrol grubuna göre daha düşüktü (p1=0,000 ve p2=0,006). Bu çalışma Alzheimer hastası bireylerin fiziksel aktivite düzeylerinin azaldığını gösterdi

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INTRODUCTION

Forty-seven million people worldwide are living with dementia (Prince et al., 2016), and this number is expected to triple by 2050 (Prince et al., 2013). There is evidence that the overall incidence of dementia in the United States is decreasing (Langa et al., 2007; Satizabal et al., 2016), although the number of US adults over age 70 with dementia or mild cognitive impairment is increasing as the population ages (Mohs et al., 2000; Kato-Narita et al., 2011). Dementia-related costs exceed those of heart disease and cancer and are often paid directly by families (Lauenroth et al., 2016). A reduction in motor performance and physical activity levels is another common symptom of early-stage AD. Motor performance may deteriorate before cognitive changes are identified and may be an indicator of cognitive decline in AD (Mohs et al., 2000; Kato-Narita et al., 2011). Only a few studies on cognitive and behavioral changes in individuals with AD have focused on changes in physical capacity (Mohs et al., 2000; Lauenroth et al., 2016). Cognitive and functional deficits are important in AD, as they are strongly associated with AD-related symptoms, such as depression, and time to death (Kato-Narita et al., 2011). A previous study reported a reduced level of physical activity among individuals with AD (Kato-Narita et al., 2011). However, studies have limited on physical activity levels in patients with mild AD.

METHODS

Ethic and Sample

The observational and cross-sectional study was conducted between April 20 and June 30, 2018. Ethical approval for the study was obtained from the ethics committee. Non-pharmaceuticals and Medical Devices Research 2017/860. Consent form was obtained from the control group who participated in the study, indicating that they participated in the study. In the AD group, the consent form indicating that the individual with AD participated in the study was taken from the family due to cognitive decline.

The study included 20 patients diagnosed with AD and followed up in the neurology dementia polyclinic and 15 individuals who presented to the polyclinic and were not diagnosed with dementia (control group) (Figure 1). The inclusion criteria were as follows: aged 60–90 years, diagnosed with AD, preserved ambulation, having no hearing impairment, having no vision impairment and having no other neuropsychiatric conditions (Figure 1).

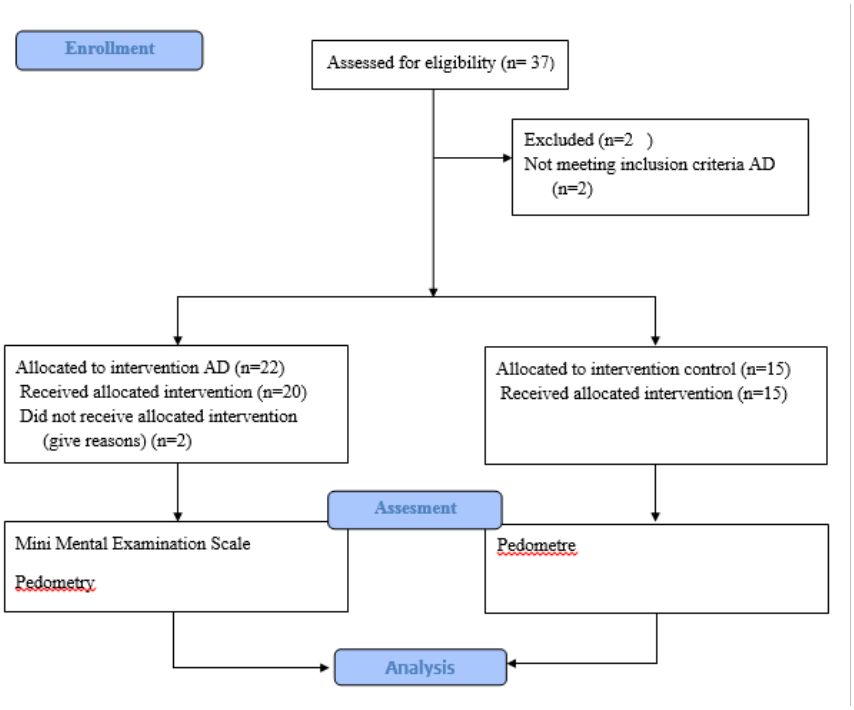

Figure 1. *Flow Chart of Study*

Data Collection

A neurologist specialized in geriatrics administered the Mini-Mental State Exam (MMSE) to the patients in the AD group. The patients and their relatives were given detailed informed about how to use the digital pedometer. Where individuals in the AD group lived alone, the participant's relatives collected and reported the pedometer data.

The following data were collected from the AD group: age, height, weight, history of previous diseases and history of orthopaedic and auditory disorders. All the patients then completed the MMSE. The tests were performed in a quiet well-lit room. Both the patients and their relatives were given detailed information about the pedometer.

Mini Mental Status Examination (MMSE)

To evaluate the cognitive status of the individuals in the study, the MMSE, which Gungen et al. demonstrated was a valid and reliable instrument in patients with mild dementia (Güngen et al., 2002), was used (Güngen et al., 2002) The MMSE is a universal cognitive scale that is generally used as an effective assessment tool for cognitive impairment in diseases affecting the mental state and in geriatric individuals. The MMSE assesses five areas of cognitive function, and the total score that can be obtained in these five areas is 30 (Folstein et al., 1975).

Digital pedometer

To measure the step number per day, we used a simple digital pedometer that could be readily used and understood by the participants. A comfortable vessel smaller than a cloth was made to place the pedometer in, so that the pedometer could be attached to the person's ankle.

The individuals in both the AD group and control group were instructed to attach the pedometer to their ankle first thing in the morning (08:00 h) and to remove the pedometer at 21:00 h. At 21:00 h, a physiotherapist telephoned each participant or the participant's relative to read the information on the digital indicator. the patient's relative to read the digital indicator. The data (number of steps per day) were recorded each day for three days In cases of data or recording errors, the participants were instructed to repeat the process, attaching the pedometer to their ankle for three consecutive days and reporting the data each evening at 21:00 h (Figure 2).

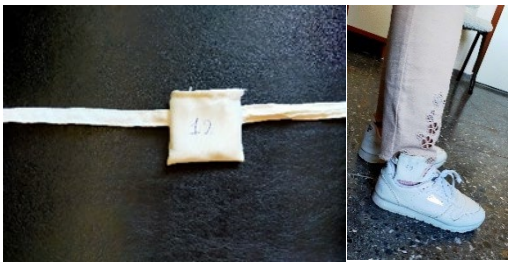

Figure 2. The vessel prepared for the pedometer and how to use it

Statistical Analysis

The analysis was performed using the SPSS 20 (IBM Corp., Armonk, NY, USA) analysis program. Descriptive statistics, with the mean, standard deviation and median values, are given. To determine the required sample size for the study, the G* Power (G* Power, version 3.0.10; Franz Faul, Kiel University, Germany) software package was used (Faul et al., 2007) The power of the study, in the study conducted by Pedrosa, it is stated that 22 patients and control groups should be included in the groups with 95% power and a 0.93 effect size based on the effect size of the pedometer value (Pedroso et al., 2018)

The Mann–Whitney *U* test was used for comparing mean scores in the two groups (step number, MMSE and age). Correlations between the dependent variables were evaluated using Spearman's correlation analysis (Pedroso et al., 2018). To determine whether the data had a normal distribution,

skewness and kurtosis were assessed. The statistical significance level was $p < 0,05$ (Neely et al., 2003).

RESULTS

The results revealed a significant between-group difference in the MMSE scores and median step number ($p < 0.05$, Table 1). Man-Whithney U analysis revealed no significant correlation between the participant's age and step number and MMSE score and step number ($p > 0.05$, Table 2).

Table 1. *General characteristics of the control and AD group and averages and standard deviations in the cognitive evaluation.*

	AD Group (*N* = 20) $\bar{X}\pm S$	**Control Group (*N* = 15) $\bar{X}\pm S$**	***p***
Age	72±5.34	68.13±6.22	0.151
MMSE	21.85±1.57	27.60±2.29	**0.000***
Step number	3910.26±2409.84	6158.04±1725.73	**0.006***
Step number median value	3512	6510	

AD: Alzheimer's disease; MMSE: Mini-Mental State Exam; SS: Standart Error; Mann–Whitney *U* test.

Table 2. *Correlation analysis results of MMSE scores and step numbers in the control and AD groups.*

			MMSE	**Age**	**Step Number**
MMSE	AD Group	r		0.099	-0.087
		p		0 .667	0.716
	Control	r		0.036	-0.138
		p		0.667	0.625
Age	AD Group	r	0.099		-0.087
		p	0 .667		0.625
	Control	r			0.198
		p			0.480
Step Number	AD Group	r	-0.189	-0.087	
		p	0.426	0.716	
	Control	r	-0.138	0.198	
		p	0.625	0.480	

AD: Alzheimer's disease; MMSE: Mini-Mental State Exam; Correlation analysis, $p < .05$.

DISCUSSION

Cognitive Function

In a systematic review, Pedroso et al. compared the results of electroencephalographic examinations of elders with and without AD and reported that those with AD had a longer latency time (416 m/s) than those without AD (375 m/s) (Hart et al., 1992; Pedroso et al., 2012). In another study, the MMSE scores of older individuals with AD were lower than those of elders without dementia (The findings of our study were in agreement with those in the literature in terms of the MMSE scores of the AD and control groups. In terms of step number, the number was lower in the AD group than in the control group.

Physical Activity

Despite many reports of reduced physical activity among those with AD (Tudor-Locke et al., 2009), anecdotal evidence from caregivers suggests that individuals with AD seem unable to remain still and that they are much more active than elders without AD. In the literature, there is noteworthy evidence that older individuals and individuals with chronic illnesses have fewer step numbers per day. The step number per day was 2,000–9,000 in geriatric individuals and 880–1,200 in individuals in the special population (breast cancer, diabetes mellitus etc.) (Jia et al., 2019). The median step number per day was 3,500–5,500 in individuals with chronic illnesses (Tudor-Locke et al., 2009). In a study by Tudor et al., the median step number of older individuals without dementia was 6,154 steps/day (Jia et al, 2019). A previous

study reported that physical activity levels and step numbers, as assessed by a pedometer, elders with mild AD were lower than those of elders without dementia (Tudor-Locke et al., 2011). Lima et al. evaluated the physical activity levels of AD patients and stated that their step number was lower than control group (4,400 steps) (Lima et al., 2010). In a previous study on physical activity levels in an older population, it was observed that the number of steps improved when using the step counter and decreased when the it was not used (Christofoletti et al., 2011). In our study, no significant results were found in the correlation analysis between the number of steps and MMSE. We think that the reason for this is the inclusion of mild and moderate Alzheimer's patients in our study. The other reason is, we motivated the patients in the AD group to increase their step number by explaining that "when you take too many steps, higher numbers will come out. This result will show that you are doing well". In our study, we evaluated cognitive function and physical activity levels in AD group versus that in the control group. In study, the median step number in the AD group was 3,512 steps/day (Table 1). The median step number of the elders without dementia was 6,510 steps/day, which is in agreement with the literature (Tudor-Locke et al., 2011). The step number in the AD group in our study was lower than that in the control group.

A previous study reported that activity levels decreased after the age of 50 years (Snyder et al., 2011; Kanat, 2006). In contrast to the literature, we found no significant difference association between age and step number. This finding is thought to stem from the age difference of the older populations of the US and western societies (Christofoletti et al., 2011). Aging populations in western cultures have greater awareness of physical activity than our society. In Turkey, awareness of the importance of physical activity among elders has increased only recently.

Considering AD and its symptoms, in our study, it was revealed once again that these patients were difficult to receive evaluations and communicate by phone. At the same time, this result represents a limitation of the study. The fact that the participants performed the activity remotely was a limitation of the present study. In AD patients, face-to-face physiotherapy and physical activity practice sessions can help to enhance physical activity level.

Limitations of the Study

This study has some limitations. AD patients generally live alone. Since their vision problems were not taken into account, they had difficulty reading the numbers on the pedometer. Afterwards, help was requested from his/her relatives.

CONCLUSION

Based on the results obtained in this study, we conclude that older individuals with mild-to-moderate AD who have cognitive and functional impairment exhibit decreased physical activity. There are several studies demonstrate the protective effect of PA on brain health. The existing evidence shows that rates of dementia could be reduced, if people were physically active (Calamia et al., 2018). Current evidence supports PA's short and long term cognitive benefits, regardless of age.

Statement of Research and Publication Ethics

This study was prepared in accordance with the rules of scientific research and publication ethics (with Necmettin Erbakan University Non-Pharmaceutical and Medical Device Research 2017/860. Ethics Committee Approval Certificate dated 10/05/2017 and numbered 2017/860).

Authors' Contributions to the Article

Author 1's contribution to the article is 50%, Author 2's contribution to the article is 20%, and Author 3's contribution to the article is 30%.

Declaration of Interest

There is no conflict of interest arising from the study on the part of the authors or third parties.

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