


## The effect of physical activity on sleep quality in the older adults in nursing homes

### *Huzurevlerinde yaşayan yaşlı bireylerde fiziksel aktivitenin uyku kalitesi üzerine etkisi*

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#### ABSTRACT

**Aim:** The aim of this study was to determine the relationship between physical activity and sleep quality in older adults living in nursing homes.

**Materials and Methods:** The study involved 456 elderly participants who were living in the nursing homes. Their demographics were noted with the face-to-face interview method. The levels of daytime sleepiness (Epworth Sleepiness Scale), physical activity (International Physical Activity Questionnaire) and sleep quality (Pittsburgh Sleep Quality Index) of the older adults were evaluated.

**Results:** The individuals were scored and grouped based on their levels of physical activity. No significant differences were observed between the groups in terms of sleep quality ( $p = 0.41$ ). However, a statistically significant difference was observed between the groups in terms of daytime sleepiness ( $p < 0.001$ ). A statistically significant, poor relationship was identified in the negative direction between the level of physical activity and daytime sleepiness ( $r = -0.16$ ,  $p = 0.03$ ). A statistically significant, poor relationship was observed in the negative direction between the level of sleep quality and daytime sleepiness ( $r = 0.20$ ,  $p < 0,001$ ).

**Conclusion:** In the older adults, daytime sleepiness is associated with the levels of physical activity. Additionally, there are no relations between the sleep quality and level of physical activity. Daytime sleepiness is listed as one of the reasons of low physical activity levels in the older adults. Daytime sleepiness should also be inquired for the assessment of physical activities.

**Keywords:** Aged, physical activity, sleep, nursing homes.

#### ÖZ

**Amaç:** Bu çalışmanın amacı, huzurevinde yaşayan 65 yaş ve üzeri yaşlı bireylerin fiziksel aktivite ile uyku kaliteleri arasındaki ilişkiyi değerlendirmektir.

**Gereç ve Yöntem:** Çalışmaya huzurevlerinde yaşayan toplam 456 yaşlı birey dahil edildi. Karşılıklı görüşme yöntemiyle demografik bilgileri kaydedildi. Yaşlıların gündüz uykululuğu (Epworth Uykululuk Skalası), fiziksel aktivite düzeyi (International Physical Activity Questionnaire) ve uyku kalitesi (Pittsburgh Uyku Kalitesi İndeksi) değerlendirildi.

**Bulgular:** Bireyler fiziksel aktivite düzeyine göre puanlanarak gruplandırıldı. Uyku kalitesi açısından gruplar arasında anlamlı fark görülmemiştir ( $p = 0,41$ ). Gündüz uykululuğu açısından ise gruplar arasında istatistiksel olarak anlamlı fark saptanmıştır ( $p < 0,001$ ).

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*Fiziksel aktivite düzeyi ile gündüz uykululuğu arasında istatistiksel açıdan negatif yönde, zayıf, anlamlı bir ilişki olduğu saptanmıştır (r = -0,16, p = 0,03). Uyku kalitesi ile gündüz uykululuğu arasında istatistiksel açıdan negatif yönde, zayıf, anlamlı bir ilişki olduğu saptanmıştır (r = 0,20, p <0.001).*

**Sonuç:** Yaşlı bireylerde gündüz uykululuğu bireylerin fiziksel aktivite düzeyi ile ilişkilidir. Bununla birlikte uyku kalitesi ile fiziksel aktivite düzeyi arasında ilişki yoktur. Gündüz uykululuğu yaşlı bireylerde düşük fiziksel aktivite düzeyi nedenleri arasındadır. Fiziksel aktivite değerlendirmelerinde gündüz uykululuğunun da sorgulanması gerekmektedir.

**Anahtar Sözcükler:** Yaşlı, egzersiz, uyku, bakımevleri.

## INTRODUCTION

The elderly population in Turkey is gradually increasing just like the trend observed around the world. With the increase in average life-expectancy, old age-related diseases are increasing in prevalence. As known, at old ages, people retire, draw away from the social life and daily chores, and move less. However, leading a physically active life is even more critical in this period, just like it is in all age groups. It is clear that physical activity is important in preventing chronic diseases and premature death (1). Exercise is important in the improvement and development of both the physical and emotional well-being of individuals (2). Physical activity is defined as all physical movements resulting in energy consumption (daily activities such as housework, cleaning etc.) (3). Today factors such as the pace of urbanization, overpopulation, increasing poverty, rising crime rates, density of traffic, air pollution, inadequacy of parks, walking paths, exercise and resting areas have a negative impact on the levels of physical activity of individuals (4). The relationship between physical activity and sleep quality has been investigated in many studies. Although studies report the positive influence of physical activity and exercise on sleep quality, there are also studies that do not support this hypothesis (5, 6).

Sleep disorders are among the most significant problems affecting the older adults. The sleep quality of the older adults has become the area of focus for many researchers in the past years. The studies carried out show that many factors may affect sleep quality (6). Physical activity is a factor that contributes to the well-being of the older adults, is a necessity for the quality of life and prevents many chronic diseases (7). It was observed that physical activity and exercise were related to higher quality sleep and less sleep disorders in healthy adults. Poor sleep quality and abnormal sleep durations (over or under 7-8 hours a day) were identified as being associated

with morbidity and mortality (8). It was seen that exercising for more than one hour a day is associated with a longer duration of sleep and that low-intensity exercises had a positive influence on sleep (8). The sleep disorders in the older adults are related to an inactive lifestyle. It was seen that older adults, who exercise regularly, have higher quality sleep and experience less sleep-related problems (5-7). In the literature, there are a few studies that investigate the relationship between physical activity and sleep. In Turkey, different studies have been conducted for determining the levels of physical activity and sleep quality; however the correlation between these two parameters is yet to be clarified. Thus, this study was carried out in order to determine whether the level of physical activity is related to sleep quality.

## MATERIALS AND METHODS

### Study Population

The study was conducted in four nursing homes located within the borders of İstanbul between March 2018 and April 2019. The cross-sectional and prospective study involved 456 elderly participants (204 female and 252 males) in nursing homes.

Participants who scored 23 or lower from the Standardized Mini-Mental State Examination; who use orthotic or prosthetic aids; who were diagnosed with a sleeping disorder; who have neurological, musculoskeletal or cardiopulmonary diseases; who are younger than 65 years and have had a history of operations, fractures and trauma in the past six months; who have uncontrolled hypertension; who have obesity or are recovering from an acute illness were excluded from the study. Standardized Mini Mental State Examination scores and personal backgrounds of the individuals were collected from their files. As the individuals were being divided into the groups, gender, age and body mass index were among the variables taken into consideration.

### Assessment of sleep quality

Pittsburgh Sleep Quality Index (PSQI) was used to assess the sleep quality. PSQI was developed by Buysse et al. in 1989 (9). Validity and Reliability studies were carried out by Ağargün et al. (10). PSQI provides a reliable, valid and standard measurement of sleep quality. The scale consists of 24 questions in total. The total score is between 0 – 21. The level of quality is classified as good sleep quality (0 – 4 points) and poor sleep quality (5 – 21 points) (9).

### Assessment of physical activity levels

For the assessment of physical activity levels, the International Physical Activity Questionnaire (IPAQ) was used. IPAQ is a community-based questionnaire that allows the duration of different levels of physical activity for the past week. There are four sections in the questionnaire (high intensity physical activity, medium intensity physical activity, walking and sitting down). The data in the assessment are analysed by being translated into metabolic equivalent (MET) values (11).

#### IPAQ Continuous Score

Expressed as MET-min per week: MET level x minutes of activity x events per week

Total MET-min/week = (Walking METs\*minute\*days) + (Moderate intensity METs\*minute\*days) + Vigorous intensity METs\*minute\*days)

Physical activity levels are classified as physically inactive (<600 MET - min/week), low levels of physical activity (minimally active) (600 – 3000 MET - min/week) and a healthy level of physical activity (very active) (>3000 MET - min/week) (11-14).

### Assessment of daytime sleepiness

Epworth Sleepiness Scale (ESS) was used for the assessment of daytime sleepiness. ESS is a scale that quantifies the level of sleepiness experienced by the individual during their daily activities. An individual may get a score from 0 to 24. Individuals with a score of 10 or more are deemed to have “increased daytime sleepiness” (15, 16). Validity and reliability studies were performed on the Turkish version (17).

### Statistical analysis

The mean and standard deviation of the data measured were calculated, the ones determined by census were indicated in numbers and

percentages. Variance analysis (ANOVA) was used for the comparison of IPAQ, PSQI and ESS scores and Pearson Correlation Analysis for investigating the relationship between sleep quality and daytime sleepiness. After the measurements are divided into groups, Bonferroni correction was used to determine which group is the cause of the difference. The confidence interval was assumed to be 95% and probability of error as  $p < 0.05$ .

## RESULTS

The study involved 456 elderly participants (252 females and 204 males). The mean age of the elderly people interviewed was  $78.29 \pm 6.51$ . Of them, 55.3% were female. The mean body mass index (BMI) of the elderly participants was  $25.26 \pm 3.04$ ,  $\text{kg/m}^2$ . There was no statistically significant difference between physical activity level and gender, age, body mass index and sleep quality. However, a statistically significant difference was found between physical activity level and daytime sleepiness. ( $p = 0.04$ ) (Table-1).

Mean PSQI score and mean sleep duration per night according to the characteristics and lifestyles of the participants were shown in Table-2. However, no statistically significant differences were observed between the groups in terms of PSQI scores ( $p > 0.05$ ). There were no statistically significant differences between ESS scores and gender, age, body mass index and sleep quality ( $p > 0.05$ ). When the individuals were grouped in accordance with their levels of physical activity, a statistically significant difference was observed between the groups in terms of ESS scores ( $p = 0.01$ ) (Table-3).

When the individuals were grouped in accordance with their IPAQ scores, no significant differences were observed between the groups in terms of sleep quality ( $p = 0.41$ ). However, when the groups were compared in terms of daytime sleepiness, a statistically significant difference was observed between the groups ( $p < 0.0001$ ) (Table-4). When the Bonferroni correction is carried out to determine which group is the cause of the variance between levels of physical activity and daytime sleepiness of the individuals, it was seen that this difference was between the minimally active and very active groups ( $p = 0.01$ ). It was also determined that the mean ESS score of the minimally active group was significantly higher than the mean ESS score of the very active group (95% Confidence interval = 0.58 - 4.42) (Table-5).

**Table-1.** Total IPAQ scores and duration of sitting down of the participants.

Characteristics	n	Total IPAQ score Mean ± SD	p	Duration of sitting down** Mean ± SD	p
<b>Gender</b>					0.59
Female	252	1867.1 ± 1605.9	0.39	7.1 ± 2.7	
Male	204	2129.8 ± 3247.8		6.9 ± 1.2	
<b>Age group, years</b>					0.59
65-74	124	2445.1 ± 3769.1	0.19	7.1 ± 2.9	
75-84	256	1831.1 ± 1765.4		7.0 ± 3.1	
≥85	76	1756.3 ± 1720.2		7.2 ± 2.8	
<b>BMI, kg/m<sup>2</sup></b>					0.69
≥25	256	1931.4 ± 2841.6	0.71	6.6 ± 3.1	
<25	200	2061.4 ± 1920.1		6.5 ± 2.9	
<b>Daytime sleepiness</b>					0.21
No	106	2159.4 ± 2721.3	<b>0.03*</b>	6.4 ± 3.1	
Yes	350	1401.2 ± 1269.5		7.1 ± 3.2	
<b>Sleep quality</b>					0.52
Poor	220	2029.9 ± 3069.5	0.78	7.1 ± 3.1	
Good	236			6.6 ± 3.2	

BMI, Body mass index; \*p <0.05; \*\* hours/day; IPAQ, International physical activity questionnaire, SD, standard deviation.

**Table-2.** PSQI scores and sleep duration per night of the participants.

Characteristics	n	PSQI score Mean ± SD	p	Sleep duration per night* Mean ± SD	p
<b>Gender</b>			0.08		0.39
Female	252	5.6 ± 3.6		7.1 ± 1.5	
Male	204	5.1 ± 3.4		6.9 ± 1.7	
<b>Age group, years</b>			0.19		0.51
65-74	124	6.1 ± 4.1		6.9 ± 1.4	
75-84	256	5.1 ± 4.2		7.0 ± 1.6	
≥85	76	5.3 ± 3.4		7.4 ± 1.8	
<b>BMI, kg/m<sup>2</sup></b>			0.41		0.41
≥25	256	5.4 ± 3.6		6.9 ± 1.6	
<25	200	5.1 ± 3.5		7.3 ± 1.8	
<b>Daytime sleepiness</b>			0.07		0.61
No	106	6.1 ± 3.9		6.9 ± 1.7	
Yes	350	5.1 ± 2.9		6.8 ± 1.8	
<b>Level of physical activity</b>			0.41		0.61
Inactive	92	6.2 ± 4.1		6.8 ± 1.8	
Minimally active	286	5.1 ± 4.2		6.4 ± 1.6	
Very active	78	4.9 ± 2.9		6.5 ± 1.3	

\*hours/day; BMI, Body mass index; PSQI, Pittsburgh Sleep Quality Index; SD, standard deviation.

**Table-3.** ESS scores of the participants.

Characteristics	n	ESS score Mean ± SD	p
<b>Gender</b>			0.19
Female	252	7.13 ± 4.96	
Male	204	6.43 ± 4.01	
<b>Age group, years</b>			0.91
65-74	124	7.12 ± 5.13	
75-84	256	7.17 ± 5.63	
≥85	76	7.44 ± 5.02	
<b>BMI, kg/m<sup>2</sup></b>			0.07
≥25	256	7.46 ± 5.26	
<25	200	6.12 ± 4.61	
<b>Level of physical activity</b>			<b>0.01*</b>
Inactive	92	7.16 ± 5.13	
Minimally active	286	7.29 ± 5.09	
Very active	78	6.21 ± 4.87	
<b>Sleep Quality</b>			0.07
Poor	200	7.14 ± 5.18	
Good	256	6.82 ± 5.09	

\*p<0.05; ESS, Epworth Sleepiness Scale; SD, standard deviation; BMI, Body mass index.

**Table-4.** Comparison of IPAQ scores with sleep quality and daytime sleepiness.

Source of the variance	Sum of squares	Degree of freedom	Mean of squares	D	P*
Daytime sleepiness	206.36	2	112.64	6.64	<b>0.01**</b>
Sleep quality	24.48	2	14.96	1.24	0.41

\*For ANOVA; p <0.05; \*\*Statistical difference between groups; IPAQ, International physical activity questionnaire.

**Table-5.** Investigation of the difference between level of physical activity and daytime sleepiness.

	Average difference ± SD	p*	95% confidence interval
<b>Inactive</b>			
Minimally active	-0.19 ± 0.81	1.00	-1.96 - 1.64
Very active	2.31 ± 0.89	0.07	-0.06 - 4.61
<b>Minimally active</b>			
Inactive	0.18 ± 0.82	1.00	-1.64 - 1.96
Very active	2.46 ± 0.78	<b>0.02**</b>	0.62 - 4.38
<b>Very active</b>			
Inactive	-2.32 ± 0.88	0.07	-4.63 - (-0.62)
Minimally active	-2.48 ± 0.78	<b>0.02**</b>	

\*For Bonferroni correction; p <0.0167; \*\*Statistical difference between groups, SD, standard deviation.

A significant correlation was not observed between the physical activity level scores and sleep quality scores of the individuals ( $r = -0.28$ ,  $p = 0.72$ ). A statistically significant, poor relationship was identified in the negative direction between the physical activity and daytime sleepiness scores ( $r = -0.16$ ,  $p = 0.03$ ). A statistically significant, poor relationship was observed in the positive direction between the parameters when sleep quality and daytime sleepiness scores were examined ( $r = 0.18$ ,  $p < 0.0001$ ).

## DISCUSSION

Physical activity is defined as all kinds of bodily motion causing the skeletal muscles to contract and the energy consumption to increase significantly. Physical activity does not require supervision and is performed at a lower intensity than exercise (3). It is known that physical activity both helps in controlling the body weight and by other mechanisms, decreases the risk of developing chronic diseases. It was reported that physical activities have a positive impact on balance, endurance, sleep, social life, emotional state and mental functions of the older adults (18).

In the study carried out by Lee et al. (19) on 216 individuals, it was determined that the total IPAQ scores of males were higher than the scores of females. In another study conducted by Deng et al. (20) on 224 individuals with a mean age of 65 years and above, the physical activity level of males was shown to be lower than females, but no significant differences were observed between two groups. This was attributed to the fact that statistically mean age of females was lower than males. Our result is in accordance with Lee et al.'s study, the total IPAQ scores of males were higher than the scores of females, although not at a significant level. The reason for this may be that women living in a nursing home in our country are less physically active, as they go out less than men.

Sleep quality and daytime sleepiness are important parameters affecting the sleep and wakefulness function. The process of ageing causes many changes on sleeping patterns. The increase observed in sleep-related problems by age affects the quality of life in the older adults. Nevertheless, depending on poor quality of life, sleep-related problems constitute a risk factor, especially in the older adults, and there is a strong connection between sleep-related problems and premature death (7).

Another parameter affecting the quality of life in the older adults is exercise. The influence of exercise on sleep has been investigated for many years. The studies on this subject matter are contradictory (21). Twenty-nine studies concluded that exercise had a positive effect on sleep quality or duration; however, four found no difference, and one reported that exercise had a negative effect on sleep. It was reported that this could be attributed to the methodological differences between studies, the difference in the physical activity levels of the individuals, limited number of individuals being placed in the control group of some studies or lack of control groups and individuals mainly with a good sleeping pattern being enrolled in the studies (21). In our study, no significant correlation was observed between the physical activity levels and sleep quality of the individuals. We believe that this result is attributable to the fact that more active older adults in the institution participated in the study and physical activity level and sleep quality were measured subjectively.

In the study carried out by Willette-Murphy et al. (22) on 68 individuals with a mean age of 64.15, PSQI score of the physically active group was measured as  $6.0 \pm 3.9$  and inactive group as  $5.8 \pm 3.0$ ; and concluded that the difference was not statistically different. In our study, PSQI score of the very active group was shown to be  $5.1 \pm 3.0$  and inactive group  $5.8 \pm 3.4$ , and these two scores were similar.

In the study carried out by Watson et al. (23) on 3403 individuals the average PSQI score was measured as  $4.9 \pm 2.6$ . The result obtained with our study are similar to the results found in the literature.

In the study carried out by Fatima et al. (24) in a nursing home included 400 individuals over the age of 60, and it was determined that 82.6% of the individuals had poor sleep quality and 29.2% had excessive daytime sleepiness. However, in our study, 48.2% of the individuals had poor sleep quality and 76.8% excessive daytime sleepiness. When the sleep quality scores and daytime sleepiness scores of the individuals were examined, a statistically significant, poor relationship was identified in the negative direction between the parameters. With this result, it was concluded that an increase in sleep quality may cause a decrease in daytime sleepiness.

In the study carried out by He et al. (25) daytime sleepiness of 26 older adults was measured. In this study utilizing ESS, a significant difference was observed between the daytime sleepiness of the physically active and inactive older adults, and it was identified that the older adults with a higher level of physical activity had a lower ESS score as compared to the ones with lower levels of physical activity.

In the study carried out by Baron et al. (26), it was indicated that 85% of the individuals with low levels of physical activity experienced daytime sleepiness, whereas 72% of the individuals with high levels of physical activity did not. A correlation between daytime sleepiness and low levels of physical activity was observed. In our study, the mean ESS score of the minimally active group was significantly higher than the very active group ( $p = 0.01$ ). It was also determined that the mean ESS score of the minimally active group was significantly higher than the mean ESS score of the very active group (95% Confidence interval = 0.58 - 4.42)

## CONCLUSION

In conclusion, with the determination of the relationship among physical activity level,

daytime sleepiness and sleep quality, studies should be planned to increase the physical activity level of older adults in nursing homes. In this way, it is thought that older adults can be protected from daytime sleepiness and their sleep quality can be increased.

It should also be noted that daytime sleepiness may be one of the reasons of low physical activity levels in older adults. Therefore, daytime sleepiness should be questioned in the assessment of physical activity level of the elderly. More studies are needed on this subject. It is believed that this study will provide insight to future studies.

## Ethical standards

The research protocol was approved by the local ethics committee on February 12, 2020 (Approval Number: 54022451-050.05.04-1993). Each participant was informed about the study and signed a consent form.

## Conflict of interest

The authors declare that they have no conflict of interest.

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