

Physical Activity Improves Sleep Quality in Nursing Homes Elderly

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Abstract

Background: Sleep disorders is one of the most important problem in older adults.

Objective of the Study: Physical activity improves sleep quality in nursing homes elderly.

Methods: The subjects of this study were 119 elderly people over the age of 65 living in nursing homes in Tehran. The demographic characteristics of the subjects were collected and recorded. Then, body composition, blood pressure and anthropometric indices including weight, body mass index [BMI], height and calf circumferences [CC], waist circumferences [WC] and hip circumferences were measured using a digital scale of OMRON, OMRON M2 blood pressure monitor and meter tape. Physical activity and sleep quality were measured by Physical Activity Scale for the Elderly (PASE) and the Pittsburgh Sleep Quality Index (PSQI) respectively.

Results: The results of Pearson correlation showed that there was a significant inverse relationship between ages with sleep quality ($p < 0.003$) and its subunits (Subjective ($p < 0.017$), Latency ($p < 0.000$), Disturbance ($p < 0.020$), Dysfunction ($p < 0.026$)). But there was a direct and significant relationship between physical activity levels with sleep quality ($p < 0.003$) and its subunits (Subjective ($p < 0.000$), Latency ($p < 0.000$), Disturbance ($p < 0.000$)). Besides, there was a positive and significant relationship between diastolic blood pressure and sleep subjective ($p < 0.024$). Non-pharmacological and cost-effective solution.

Conclusion: According to the findings of this study physical activity can use as a non-pharmacological and cost-effective solution to improve sleep quality and prevent its complications in elderlies.

Keywords: Sleep Quality; Sedentary; Older Adults; Life Style; Physical Activity

The aging period is associated with gradual changes in the metabolic activities and a decrease in the capacity of the cells to maintain homeostasis [1,2]. Thus, aging can be defined as a result a wide ranges of cellular and molecular damages over the times, which is associated with numerous disorders in the physiological processes of the body [3]. According to the World Health Organization (WHO), the population of people over 60 years old was reported to 900 million people in 2015 and it is predicted that until the year 2050, this number will reach to more than two billion people [4]. The growing trend of the elderly population in Iran has been associated with many concerns related to the health community. Regarding the Statistics Center of Iran, in 2019, 8 million people (About 9.9%) of the country's population were included the people over 60 years old; It is also estimated that this figure will reach to about 26 million people (About 26%) by 2050 [5].

On the other terms, Geriatric Syndrome (GS) includes a set of disorders which it is involved the dementia, fall, decreased sleep quality level, urinary incontinence and also it is reported that about half of the elderly people over 60 years old have symptoms of Geriatric Syndrome [6-8]. In the meantime, the onset time and severity of GS are influenced by different factors such as lifestyle (Physical activity and food dietary) social and economic status, as well as living environment [8-10].

Recent studies have shown sleep is a vital physiological process and plays an important role in human physical and mental health [11,12]. Any disorders in the sleep quantity or quality can have significant negative impacts on the mental and physical functioning of individuals. Studies have shown that about 30 to 45% of the world's population suffers from sleep disorders, and many factors such as age, gender, physical and mental health, job and social class of individuals can be involved in the development of sleep disorders [13,14]. The growing evidence shows that decreased sleep quality levels are one of the most serious problems of the elderly people. Also, epidemiological studies show that more than 57% of the older adult have poor sleep quality and only 12% of them have good sleep quality [15].

On the other hand, Ohayon, *et al.* have reported a prevalence of sleep disorders in the elderly living in nursing homes over more than 75% [16]. Decreased sleep quality can have consequences such as fall, decreased life expectancy, chronic fatigue, cognitive and physical dysfunction, social problems, decreased quality of life, and increased elderly mortality [17]. Sleep disorders are also associated with decreased immune system function, dysfunction of the hypothalamus, pituitary and adrenal glands, increased blood pressure, and cardiovascular disease [18].

Studies indicate that the majority of elderly often use sleeping pills to improve sleep quality. However, due to the side effects and short-term effects of these drugs on sleep quality, cannot be used as a safe approach to prevent and treat of sleep disorders in the elderly [19]. In addition, the role of physical activity and regular exercise in the prevention and treatment of many diseases, especially aging disorders, has been reported in our previous studies [6,8,10,20].

Gerontology researchers have stated that regular physical activity can play an effective role in improving the quality of life, chronic diseases, sleep quality of the elderly and other groups by many mechanisms [6,10,21]. In fact, contrary to popular belief that sleep and physical activity are separate behaviors which are controlled by different physiological mechanisms and have not any influence on each other and the evidence showed that there is a positive relationship between physical activity and sleep quality levels [22]. In a longitudinal study in 2012 was reported that an active lifestyle and a reduction in sedentary behaviors are important factors to improving the sleep quality of in the elderly [22]. Beside, in comparison with sleep quality between active and inactive men, Kamrani, *et al.* (2014) were concluded that the level of sleep quality in the active group of men is significantly higher [23].

Regarding to the effective role of sleep quality on physical function and mental health of the elderly and the importance of different factors such as physical activity and exercise, affecting on it and the lack of research in this field in nursing homes in Iran, the objective of the present study was to investigate the relationship between physical activity with sleep quality in nursing homes in Tehran City.

Methods

Subjects and study design

The present study based on cross-sectional method in terms of questionnaire design was performed from October to December 2018 in 10 nursing homes in Tehran City. The sample size was calculated 131 people with a confidence interval of 0.95% using Cochran's formula. About 131 elderly people over 60 years old were voluntarily announced their readiness to participate in the study which after the conducted surveys based on inclusion and exclusion criteria, about 119 people of them (33 men and 86 women) who were eligible to participate in the test, as a result were selected as the final sample. After acquiring the necessary permits to conduct the research, written

and informed consent was obtained from the individuals. In addition, the subjects were assured that their responses would be applied for the purposes of the research.

Inclusion and exclusion criteria

The inclusion criteria were: the people over 65 years old, staying in a nursing home for more than 90 days and lack of severe dementia or Alzheimer. Also, having any contagious disease and infection, body mass index was lower than 17 and inability to conduct interviews, were the exclusion criteria of this study.

Data collection

The general assessment was performed using a demographic questionnaire that was included educational and married status, medical characteristics, diseases and symptoms. Then anthropometric and body composition indices including height, waist circumference, pelvic circumference and weight were measured and recorded. Height and weight were measured respectively using a tape measure and a digital scale of the OMRON model with an accuracy of 0.1 kg and with a minimum of clothing. In addition, waist circumference and pelvic circumference were measured and recorded using a tape measure. Waist to pelvic ratio (WHR) was calculated by dividing the waist circumference to the pelvis circumference. BMI was also calculated using the weight formula (kg)/height squared (M). Also, blood pressure of the subjects was measured and recorded after sitting for ten minutes at rest status and using the OMRON M2 blood pressure device and from the left hand.

Sleep quality assessment

The Pittsburgh Sleep Quality Questionnaire (PSQI) was used to assess the level of sleep quality. This questionnaire consists of 18 questions that assess the level of sleep quality in eight scales which are as follows: Subjective sleep quality, Sleep latency, Sleep duration, Habitual sleep efficiency, Sleep disturbances, use of sleeping medication, Daytime dysfunction and total score. A higher score in this questionnaire indicates a lower level of sleep quality in individuals. Scores equal to or higher than 5 indicate the poor sleep quality of individuals. This questionnaire has an appropriate validity and reliability (Cronbach's alpha coefficient: 0.83) in the Iranian population [24].

Physical activity assessment

The Physical Activity Scale for the Elderly Questionnaire (PASE) was used to assess the physical activity level of the elderly. This questionnaire consists of 13 questions and 4 sections of physical activity level that assess the Leisure Activity Component, Housework Activity, Work-Related Activity and total score. The validity and reliability of this questionnaire has been approved in the Iranian population (Cronbach's alpha coefficient: 0.97) [25].

Statistical analysis

The Kolmogorov-Smirnov test was used to evaluate the normality of the data. Also, the assessment of correlation between the variables was performed using Pearson correlation coefficient. In addition, the independent T-test was used to evaluate the differences of the data between the groups of low sleep quality and normal sleep quality. Statistical analysis of data was performed using SPSS software version 21 at a significant level of $p < 0.05$.

Results

The characteristics of the subjects are shown in table 1. The mean age of subjects was 74.17 ± 8.67 .

Variables		Mean ± SD	N (%)
Age (year)		74.17 ± 8.67	
Height (cm)		154.75 ± 10.53	
Weight (kg)		62.03 ± 13.23	
WHR		0.90 ± 0.075	
BMI (kg/m ²)		26.82 ± 6.41	
SBP (mmHg)		135.22 ± 24.36	
DBP (mmHg)		82.59 ± 14.72	
PASE score		37.85 ± 49.16	
SQ score		7.48 ± 3.40	
Education	Not literate		28 (23.53%)
	Primary school		31 (26.05%)
	Middle school/ diploma		42 (35.29%)
	bachelor		13 (10.92%)
	Master/PHD		5 (4.20%)

Table 1: General, anthropometrical and physiological indices of subjects.

WHR: Waist to Hip Ratio, BMI: Body Mass Index, SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, PASE: Physical Activity Scale for Elderly, SQ: Sleep Quality.

The results of Pearson correlation showed that there was a significant inverse relationship between ages with sleep quality ($p < 0.003$) and its subunits (Subjective ($p < 0.017$), Latency ($p < 0.000$), Disturbance ($p < 0.020$), Dysfunction ($p < 0.026$)). But there was a direct and significant relationship between physical activity levels with sleep quality ($p < 0.003$) and its subunits (Subjective ($p < 0.000$), Latency ($p < 0.000$), Disturbance ($p < 0.000$)). Besides, there was a positive and significant relationship between diastolic blood pressure and sleep subjective ($p < 0.024$) (Table 2).

		SQ score	Subjective	Latency	Duration	Efficiency	Disturbance	Medication	Dysfunction
Age (year)	R	0.272**	0.218*	0.321**	0.037	0.025	0.214*	-0.058	0.204*
	P	0.003	0.017	0.000	0.692	0.786	0.020	0.529	0.026
WHR	R	0.041	0.051	0.075	0.056	0.147	0.045	0.031	-0.107
	P	0.657	0.579	0.418	0.547	0.111	0.628	0.734	0.246
BMI (kg/m ²)	R	-0.047	0.090	-0.054	0.032	0.114	-0.012	0.035	0.120
	P	0.609	0.328	0.560	0.733	0.217	0.899	0.706	0.195
Edu.	R	-0.114	-0.237**	-0.159	0.163	-0.020	-0.147	0.055	-0.114
	P	0.217	0.009	0.084	0.077	0.831	0.110	0.551	0.217
SBP (mmHg)	R	-0.114	-0.133	-0.046	0.031	0.046	-0.103	-0.153	-0.089
	P	0.219	0.150	0.619	0.736	0.619	0.266	0.097	0.338
DBP (mmHg)	R	-0.135	-0.207*	-0.136	0.023	0.019	0.026	0.032	-0.092
	P	0.144	0.024	0.140	0.807	0.838	0.783	0.733	0.321
PASE score	R	-0.274**	0.396**	-0.468**	0.175	0.054	-0.267**	0.032	-0.116
	P	0.003	0.000	0.000	0.057	0.560	0.003	0.733	0.211

Table 2: The associations between physiological and physical activity levels with sleep quality and its subunits.

SQ: Sleep Quality; WHR: Waist to Hip Ratio; BMI: Body Mass Index; Edu: Educational Status; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; PASE: Physical Activity Scale for Elderly.

*: The mean difference is significant at the 0.05 level.

**.: The mean difference is significant at the 0.01 level.

As indicated in table 3, by applying the recommended cut-off point 5 on The Pittsburgh Sleep Quality Index (PSQI) [24], participants classified as low and normal sleep quality groups. Then results of T-test show that Compared with the NSQ group, the PSQ group had a significantly higher age ($p < 0.002$). Also sleep quality subunits scores such as Subjective ($p < 0.000$), Latency ($p < 0.000$), Disturbance ($p < 0.000$), Medication ($p < 0.001$), Dysfunction ($p < 0.000$) in PSQ was significantly higher than NSQ group. Also, physical activity levels in PSQ was significantly lower than NSQ group ($p < 0.014$).

Variables	Sleep quality ≥ 5 Normal Sleep Quality (NSQ)	Sleep quality < 5 Low Sleep Quality (PSQ)	P-value
Age (year)	75.37 \pm 8.35	69.42 \pm 8.42	0.002**
Height (cm)	154.40 \pm 10.43	156.13 \pm 11.04	0.476
Weight (kg)	61.59 \pm 12.89	63.78 \pm 14.66	0.472
WHR	0.902 \pm 0.078	0.909 \pm 0.068	0.693
BMI (kg/m ²)	26.60 \pm 6.14	27.70 \pm 7.45	0.455
Education	1.43 \pm 1.12	1.58 \pm 1.02	0.546
SBP (mmHg)	133.38 \pm 24.14	142.50 \pm 24.34	0.101
DBP (mmHg)	81.29 \pm 14.25	87.71 \pm 15.74	0.056
PASE score	31.13 \pm 44.33	64.44 \pm 58.67	0.014*
Subjective	1.42 \pm 0.78	0.54 \pm 0.59	0.000**
Latency	1.88 \pm 1.15	0.83 \pm 0.87	0.000**
Duration	0.54 \pm 0.96	0.25 \pm 0.532	0.055
Efficiency	0.25 \pm 0.52	0.17 \pm 0.38	0.453
Disturbance	1.16 \pm 0.624	0.5 \pm 0.59	0.000**
Medication	2.14 \pm 1.28	1.17 \pm 1.17	0.001**
Dysfunction	1.09 \pm 0.923	0.13 \pm 0.34	0.000**

Table 3: Differences between general, physiological and sleep quality subunits between Normal and low sleep quality groups.

*: Correlation is significant at the 0.05 level (2-tailed).

Discussion

Several factors are influenced on the sleep quality of the elderly which leads to negative biological and physiological consequences [26]. These consequences include the fatigue, memory fail, attention and concentration deficit and heart dysfunction such as tachycardia [27,28]. More broadly, sleep disorders are associated with an increased risk of fall, fatigue, and weakness [27]. Also, lack of sleep or decreased sleep quality level lead to the incidence and development of destructive effects on the cognitive function of the elderly [28,29]. In addition, it has reported that sleep disorders have a direct relationship with depression, dementia, and mood changes [29,30]. On the other term, different factors such as chronic diseases including cardiovascular disease, type 2 diabetes, high blood pressure, stroke, cardiomyopathy and neurological diseases such as cognitive impairment and depression, Parkinson, consuming various medicine, change in circadian rhythm, skeletal muscle pain, osteoarthritis and physical inactivity are considered as the factors involved in sleep disorders [31,32]. In this regard, it has been reported that there is a direct relationship between heart disease, obesity, arthritis, diabetes and osteoporosis with sleep disorders [33]. The recent studies in this field have also reported that the prevalence of fall, fatigue, disability, hospitalization and premature mortality in the elderly with sleep disorder is significantly higher than the elderly with suit sleep [34].

In the present study, it was observed a significant and inverse relationship between age with total sleep quality and its subunits (subjective sleep quality, sleep latency, sleep disturbances and daytime dysfunction), also, the mean of age in the low sleep quality (LSQ) group was significantly higher than the normal sleep quality (NSQ) group. The results of many studies in this field are consistent with our findings. Miranda, *et al.* (2015) were reported that the individuals with increasing age experience more Insomnia so that its incidence amount varies greatly in different people [35]. Previous studies have shown that any change in sleep homeostasis, the circadian pacemaker, degeneration of the suprachiasmatic nucleus (SCN) which are affected on the circadian rhythms and decreased melatonin output. Mentioned factors are influenced by the increased age and lead to the incidence and development of sleep disorders and related consequences to it [35]. On the other hand, the increased age with negative changes in body homeostasis and musculoskeletal changes has led to the incidence and development of problems such as non-communicable diseases, disability and sarcopenia which is associated with decreased sleep quality [2,6,10]. In the meantime, physical activity and exercise can be used as a non-pharmacological and safe solution to mitigate these problems [36]. In fact, physical activity reduces the risk of these diseases by improving many physiological and anatomical functions and can improve the sleep quality, indirectly [37].

In the present study, it was observed a significant and inverse relationship between physical activity level with total sleep quality and its subunits (subjective sleep quality, sleep latency and sleep disturbances), also, the mean of physical activity levels in the normal sleep quality (NSQ) group was significantly higher than the low sleep quality (LSQ) group. In general, there are two pharmacological and non-pharmacological methods with extensive advantages and disadvantages for the treatment of poor sleep quality in the elderly [38]. The pharmacological method is associated with side effects and sometimes has short-term effects [39]. Beside, physical activity which is a non-pharmacological, low-risk, low-cost and available method with extensive health benefits, leads to peace of mind, optimal energy consumption, physical fatigue-related movement, and thus maintain and increase the sleep quality in the elderly [39]. According to the Centers for Disease Control and Prevention (CDC), exercise and physical activity are recognized as a safe alternative for existing pharmacological methods to improve sleep quality [40]. The results of several studies show that sleep disorder increases the risk of various diseases by reducing the body's resistance to disease and free radicals [41]. In addition, recent findings have shown that exercise is associated with a reduction in oxidative stress and inflammatory cytokines, which through immunologic changes lead to improve the immune system function and also improve the sleep quality in the elderly [42]. Moreover, in other study researchers reported that physical activity is associated with a decrease in brain-derived neurotrophic factor (BDNF), interleukin- β 1 (IL- β 1), and hyperglycemia which leads to improve overall sleep quality [43]. The results of a review study showed that physical activity with low to moderate intensity associated with improve various subunits of sleep quality and significantly increases the sleep quality level while intense physical activities generally with a delay in the onset of sleep leads to decrease sleep quality [44]. In overall, most of the researches in this area have recommended light to moderate intensity activities to improve sleep quality in the elderly. However, the people with different health conditions (Diseases and physical conditions, mental and emotional conditions and nutritional conditions) should be considered in determining the intensity and type of physical activity appropriate for the elderly. For example, the experts recommend home activities such as washing dishes, sweeping, and light activities such as stretching and walking in people who do not have enough time for regular exercise [2,45]. This issue with the increase the level of overall physical activity helps to improve sleep quality and to prevent many of the consequences of insomnia and sleep disorders.

Conclusion

The identification of potential factors that lead to decrease the sleep quality in the elderly, are influenced on the prevention, treatment and improvement of this disorder. Our study showed the promising results in order to improve sleep disorders in the elderly by increasing physical activity. Therefore, physical activity can be introduced as an effective, safe, accessible and cost-effective method with extensive benefits to improving sleep quality, functional and mental condition of the elderly. Then, encouraging the elderly people to participate more and more in sports activities is vital to maintain the individual and social health.

Limitations of the Study

Although all subjects were selected based on inclusion and exclusion criteria, but there are some limitations in this project. First, the classification of the level of physical activity according to the intensity could provide more information about the appropriate activities to improve the sleep quality of the elderly. On the other hand, factors such as economic status and history of physical activity can also affect the sleep quality which were not considered and evaluate in this study. In addition, because of the cross-sectional design, this study cannot properly illustrate cause-and-effect relationships.

Ethics Approval and Consent to Participate

The researcher ensured that participants' identity and what they said or did during research were maintained confidential. In addition, they were given a detailed explanation about the study's purpose and methods. The research protocol was approved by the Health Committee of the Information Services Corporation [Iran].

Consent for Publication

Informed consent has been obtained from all the participants.

Availability of Data and Materials

The authors confirm that the data supporting the findings of this study are available within the article.

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