The Impact of Altitude on Sleep Quality, Daily Living Activities, and Quality of Life in Elderly Residents of Turkish Nursing Homes: A Cross-Sectional Analysis*

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Abstract

Aim: This study aims to assess the influence of altitude on sleep quality, daily living activities, and quality of life among elderly residents in nursing homes located in distinct altitudinal regions within Türkiye.

Method: A cross-sectional investigation encompassed 92 voluntary elderly participants residing in nursing homes situated in both the eastern and western regions of Türkiye during the period spanning from July 2020 to January 2021. Cognitive function was evaluated through the Mini Mental State Test (MMST), while the quality of life was gauged using the World Health Organization Quality of Life Scale for the Elderly Model (WHOQOL-OLD). Daily living activities were quantified via the Barthel Index test, and daytime sleepiness was assessed using the Epworth Sleepiness Scale (ESS). The Pittsburgh Sleep Quality Index (PSQI) was employed to appraise sleep quality over a one-month period. Statistical analyses entailed Chi-square, Shapiro-Wilk, Mann-Whitney U, and Spearman tests.

Results: The data reveal a statistically significant variance in the Pittsburgh Sleep Quality Index scores among elderly residents dwelling at distinct altitudes ($p < 0.05$). The mean PSQI scores of elderly inhabitants in the eastern region were notably higher compared to their counterparts in the western region. Additionally, a statistically significant contrast was discerned in the Quality of Life Scale (WHOQOL-OLD) among elderly individuals residing at varying altitudes ($p < 0.05$). The mean WHOQOL-OLD scores for elderly residents in the eastern region were notably lower than those observed in the western region.

Conclusion: This study ascertained that elderly residents inhabiting lower-altitude regions experienced superior sleep quality compared to their counterparts in higher-altitude areas.

Keywords*:* Altitude, daily living activities, elderly, sleep quality, quality of life.

Türkiye'deki Huzurevlerinde Kalan Yaşlılarda Rakımın Uyku Kalitesi, Günlük Yaşam Aktiviteleri ve Yaşam Kalitesi Üzerindeki Etkisi: Kesitsel Bir Analiz

Öz

Amaç: Bu çalışmanın amacı, Türkiye'nin farklı rakım bölgelerinde bulunan huzurevlerinde ikamet eden yaşlı bireylerde rakımın uyku kalitesi, günlük yaşam aktiviteleri ve yaşam kalitesi üzerindeki etkisini sistematik olarak değerlendirmektir.

Yöntem: Bu kesitsel araştırma, Temmuz 2020 ile Ocak 2021 tarihleri arasında Türkiye'nin doğu ve batı bölgelerinde yer alan huzurevlerinde yaşayan 92 gönüllü yaşlı bireyi kapsamaktadır. Bilişsel işlevler Mini

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ETHICAL STATEMENT: This study was carried out with the approval of the Ethics Committee of Halic University, dated 26/06/2020 and numbered 115-01 A signed subject consent form in accordance with the Declaration of Helsinki was obtained from each participant.

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Mental Durum Testi (MMST) ile değerlendirilmiştir. Yaşam kalitesi Dünya Sağlık Örgütü Yaşlılar İçin Yaşam Kalitesi Ölçeği (WHOQOL-OLD), günlük yaşam aktiviteleri Barthel İndeksi, gündüz uykululuk durumu Epworth Uykululuk Ölçeği (ESS), uyku kalitesi ise son bir ayı kapsayacak şekilde Pittsburgh Uyku Kalitesi İndeksi (PUKİ) ile ölçülmüştür. İstatistiksel analizlerde Ki-kare, Shapiro-Wilk, Mann-Whitney U ve Spearman testleri kullanılmıştır.

Bulgular: Elde edilen veriler, farklı rakımlarda yaşayan yaşlı bireylerin PUKİ puanlarında istatistiksel olarak anlamlı farklılık bulunduğunu göstermektedir ($p<0,05$). Doğu bölgesinde yaşayan bireylerin ortalama PUKİ puanları, batı bölgesindekilere göre belirgin şekilde daha yüksek bulunmuştur. Benzer şekilde, WHOQOL-OLD puanları açısından da istatistiksel olarak anlamlı farklılık saptanmıştır ($p<0,05$); doğu bölgesinde yaşayan bireylerin yaşam kalitesi puanları batı bölgesindekilere kıyasla daha düşüktür.

Sonuç: Bu çalışma, daha düşük rakımlı bölgelerde yaşayan yaşlı bireylerin daha yüksek rakımlı bölgelerde yaşayanlara kıyasla daha iyi uyku kalitesine sahip olduğunu ortaya koymuştur. Ayrıca, huzurevlerinde yaşayan yaşlı bireylerin genel olarak ortalamanın altında bir uyku kalitesi sergilediği belirlenmiştir.

Anahtar Sözcükler: Yükseklik, günlük yaşam aktiviteleri, yaşlılar, uyku kalitesi, yaşam kalitesi.

Introduction

Aging, an intrinsic and inevitable process, is often regarded as one of the most challenging phases of human life. With advancing age, individuals experience a decline in functional capacity, structural alterations, exhaustion, and phenotypic changes. This period is marked by a deteriorating state of body structures and systems, accompanied by a diminishing overall capacity[1]. Aging, characterized as a pathological progression, signifies a degenerative phase marked by an increase in physiological disorders.

Significant alterations occur across various bodily systems with aging, including the pulmonary, urinary, cardiovascular, endocrine, neurological, musculoskeletal, gastrointestinal, and integumentary systems. It has been observed that shifts in sleep patterns accompany these physiological changes, resulting in reduced sleep quality and an increased prevalence of insomnia complaints among older individuals[2-3]. While sleep issues affect all age groups, they are particularly prevalent in the elderly, owing to a constellation of physical, social, psychological, economic, and environmental factors that tend to accumulate with age. Studies report that sleep disorders affect 30-60% of the elderly population[4], with over half of elderly individuals experiencing sleep-related problems and approximately two-thirds of nursing home residents affected by such issues[5]. Given that sleep constitutes a third of one's life, it is profoundly influenced by high altitudes.

Poor sleep quality experienced by individuals residing at high altitudes can lead to cognitive and emotional disturbances as well as daytime dysfunction[6,7]. Altitudes below 500 meters are generally considered sea level, while altitudes at or above 1000 meters are categorized as high altitude. Physiological effects on the body are typically observed at altitudes exceeding 1500 meters[8]. Factors such as frequent awakenings during sleep and reduced oxygen availability have been cited as contributing to decreased sleep quality in high-altitude areas[6,9]. Moreover, the heightened prevalence of sleep disorders among the elderly further compounds the impact on physical activity and quality of life[10,11].

Quality of life is a subjective measure encapsulating an individual's overall well-being, encompassing their physical health, emotional state, cognitive function, perceptions, and

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symptoms. In evaluating the quality of life among the elderly, it is imperative to underscore symptoms commonly experienced in this demographic, such as nocturia (frequent urination at night), shuffling gait, orthostatic hypotension, and daytime drowsiness[12,13]. In a study by Hayashino et al. conducted in Japan with 3403 participants, poor sleep quality was found to be associated with the mental health component of the quality of life scale[14]. The majority of elderly individuals contend with health-related complaints and irreversible declines in physical and functional capabilities[15].

Activities of daily living (ADL) encompass the assessment of an individual's functional and physical independence, comprising basic activities such as personal hygiene, mobility, physical activity, nutrition, bathing, toileting, walking, transferring, and ambulation. More intricate activities, including housework, financial management, and driving, constitute instrumental activities of daily living[16]. Age-related weakening of muscle strength and bone structure results in diminished balance and motor coordination control, which, in turn, contributes to increased difficulty in performing ADLs and heightened dependency levels[17]. Research has indicated that poor sleep quality negatively impacts performance and select ADLs among the elderly, leading to social and cognitive issues and ultimately exacerbating the decline in quality of life[18,19].

Upon reviewing the existing literature, no prior study was identified that concurrently assessed sleep quality, quality of life, and ADLs in individuals aged 65 and above residing in nursing homes across various regions and altitudes within Türkiye. Our study seeks to address this gap by evaluating sleep quality, ADLs, and quality of life with respect to altitude variations in elderly individuals residing in nursing homes located in both the eastern and western regions of Türkiye, encompassing two distinct cities.

Material and Methods

Study Design

This cross-sectional study was conducted in two nursing homes in two different districts between July 2020 and January 2021. Our study was conducted in the Nursing Home and Rehabilitation Centre in Ağrı province and the privately owned Nursing Home Elderly Care and Rehabilitation Centre in Maltepe district of Istanbul province. A total of 92 participants were included, comprising 46 individuals from each facility who voluntarily agreed to participate and achieved a Mini Mental Test score of 24 or higher.

Data Collection

Data were collected using Sociodemographic Information Form, Mini Mental State Examination (MMSE), World Health Organization Quality of Life Scale Elderly Model (WHOQOL-OLD), Activities of Daily Living Assessment (Barthel Index), Epworth Sleepiness Scale (ESS), and Pittsburgh Sleep Quality Index (PSQI). By explaining the purpose of the research, the data were collected by the researchers after obtaining written permission from those who voluntarily agreed to participate in the research.

Sociodemographic Information Form: Developed by the researcher, this form gathered introductory information about the participants. It covered age, gender, weight, height, body mass index, duration of residency in the nursing home, roommate status, and comfort level within the facility.

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Mini Mental State Examination (MMSE): The MMSE is a widely used cognitive assessment tool developed by Folstein et al. in 1975. It comprises 30 points, with scores below 24 indicative of dementia or cognitive impairment, while scores of 24 and above are considered normal. The MMSE evaluates various cognitive domains including attention, language, memory, orientation, visual function, copying, drawing, and reading[20]. It possesses validated Turkish reliability and validity[21].

World Health Organization Quality of Life Scale Elderly Model (WHOQOL-OLD): This instrument was employed to assess the quality of life among elderly individuals. Comprising 24 items divided into six sections—social participation, past, present, and future activities, emotional functions, independence, death and dying, and closeness—it elicits responses on a five-point Likert scale, with scores ranging from 1 to 5. Higher scores denote a higher quality of life[22]. The WHOQOL-OLD scale has been validated and exhibits reliability in Turkish[23].

Activities of Daily Living Assessment (Barthel Index): The Barthel Index was adapted for Turkish patients by Küçükdeveci in 1999 and is employed to evaluate the dependency levels of individuals in performing activities of daily living. It consists of ten main items, encompassing nutrition, wheelchair-to-bed and bed-to-wheelchair transfers, self-care, toileting, bathing, walking on a smooth surface (if applicable), climbing stairs, dressing and undressing, bowel care, and bladder care. The total score ranges from 0 to 100, with classifications as follows: 0-20 points signify full dependence, 21-61 points denote high dependence, 62-90 points indicate moderate dependence, 91-99 points suggest mild dependence, and 100 points represent full independence[24].

Epworth Sleepiness Scale (ESS): The ESS is a widely used scale designed to assess daytime sleepiness in adults. It comprises eight items that address typical daily situations, with each item rated on a scale of 0-3. A consistent scoring approach is applied across all questions, where 0 indicates never sleepy, 1 denotes moderately sleepy, and 3 signifies highly likely to fall asleep. The total score falls within the range of 0-24, with scores of 0-10 considered within the normal range for sleep propensity[25]. The ESS, developed by Johns in 1991, is a self-report-based scale that qualitatively and quantitatively measures daytime sleepiness. Its Turkish validity and reliability have been established[26].

Pittsburgh Sleep Quality Index (PSQI): In our assessment of sleep quality, we employed the PSQI, a questionnaire developed by Buysse et al. in 1989, renowned for its reliability and validity[27]. The PSQI is a comprehensive tool comprised of 19 items designed to evaluate both the quality and quantity of sleep experienced over the preceding month. It encompasses seven domains: subjective sleep quality (1 item), sleep duration (1 item), use of sleep medications (1 item), sleep latency (2 items), daytime functional impairment (2 items), habitual sleep efficiency (3 items), and sleep disturbances (9 items). Each question within these domains is rated on a scale from 0 to 3, where 0 signifies "very good," 1 denotes "quite good," 2 indicates "quite bad," and 3 represents "very bad." The total score can range from 0 to 21. In accordance with previous research[28], a PSQI score of 5 or higher was considered indicative of poor sleep quality. The scale was previously adapted into Turkish by Ağargün et al. [26] in 1996.

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Ethical Statement

The study adhered to ethical guidelines, and necessary approvals were obtained from the Halic University Non-Interventional Clinical Research Ethics Committee (Approval date: June 26, 2020; Approval number: 05). The principle of voluntary participation was upheld when selecting individuals for the study, and throughout the research process, the Helsinki Declaration of Human Rights was diligently observed to safeguard individual rights.

Data Analysis

In this study, data were subjected to statistical analysis using the IBM SPSS (v.23) package. Descriptive statistics were employed to present the data, including mean with standard deviation (X±SD) for continuous variables and frequency with percentages (n%) for categorical variables. Normality of the data distribution was assessed using the Shapiro-Wilk test, which revealed non-normal distribution characteristics. Consequently, the Mann-Whitney U test was employed to compare data between two groups. The Spearman correlation test was utilized to explore relationships between numerical variables, while the chi-square test was employed to compare categorical variables. Statistical significance was defined at the $p<0.05$ threshold.

Limitations and Challenges of the Study

The global outbreak of the COVID-19 pandemic, which coincided with the data collection period of our research, significantly impacted the recruitment process. Since the data were collected through face-to-face interviews, strict public health measures, social distancing protocols, and participants' concerns about close contact led to a reduced willingness to participate. Consequently, this resulted in a limited number of participants in the study.

Results

The participants were divided into 2 groups according to the cities they stayed in; those staying in nursing homes in Istanbul (n=46) and those staying in nursing homes in Eastern province (n=46). The p-values for the Age, Height, Weight, and BMI variables were found to be greater than 0.05 for both cities where the study participants resided. In other words, there is no significant difference between the elderly individuals living in the provinces of Ağrı and Istanbul with respect to these variables (Table 1).

Table 1. Physical characteristics of the participants (n= 92).

	Province	n	Mean	SD	p
Age	**Eastern**	46	70.67	5.906	0.080
	Western	46	75.15	8.052	
Height (m)	**Eastern**	46	1.67	0.068	0.690
	Western	46	1.67	0.078	
Weight (Kg)	**Eastern**	46	77.48	9.545	0.460
	Western	46	75.82	9.231	
Body Mass Index	**Eastern**	46	27.51	3.330	0.357
	Western	46	27.01	3.037	

P < 0,05*, **SD: Standard Deviation, Mann-Whitney U Test

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Table 2 presents the demographic data of the participants. In the Eastern Region, 54.3% of the participants were male, and 45.7% were female, while in the Western Region, 28.3% were male, and 71.7% were female. In the East, 23.9% of the participants were married, 67.4% were single, and 8.7% were divorced. In the West, 15.2% were married, and 84.8% were single. In the East, the highest proportion of participants (41.3%) had been residing in a nursing home for less than 1 year, whereas in the West, the highest proportion (69.6%) had been in a nursing home for 1-5 years. The percentage of individuals with roommates was 65.2% in the East and 71.7% in the West. Regarding comfort in the nursing home, 71.7% in the East and 73.9% in the West reported feeling comfortable.

Table 2. Demographic data of the participants.

		Province				
		Eastern		**Western**		
		n	**%**	**n**	**%**	**p**
Gender	**Male**	25	54.30	13	28.30	0.019*
	Female	21	45.70	33	71.70	
Marital Status	**Married**	11	23.90	7	15.20	
	Single	31	67.40	39	84.80	0.055
	Divorced	4	8.70	-	-	
Length of Stay in Nursing Home	**0-1 Year**	19	41.30 30.40 28.30	10	21.70	0.001*
	1-5 Years	14		32	69.60	
	More than 5 Years	13		4	8.70	
Roommate	**Yes**	30	65.20	33	71.70	0.654
	No	16	34.80	13	28.30	
Comfort Level in the Nursing Home	**Yes**	33	71.70	34	73.90	0.990
	No	13	28.30	12	26.10	

p < 0,05 *, **Chi-Square Test

Table 3 presents the Comparison of Sleep Quality. According to the data obtained, there is a statistically significant difference in the PSQI between the elderly individuals living at different altitudes. Accordingly, the average PSQI values of the elderly living in eastern province are higher than those of the elderly living in western. However, there is no significant difference between the elderly living at different altitudes in the Epworth Sleepiness Scale

Table 3. Comparison of sleep quality

	Province	**n**	**Mean**	**SD**	**p**
PSQI	**Eastern**	46	7.04	3.602	0.018*
	Western	46	5.28	2.663	
ESS	**Eastern**	46	8	4.953	0.664
	Western	46	7.84	3.353	

p<0.05*, **SD: Standard Deviation, PSQI: Pittsburgh Sleep Quality Index, ESS: Epworth Sleepiness Scale, Mann Whitney U Test

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Table 4 presents the Comparison of Quality of Life. According to the data obtained, a statistically significant difference exists in the Quality of Life Scale among the elderly individuals living at different altitudes. Notably, the average WHOQOL-OLD values of the elderly residing in Ağrı province are lower than those of their counterparts living in Istanbul.

Table 4. Comparison of quality of life.

	Province	n	Mean	SD	p
WHOQOL-OLD	**Eastern**	46	60.89	10.764	0.001*
	Western	46	71.13	11.271	

p<0,05*, *WHOQOL-OLD: World Health Organization Quality of Life Scale for the Elderly Model, Mann Whitney U Test

For a more detailed exploration of participants' daily living activity status, please refer to Table 5, which presents the Comparison of Participants' Daily Living Activity Status. According to the data obtained, there is no statistically significant difference between the Daily Living Activity Status of the elderly living at different altitudes.

Table 5. Comparison of participants' activities of daily living status

Province		n	Mean	SD	p
Barthel Index	**Eastern**	46	79.45	16.337	0.350
	Western	46	76.08	16.895	

p<0.05*; *Mann Whitney U Test

Discussion

Sleep, a fundamental component comprising one-third of human life, undergoes profound alterations in high-altitude regions. Poor sleep quality experienced at elevated altitudes can precipitate cognitive and emotional imbalances and result in daytime dysfunction[29]. Roughly 250 million individuals across the globe reside at altitudes exceeding sea level[30,31]. In the eastern region of our study area, the altitude is 1640 meters, whereas the western region's altitude is merely 120 meters.

In this study, a significant difference was observed in PSQI scores among elderly individuals living at different altitudes, whereas ESS scores did not show a significant variation. This may be attributed to reduced oxygen levels at higher altitudes, which can negatively affect sleep quality without necessarily increasing daytime sleepiness. Additionally, environmental and socioeconomic differences across regions may influence perceived sleep quality (PSQI) more than daytime sleepiness (ESS).

Sakamoto et al.[32] conducted a study investigating the influence of high altitude on the sleep quality of elderly individuals residing in high-altitude regions, specifically in the settlement zone ranging from 2800 to 4200 meters in the Kashmir region of India. The study encompassed 112 individuals, and their sleep quality was assessed using the Insomnia Severity Index (ISI). The study results concurred with our findings, revealing that high altitude detrimentally affected sleep quality. A study in Islamabad evaluated sleep quality in the elderly using PSQI and found a high prevalence of poor sleep quality,

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particularly among women, though it did not compare different altitudes[33]. Sleep disturbances are estimated to afflict 10-50% of the elderly population, and research has shown a significant association between the total ISI score and total PSQI score[1,34]. Despite differences in participant numbers, altitude levels, and sleep assessment tools, our findings align with these previous observations.

Research in Colombia indicated that living at higher altitudes negatively affected overall quality of life in older adults, impacting physical and psychological health but without specifying a direct link to poorer sleep quality[35]. In a study with elite swimmers, sleep quality appeared unaffected during a 14-day training camp at moderate altitude (1,500 meters), suggesting that moderate altitude may not significantly impact subjective sleep assessments despite changes in sleep patterns[36]. The lack of impact on sleep quality in elite swimmers may be due to their higher cardiorespiratory adaptability to altitude. In contrast, elderly individuals have reduced physiological reserves, making them more susceptible to altitude-related effects on sleep quality. Additionally, environmental and psychosocial factors may further influence subjective sleep perception in non-athletic older populations.

Gupta et al.[37] conducted an investigation into the effect of altitude on subjective sleep quality among populations dwelling at high and low altitudes in the Himalayan and sub-Himalayan regions of India across three different altitude zones (400 meters, 1,900-2,000 meters, and 3,200 meters). The study generally reported that individuals participating in the research experienced poor sleep quality, with higher reports of poor-quality sleep at high altitudes compared to low altitudes. This study's findings align with this observation, as we observed lower sleep quality among participants residing in nursing homes in the eastern region of Türkiye.

A study examining patients with obstructive sleep apnea (OSA) found that while both PSQI and ESS scores were relevant in assessing sleep quality and daytime sleepiness, the association between them was not strong. The study highlighted that polysomnographic measures, such as hypoxia levels, were more strongly linked to subjective sleep quality in this population than ESS scores[38]. While the PSQI primarily assesses nighttime sleep quality, the ESS gauges the propensity to fall asleep in various daytime situations. Furthermore, the relationship between polysomnography and ESS was also noted as weak and inconsistent. Our study, too, revealed inconsistencies between PSQI sleep scale scores and ESS scores, reinforcing these previous observations.

It is well-established that individuals residing in high-altitude areas frequently experience deteriorations in sleep quality, attributable to factors such as frequent nocturnal awakenings and reduced oxygen levels[8]. This research unveiled higher mean PSQI scores for elderly individuals in nursing homes in the eastern region compared to those in the western region, with no statistically significant variance in ESS scores. These findings underscore the adverse impact of high altitude on the sleep quality of elderly individuals.

A case study on sleep disturbances at high altitudes reported that sleep quality progressively declined as altitude increased[9]. Despite our study's focus on nursing home settings, we observed analogous outcomes. Sleep disorders tend to be more prevalent among the elderly population, contributing to issues such as depression, compromised

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attention, heightened fall risk, diminished activities of daily living, and a reduced quality of life[39,40].

In this investigation, we observed a noteworthy disparity in the mean WHOQOL-OLD scores between elderly individuals residing in the eastern and western regions of Türkiye. Specifically, the elderly in the eastern region reported significantly lower scores compared to their western counterparts. This study findings elucidate that the adverse effects of high altitude extend beyond sleep quality and extend to a substantial degradation in the quality of life for individuals experiencing poor sleep.

Supporting our research outcomes, Liu et al.[5] conducted a comprehensive comparative analysis examining sleep disorders and their connection to the quality of life among older adults inhabiting nursing homes situated in both high and low-altitude regions. Their study yielded the conclusion that sleep quality among elderly individuals residing in high-altitude nursing homes was notably compromised, and sleep disorders exerted a substantial detrimental impact on their overall quality of life. These findings harmonize with a broader body of literature, reinforcing the notion that diminished sleep quality tends to erode the quality of life, especially in individuals dwelling in high-altitude locales.

Notably, our study did not discern any statistically significant discrepancies in the activities of daily living among elderly individuals residing in nursing homes located at various altitudes across the eastern and western regions of Türkiye. Despite the contrast in altitudinal conditions, our research suggests that altitude per se does not exert a significant influence on the performance of daily living activities.

In a study conducted embarked on an extensive geriatric assessment involving 393 elderly mountaineers in Qinghai, China, aged 60 years and older, who resided in Haiyan County. This assessment encompassed an evaluation of activities of daily living, quality of life, and metabolic syndrome. Intriguingly, the study findings indicated that Tibetan elderly highlanders in Qinghai exhibited lower scores in basic activities of daily living in comparison to their Han or Mongolian highlander counterparts. The researchers attributed these observed differences in activities of daily living to the distinct lifestyles of elderly individuals in different regions[41]. Nevertheless, it is important to note that these findings deviate from the conclusions drawn from our study. Existing research has consistently documented the adverse impact of compromised sleep quality on activities of daily living[42,43].

Conclusion

This study discerned a notable divergence in the sleep quality experienced by elderly individuals residing in provinces at varying altitudes. Specifically, elderly individuals living in low-altitude provinces exhibited superior sleep quality compared to their counterparts in high-altitude provinces.

The comprehensive evaluation of sleep quality, activities of daily living, and quality of life among elderly individuals inhabiting nursing homes necessitates a thorough consideration of their residing environment. To enhance the quality of life, promote activities of daily living, and ameliorate sleep quality among this demographic, strategic

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interventions and lifestyle modifications are imperative. These measures should encompass optimizing exposure to natural daylight, incorporating physiotherapy rehabilitation programs, and fostering positive lifestyle changes.

The integration of these interventions can serve as a pivotal strategy for enhancing the overall well-being of elderly individuals within nursing homes. By addressing their sleep quality, activities of daily living, and quality of life in the context of their living environment, we can aspire to achieve more effective outcomes in the pursuit of improved health and well-being for this vulnerable population.

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REFERENCES

1. Lee J, Kim HJ. Normal aging induces changes in the brain and neurodegeneration progress: Review of the structural, biochemical, metabolic, cellular, and molecular changes. *Frontiers in Aging Neurosci*. 2022;14:931536.
2. Spira AP, Kaufmann CN, Stone KL. *Sleep, Circadian Rhythms, and Aging: Advancing Knowledge to Promote Older Adults' Health*. Oxford University Press US, 2023.
3. Drăgoi CM, Nicolae AC, Ungurianu A, Margină DM, Grădinaru D, Dumitrescu IB. Circadian rhythms, chrononutrition, physical training, and redox homeostasis—molecular mechanisms in human health. *Cells*. 2024;13(2):138.
4. Gordon NP, Yao JH, Brickner LA, Lo JC. Prevalence of sleep-related problems and risks in a community-dwelling older adult population: A cross-sectional survey-based study. *BMC Public Health*. 2022;22(1):2045.
5. Liu S, Chow IH, Lu L, et al. Comparison of sleep disturbances between older nursing home residents in high-and low-altitude areas. *J. Geriatr. Psychiatry Neurol*. 2020;33(6):370-376.
6. Kong F. *Updates in Sleep Neurology and Obstructive Sleep Apnea: Sleep Disorder at High Altitude*. IntechOpen; 2021.
7. Qin Z, Kang D, Feng X, Kong D, Wang F, Bao H. Resting-state functional magnetic resonance imaging of high altitude patients with obstructive sleep apnoea hypopnoea syndrome. *Sci. Rep*. 2020;10(1):15546.
8. Xie Y, Wang N. The eye and high altitude. *Integrative Ophthalmology*. 2020:95-100.
9. Srivali N, Tobias L. 1037 Central sleep apnea due to high altitude periodic breathing. *Sleep*. 2023;46(Supplement_1):A455-A455.
10. Christodoulou E, Pavlidou E, Mantzorou M, et al. Depression is associated with worse health-related quality of life, lower physical activity levels, and inadequate

sleep quality in a Greek elderly population. *Psychol Health Med*. 2023;28(9):2486-2500.

11. Seol J, Lee J, Nagata K, et al. Combined effect of daily physical activity and social relationships on sleep disorder among older adults: Cross-sectional and longitudinal study based on data from the Kasama study. *BMC Geriatrics*. 2021;21:1-10.

12. Awade AR, Ibrahim NAEF, Abd El Moniem MM. The Relationship between nocturia, sleep quality and daytime energy among community dwelling older adults. *Alex. Sci. Nurs. J*. 2020;22(1):81-91.

13. Kim N, Park J, Hong H, Kong ID, Kang H. Orthostatic hypotension and health-related quality of life among community-living older people in Korea. *QLife Res*. 2020;29:303-312.

14. Hayashino Y, Yamazaki S, Takegami M, Nakayama T, Sokejima S, Fukuhara S. Association between number of comorbid conditions, depression, and sleep quality using the Pittsburgh Sleep Quality Index: Results from a population-based survey. *Sleep Med.*. 2010;11(4):366-371.

15. Dagnino AP, Campos MM. Chronic pain in the elderly: Mechanisms and perspectives. *Front. Hum. Neurosci*. 2022;16:736688.

16. Ran L, Jiang X, Li B, et al. Association among activities of daily living, instrumental activities of daily living and health-related quality of life in elderly Yi ethnic minority. *BMC Geriatrics*. 2017;17:1-7.

17. Wu R, Ditroilo M, Delahunt E, De Vito G. Age related changes in motor function (II). Decline in motor performance outcomes. *Int J Sports Med*. 2021;42(03):215-226.

18. Leng M, Yin H, Zhang P, et al. Sleep quality and health-related quality of life in older people with subjective cognitive decline, mild cognitive impairment, and Alzheimer disease. *The J Nerv Ment Dis*. 2020;208(5):387-396.

19. Petrovsky D, Varasse M, Hodgson N. Relationship between sleep and quality of life in older adults with mild cognitive impairment. *Innov. Aging*. 2020;4(Suppl 1):619.

20. Gluhm S, Goldstein J, Loc K, Colt A, Van Liew C, Corey-Bloom J. Cognitive performance on the mini-mental state examination and the montreal cognitive assessment across the healthy adult lifespan. *Cogn Behav Neurol*. 2013;26(1):1-5.

21. Gungen C. Standardize Mini Mental Test'in Türk toplumunda hafif demans tanısında geçerlik ve güvenilirliği. *Turk Psikiyatri Derg*. 2002;13:273-281.

22. Gobbens RJ, van Assen MA. Psychometric properties of the Dutch WHOQOL-OLD. *HQOL*. 2016;14:1-9.

23. Eser S, Saatlı G, Eser E, Baydur H, Fidaner C. The reliability and validity of the Turkish version of the World Health Organization Quality of Life Instrument-Older Adults Module (WHOQOL-Old). *Turk. Psikiyatri Derg*. 2010;21(1).

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24. Young Y, Fan MY, Hebel JR, Boult C. Concurrent validity of administering the functional independence measure (FIM) instrument by interview. *American Am J Phys Med Rehabil*. 2009;88(9):766-770.

25. Smith TG, Robbins PA, Ratcliffe PJ. The human side of hypoxia-inducible factor. *British Journal of Haematology*. 2008;141(3):325-334.

26. Ağargün MY, Çilli AS, Kara H, et al. Epworth Uykululuk Ölçeği'nin geçerliği ve güvenirliği. *Türk Psikiyatri Derg*. 1999;10(4):261-267.

27. Buysse D. The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry*. 2003;18:498.

28. Ağargün MY. Pittsburgh uyku kalitesi indeksinin geçerliği ve güvenirliği. *Turk Psikiyatri Derg*. 1996;7:107-115.

29. Pinto Leite CM, Mariano-Neto E, Rocha PLBd. Biodiversity thresholds in invertebrate communities: The responses of dung beetle subgroups to forest loss. *PLoS One*. 2018;13(8):e0201368.

30. Gao C, Ciren J, Wang D, Zhang Z, Ge R, Yan Le. Assessment of psychological and social fitness in healthy adults permanently living at very high altitude. *International Journal of Int. J. Environ. Res. Public Health*. 2023;20(3):2013.

31. Tremblay JC, Ainslie PN. Global and country-level estimates of human population at high altitude. *Proc. Natl. Acad. Sci.* 2021;118(18):e2102463118.

32. Sakamoto R, Okumiya K, Norboo T, et al. Health and happiness among community-dwelling older adults in Domkhar valley, Ladakh, India. *Geriatr Gerontol Int*. 2017;17(3):480-486.

33. Siddiqui N, Farooq R, Saadat S, et al. Poor sleep quality: A wake-up call for the elderly at a tertiary care centre in Islamabad, Pakistan. *Sleep*. 2020;3:6.

34. Alqahtani JS, AlRabeeah SM, Aldhahir AM, et al. Sleep quality, insomnia, anxiety, fatigue, stress, memory and active coping during the COVID-19 pandemic. *Int. J. Environ. Res. Public Health*. 2022;19(9):4940.

35. Pinzón-Rondón AM, Botero JC, Mosquera-Gómez LE, Botero-Pinzon M, Cavelier JE. Altitude and quality of life of older people in Colombia: A multilevel study. *J. Appl. Gerontol*. 2022;41(6):1604-1614.

36. Vitale JA, Ieno C, Baldassarre R, et al. The impact of a 14-day altitude training camp on olympic-level open-water swimmers' sleep. *Int. J. Environ. Res. Public Health*. 2022;19(7):4253.

37. Gupta R, Ulfberg J, Allen RP, Goel D. Comparison of subjective sleep quality of long-term residents at low and high altitudes: SARAHA study. *J Clin Sleep Med*. 2018;14(1):15-21.

38. Kania A, Polok K, Celejewska-Wójcik N, et al. Clinical and polysomnographic features associated with poor sleep quality in patients with obstructive sleep apnea. *Medicina*. 2022;58(7):907.

39. Olatunde K, Patton S. Insufficient sleep and health care utilization: A scoping review. *Innov Aging*. 2021;5(Suppl 1):832.

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40. Putekova S, Martinkova J, Hutkova M. Sleep disturbances in seniors with parkinson's disease. *Clinical Social Work and Health Intervention*. 2020;11(4):68 – 77.

41. Lin S. Functional disability among middle-aged and older adults in China: The intersecting roles of ethnicity, social class, and urban/rural residency. *Int. J. Aging Hum*. Dev. 2023;96(3):350-375.

42. Ganidagli S, Ozturk E, Ozturk ZA. Risk factors of poor sleep quality in older adults: An analysis based on comprehensive geriatric assessment. *Curr Med Res Opin*. 2023;39(5):701-706.

43. Hu Z, Zhu X, Kaminga AC, Zhu T, Nie Y, Xu H. Association between poor sleep quality and depression symptoms among the elderly in nursing homes in Hunan province, China: A cross-sectional study. *BMJ Open*. 2020;10(7):e036401.

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