Original Article

Sleep Quality and Frailty Association in the Elderly

Asociación entre calidad de sueño y fragilidad en adultos mayores

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Summary

Objective: To analyze the association between sleep quality and frailty syndrome in the elderly who are attending a general hospital. **Methods:** Cross-sectional analytical study conducted at the General Hospital of the Zone No. 27 of the Mexican Institute of Social Security from November 2022 to April 2023, in Mexico City, Mexico; 170 adults ≥ 60 years of age attending geriatric consultation participated, non-probability sampling was used. The Pittsburgh Sleep Quality and FRAIL for frailty questionnaires were used; to exclude other factors that could influence the development of frailty, the Geriatric Depression Scale, and the Mini Nutritional Assessment were used. Descriptive statistics, X^2 test to evaluate significant differences between groups, prevalence ratio (PR) to evaluate the likelihood of frailty with poor sleep quality, and binary linear regression to explore the influence of other variables on frailty were performed. **Results:** The mean age was 79.6 ± 8 years, women represented 71.2% (n= 121) of the sample. It was reported that 48.2% (n= 82) of the patients showed frailty, and 68.8% (n= 117) poor sleep quality, regarding the evaluation of confounding variables, 55.8% (n=95) showed depression, and 3.5% (n= 6) malnutrition. An association was found between sleep quality and frailty ($p < 0.001$), the PR for frailty was 14.52 (CI 5.72-36.83). The linear regression model for sleep quality was 10.33 (95% CI: 3.92-27.25), and for depression 2.34 (95% CI: 1.10-4.94). **Conclusion:** an association was found between poor sleep quality and frailty, with a 14.52-fold increase in the probability of presenting frailty in those with poor sleep quality.

Key words: Frailty Syndrome, Elderly, Sleep Quality, Sleep Disorders, Aging.

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Resumen

Objetivo: analizar la asociación entre calidad del sueño y síndrome de fragilidad en adultos mayores adscritos a un hospital general. **Métodos:** estudio transversal analítico realizado en el Hospital General de Zona No. 27 del Instituto Mexicano del Seguro Social de noviembre de 2022 a abril de 2023 en la Ciudad de México, México; participaron 170 adultos ≥ 60 años que asistieron a consulta de geriatría, se utilizó muestreo no probabilístico. Se aplicaron los cuestionarios de calidad de sueño de Pittsburgh y de FRAIL para fragilidad; para descartar otros factores que pudieran influir en el desarrollo de fragilidad se utilizó la escala de depresión geriátrica y el *Mini Nutritional Assessment*. Se realizó estadística descriptiva, prueba de X^2 para evaluar si existían diferencias significativas entre grupos, razón de prevalencias (RP) para evaluar la probabilidad de presentar fragilidad con mala calidad de sueño y regresión lineal binaria para explorar influencia de otras variables en la fragilidad. **Resultados:** la media de edad fue de 79.6 ± 8 años, las mujeres representaron 71.2 % (n= 121) de la muestra. Se reportó que 48.2 % (n= 82) de los pacientes mostró fragilidad y 68.8% (n= 117) mala calidad del sueño, respecto a la evaluación de variables de confusión, 55.8 % (n= 95) presentó depresión y 3.5% (n= 6) mostró desnutrición. Se encontró asociación entre calidad del sueño y fragilidad (p < 0.001), la RP para fragilidad fue de 14.52 (IC 5.72-36.83). El modelo de regresión lineal para calidad de sueño fue de 10.33 (IC 95%: 3.92-27.25) y para depresión 2.34 (IC 95%: 1.10-4.94). **Conclusión:** se encontró una asociación entre la mala calidad de sueño y la fragilidad, con un aumento de 14.52 veces en la probabilidad de presentar fragilidad en aquellos con mala calidad de sueño.

Palabras clave: síndrome de fragilidad, adulto mayor, calidad de sueño, trastornos del sueño, envejecimiento.

Introduction

Aging is associated with changes in sleep composition over the years. These changes are associated with changes in sleep onset time and earlier awakenings, longer sleep latency, shorter total sleep time, more fragmented sleep, as well as shorter sleep cycles, and less sleep quantity.[1,2]

Sleep quality is a crucial aspect for human beings and is reflected in the self-satisfaction of the individual when he or she perceives that he or she sleeps well at night, and also has an adequate performance during the day.[3,4] Currently, in Mexico, there are reports of the prevalence of poor sleep quality, 49.1% in adults over 60 years of age.[5]

On the other hand, frailty is a multifactorial syndrome characterized by a decline in the body's ability to restore balance in the face of environmental challenges. This capacity decreases with age and is affected by external stressors, such as physical, social, biological, and psychological factors, which contribute to the decline of multiple physiological systems.[6-8]

In Latin America, the prevalence of frailty in people aged 60 years and older is between 21-48%, in Mexico it is 39% and is more frequent in women.[9,10] This is important for the healthcare system as it increases the risk of dependency, falls, hospitalizations, and death.[11]

The relationship between sleep quality and frailty has been the subject of research worldwide, and there is evidence to suggest that poor sleep quality increases the prevalence of frailty,[12-15] as they share some pathophysiological mechanisms, such as an increased inflammatory response with a consequent increase in the production of proinflammatory cytokines, thereby promoting muscle wasting, weakness, and disability; it has also been noted that sleep disturbances can alter the hypothalamic-pituitary-adrenal and hypothalamic-pituitary-gonadal axes, as well as the circadian rhythm.[16]

Despite the importance of these issues, the studies in Mexico present limitations in terms of research on this problem in the group of the elderly. Therefore, the objective of this study was to determine the association between sleep quality and frailty syndrome in a population of adults who attended a geriatric consultation.

Methods

An analytical cross-sectional study conducted from November 2022 to April 2023, in the geriatrics service of the General Hospital of the Zone (HGZ) No. 27 of the Mexican Institute of Social Security (IMSS) in Mexico City, Mexico. Non-probabilistic sample, the proportion formula for finite samples was used, and the average number of first-time consultations in the geriatrics service was considered as a reference.

Adults of both genders aged 60 years and older, who attended the geriatrics consultation for the first time and signed the informed consent form were included. Participants with cognitive impairment using the Pfeiffer questionnaire,[17] oncologic history or high risk of obstructive sleep apnea according to STOP-BANG,[18] institutionalized persons brought to the consultation, and patients with ≤ 3 basic

activities of daily living according to the Katz index were excluded.[19]

Demographic data were collected, and the FRAIL questionnaire which is validated in the Mexican population,[20] and the Mini Nutritional Assessment (MNA) scale, which has been validated internationally, and has a sensitivity of 98%, and specificity of 100% in its full version[21] were used to assess frailty.[22] The Pittsburgh Sleep Quality Index (PSQI),[22] which has a sensitivity of 89.6% and specificity of 86.5%, with a positive predictive value of 80.66 in its Spanish version,[22,23] was used.

The abbreviated version of the Geriatric Depression Scale (GDS) was used, which has been validated in Mexico, and has a sensitivity of 81.1%, and a specificity of 76.7%.[17,24]

For descriptive statistics, an analysis of qualitative variables was performed, expressed in frequencies, and percentages. For quantitative variables (age, Pittsburgh Scale score, MNA, GDS), measures of central tendency (mean and median), and dispersion (standard deviation, maximum and minimum) were used.

For the FRAIL analysis, the results of the categories were grouped into two groups: non-fragile (pre-fragile and non-fragile), and fragile, while, for the MNA, patients without malnutrition, and those at risk of malnutrition were grouped into the same group called without malnutrition.

For the inferential analysis, comparisons were made between two groups, the X^2 test was used to analyze qualitative variables and PR was calculated to determine the association between variables. The confounding variables that showed statistical significance in relation to the development of frailty in patients in both groups were evaluated by binary linear regression analysis. A value of $p<0.05$ was considered statistically significant. The SPSS v. 25 program was used for the statistical analysis.

The study was approved by the ethics and research committee, and an informed consent form, from the IMSS, was signed according to current regulations.

Results

During the study period, 170 patients met the selection criteria, with a mean age of 79.6 ± 8 years, of whom 71.2% (n= 121) were women, and 28.8% (n= 49) men; 52.4% (n= 89) were widowed, and 31.2% (n= 53) married, 92.9% (n= 158) were not working. The age group 80-89 years was the most represented in the study with 74 participants, representing 43.5% of the total number of participants (Table 1).

It was found frailty in 48.2% (n= 82), malnutrition in 3.5% (n= 6), and depression in 55.8% (n= 95) of the participants (Table 2). The mean MNA was 22.6±2.7, the mean FRAIL was 2.68±0.33, the mean Pittsburgh Index was 7.18±3.266, and the mean GDS was 5.96±3.644.

Subsequently, sociodemographic, and clinical aspects were analyzed, and groups of participants with and without frailty were compared (Table 3).

Poor sleep quality was reported by 68.8% (n= 117). Statistically significant differences were observed between the good and poor sleep quality groups ($p<0.00$), with a prevalence ratio of 14.52 CI (5.72-36.83), as shown in Table 4. When the statistically significant variables for frailty were subjected to a binary linear regression model, the

Table 1. Population General Characteristics

	Frequency	Percentage %
Gender		
Women	121	71.2
Men	49	28.8
Age Groups		
60-69 years	23	13.5
70-79 years	58	34.1
80-89 years	74	43.5
90-99 years	15	8.8
Marital Status		
Single	19	11.2
Married	53	31.2
Widow/er	89	52.4
Divorced	7	4.1
Cohabiting	2	1.2
Job		
No	158	92.9
Yes	12	7.1

Table 2. Characteristics of the Scales Applied in the Sample

Scale		
FRAIL	**Fragile**	**Non-fragile**
	48.2% (n=82)	51.8% (n=88)
MNA	**With Malnutrition**	**Without Malnutrition**
	3.5% (n=6)	96.5% (n=164)
Pittsburgh Index	**Poor Sleep Quality**	**Good Sleep Quality**
	68.8% (n=117)	31.2% (n=53)
GDS	**With Depression**	**Without Depression**
	55.8% (n=95)	44.2% (n=75)

Table 3. Comparison of Groups on Sociodemographic and Clinical Factors

		Non-fragile (n) %	Fragile (n) %	p
Age Groups (years)	60-69	(14) 8.23	(9) 5.29	0.545
	70-79	(33) 19.4	(25) 14.7	
	80-89	(34) 20	(40) 23.5	
	90-99	(7) 4.11	(8) 4.70	
Job	No	(79) 46.47	(79) 46.47	0.95
	Yes	(9) 5.29	(3) 1.76	
Marital Status	Single	(10) 5.88	(9) 5.29	0.271
	Married	(34) 20	(19) 11.17	0.001
	Widow/er	(41) 24.11	(48) 28.23	0.001
	Divorced	(2) 1.17	(5) 2.9	0.201
	Cohabiting	(1) 0.58	(1) 0.58	0.341
Gender	Men	(25) 14.7	(24) 14.11	0.902
	Women	(63) 37.05	(58) 34.11	
Depression	Without Depression	(54) 31.76	(21) 12.35	0.001
	With Depression	(34) 20	(61) 35.88	
Nutritional Status	Without Malnutrition	(86) 50.5	(78) 45.88	0358
	With Malnutrition	(2) 1.17	(4) 2.35	

Table 4. Analysis of the Association Between Sleep Quality and Frailty Syndrome

	Fragile
Poor Quality	76 (44.7%)
Good Quality	6 (3.5%)
Total	82 (48.2%)

Prevalence Ratio		p Value
14.52 CI (5.72-36.83)		0.000

following values were obtained for poor sleep quality 10.338 CI 95% (3.92-27.25), and for depression 2.342 CI 95% (1.10-4.94). The Nagelkerke R-squared was 0.348.

Discussion

The present study focused on examining the relationship between sleep quality and frailty in the elderly; the results illustrate aspects related to frailty in this population and highlight the importance of considering sociodemographic, and mental health factors.

The sample was composed mainly of women (Table 1), in accordance with national statistics that indicate a higher proportion of this gender in the population of the elderly.[25] This is consistent with the trend observed in Mexico, where women have greater longevity and a higher life expectancy than men,[26] which is reflected in this population.

The high prevalence of women in our study supports the importance of studying frailty in this population, given their differences in health and longevity, as well as the importance of implementing specific interventions in primary care for a multidisciplinary approach to this condition.[27,28]

Marital status emerged as an important factor to consider in this population (Tables 1 and 2). A meta-analysis showed an association between living alone and frailty, suggesting that not living alone may have an impact on social support, and may contribute positively or negatively to frailty risk.[29] This feature highlights the importance of considering these factors in both research and care of the elderly.

The analysis of sleep quality yielded relevant results, with the majority of participants having poor sleep quality

(Table 2). Previous studies have documented the high prevalence of sleep disorders in the Mexican population,[30,31] as well as greater variability in sleep duration in people aged 60 years and older compared with adults aged 18 to 59 years;[32] however, there are few studies that report poor sleep quality in this demographic group.[5,14,32]

The difference in prevalence between our results and those of previous studies could be due to the characteristics of patients who seek care in a geriatric clinic, since some of the pathologies that lead them to seek medical attention may have an impact on their sleep quality.[33-35] In contrast to some studies,[5,14] the characteristics of the participants were different in that they were not individuals seeking care for a specific symptom or disease.

Other studies have concluded that there is a strong association between poor sleep quality, and frailty in the elderly; the above is reinforced in those with moderate to severe poor sleep quality, having this relationship with the mechanisms they share with each other.[13,16,36] Our research supports the above conclusion with a prevalence ratio of 14.52, indicating that people with poor sleep quality are approximately 14.52 times more likely to experience frailty compared to those with good sleep quality (Table 4).

This finding is supported by the values of Pearson's X^2 statistic, and the p-value obtained in (Table 4), indicating a significant difference in the distribution of sleep quality between the frail and non-frail groups.

There is precedent for the importance of assessing and treating sleep quality, and sleep disorders in geriatric patients,[37,38] as well as the importance of understanding the relationship between sleep disorders, and comorbidities in the care of the elderly,[39] highlighting the need to consider sleep as a fundamental element in the comprehensive care of this population.

This study found an association between poor sleep quality and an increased likelihood of frailty. It also highlighted a significant association between depression and frailty in older adults, adding a relevant finding to the study. Previous research has highlighted the importance of mental health in relation to frailty, concluding that early identification of these factors could be crucial in preventing or delaying its development. Depression has also been added as a risk factor for frailty.[36,40] These findings reinforce the importance of considering sleep quality and depression when assessing frailty risk.

However, it is essential to emphasize in this study that only 34.8% of frailty can be attributed to these variables, according to the Nagelkerke coefficient. The remainder of the variability must be attributed to factors not identified in this study, highlighting the need to explore other variables to obtain a more complete understanding of this condition.

The main strength of this study is its clinical focus on the health of the elderly, supported by the use of validated and standardized measurement tools.

Limitations of the study included a small sample size, which affects the generalizability of results, it is suggested that a larger sample size would be adequate, the cross-sectional design limits the ability to establish causal relationships, the location of the study in a single hospital affects the representativeness of the results. In addition, factors not considered such as physical activity and other medications indicated for comorbidities and not only indicated as part of the treatment of sleep, or mood disorders may influence the relationship between sleep quality, depression, and frailty.

Future research is suggested to further investigate the underlying mechanisms of the relationship between sleep quality, frailty, and mental health in order to develop preventive interventions.

Conclusion

This study investigated the relationship between sleep quality and frailty in the elderly. A significant association was found, in which those with poor sleep quality were 14.52 times more likely to develop frailty. In addition, depression was associated with an increased risk of frailty. However, it is recognized that these factors explain only part of the frailty in this population. It was suggested to investigate the underlying mechanisms with long-term follow-up to address frailty more comprehensively in older adults.

Authors' Contribution

E V-G: drafting of the manuscript, collection of information, and specimens, participation in all phases of the study; C H-R: supervision of the research project and the work team, participation in all phases of the study, including design, and data analysis, performing statistical analyses, and presentation of results. J M-V; G V-Y; and L P-O: participation in all phases of the study, including design planning, data collection and analysis, and revisions of the manuscript during preparation.

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Conflicts of interest

The authors declare not having competing interests.

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