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Sleep Quality, and Fatigue As Predictive Factors For Mechanical Neck Pain

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Article History	Abstract
	*Aims: The purpose of our study was to investigate the relationship between mechanical neck pain and sleep disorders, mental and physical fatigue, and the rising expectations of people in modern societies regarding their work, families, and social lives. Mechanical neck pain is a common problem that can result in disability .**Methods:** We included 230 patients with mechanical neck discomfort, with a mean age of 25.62 ± 9.25years, in our study. The Neck Disability Index, Chalder Fatigue Scale, and Pitssburg Sleep Quality Index was applied to all participant. **Results:** Multiple linear regression analysis revealed that the overall model explained 22% of the variance of NDI score. Both sleep quality scale and fatigue scale were significantly associated and can predict NDI score (p < 001) .**Conclusion:** sleep quality and fatigue were found among the independent determinants of neck disability. Therefore, physiotherapists who treat patients with mechanical neck pain should advise them to get enough sleep and teach them relaxation techniques to help them feel less stressed and exhausted, which will lower their neck discomfort.*

1. Introduction

People with neck pain who don't have identified pathological cause for their symptoms, are usually diagnosed as having mechanical neck pain, which is well known muscular condition (1)
Neck pain is one of the most serious work-related health issues, and it is linked to a variety of factors, including physical and psychological stress(2), Approximately half of all people will have a clinically significant neck pain episode over their lifetime, also it considered as the fourth most common cause of disability, after back pain, depression, and joint pain according to the Global Burden of Disease 2010 Study(3).

Cervical spine pain, whether it is associated with radiculopathy or not, has a substantial negative influence on people's physical and emotional health. It is a huge burden on individuals, families, and societies(4) and The literature clearly shows a relationship between psychological factors and neck/back pain (5).

The relationship between sleep quality and neck pain is bidirectional, as both can lead to the other (5), Individuals experiencing neck pain tend to suffer from lower quality sleep compared to those without such discomfort. Specifically, in middle-aged women.(6).

It is recognized that a good night's sleep is essential for maintaining physical and mental health, as well as general wellness; however, young adults often suffer from inadequate sleep, characterized by

unsatisfactory perceived sleep quality, brief sleep periods, irregular sleeping schedules, or symptoms of insomnia.(7).

Most of the physical stress such as poor postural control, decreased range of motion, neuromuscular deficits, and postural deviations are well demonstrated in studies of patient with neck pain and mostly result from impaired performance of the neck extensor and neck flexor muscles(8).

Approximately 75% of the world's population spends the majority of their time using electronic devices like smartphones, iPads, laptops, electronic readers, video-game devices, and so on(9); an extended period of time spent in uncomfortable positions may cause changes in the normal alignment of the head, shoulder, and spinal curves, resulting in forward head posture, round shoulders, a rounded back, and an anterior thoracic spine(10).

Numerous studies have found a strong correlation between musculoskeletal pain, including neck pain, and indices of mental health(11).

Contemporary studies have shown that individuals with neck pain perceive pain in a distinct manner compared to those without pain, resulting in both localized and widespread heightened sensitivity to mechanical pressures. (12).Majority of studies has looked into how musculoskeletal pain affects sleep quality and physical-mental fatigue (13, 14). But there is no study showed the effects of sleep quality and physical-mental fatigue on mechanical neck pain. So our study aimed at examine the effect of sleep quality and fatigue on chronic mechanical neck pain

Material and method:

Participants:

A cross-sectional study of 230 participants (173 females and 57 males) with an average age of 25.62 ± 9.25 years was carried out. We got informed consent forms from each participant.

Figure 1 displayed a flowchart for sample selection, this study was approved by the Research Ethical Committee of the Faculty of Physical Therapy, Cairo University (REC012004388) and trial registration number was (NCT05994066). Ages between 16 and 35, Neck Disability Index (NDI) scores greater than four points, willingness to volunteer for the study, and adequate cooperation to finish the questionnaires were the inclusion criteria. The exclusion criteria included a history of head or neck surgery, cervical disc herniation, scoliosis, and any neurological or systemic disorder. Google Forms was used to conduct online surveys as part of the study. Potential respondents were emailed and sent the link to the online survey via WhatsApp.
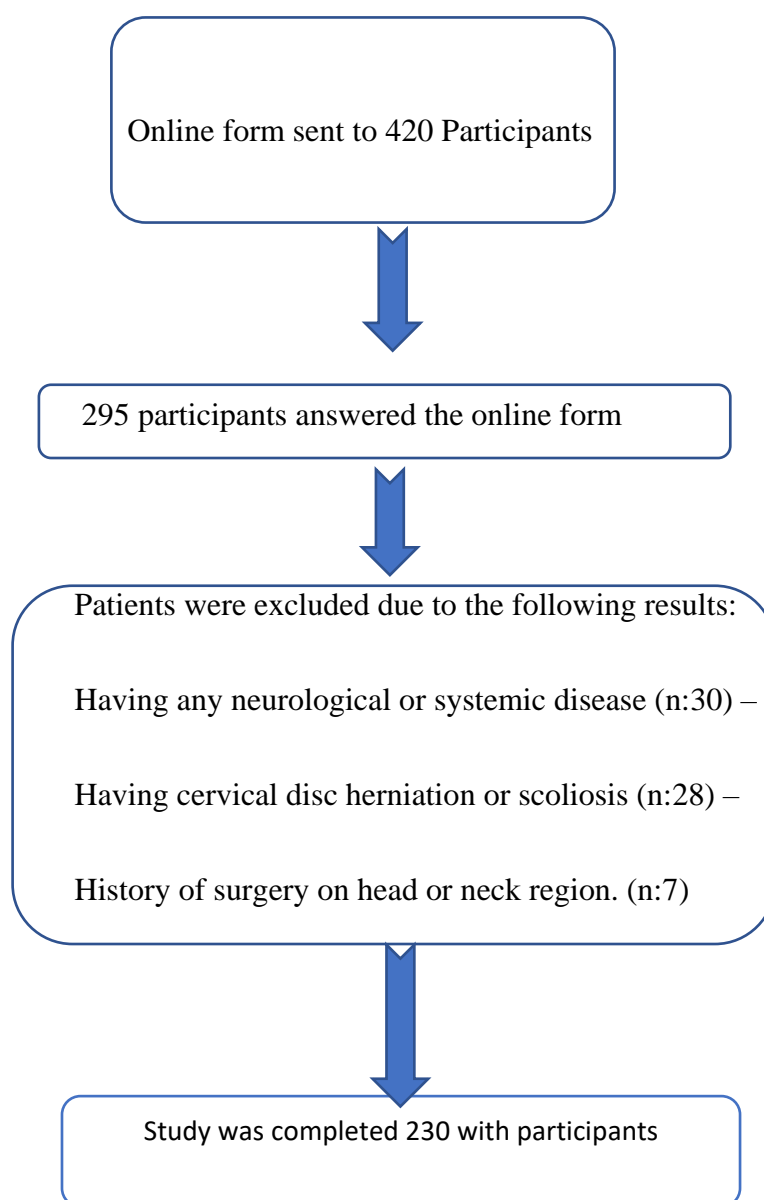
Figure 1. Sample selection flowchart.

Data collection/procedure:

Each participant demographics were noted. Every participant finished the Pittsburgh Sleep Quality Index (PSQI), the NDI, and the Chalder Fatigue Scale (CFS).

The subjects' functional impairment and degree of pain were assessed using the Arabic version of the NDI. Ten questions make up the NDI, and they address topics such as the degree of discomfort, one's capacity for self-care, lifting weights, job capacity, headache intensity, focus, sleep quality, driving, and recreational activities. A total score might have a value of 0 or 50. "No disability" is represented by zero to four points, "moderate disability" by five to fourteen points, "severe disability" by twenty-five to thirty-four points, and "complete disability" by thirty-five to fifty points (15).

Buysse et al. (16) created the Pittsburgh Sleep Quality Index (PSQI). Nineteen of the twenty-four items on this scale are completed by the individual, and five are completed by their bed partner. Of the 19 items that the person must answer, 18 are scored and used to determine the quality of sleep; the remaining 6 things are used to collect clinical data. Subjective sleep quality, sleep latency, duration, habitual sleep efficiency, sleep disturbance, usage of sleeping medicines, and dysfunction throughout the day are its seven components. The sum of the component scores yields the overall PUKI score. Each

component's overall score extends from zero to three, while PUKI's overall score spans from 0 to 21. high Scores denote inadequate quality of sleep. A total score of five or lower denotes high-quality sleep.

In the study, the Arabic version of the questionnaire was utilized, where scores exceeding five signify suboptimal sleep quality (6).

The Chalder Fatigue Scale (CFS) was created by Trudie Chalder and colleagues in 1993 (18). The 11-item CFS includes a 7-item sub-dimension measuring physical tiredness and a 4-item sub-dimension measuring mental weariness (19). The Likert scale had four points. Every item has a point value ranging from zero to three. The ranges for the physical , mental sub-dimensions and the overall fatigue score of weariness are 0 to 21, 0 to 12, and 0 to 33 respectively. High scores suggest a higher degree of exhaustion (18). The study (19) employed the Arabic version of the questionnaire.

Statistical analysis:

Descriptive statistics were utilized in presenting the subjects demographic and clinical data. The normality of data was checked using Shapiro-Wilk test. Pearson correlation coefficient was conducted to investigate the correlation between NDI, sleep quality scale and fatigue scale. Mann-Whitney test was conducted for comparison between subjects with and without neck disability. Multiple linear regression was used to determine the independent variables that had significant association with NDI results. The level of significance for statistical tests was set at $p < 0.05$. All statistical measures were performed through the statistical package for social sciences (SPSS) version 25 for windows.

Results

Subjects' characteristics:

230 subjects participated in this study. Their mean $\pm$ SD age was 25.62 ± 9.25 years respectively with maximum of 35 years and minimum of 16 years. 216 (93.91%) subjects had neck disability and 14 (6.09%) subjects were free. Participant characteristics are presented in table (1).

Table 1. Participant characteristics.

	Mean ± SD	Maximum	Minimum
Age (years)	25.62 ± 9.25	60	18
Sex, n (%)			
Males	57 (24.8%)		
Females	173 (75.2%)		
Job, n (%)			
Student	139 (60.4%)		
Employee	54 (23.5%)		
Not working	37 (16.1%)		

SD, Standard deviatio

NDI, sleep quality scale and fatigue scale in subjects with neck disability:

The mean $\pm$ SD NDI of the study group was 24.29 ± 15.58. The mean $\pm$ SD of sleep quality scale and fatigue scale in subjects with neck disability were 11.28 ± 5.29 and 3.10 ± 2.99 respectively. (Table 2).

Table 2. *Descriptive statistics of NDI, sleep quality scale and fatigue scale in subjects with neck disability:*

	Mean ± SD
NDI	24.29 ± 15.58
Sleep quality scale	11.28 ± 5.29
Fatigue scale	3.10 ± 2.99

SD, Standard deviation

Correlation between NDI, sleep quality scale and fatigue scale in subjects with neck disability:

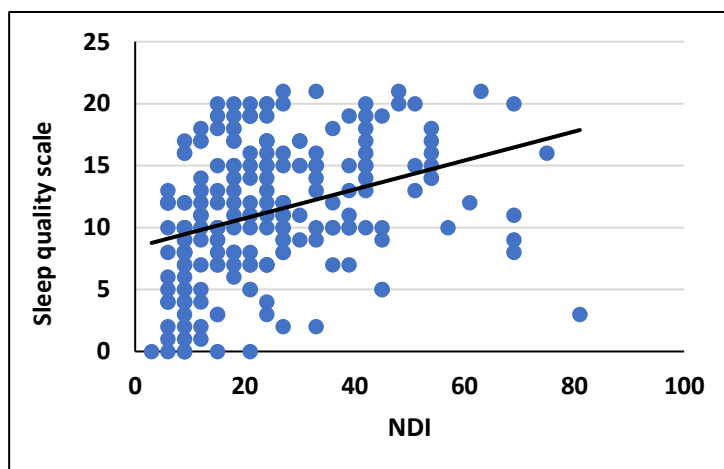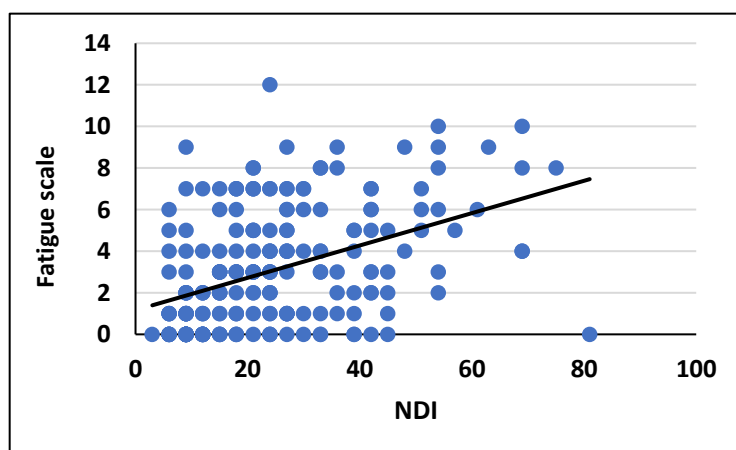The correlation between NDI and sleep quality scale was moderate positive significant correlation (r = 0.333, p = 0.001) and was moderate positive significant correlation with fatigue scale (r = 0.429, p = 0.001).

The correlation between sleep quality scale and fatigue scale was moderate positive significant correlation (r = 0.390, p = 0.001). (Table 3, figure 1-2).

Table 3. Correlation between NDI, sleep quality scale and fatigue scale:

	Sleep quality scale		Fatigue scale	
	r - value	p- value	r - value	p- value
NDI	0.333	0.001	0.429	0.001
Sleep quality scale			0.390	0.001

r value: Pearson correlation coefficient; p value: Probability value

Figure (2). Correlation between NDI and sleep quality scale.

Figure (3). Correlation between NDI and fatigue scale

- Comparison of sleep quality scale and fatigue scale between subjects with and without neck disability:

There was a significant increase in sleep quality scale and fatigue scale of subjects with neck disability compared with that of subjects without neck disability ($p < 0.001$). (Table 3).

Table 3. Comparison of sleep quality scale and fatigue scale between subjects with and without neck disability:

	Subjects with neck disability	Subjects without neck disability		
	Median (IQR)	Median (IQR)	U- value	p value
Sleep quality scale	11 (15-8)	6.5 (8.25-2)	614.5	0.001
Fatigue scale	3 (5-1)	0 (0.25-0)	490	0.001

IQR: Interquartile range; value: Mann-Whitney test value; p-value, probability value

- Prediction of NDI score:

Multiple linear regression analysis revealed that the overall model explained 22% of the variance of NDI score. Both sleep quality scale and fatigue scale were significantly associated and can predict NDI score ($p < 001$).

Table 4. Prediction of NDI from sleep quality scale and fatigue scale:

Model	R^2	B	t	p- value	95% CI	
					Lower Bound	Upper Bound
Sleep quality scale	0.22	0.575	2.965	0.003	.193	.957
Fatigue scale		1.964	5.361	0.000	1.242	2.686

B: Regression coefficient; value: p-value, probability value

Discussion:

This cross-sectional research investigated how sleep quality, as well as mental and physical fatigue, impact mechanical neck pain, which is a departure from most studies that typically examine the influence of neck pain on these three factors. The participant pool predominantly consisted of female students ranging in age from 16 to 35 years.

The result found moderate positive significant correlation between NDI and sleep quality (r = 0.333, p = 0.001) as well as physical fatigue (r = 0.429, p = 0.001). table 3, since the majority of our participant were female and in general risk ratios were higher in females than males (13) (14), also the student are more susceptible through their year of education to the regular activities, like attending lectures, using computers for study purposes, studying for extended periods of time, and participating in practical training sessions, necessitate prolonged sitting and standing, which increases the risk of neck pain, particularly if done with bad posture. And this is discussed by Saddam F. Kanaan et.al in Predictors of neck disability among undergraduate students: A cross-sectional study(11).

The research shows that patients with neck pain have higher scores on the sleep quality scale compared to those without neck pain. A multiple linear regression analysis indicated that the model accounted for 22% of the variation in the Neck Disability Index (NDI) score. Both the sleep quality and fatigue scales showed a significant correlation and predictive ability for the NDI score (p < 0.01). The link between neck pain and sleep quality was confirmed by a study conducted by Gunnel Peterson and Nicklas Pihlström, which found a significant relationship between uninterrupted sleep and pain in the upper body, aligning with our findings. However, their study found no link between general physical activity and upper body pain, which differs from our results. (20).

Research conducted by Juha P. Auvinen and colleagues corroborates our findings and determines that inadequate amount or quality of sleep at ages 15–16 years is a predictor of neck pain and lower back pain (LBP) in females aged 18–19 years. (21).

As per the research carried out by Casey et al. (22), it was observed that emotional exhaustion can serve as an indicator for mechanical neck pain. This implies that people who undergo emotional exhaustion are at a higher risk of developing neck pain owing to mechanical reasons like repetitive movements or incorrect posture, which coincides with our findings.

The study discovered significant differences in the quality of sleep among middle-aged women based on their general characteristics, age, number of comorbidities, and perceived physical work difficulty. The results suggest that younger women have poorer sleep quality. The majority of participants were employed, with women in their 30s having both work and home responsibilities, leading to occupational stress and physical strain from housework and childcare, which negatively affected their sleep quality. Therefore, it is essential to provide support measures for these women by thoroughly evaluating occupational, environmental, and situational factors. The study also found that participants with comorbid diseases had worse sleep quality than those without such diseases, which is consistent with previous research. (6, 23-25)

Limitation of the study

The present study is subject to certain constraints. Initially, we did not utilize an MRI or any other diagnostic tools to identify the underlying reasons for the mechanical neck pain. Furthermore, the assessment of fatigue and sleep quality was based on self-reported subjective measures.

Conclusion

The scales measuring sleep quality and fatigue were significantly correlated with the exacerbation of mechanical neck pain, and conversely, mechanical neck pain was found to intensify issues related to both sleep quality and fatigue.

Our research suggests that physical therapists managing individuals with chronic mechanical neck pain should counsel their patients on achieving sufficient sleep and instruct them in relaxation methods to reduce stress and fatigue, thereby helping to mitigate neck pain.

Conflict of interest statement
The authors declare no conflict of interest.

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