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Sleep Quality in Chronic Neck Pain Patients

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ABSTRACT

Introduction: Neck Pain (NP) is a significant public health issue. Many people's social and economic participation is harmed as a result of NP. Patients with this condition frequently complain of fatigue and pain. Both can disrupt patients' daily lives by affecting their sleep quality, which can lead to psychological issues. However, the prevalence of fatigue and its relationship with pain, sleep quality, and psychological factors in NP patients has not been thoroughly investigated.

Aim: To investigate the prevalence of fatigue and its relationship to pain intensity, depression, anxiety, and sleep disturbance in NP patients.

Materials and Methods: Between March and November 2019, a cross-sectional study of 296 NP patients with a mean age of 37.2 years (181 males and 115 females) was conducted. It was held at the Physiotherapy Department. To assess fatigue, depression and anxiety, sleep quality, and pain intensity, the Multidimensional Fatigue Inventory (MFI), Hospital Anxiety and Depression Scale (HADS), Pittsburgh Sleep Quality Index (PSQI), and Numeric Pain Rating Scale (NPRS) were used. For analysis, Spearman's rank correlation coefficient and the Mann-Whitney U test were used.

Results: The participants' point prevalence of severe fatigue was 39.86%. Pain intensity, psychological factors, and sleep quality were all associated with fatigue (p0.05). In this sample, we also found a significant relationship between sleep quality and psychological factors (p0.05).

Conclusion: Fatigue was a significant factor in NP patients, and it was linked to pain intensity, depression, anxiety, and sleep disturbance. Fatigue was more prevalent in the chronic stage of NP than in the acute stage. Identifying these risk factors may aid in the prevention and management of NP and its associated co-morbidities.

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INTRODUCTION

Neck pain is a disabling musculoskeletal condition that frequently interferes with patients' daily activities [1]. The one-year prevalence of NP ranges from 4.8% to 79.5% [2]. It imposes a significant financial burden on both the individual and the community [3]. NP is caused by a variety of physiological and psychosocial factors [4]. One of these factors that could be involved in NP is fatigue [5]. Fatigue is a complex phenomenon with few precise definitions [6]. It has, however, been defined as a subjective and internal feeling of exhaustion that may or may not be related to physical activity. It can become chronic, interfering with daily activities [7].

Fatigue has a negative impact on both mental and physical health; it can impair or delay the recovery process and cause psychological impairments [8, 9]. It has also been found to be closely related to pain intensity, which may be aetiological in nature for chronic pain participants [10].

A few studies have found a link between fatigue, depression, and sleep disturbances in people with Chronic Low Back Pain (CLBP) and fibromyalgia [11-13]. CLBP, for example, has a high prevalence of fatigue [11]. Poor sleepers reported more fatigue and pain than good sleepers, indicating an association between fatigue and sleep disturbance in CLBP [14]. CLBP has also been linked to a strong link between fatigue and depression [12]. Such associations, however, are poorly

documented in NP. There is a scarcity of research on fatigue and its relationship to depression, anxiety, and sleep disturbance in NP patients. More research into the complexities of fatigue, psychological factors, and sleep disturbances is required to develop targeted interventions for the treatment of NP.

As far as we are aware, no previous research has adequately investigated the prevalence of subjective fatigue in the acute and chronic stages of NP, which is also a major concern in patient management. A thorough understanding of the relationships between all of these factors would be beneficial in understanding and explaining how these factors interact and result in high costs and sufferings.

As a result, the current study had two objectives: To investigate the prevalence of fatigue in the acute and chronic stages of NP, as well as the relationship between fatigue, pain intensity, psychological factors, and sleep disruptions in NP patients. It was hypothesized in this study that NP participants would have a high prevalence of fatigue and that fatigue would have a significant association with pain intensity, sleep quality, and psychological factors.

MATERIALS AND METHODS

Over a 10-month period (March to December 2019), a cross-sectional survey of NP patients was conducted at the Centre for Physiotherapy and Rehabilitation Science, Calculating sample size: A sample of 296 NP patients (181 males and 115 females) was drawn using the free open-source epidemiological statistics toolset (Open EPI) and data on the prevalence of fatigue in low back pain patients [11]. The number of participants was calculated using a design effect of 1.0, a 95% confidence interval limit, and an expected frequency of 26%.

After applying inclusion and exclusion criteria, a total of 402 participants with NP were screened, and 296 were eventually recruited.

Participants in the acute (three months) and chronic (more than three months) stages of pain [15]; participants aged 18 and older; no spine surgery in the previous year; preserved communication; and working knowledge of English were included in this study.

Criteria for exclusion: Cancer, acute or chronic medical conditions, and any medication or disease that made informed consent impossible were all excluded from the study.

STUDY PROCEDURE

The participants were carefully screened and assessed for eligibility by the principal investigators. All of the patients were fully informed about the procedure and their right to withdraw at any time during the study. Before enrolling in the study, they provided written informed consent. NP participants' socio-demographic data was collected, which included questions about their age, height, weight, BMI, gender, marital status, level of education, income, and employment status (retired, employed, applicant). Lifestyle questions (physical activity level, smoking, alcohol consumption, coffee, and tea) were also asked. The MFI, Hospital Anxiety and Depression Scale (HADS), PSQI, and Numeric Pain Rating Scale were all administered to each participant.

OUTCOME MEASURES

Fatigue: MFI assessed fatigue. It is a self-reporting instrument used to assess subjective fatigue [16]. It consists of 20 items designed to assess five fatigue subscales: general fatigue, physical fatigue, mental fatigue, decreased activity, and decreased motivation. There are five points on each subscale. Each subscale has a score range of 4 to 20, and the total score range is 20 to 100. A higher score indicates greater fatigue. A general fatigue domain score of 13 or a reduced activity domain score of 10 has been identified as an indicator of severe fatigue [17]. In this study, the general fatigue subscale score was preferred and used to indicate severe fatigue, as previously recommended [16]. The MFI is a psychometrically appropriate fatigue questionnaire with high internal consistency and validity [16].

HADS examined psychological factors such as depression and anxiety. It is a reliable self-rating scale for assessing depression and anxiety [18]. HADS is made up of 14 items, seven of which deal with anxiety and the other seven with depression. Each question has four possible answers, which correspond to scores ranging from 0 to 3. As a result, the score for depression and anxiety ranges from 0 to 21 points: 0-7 indicating no depression or anxiety symptoms, 8-10 indicating mild symptoms, 11-14 indicating moderate depression and anxiety, and 15 indicating severe depression and anxiety symptoms [19]. The HADS has consistently performed well in assessing the severity of depression and anxiety symptoms in psychiatric and somatic primary care patients as well as the general population [20].

Sleep quality: The PSQI was used to assess sleep quality in NP patients. It is a self-reporting questionnaire in which participants describe their sleep quality over a one-month period [21]. The PSQI has been widely and extensively used in clinical and research settings among various populations. The PSQI consists of 19 questions divided into seven components that add up to form a PSQI global score. Sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medications, and daytime dysfunction are the seven components. Each component is scored from 0 to 3. And the total score is calculated by adding the scores from the seven components, yielding a total score ranging from 0 to 21; the higher the score, the greater the sleep disturbance. A score of more than five indicates poor sleep quality [21].

Pain intensity was assessed using an 11-point Numerical Pain Rating Scale (NPRS). The NPRS asks participants to rate their pain on a scale of 0 to 10, with 0 representing "no pain" and 10 representing the "worst possible pain." The NPRS is simple to use and has been widely used in research and in

various musculoskeletal conditions. It has good validity, and previous research shows a positive and significant relationship between NPRS and other pain intensity measures [22]. Physical activity was assessed by asking, "In the last week, how many days have you done a total of 30 minutes or more of physical activity, which was sufficient to raise your breathing rate?" This may include recreational activities such as brisk walking or cycling, but it should not include activities that may be required for your job." The question has an open-ended response range of zero to seven days in the previous week [23]. This question has moderate validity and strong repeatability, indicating that it has the potential to screen participants for a variety of physical activity interventions [23].

STATISTICAL ANALYSIS

Because the data was not normally distributed, the distribution was initially checked using the Kolmogorov-Smirnov test. The information was entered into a database and analyzed with SPSS-version 21. Spearman's correlation coefficient was used to assess the relationships between fatigue, pain, sleep, and psychological factors at an alpha level less than 0.05. Mann-whitney The U test was used to compare the prevalence of fatigue, depression, anxiety, and sleep disturbance among (acute-chronic) NP participants, as well as male and female participants.

RESULTS

Prevalence of fatigue in NP Patients

Among the recruited patients, 167 had chronic (lasting more than three months) pain and 129 had acute (lasting less than three months). 41.7% of the participants were married, 94% had completed at least a high school diploma, and 43.7% were employed. The average age of the participants was 29.8511.1, and the average present pain intensity was 4.841.7. [Table/Fig-1] shows the demographic and clinical characteristics of NP patients.

Overall, 118 participants (39.86%) had MFI general fatigue of >13, and thus 115 (38.85%) were classified as severely fatigued [Table/Fig-2]. When the data was divided into two groups (acute stage and chronic stage), we discovered that participants in the acute and chronic stages of NP have significantly different levels of fatigue. Chronic NP patients had a higher prevalence of fatigue (49.1%) than acute NP patients (27.1%) (p0.05). There was no significant gender difference in fatigue severity, p>0.05 [Table/Fig-2].

Psychological Factors, Sleep Disturbance and Physical Activity Status In Np Patients

More than half of the participants reported sleep disturbances and anxiety symptoms, and nearly half reported depressive symptoms. The results did not show a gender difference in depression, anxiety, or sleep disturbance (p>0.05), but there were significant differences between the chronic and acute stages of NP, with chronic NP patients reporting more depressive and anxiety symptoms, as well as sleep disturbances (p0.05) [Table/Fig-3,4].

Variables	Minimum	Maximum	Mean±SD†
Age (in years)	21	57	30.3±7.2
Body mass index (kg/m^2)	15.6	33.8	23.6±3.0
Present pain intensity	1	9	4.85±1.7
Average pain intensity	0	9	4.6±4.6
MFI‡			
Global score	4	80	53.4±12.4
General fatigue	1	19	11.5±3.2
Physical fatigue	4	20	11.3±3.0
Mental fatigue	1	20	10.4±3.2
Reduced activity	4	19	10.5±3.0
Reduced motivation	3	19	10.0±3.0
PSQI§			
Global score	0	13	6.3±3.0
Sleep quality	0	3	1.3±0.7
Sleep latency	0	4	1.4±0.9
Sleep duration	0	3	1.0±0.7
Sleep efficiency	0	3	0.6±0.8
Sleep disturbance	0	3	0.9±0.5
Sleep medication	0	3	0.1±0.4
Daytime dysfunction	0	3	1.0±0.8
HADS‖			
Anxiety score	0	20	8.6±3.8
Depression score	0	18	7.2±3.3

[Table/Fig-1]: Demographic and clinical characteristics of neck pain patients.
†Standard deviation; ‡Multidimensional fatigue inventory; §Pittsburgh sleep quality index; ‖Hospital anxiety and depression scale

Fatigue domains	Group	Mean rank	Significant level (Z)
Global MFI* score	Acute	125.69	<0.001 (-3.93)
	Chronic	165.10	
General fatigue	Acute	126.64	<0.001 (-3.78)
	Chronic	164.37	
Physical fatigue	Acute	121.61	<0.001 (-4.68)
	Chronic	168.23	
Mental fatigue	Acute	134.11	0.014 (-2.46)
	Chronic	158.65	
Reduced activity	Acute	134.97	0.021 (-2.3)
	Chronic	157.99	
Reduced motivation	Acute	137.11	0.054 (-1.9)
	Chronic	156.35	
Global MFI score	Male	142.36	0.122 (-1.54)
	Female	158.16	
General fatigue	Male	140.85	0.052 (-1.94)
	Female	160.55	
Physical fatigue	Male	141.46	0.074 (-1.78)
	Female	159.58	
Mental fatigue	Male	142.85	0.152 (-1.433)
	Female	157.85	
Reduced activity	Male	145.61	0.464 (-0.732)
	Female	153.04	
Reduced motivation	Male	145.27	0.413 (-0.819)

[Table/Fig-2]: Items of multidimensional fatigue inventory (Results of Mann-whitney test).

*Multidimensional Fatigue Inventory

The analysis of the relationship between psychological factors and sleep quality reveals a significant relationship between these factors. Only 14% of the sample was physically active, and 86% did not meet the minimum recommended level of physical activity, which is 150 minutes per week of moderate-intensity aerobic physical activity [24].

Anxiety symptoms	Participants N (%)
Normal (0-7)	105 (35.6%)
Borderline case (8-10)	95 (32.1%)
Case (11-21)	96 (32.3%)
Depression symptoms	Participants (N=296)
Normal (0-7)	155 (52.4%)
Borderline case (8-10)	94 (31.7%)
Case (11-21)	47 (15.7%)

[Table/Fig-3]: Hospital Anxiety and Depression Scale.

Pittsburgh sleep quality index	Participants (N=296)
Normal sleep quality (0-5)	117 (31.1%)
Mild disturbance (6-8)	113 (38.2%)
Moderate disturbance (9-12)	62 (20.9%)
Severe disturbance (>12)	4 (1.4%)

[Table/Fig-4]: Sleep quality in neck pain patients

Bvv Correlations between Pain Intensity, Anxiety, Depression, and Sleep and Fatigue Except for mental fatigue, the Global score and all MFI domains are significantly correlated with pain intensity (p0.005). There was also a significant correlation (p0.005) between the Global fatigue score and its domains and psychological factors. Furthermore, all fatigue domains and the Global MFI score were significantly associated with sleep quality (p0.005). Furthermore, a significant relationship between psychological factors and sleep quality was discovered (p0.005). [Table/Fig-5].

DISCUSSION

The study's goal was to look at the prevalence of fatigue in both the acute and chronic stages of NP and to see if there was a link between fatigue and depression, anxiety, and sleep disturbances. To the best of our knowledge, no previous research has looked into the prevalence of subjective fatigue among acute and chronic NP patients. The current study reveals that fatigue is a significant issue in NP. The fatigue prevalence in this sample was high (39.86%), which is higher than the 9.9% and 0.9% observed in the general population, respectively [25]. A previous study with a smaller sample size of chronic NP patients (N=33) found that fatigue is a common complaint among chronic NP patients [5]. The study was the first to use a fatigue inventory to clearly document fatigue in patients with chronic NP and CLBP. This study's findings and discussion were based primarily on data collected from CLBP patients (N=175) rather than chronic NP patients (N=33). Furthermore, only people suffering from chronic pain were recruited for the study [5]. There was also a high prevalence of fatigue among CLBP patients, which was 26% and 70%, respectively [11,12].

The data in this study was divided based on gender (male or female) and NP stage (acute or chronic). There were no gender differences in fatigue; however, there was a significant difference in fatigue between the acute and chronic stages of NP. Fatigue is a common complaint in both the acute and chronic stages of NP, but participants in the chronic stage reported significantly higher levels of fatigue than those in the acute stage. Fishbain DA et al., 2003 reviewed a large body of literature (17 high quality articles) that indicates a significant relationship between fatigue level and pain intensity across various clinical conditions [10]. A previous study on rheumatoid arthritis patients found a significant link between fatigue and pain [26]. A recent study found a strong and significant relationship between pain severity and fatigue level in CLBP patients [27]. As a result, the current findings support previous research on the relationship between pain and fatigue.

Parameters	Present pain	Average pain	MFI* global	GF†	PF‡	MF§	RA‖	RM**	PSQI†† global	Anxiety score	Depression score
Present pain	-	-	0.331**	0.352**	0.261**	0.125*	0.213**	0.322**	0.434**	0.340**	0.283**
Average pain	-	-	0.308**	0.303*	0.214**	0.163**	0.174**	0.298**	0.405**	0.379**	0.302**
MFI global	0.331**	0.308**	-	-	-	-	-	-	0.473**	0.429**	0.456**
GF	0.352**	0.303**	-	-	-	-	-	-	0.407**	0.410**	0.296**
PF	0.261**	0.214**	-	-	-	-	-	-	0.299**	0.322**	0.348**
MF	0.125*	0.163**	-	-	-	-	-	-	0.425**	0.300**	0.296**
RA	0.213**	0.174**	-	-	-	-	-	-	0.309**	0.277**	0.271**
RM	0.322**	0.298**	-	-	-	-	-	-	0.378**	0.310**	0.390**
PSQI global	0.434**	0.405**	0.473**	0.407*	0.299**	0.425**	0.309**	0.378**	-	0.409**	0.429**
Anxiety score	0.340**	0.379**	0.429**	0.410*	0.322**	0.300**	0.277**	0.310**	0.409**	-	0.613**
Depression score	0.283**	0.302**	0.456**	0.296*	0.348**	0.296**	0.271**	0.390**	0.429**	0.613**	-

[Table/Fig-5]: Spearman rank correlation coefficient.
*Multidimensional fatigue inventory; †General fatigue; ‡Physical fatigue; §Mental fatigue; ††Pittsburgh sleep quality index; ‖Reduced activity; **Reduced motivation; *Correlation is significant at the 0.05 level(2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

The cause of fatigue symptoms is not well understood. The structures related to pain physiology, on the other hand, can explain the fatigue-pain association. Involvement of structural lesions that impair the normal activation process in pathways connecting the higher cortical center and the basal ganglia, thalamus, and limbic system [28]. These similarities may explain the close relationship found in the relevant literature between fatigue and pain. Previous research has

indicated that improvement in fatigue level may be secondary to reduction in pain intensity [29]. And this link could be aetiological, as previous research suggests that fatigue reduction is mediated by pain reduction, night pain, and sleep interference [9,10].

The significant association of fatigue domains with depression, anxiety, and sleep disturbance in this population is one of the most remarkable findings to emerge from the current findings. The link between fatigue and depression and anxiety appears to be significant, as both symptoms perpetuate fatigue [30]. It has been demonstrated that higher levels of depression are associated with an increase in fatigue [31]. It is also important to remember that one of the diagnostic criteria for depression is fatigue [32]. Fewer studies have been conducted to investigate the relationship between fatigue symptoms and anxiety. Although the evidence appears to suggest that anxiety is associated with a poor fatigue prognosis [33], determining the precise nature of the association may be difficult and requires additional research.

It would appear intuitive to propose a link between fatigue and sleep disturbance, as fatigue would logically lead to sleep disturbance or vice versa. However, the nature of their relationship is unknown. Previous research, however, has discovered a link between the magnitude of fatigue observed and the corresponding disturbances [34]. The experimental study, which demonstrated an increased level of fatigue with experimentally created sleep deprivation [35,36], provides the most compelling evidence concerning the association between fatigue and sleep disturbance. It is critical to remember that there appears to be a complex interrelationship between fatigue and sleep [35]. It's also worth noting that none of the studies in the literature were able to determine whether sleep disturbance has a direct impact on fatigue or whether this association is mediated by the increased level of pain found after poor sleep [37].

This finding highlights how little is known about fatigue and its relationship to depression, anxiety, and sleep disturbance in NP patients. These findings have important implications for understanding the causes of NP as well as improving and managing the signs and symptoms associated with it. Our findings are consistent with those of Fishbain DA et al. (2004), who discovered a link between depression and fatigue in CLBP and chronic NP patients [5]. According to the findings, depression is a significant predictor of fatigue in CLBP and chronic NP patients. Furthermore, depression was found to be strongly related to fatigue in CLBP patients [12]. There has been little research on the relationship between fatigue and sleep in NP patients. The current findings show a significant relationship between fatigue and sleep. Moxham EG, 1999, discovered that sleep disturbance mediates the relationship between fatigue and pain in fibromyalgia patients [38]. Similar findings have been observed in fibromyalgia patients, where fatigue was found to be significantly associated with sleep disruption [13]. CLBP is associated with fatigue, sleep disturbance, and depression, according to a recent study conducted by Saravanan A et al., 2019 [27].

The current study's findings on psychological factors and sleep quality in NP patients are also significant. The findings show that symptoms of anxiety, depression, and sleep disturbance are prevalent in NP patients and are significantly correlated. Depression was found to be a significant predictor of sleep disturbance in chronic pain patients [39]. Previous research has found a link between depression and sleep disturbance in CLBP [40]. The current findings also show that anxiety, depression, and sleep disturbance are more prevalent in the chronic stage of NP than in the acute stage.

The findings of the index study could provide critical information about the pathogenesis of acute and chronic NP. In general, the exact cause of NP is unknown, though there is agreement that the most likely causes of NP are multi-factorial in nature. Many patients with NP who have chronic pain report that their symptoms were initially acute and then progressed to a long-term condition. Efforts have been made in recent decades to identify patients with acute pain who are at high risk of developing chronic pain. This identification process is theoretically and clinically significant. Previous research has implicated psychosocial factors such as depression and anxiety in the pathophysiology of acute and chronic pain, as well as the transition from acute to chronic pain conditions [41]. The current findings add to the existing literature on the transition from acute to chronic NP. The findings indicate that fatigue, depression, anxiety, and sleep disturbances are more prevalent in the chronic stage of NP than in the acute stage, implying that the aforementioned factors may play a role in the aetiology of acute NP as well as the transition from acute to chronic NP. As a result, managing these factors is likely to be critical in preventing or controlling NP symptoms. The current study's findings establish a link between fatigue, depression, anxiety, and sleep disturbance, prompting us to recommend treating these symptoms as soon as they are identified.

The role of fatigue, depression, anxiety, and sleep disturbance in NP is highlighted in this study. Appropriate intervention for these factors may aid in the reduction of pain-related co-morbidities in NP. Our findings suggest that fatigue management, depression and anxiety symptoms reduction, and restoration of healthy sleep may be beneficial to NP patients in reducing pain or reducing their vulnerability to developing more severe stages of pain. The increased frequency of fatigue in chronic NP can also be used to predict the development of chronicity. As a result, improving these co-morbidities may reduce vulnerability to NP and allow for more effective therapeutic intervention

LIMITATIONS

The current study lacked objective methods for evaluating fatigue and other variables. Due to the large sample size, it was difficult to account for all confounders such as age, stress, fear, and pain catastrophizing. Future research could

address these limitations by employing a different methodology that allows for the validation of this association.

CONCLUSIONS

The current study discovered a high prevalence of fatigue in NP patients. Fatigue was significantly associated with pain intensity, anxiety, depression, and sleep. More research is needed to identify the factors that may be linked to fatigue in NP patients. The relationships between these variables appear to indicate that an indirect pathway exists between them, but more research is needed to thoroughly investigate this issue. Fatigue, sleep disturbance, and psychological factors in NP are largely unexplored and underappreciated. Future research is needed to confirm this association and investigate the prognostic capacities of these factors. More interventional and cross-sectional studies are needed to investigate when and how these factors emerge, as well as how they interact and impact pain intensity. Furthermore, more research into the effects of various treatment approaches on these factors is required.

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