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Correlation of Sleep Duration and Musculoskeletal Pain in Night Shift Security Guards

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Abstract: ***The objective of this study was to find a correlation between the sleep duration and musculoskeletal pain in night shift security guards. They not only have their sleep compromised due to their work shifts but also have work related musculoskeletal disorders. A total of 100 security guards participated in the study, who were asked about their sleep durations and any musculoskeletal pain. The screening tools used for the study were theNordic Musculoskeletal Questionnaire and the Visual Analogue Scale,which were used for assessing the pain site and level respectively. The findings indicate an inverse correlation between the sleep duration and musculoskeletal pain (r value = -0.07431, P value = 0.4625). Also, the study identifies the primary sites of pain complaints among the security guards which were lower back, followed by knee and ankle respectively.***

Keywords: Sleep duration, Nordic Musculoskeletal Questionnaire, security guards, pain, night shift

1. Introduction

Sleep is a natural state of mind and body characterized by altered consciousness, reduced sensory activity, decreased muscle activity, and limited interaction with the surroundings.However, both excessive and insufficient sleep durations have been associated with an increased risk of various health problems. Numerous studies have reported that sleep deprivation has adverse effects on clinical outcomes in patients with musculoskeletal (MSK) pain, exacerbating pain levels, psychological well-being, and physical functionality. Sleep disturbances are also linked to systemic diseases such as type 2 diabetes, coronary heart disease, stroke, and increased mortality rates. [1], [2], [3], [4], [5]

In recent years, there has been a significant rise in the prevalence of MSK disorders due to the demands of modern industrial lifestyles. These disorders not only contribute to employee absenteeism but also have a profound impact on their overall quality of life.[5] Workers involved in repetitive and static tasks are particularly susceptible to work-related MSK disorders, stress, fatigue, and even psychological conditions that can trigger pain, even without the presence of an actual injury. [6], [7]

Security guards, for instance, spend the majority of their working hours in either a standing or a sitting position. This prolonged standing places them at a higher risk of hazards associated with this posture. Similarly, prolonged sitting, defined as remaining sedentary for extended periods of 2 hours or more, has been found to increase the likelihood of developing MSK disorders, especially low back pain. Health consequences linked to prolonged sitting include cardio-metabolic diseases, type 2 diabetes, obesity, coronary artery disease, MSK disorders, certain types of cancer, and an increased risk of premature death.[8]

Sitting for extended periods significantly affects the spacing between the vertebrae in the spine, leading to elevated pressures on intervertebral discs compared to standing or walking. Depending on the sitting posture, the pressure levels vary, with upright sitting without back support leading to 140% of standing disc pressure, and sitting with a forward trunk lean resulting in 190% of standing disc pressure. In addition to elevated disc pressures, sitting puts strain on ligaments and increases loads on muscles and tendons, raising the risk of pain, discomfort, strains, and injuries associated with postural stress disorders, joint compression, and soft-tissue injuries. Recent studies have also shown a strong association between static sitting behaviour and experiencing back pain within the last 24 hours.[9]

Sitting for prolonged periods can also weaken back muscles and lead to an imbalance in posture, characterized by hunched shoulders and a forward head position. Unfavourable working postures can result in increased muscle tension in the neck and shoulders, leading to elevated pressure on blood vessels and reduced blood flow, resulting in painful neck, shoulder muscles, and cold hands.[9]

Another factor to consider is shift work, which involves working outside the conventional hours of 7 a.m. to 6 p.m.Individuals engaged in service jobs often have to work day and night shifts. [10],[11] Unfortunately, night shift security guards experience disrupted sleep patterns, which, combined with prolonged sitting, make them particularly susceptible to MSK discomfort.

2. Literature Survey

1) Chun, Min Young et al. Conducted a study on Association between sleep duration and MSK pain. This study analyzed data from the Korea National

Health and Nutrition Examination Survey, involving 17,108 adults aged 50 years and above. The participants' self-reported daily sleep duration and the presence of musculoskeletal (MSK) pain in the knee joint, hip joint, or low back were examined. The findings revealed a U-shaped relationship between sleep duration and the presence of MSK pain. After accounting for other factors, it was observed that individuals who slept for ≤5 hours or ≥9 hours had a significantly higher likelihood of experiencing MSK pain for more than 30 days within a 3-month period. Furthermore, those who reported sleeping for ≤5 hours or ≥9 hours had a higher prevalence of multi-site MSK pain compared to those who slept for 7 hours.

2) Martinez-Gomez D, Eisenmann JC, Gomez-Martinez S, et al. Conducted a study on, Sleep duration and emerging cardiometabolic risk markers in adolescents.The study found a significant inverse association between sleep duration and C-reactive protein (CRP) levels, after controlling for sex, age, and pubertal status. This relationship remained consistent even when considering moderate-to-vigorous physical activity (MVPA). However, the association between sleep duration and CRP levels was slightly weakened when body mass index (BMI) was included. These findings suggest that inadequate sleep duration during adolescence may independently contribute to cardiovascular and metabolic diseases through its impact on CRP levels.
3) Kaur, S., Sudhakar, K., & Gupta, S. In their study To Study the prevalence of MSK Disorders in Security guards In their study on the prevalence of musculoskeletal (MSK) disorders in security guards, the researchers found that the promotion of industrial life has led to a significant increase in MSK disorders. These disorders have become a major cause of employee absenteeism and have a significant impact on their quality of life. The study conducted a cross-sectional survey involving 100 security guards in Punjab, India, aged between 30 and 50 years. Among the participants, 68% reported MSK discomfort in various areas, with back pain being the most common issue. The prevalence of MSK disorders was highest among security guards aged 46-50 years (97.1%) and the age group of 41-45 years (76.2%). A common risk factor identified was repetitive gate opening, which is inherent to their job. The security guards most commonly used coping strategy for MSK discomfort was switching from a standing to a sitting position.
4) Daneshmandi, H. et al Conducted a study on Adverse Effects of Prolonged Sitting Behaviour on the General Health of Office Workers. In their study, the researchers emphasized that excessive sitting behaviour poses a significant risk for various adverse health outcomes. Their findings revealed that a substantial percentage of participants experienced symptoms related to prolonged sitting. Specifically, 53.5% reported neck symptoms, 53.2% reported lower back symptoms, and 51.6% reported shoulder symptoms. These results strongly suggest that spending long durations in a seated position is associated with detrimental effects such as fatigue throughout the workday, reduced job satisfaction, hypertension, and the development of musculoskeletal (MSK) disorder symptoms in areas including the shoulders, lower back, thighs, and knees among office workers.
5) Cappuccio FP, et al. Conducted a study on Sleep duration predicts cardiovascular outcomes: a systematic review and meta-analysis of prospective studies. In this comprehensive meta-analysis study, 15 articles were selected from various databases including MEDLINE (1966-2009), EMBASE (from 1980), the Cochrane Library, and manual searches. This study aimed to investigate the relationship between sleep duration and cardiovascular outcomes. The researchers found compelling evidence to suggest that both short and long durations of sleep serve as predictors or markers of cardiovascular outcomes.
6) Cariou M, Galy E, Mélan C. Conducted a study on Differential 24-hour variation of alertness and subjective tension in process controllers: Investigation of the relationship with body temperature and heart rate. This study examined the effects of shift work and time-on-shift on alertness, perceived tension, and physiological variables. While alertness and body temperature displayed circadian variations in real-job conditions, the circadian variations in heart rate (HR) were partially masked. Factors such as job demands influenced subjective tension and masked the circadian variations in HR.

3. Problem Definition

Sleep disturbance is linked to systemic diseases like type 2 diabetes, coronary heart disease, and stroke, and is associated with increased mortality. Sleep deprivation also negatively impacts clinical outcomes in patients with musculoskeletal (MSK) pain, exacerbating pain levels, psychological health, and physical functionality. [2],[3],[4]A study in Korea found that both longer and shorter sleep durations were associated with a higher prevalence of MSK pain.[1] Healthcare professionals should recognize the relationship between MSK pain and sleep problems when treating patients. Night shift security guards, who experience disrupted sleep cycles and are exposed to MSK issues due to static postures and repetitive movements, have limited evidence regarding the correlation between sleep duration and MSK pain. Therefore, this study was aimed to explore this relationship specifically in night shift security guards.

4. Method

In this study, several key steps were followed to ensure a comprehensive and informed approach. Written informed consent was obtained from all participating subjects, ensuring their voluntary participation. The purpose of the study and the procedures involved was clearly explained at the outset, ensuring transparency and understanding. Demographic data was collected, and subjects were selected based on specific inclusion and exclusion criteria. The inclusion criteria include patients who were willing to participate, patients who had less than 7 hours of sleep, patients who worked for at least 5 days a week, and patients who had been working as night shift security guards for the past 2 years. Conversely, the exclusion criteria comprise patients with a history of any recent injury, patients with any

systemic disease, patients with a previous history of musculoskeletal (MSK) pain, and patients with a history of any psychological disease.

To assess sleep duration, patients were asked a direct question: "How many hours do you usually sleep per day?" This information was recorded for analysis. Furthermore, the assessment of MSK pain was conducted using the Visual Analogue Scale, allowing patients to express the intensity of their pain accurately. The patients were also be screened for pain in various sites using the Nordic MSK questionnaire. The different components of the questionnaire were thoroughly explained to the patients, ensuring their comprehension, and then they were asked to complete the questionnaire. Lastly, after data collection, a comprehensive analysis was performed to gain insights and draw conclusions from the gathered information. These meticulous steps contributed to the overall quality and validity of the study's findings

5. Results

Data was collected on assessment sheets. Microsoft Excel was used to make the tables and the data was analysed and graph were plotted using MedCalc® statistical software version 20.218.

Table 1: Data summary

Descriptive Statistics	No.	Minimum	Maximum	Mean	Std. Deviation
Age	100	22	56	33.91	7.265658813
Hrs. of Shift	100	8	12	10.435	0.970928432
Hrs. of Sleep	100	0	8	5.37	1.360741034
VAS	100	0	9	3.76	3.008808617

The mean age of night shift security guards participating in the study was 33.91 ± 7.26 years. The average duration of each shift worked by the night shift security guards was found to be 10.435 ± 0.97 hours. Additionally, the mean hours of sleep reported by the participants were 5.37 ± 1.36 hours. The assessment of musculoskeletal pain using the visual analogue scale (VAS) yielded an average score of 3.76 ± 3.

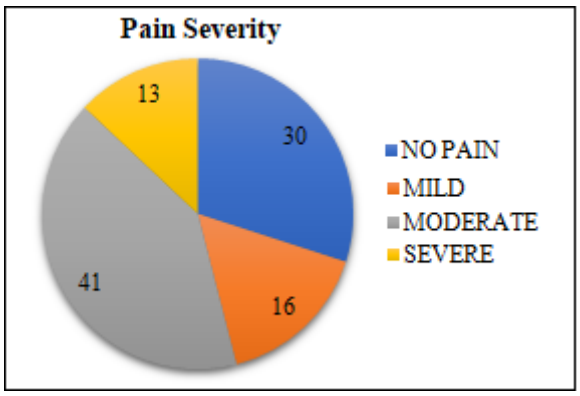

Figure 1: This bar graph represents the severity of the pain

The study found that among the night shift security guards, 41% reported experiencing moderate pain. A significant portion of guards, accounting for 30%, reported no pain at all. Mild pain was reported by 16% of the guards, while a smaller percentage of 13% reported severe pain.

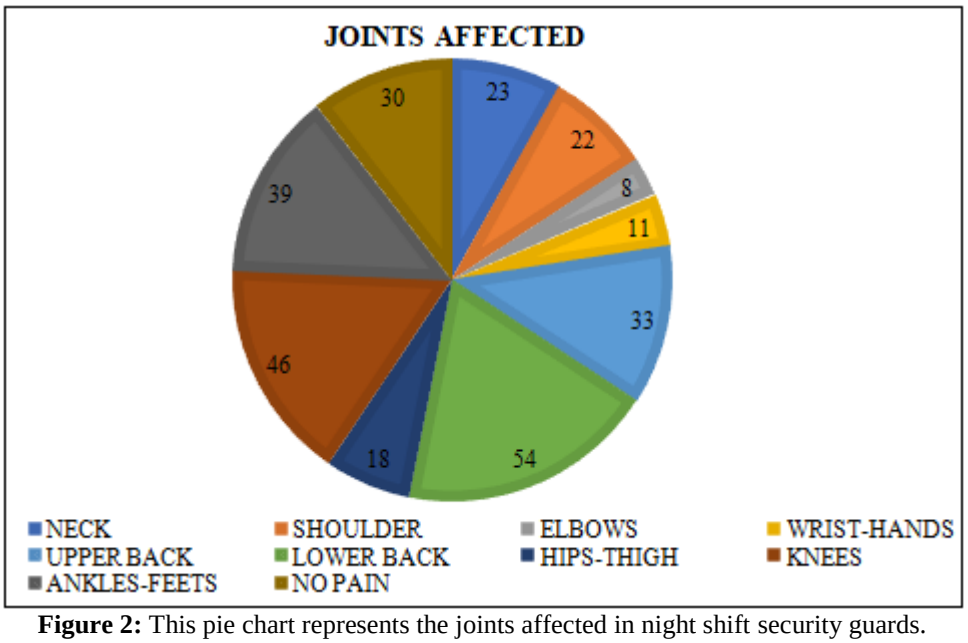

Figure 2: This pie chart represents the joints affected in night shift security guards.

The study revealed that the most commonly reported pain site among the night shift security guards was the lower back, with a total of 54 guards experiencing discomfort in this area. Following closely behind, 46 guards reported pain in their knees, while 39 guards complained of ankle pain. Other reported pain sites included the upper back (33 guards), neck (23 guards), shoulders (22 guards), hips and thighs (18 guards), wrist and hand (11 guards), and elbows (8 guards). It is noteworthy that 30 guards did not report any joint pain. These findings highlight the specific areas of the body that are most susceptible to pain among the night shift security guards in the study.

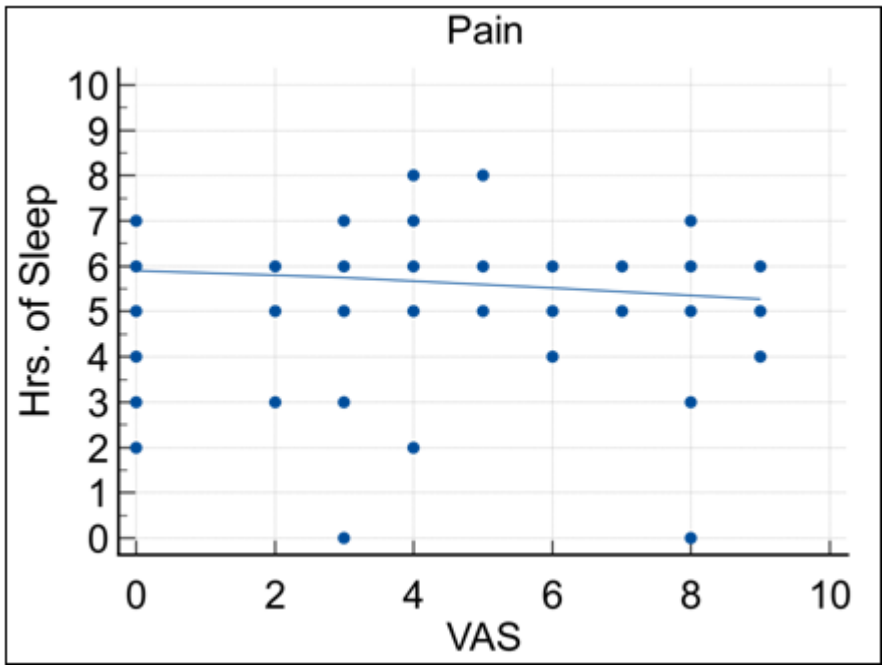

Figure 3: The scatter plot shows the correlation between hours of sleep and pain intensity in night shift guards.

The Karl Pearson's test was used to find the correlation between hours of sleep and the pain intensity.

Table 2: P value and r value

Correlation (r value)	P Value
-0.07431	0.4625

From the scatter plot and the Pearson's coefficient it is seen that there is an inverse correlation between hours of sleep and pain intensity.

6. Discussion

This study aimed to investigate the correlation between sleep duration and musculoskeletal (MSK) pain in night shift security guards. A total of 100 willing guards were included in the study, while those with recent MSK injuries or a history of systemic or psychological diseases were excluded.

Data was collected using data sheets, where guards provided information about their shift hours and daily sleep duration. MSK pain was assessed using the Visual Analogue Scale (VAS), and the pain site was determined through the Nordic Musculoskeletal Questionnaire. The mean age of the security guards was 33.91 ± 7.26 years, with an average shift duration of 10.435 ± 0.970 hours and an average sleep duration of 5.37 ± 1.36 hours.

The study revealed that 41% of guards experienced moderate pain, while 30% reported no pain. Additionally, 16% had mild pain, and 13% reported severe pain (as shown in Figure 2). Guards in this occupation often engage in prolonged sitting and standing, which exposes them to work-related musculoskeletal disorders and associated pain or discomfort. While mild and severe pain can be more clearly defined, moderate pain indicates a gradual impact on normal functioning. Neglected mild pain can escalate and affect day-to-day activities, leading to increased severity. Guards described their pain as moderate, as it was not unbearable but still caused discomfort in their daily lives and work.[5],[17]

Regarding the most common pain sites reported by guards, 54 complained of lower back pain, followed by 46 with knee pain and 39 with ankle pain. Lower back pain often results from muscle fatigue due to maintaining an upright posture throughout their shifts and the stress on the lower vertebrae from prolonged postures.[5],[6] Additionally, pain and discomfort may be caused by tissue damage resulting from prolonged low-intensity loading and stress on passive structures such as ligaments and intervertebral discs.[18],[20],[21]

The primary objective of the study was to examine the correlation between sleep duration and MSK pain. The results showed an inverse relationship, indicating that decreased sleep duration was associated with increased MSK pain. This can be attributed to sleep deprivation increasing an individual's sensitivity to noxious stimuli while reducing pain-inhibitory mechanisms.[22] Night shift security guards, who often have compromised sleep, are susceptible to work-related MSK disorders such as lower back and knee pain, as observed in this study. Reduced sleep duration can also worsen an individual's MSK condition, psychological state, physical functioning, and impact systemic diseases like type 2 diabetes, coronary heart disease, stroke, and overall mortality rate.[2],[3],[4]

These findings highlight the importance of addressing sleep duration and quality as a critical factor in preventing and managing musculoskeletal pain among night shift security guards. Implementing strategies to optimize working conditions, raising awareness about sleep hygiene, and providing appropriate interventions and support can significantly improve the well-being and overall health outcomes of these individuals. Further research is needed to explore additional factors influencing the sleep-pain relationship and to develop targeted interventions tailored to the unique needs of night shift workers in various industries.

7. Conclusion

In conclusion, the study revealed an inverse relationship between sleep duration and musculoskeletal (MSK) pain in night shift security guards. As sleep duration decreased, MSK pain increased. The majority of guards reported moderate pain, followed by those reporting no pain. The lower back was identified as the most commonly affected joint, followed by the knees and ankles.

This study provides valuable insights into the major areas of MSK pain among security guards and emphasizes the significance of adequate sleep duration. However, certain limitations should be acknowledged. The sample size was limited, focusing on a specific age group and occupation, which restricts the generalizability of the findings to other populations. Additionally, the study solely considered sleep duration and did not examine sleep quality or other sleep-related factors. Nevertheless, the implications of these findings are crucial for the management and well-being of night shift security guards. Recognizing the importance of addressing sleep duration and quality can help prevent and manage MSK pain in this population. Employers and healthcare professionals should prioritize interventions that promote adequate sleep and create supportive work environments.

8. Further Scope

Indeed, future research should take into account the suggestions you mentioned to further enhance our understanding of the sleep-pain relationship. Conducting similar studies on a broader scale with larger populations would provide more robust and generalizable findings. By including people from various age groups, we can better understand how sleep duration and MSK pain may differ across different stages of life.

Expanding the study to include individuals from different occupations would also be valuable. This would allow for a comparison of sleep duration, pain levels, and potential occupational factors that may contribute to MSK pain. It could help identify specific occupations that are at higher risk and inform targeted interventions to mitigate MSK pain in those professions.

Furthermore, using different outcome measures in similar studies would offer a more comprehensive perspective on the sleep-pain relationship. Exploring measures such as sleep quality, sleep architecture, pain intensity, functional limitations, and psychological factors could provide a more nuanced understanding of the complex interplay between sleep and pain.

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