SYSTEMATIC REVIEW

Relation of sleep and musculoskeletal disorders among workers: A systematic review

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Abstract

Objective: To systematically review literature on the relationship of sleep with musculoskeletal disorders.

Method: The systematic review was conducted after approval from the ethics review board of the University of Lahore, Lahore, Pakistan, and comprised search of relevant literature published from 2012 to 2020 on Web of Science, Latin America and the Caribbean Literature on Health Sciences and PakMedinet electronic databases. The key words used during the search included workers, musculoskeletal pain, insomnia, musculoskeletal diseases, pain and sleep disorders. outcome measures were the Nordic Musculoskeletal Questionnaire, Numerical Rating Scale, Musculoskeletal Complaint Severity Index, Epworth Sleepiness Scale, Bergen Insomnia Scale, Karolinska Sleepiness Questionnaire and the National Institute for Occupational Safety and Health score. PROSPERO CRD42021281084

Results: Of the 1,538 studies found, 13(0.8%) were reviewed. The relationship between pain and sleep was not found among studies but, sleep disturbances were found to be linked to MSK pain in various parts of the body among workers.

Conclusion: Healthy lifestyle contributing to improvement in sleep quality and prevention of musculoskeletal pain should be considered in order to enhance the quality of life among workers.

Systematic review registration: PROSPERO CRD42021281084

Keywords: Allied health personnel, Insomnia, Musculoskeletal pain, Musculoskeletal diseases, Pain, Sleep disorders.

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Introduction

Work related musculoskeletal disorders (MSDs) are overuse disorders of the tendons, muscles, joints, nerves and the circulatory system that are caused or exacerbated by work or the work surroundings over time. They are associated with discomfort, pain and functional loss in the area affected by a complex interplay among physical, mental, biomechanical and physiological job loads, as well as behavioural and cognitive aspects.[1]

Both sleep and pain have an impact on one another. Sleep difficulties can worsen pain, while pain makes sleeping difficult. Pain-on and pain-off neurons can help us understand the anatomical relationships of pain and sleep phenomenon. The wake-sleep cycle has an effect on these neurons in the nucleus raphe magnus, which help and hinder nociceptive impulses to thalamocortical paths. Deep sleep fully activates inhibitory pain-off nerve cells, whereas waking fully activates excitatory pain-on nerve cells. Serotonin is important in inducing both analgesia and deep sleep.[2]

In prior researches, MSD was exacerbated by urging physical labour and demanding labour environment, such as carrying heavy objects or lifting them, positions that are exhausting, uncomfortable posture or repetitive movements.

MSDs have been associated with and attributed to psycho-stressful work as well, like psychosocial variables, including working stresses, including time restrictions, reduced employment, insufficient social or supervisory support, effort-reward imbalance, or conflict between career and family. This applies to sleep issues and disorders commonly faced by hospital staff, particularly nurses, which have potential risks similar to that of MSD, but appear to be linked to musculoskeletal (MSK) pain. Despite the fact that anxiety and discomfort in general, and occupational overload and MSK pain, in particular, are identified as predictors or correlates of sleep deprivation, only a few researchers have looked at stress-related and severe MSDs in relation to sleep disorders (SDs).[3]

Literature suggests 7.40 hours of sleep are essential for the wellbeing of workers, physically and mentally, while work time has shown to affect sleeping, and even if the official work weekly standard is 40 hours, some workers opt for overtime and thus develop insomnia.[4]

Multiple sleep problems are quite well-documented as the cause of increased sensitivity to pain and an increased risk of pain.[5] A literature review conducted by Menfee et al.[6]

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suggested that sleeping measures commonly associated with chronic pain are daytime sleeping and insomnia. Disrupted sleep could lead to sleeping during the day. Sleep deprivation during the day relates to an individual's daily lifestyle of sleep. Changani et al.[7] discovered that sleepy people had a lower tolerance level than non-sleepy people. In longitudinal and cross-sectional studies,[8] sleepiness has also been linked with MSK pain.

In both longitudinal and cross-sectional research, insomnia has also been linked to a higher risk of MSDs and headache.[9] In a massive population research of 10,412 individuals, insomnia was linked to lower pain threshold. Besides, Dzierzewski et al.[10] showed that elderly people suffering from insomnia reported more pain after a night of lower sleep time, which in itself is a characteristic of insomnia.

Workplace wellbeing is often impacted by MSDs. Sustaining a standing pose for extended periods of time throughout work practice may have a harmful impact on school teachers' life quality. Employees who frequently indulge in hand-based activities have been found to encounter body pain, especially in the lumber region and upper body (shoulders).[11] As a result, the lower body is frequently assisting the release of the body structure, which can contribute to MSDs.

Similarly, inadequate sleep quality has been reported to have a significant influence on daytime activities in people suffering from chronic pain. Sleep quality is an essential factor in one's wellness, with inadequate sleep contributing to MSK pain episodes. Sleep deprivation has previously been shown to increase fatigue and pain.[12]

Sleep difficulties, depression and MSK discomfort symptoms frequently coexist. Farmworkers who suffer from sleep disorders, depression or MSK pain may be at a higher risk of job injuries, in addition to being at a higher risk of developing various medical conditions.[13,14] Operating with dangerous chemicals, managing pointed farm tools, and bending and lifting heavy loads on a regular basis are risk factors that increase the chance of injury. Considerations about the incidence and relationship between drowsiness, depressed symptoms, and MSK discomfort among farmworkers are thus justified. The complexity of getting a sufficient and undisturbed night's sleep may be exacerbated by congested standards of living.[15]

Sleep problems are a crucial element of depression. A study discovered that Latino migrant farmworkers who reported sleep issues or depression were more likely to suffer from persistent back pain. Physically demanding job, like that executed by farmworkers, has been linked to an increased risk of sleep disruption.[16]

Sleep disorders have been widely documented in literature in recent years, impacting people of all ages. Research has found that the general public has a higher incidence of sleep disorders, with rates ranging from 10% to 48%.[17,18]

In Brazil, accurate insomnia was found to affect 32% of the population.[19] Furthermore, a significant rise in sleep-related concerns, such as difficulty initiating and maintaining sleep, has been reported. Workers in the manufacturing industry who frequently work near conveyor belts at a specified pace or in a repetitive manner, are thought to be the most susceptible to work-related MSK injuries. Moreover, a shift in industrial structure has increased the prevalence of work-related MSK injuries.[20] The connection between pain and sleep is bi-directional, and poor sleep quality and inadequate sleep cycles have been implicated in the development of chronic pain in observational studies.[21]

This systematic review studies on the relationship of sleep with musculoskeletal disorders.

Materials and Methods

The systematic review was conducted after approval from the ethics review board of the University of Lahore, Lahore, Pakistan, and comprised search of relevant literature published from 2012 to 2020 on Web of Science (WOS), Latin America and the Caribbean Literature on Health Sciences (LILACS) and PakMedinet electronic databases. The review was conducted in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[22] The protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO),[23] in accordance with PRISMA-P guidelines (PROSPERO CRD42021281084).

The search strategy entailed combining key terms and Boolean operators, such as AND, OR, and NOT, relevant to the research following the PECOS format.[24] Those included were observational or cross-sectional studies related to MSK pain and sleep disorders of subjects who were workers in any field. The studies were peer-reviewed, published in scientific journals with no language or time restriction, and their full text was available. Studies were excluded if the patient population from hospital were part of the study, or were randomised controlled trials (RCTs), or data was collected using self-designed questioners, or if the full text was not available.

EndNote X7 software was used to store data. After removing duplicate records, screening of the studies was undertaken based on abstract and full texts. Data was extricated from the selected studies, such as methods,

sample size and demographics. Comparisons were done of the outcomes, and the studies were assessed using a critical assessment tool related to methodological quality of the studies.[25]

Also used was the Appraisal tool for Cross-Sectional Studies (AXIS) tool that takes into account study design, quality and the likelihood of bias.[25-27] Two researchers evaluated independently the risk of partiality for each study.

Outcomes of interest were work-related MSDs, sleep disorders, Karolinska Sleepiness Questionnaire (KSQ), Nordic Musculoskeletal Questionnaire (NMQ), Bergen Insomnia Scale, Numerical Rating Scale (NRS), Epworth Sleepiness Scale (ESS), and Bergen Insomnia Scale (BIS).

Results

Of the 1,538 studies found, 13(0.8%) were reviewed (Figure). Characteristics of all the studies were noted and compared (Table-1).[4,9,12,28,29,32,34-40] Critical appraisal score of the studies ranged 15-19 (Table-2).

The relationship between pain and sleep was not found among studies but, sleep disturbances were found to be linked to MSK pain in various parts of the body among workers.

Discussion

The focus of the current systematic review was to examine the evidence suggesting a correlation between sleep and MSK pain. A total of 13 descriptive, observational, cross-sectional studies were analysed that had a total of

Table-1: Summary of the studies reviewed.

NO.	Study Author (Latest to old)	Summary table of included studies				
		Country	Participants	Population	Mean Age (years)	outcome of interest
1.	Matre D. et al., 2020[28]	Norway	1585	Nurses	G1:37.4±7.6 G2:33.3±9.4 G3:32.5±7.8 G4:31.7±7.9	BIS NPS
2.	Marklund S. et al., 2020[38]	Sweden	187	Dentists	37.4±5.1	NRS WAI
3.	Hämmig O. 2020[29]	Switzerland	1232	Health professionals	25-55	Swiss Health Survey
4.	de Souza JM et al., 2020[12]	Brazil	242	Teachers	45.0 ±10.97	NMQ
5.	Skarpsno ES et al., 2019[32]	Norway	678	Workers	G1:44.8±9.7) G2:45.2±9.8	NRS
6.	Ando H. et al., 2019[4]	Japan	1747	Workers	42.1±12.3	self-administered questionnaire
7.	Zhang, Y. et al., 2018[34]	USA	397	Nurses	43.2±12.0	NRS
8.	Katsifaraki, M. et al., 2018[9]	Norway	1032	Nurses	41.61±11.20	MSI, ESS, BIS, PSQI
9.	de Oliveira Sato T et al., 2018[35]	Brazil	568	Workers	45.3±9.8	NMQ
10.	Moreno CR et al., 2016[39]	Brazil	1591	Airline Pilots, rural Workers, factory workers	27.3±3 7.4 39.1± 9.7 42.0± 14.1	KSQ NMQ
11.	Martins AJ et al., 2016[36]	Brazil	488	Factory Workers	18-40	KSQ WAI NMQ
12.	Sandberg JC et al., 2012[40]	USA	300	Farm workers	18-40	ESS NIOSH
13.	(Buxton OM et al., 2012[37]	USA	1572	Patient Care Workers	41.4±11.7	NMQ

NPS: Number of pain sites, NMQ: Nordic musculoskeletal questionnaire, NRS: Numerical rating scale, WAI: Work ability index, MSI: Musculoskeletal complaint severity index, ESS: Epworth sleepiness scale, BIS: Bergen insomnia scale, PSQI: Pittsburgh sleep quality index, KSQ: Karolinska sleepiness questionnaire, NIOSH: National Institute for Occupational Safety and Health.

Table-2: Critical appraisal of the ethodological quality of the studies reviewed.

No	Study Author	Introduction	Method											Result				Discusion		Other		Total
	(Latest to old)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1	Matre D. et al., 2020[28]	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	1	16
2	Marklund S. et al., 2020)[38]	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0	1	16
3	Hämmig O.2020[29]	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	18
4	de Souza JM et al., 2020[12]	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	18
5	Skarpsno ES et al., 2019[32]	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	18
6	Ando H. et al., 2019[4]	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0	1	16
7	Zhang, Y. et al.,2018[34]	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	17
8	Katsifaraki, M. Et al.,2018[9]	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	0	0	1	15
9	de Oliveira Sato T et al.2018[35]	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	18
10	Moreno CR et al.,2016[39]	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	19
11	Martins AJ et al.,2016[36]	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	19
12	Sandberg JC et al.,2012[40]	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	18
13	Buxton OM et al.,2012[37]	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	18

1: Yes, 0: N

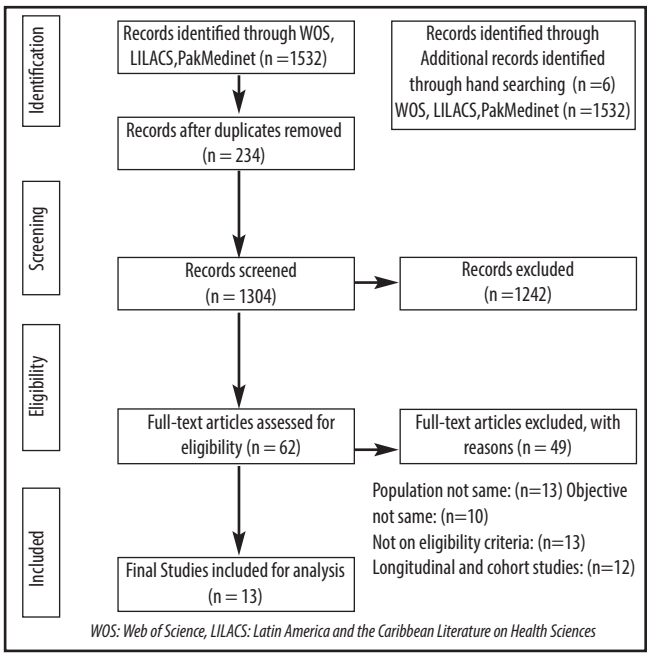

Figure: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA flow-chart.

11,619 respondents with MSK pain. The studies had been conducted between 2012 and 2020, and the most commonly used questioners included NMQ, NRS, ESS and BIS.

With the passage of time, people's trust in evidence-based practice is growing. An expert panel used the Delphi approach created by Downes MJ, et al. in the current review to assess the methodological quality of the studies.[25] In one of the studies reviewed, pain concerns were not related to shift work schedules, or the amount of night shifts worked the preceding year, and were only marginally related to the number of rapid returns during that year. Insomnia condition was positively connected with pain symptoms. A contrast was also made regarding the dispersion of pain, which was assessed as the frequency of pain sites and widespread pain, as the frequency of pain sites has been found to have a strong linear association with general wellbeing. The review discovered a link between insomnia and all three pain measurements. Many longitudinal studies have found a link between insomnia and pain, supporting the idea that the primary goal should be to develop work schedules that promote better sleep. According to an analysis of 15 experimental investigations, insufficient sleep time is a highly plausible mediator because it raises perception of pain, and sleep quality appears to impact the next day's distress.

Earlier investigations, used variations of (NMQ) Nordic Musculoskeletal Questionnaire, which is widely regarded as a standard tool in epidemiological studies analysing MSK problems.[28]

On the basis of the Work Ability Index (WAI), nearly 20% dentists reported lower output in terms of quality and quantity of work due to pain or discomfort, with slightly >6% reporting poor-to-moderate work capacity. Poor sleep quality, high level of stress, and multi-site pain were also common, and all were connected to productivity (Table 1).

Severe MSDs, particularly vigorous base workloads were found to be substantially more common among nurses than among various other healthcare workers. However, while the frequency of severe MSDs has been reported to be strongly higher in nursing staff than in other healthcare professionals, these rates vary greatly among healthcare professionals (Table 1). The review also found that general stress was a much stronger risk factor for sleep disturbances than job stressors amongst healthcare professionals in specific and general healthcare workers in particular.[29]

Poor sleep quality was linked to MSK discomfort in Brazilian public school teachers (Table 1). Some important factors, such as chronic stress and a high job, may contribute to a relationship between sleep deprivation and MSDs. Overwork may be associated with less time for rest and relaxation, as well as excessive tiredness, both of which can disrupt sleep.

In a longitudinal research in Sweden, Rasmussen-Barr et al.[30] established a relationship between moderate to severe sleep disruptions and low back pain, while Tekeoglu et al.[31] in Finland observed a relationship between sleepiness and pain in people with shoulder impingement syndrome.

If sleeping time is limited or sleep quality is poor, it can cause a number of psychological and physical changes, such as increased muscular tension and pain episodes in various parts of the body.[12]

Previous research has found that physical activity at work and discomfort are individually and positively related to sleep issues. Workers with high levels of occupational physical activity (OPA) are subjected to additional vulnerabilities at work, like psychosocial stresses, which may influence both MSK pain and sleep.[32]

Yamada et al.[33] reported that the most common location of chronic pain that affected work was the lumbar, shoulders, head, neck, and lower limbs, in order of descending prevalence.

The current review found a link between chronic musculoskeletal pain (CMP), working hours, and sleeping hours. A study found a link between sleeping hours and chronic pain that did not include working hours.[4]

A higher incidence of work-related MSK pain and sleep disorders was found in a study of nearly 400 hospital nurses (Table 1).

Rising frequency of sleep disorders among nurses are of essential relevance since insomnia has been shown to be a threat to occupational health and safety, and, for nurses, it is likely to impair healthcare service quality and safety of the patient.

Sleep onset delay of 30 minutes or over was related with a 32% greater risk of work-related MSDs (WMSDs), and, additionally, nurses who acknowledged taking sleep-promoting medications had a 39% higher incidence of WMSDs than nurses who did not disclose using any sleep-promoting medication.[34]

Insomnia measured by BIS was more strongly connected with MSK discomfort than sleepiness measured by ESS, and the overall Pittsburgh Sleep Quality Index (PSQI) score was not really related to any of the pain complaints. ESS has been linked to MSK pain, headache and neck pain. Furthermore, BIS was substantially related with MSK discomfort in the current population, which is consistent with earlier findings.[29]

A study found that work-related strain was linked to poor sleep quality, implying that high physical demands at workplace may be linked to sleep disruptions. Working hours and occupation play a part in the sleep-pain connection, highlighting the importance of future research in this area.[35]

A study reported a higher incidence of sleep disruptions among rubber tappers with high physical activity compared to industrial workers with low/moderate physical activity. It also found that intensive physical exercise had a negative impact on sleep.[35] According to a research of rural labourers engaged in coffee harvesting, which is field work involving risky and stressful workplace settings, had MSK pain and a decrease in sleep quality.[36]

The review evaluated the sleep- and work-related effects of body discomfort, work hindrance caused by pain, and functional restrictions of daily chores. Despite adjusting for socio-demographic, psychiatric and occupational characteristics, strong and substantial correlations of sleep deprivation remained with pain, functional limitation and workplace interference. Insufficient sleep, insomnia symptoms, sleep inadequacy, or any combination of the three, may thus be linked to occupational susceptibility or may reflect additional health-related impacts of occupational exposures, exacerbating the repercussions of past workplace exposures. Alternatively, body pain, pain-related work interruption, and functional restrictions in daily living duties may raise the chance of sleep insufficiency.[37]

This study was not conducted with various parameters like work, stress or working hours and sleeping hours. The analysis of cause and effect relationship between musculoskeletal pain and sleep is hindered due to the cross sectional methodology. In terms of limitations, the current review did not include data on factors like physical and psychosocial work strain, work-family conflict, and working other paid jobs, which could have had residual confounding effect. Besides, a longitudinal study is needed for objective evaluation of sleep, and to verify the incidence and direction of causality in workers.

Conclusion

Literature supported the existence of relationship between pain and sleep. Sleep disturbances were found to be linked with MSK pain in various parts of the body in workers. The type of profession may play a role in the sleep-pain link. Healthy lifestyle contributing to improvement in sleep quality and prevention of MSK pain should be considered in order to enhance workers' quality of life.

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