

KORESPONDENSI

1. Submitted to the journal “Medicina Clinica Practica”
2. Revision: Accepted with revision
 - Revised version received
 - Revised version with track changes
3. Manuscript revisions
4. Paper accepted for publication
5. Process Producing Accepted Article (24-02-2021)
6. Publishing Agreement Completed (25-02-2021)
7. Proofs (04-03-2021)
8. Paper published (28-04-2021)

Revised version received

RELATIONSHIP BETWEEN SLEEP QUALITY, PAIN INTENSITY IN PATIENTS WITH CHRONIC LOW BACK PAIN

Andi Kurnia Bintang*, Ivan Santosa, Yudy Goysal, Muhammad Akbar, Susi Aulina

Department of Neurology, Faculty of Medicine, Hasanuddin University

*Corresponding author

Email address: a.kurnia_b@yahoo.co.id; pmc@agri.unhas.ac.id

Abstract

The general objective of this study was to determine the relationship between sleep quality and pain intensity in chronic low back pain patients. Cross-sectional analytic study with consecutive sampling. Chronic patients who met the inclusion criteria at clinic neurology Wahidin Sudirohusodo Makassar. Independent variable: sleep quality, measured by the Pittsburgh Sleep Quality Index (PSQI) score. Dependent variable: pain intensity, measured by the Visual Analog Scale (VAS) score. Data analysis using a Chi-Square test. A total of 29 samples met our inclusion criteria and divided into two groups, 23 samples of poor sleep quality, and six samples of good sleep quality. Within the poor sleep quality group, five patients (21,7%) had mild pain intensity, 11 patients (47,8%) had moderate pain intensity, and seven patients (30,4%) had severe pain intensity. In good sleep quality, five patients (83,3%) had mild pain intensity, one patient (16,7%) had moderate pain intensity, and no samples with severe pain intensity. A significant relationship found between sleep quality and pain intensity ($p=0.017$). There is a relationship between sleep quality and pain intensity. Poor sleep quality is associated with increased pain intensity in patients with chronic low back pain.

Introduction

Sleep is defined by the Sleep Disorders Management Guide (2017) by the PERDOSSI. Sleep is defined by the Sleep Disorders Management Guide (2017), the Sleep Disorders Study Group of the Indonesian Neurologist Specialist Association (PERDOSSI) is a reversible decrease in consciousness that is a physiological and recurrent form, usually, a decline in cognitive function globally, so the brain does not respond to surrounding stimuli. The function of sleep can be seen by the fact that people spend about a third of their live sleep. Sleep quality has several components that involve a variety of domains, including assessments of sleep duration, sleep latency, sleep efficiency, sleep dysfunction, and the use of sleeping pills, if one or more of the disrupted domains will result in decreased sleep quality. Poor sleep quality has been associated with increasing age, low socioeconomic status, poor general health, poor lifestyle behavior. Changes in terms of quality, quantity, and sleep patterns cause sleep disturbance. Sleep disturbance is proven to increase the stress response so that it can delay the healing process, causing sequelae that are detrimental to the

Commented [MOU1]: Should be "SLEEP QUALITY AND PAIN INTENSITY..."

Commented [MOU2]: The affiliation of this paper must include city and country of the authors

Commented [MOU3]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

Commented [MOU4]: Please add keywords consisting of 3-5 words after the abstract.

Commented [MOU5]: Abstract format is not suitable, it should be structured with the sections: Objective, Method, Result, Conclusion

Commented [MOU6]: Should be "Introduction"

Commented [MOU7]: You must first provide the full name

Commented [MOU8]: "live sleep" change to "live sleeping"

Commented [MOU9]: Add "and" between these words

Commented [MOU10]: The side effects of sleep disturbance on health are also very important in this section.

cardiovascular system, metabolism, and endocrine. Moreover, it can cause hyperalgesia and contribute to the dysregulation of emotional reactivity.^{1,2,3,4,5,6}

In the United States, there are 50-70 million adults who have sleep disorders with the proportion of insomnia of 6-10% and sleep apnea of 10-25%. The Center on Sleep Disorders Research estimates that 38,000 deaths occur per year for cardiovascular cases due to sleep disorders. Another study conducted in the Netherlands with a total of 20,000 patients aged 12 years or older showed an alarming prevalence, with 21.2% of men and 33.2% of women having some type of sleep disorder.^{3,7}

Based on the Alsaadi et al. study, data for 1936 patients were taken from 13 other author studies between 2001-2009, found the prevalence of sleep disorders in patients with low back pain by 58.9%. Another study conducted by Franca et al., in 51 patients with chronic low back pain found 82.35% of patients with sleep disorders. According to research conducted by Donoghue et al., mentioned that patients with chronic low back pain (chronic NPB) have significantly poor sleep quality, both subjectively and objectively. This study also showed a statistically significant relationship between low back pain with disability levels and subjective sleep quality.⁸

Sleep disturbance is a pervasive issue that affects a substantial proportion of the population and has a significant impact on society. The economic implications of this condition are staggering, with the annual cost of treating moderate-severe sleep disorders in the United States alone estimated to be a whopping 165 billion US dollars. To put this into perspective, this figure is considerably higher than the costs associated with treating other non-communicable diseases, such as heart failure, stroke, hypertension, and asthma, which range from 20 to 80 billion US dollars. Given the profound economic burden of sleep disturbances, it is essential to invest in effective interventions and treatments that can alleviate the symptoms and improve the quality of life for those affected by this condition.⁹

Chronic pain and sleep disorders has a reciprocal relationship and are often found together. Sleep deprivation of 8 hours each night is considered to be of reduced sleep duration and can cause long-term disruption in sleep patterns. Reduced sleep duration and poor sleep quality reduced pain threshold in subjects experiencing pain and mental capacity to cope with pain, and vice versa ie, chronic pain cause a decrease in sleep quality. Sleep disturbance is a common problem that is often found as much as 50-70% in patients with chronic non-malignant pain. Sleep disorders in patients with chronic pain such as chronic LBP cases, include a variety of factors and are characterized by reduced sleep efficiency, sleep duration, increased sleep latency, daytime sleepiness. Difficulty in starting and maintaining sleepa symptom that are often find in the general population. Difficulty in going to sleep, maintaining sleep, waking up earlier has been found in chronic pain patients. Chronic LBP is one of the most common symptoms of chronic pain. Decreased slow-wave sleep appears to be responsible for increased sensitivity to pain.^{9,10}

Commented [MOU11]: Should be merged "1-6"

Commented [MOU12]: The period is missed

Commented [MOU13]: "netherlands" change to "Netherlands"

Commented [MOU14]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

Commented [MOU15]: "Mentioned" change to "mentioned"

Commented [MOU16]: This sentence is so large, please summarize it

Commented [MOU17]: "has" change to "have"

Commented [MOU18]: "8" change to "eight"

Commented [MOU19]: This sentence does not have any verb, please check

Commented [MOU20]: Please revise this sentence, there is an error in grammar

Based on several studies that show a relatively high prevalence and sizable economic impact for cases of chronic low back pain with sleep disorders. PSQI is an effective instrument for measuring sleep quality and patterns in adults, which can distinguish between "poor" and "good" sleep quality through 7 components. Pain intensity assessed by VAS score, VAS is an instrument for valid and reliable pain assessment.^{11,12}

Method

This study is a type of observational analytic study using cross-sectional studies. The study population was all patients with chronic low back pain who sought treatment. The sample of this study was chronic low back pain sufferers who met the inclusion and exclusion criteria. The sample obtained by a consecutive sampling method.

Result

Characteristics of subjects with chronic low back pain

This study was conducted at Wahidin Sudirohusodo General Hospital and Network Hospital in April-May 2019. Table 1 shows, a total sample was obtained with a higher number of women, 19 of them (65.5%), and as many as men ten people (34.5%). Based on education and employment, patients with chronic low back pain who received elementary school education were 3 people (10.3%), junior high school as many as 3 people (10.3%), high school as many as 11 people (37.9%), and Diploma- There were 12 scholars (41.3%). While in terms of work divided into high-risk work and low risk of chronic low back pain. Heavy and rough work is considered as a job with a high risk of 2 people (6.9%), and low-risk jobs of 27 people (93.1%). Based on the data, diplomas-scholars has the most chronic low back pain, while many low-risk jobs experience chronic low back pain.

Baseline data of the subjects showed the distribution of the age group, the group of patients aged 21-40 years as many as eight people (27.6%), the group of patients aged 41-60 years as many as 18 people (62.1%), the group of patients with age > 60 years amount to 3 people (10.3%). While the duration of pain three months - 1 year has the most subjects experiencing chronic low back pain as many as 16 people, duration of 1 year-2 year by three people, and duration > 2 years of 10 people. Obese patients with chronic low back pain were 13 people (44.8%), and not obese as many as 16 people (55.2%).

Based on the Visual Analog Scale (VAS) score, the number of chronic low back pain patients who had mild pain intensity was ten people (34.5%), the most intensity was moderate pain by 12 people (41.4%), and severe pain as much as seven people (24.1%). The PSQI questionnaire assessed the sleep quality of chronic low back pain patients. Chronic low back pain subjects with good sleep quality were six people (20.7%), while poor sleep quality were 23 people (79.3%).

Table 1

VARIABLE		Total Sample (N=29)	Frequence
Gender	Male	10	34,5

Commented [MOU21]: You must first provide the full name

Commented [MOU22]: It is important to add the research objectives to this section

Commented [MOU23]: It is better to add the research location and time of research implementation.

Commented [MOU24]: It is better to add an explanation/category included in the inclusion and exclusion criteria in the selection of research samples.

Commented [MOU25]: how many samples ?

Commented [MOU26]: "3 people" change to "three people"

Commented [MOU27]: "3" change to "three"

Commented [MOU28]: "has" change to "have"

Commented [MOU29]: "amount" change to "amounted"

Commented [MOU30]: It is better if this sentence also includes the percentage of the number who experience back pain based on duration

Commented [MOU31]: Put space

Commented [MOU32]: Please add the table title

Commented [MOU33]: "VARIABLE" change to "Variable"

Commented [MOU34]: What is the unit?

Commented [MOU35]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

	Female	19	65,5
Age	21-40 years	8	27,6
	41-60 years	18	62,1
	>60 years	3	10,3
Education	Elementary school	3	10,3
	Junior High school	3	10,3
	Senior High School	11	37,9
	Diploma-Bachelor	12	10,3
Occupation	Low risk	27	93,1
	High risk	2	6,9
Duration	Three months – 1 year	16	55,2
	>1 year-2 year	3	10,3
	>2 year	10	34,5
Body Mass Index	No Obesity	16	55,2
	Obesity	13	44,8
Visual Analog Scale (VAS)	Mild	10	34,5
	Moderate	12	41,4
	Severe	7	24,1
PSQI	Good	6	20,7
	Poor	23	79,3
Total		29	100

Relationship between sleep quality and pain intensity

In table 2 shows the number of subject groups of good and poor sleep quality on pain intensity. In subjects with good sleep quality, they have mild pain intensity as many as five people (83.3%), moderate pain one person (16.7%), and there were no subjects with severe pain intensity. Whereas the subjects with poor sleep quality have mild pain intensity as many as five people (21.7%), moderate

Commented [MOU36]: Should be "Junior high school"

Commented [MOU37]: Should be "Senior high school"

Commented [MOU38]: Should be "Diploma-bachelor"

Commented [MOU39]: "Body Mass Index" change to "Body mass index"

Commented [MOU40]: "No Obesity" change to "No obesity"

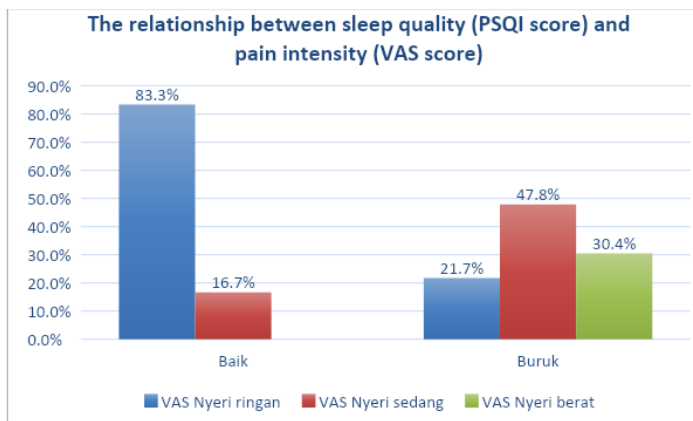
Commented [MOU41]: Please pay attention to the writing table format, remove horizontal lines

Commented [MOU42]: "Relationship" change to "The relationship"

pain as many as 11 people (47.8%), and severe pain as many as seven people (30.4%), with a P-value = 0.017

Table 2

PSQI		VAS			Total	P-value
		mild	moderate	severe		
Good	N	5	1	0	6	0,017
	%	83,3%	16,7%	0,0%	100,0%	
Poor	N	5	11	7	23	
	%	21,7%	47,8%	30,4%	100,0%	
Total	N	10	12	7	29	
		34,5%	41,4%	24,1%	100,0%	



Graphic 1. Relationship between Sleep Quality (PSQI score) and Pain Intensity (VAS score) in Chronic LBP patients

Discussion

Chronic pain that is most often complained of by people is chronic low back pain. The effects of chronic LBP include considerable clinical, social, and economic aspects throughout the world. Chronic LBP has multifactorial causes such as work or physical activity, body mass index associated with obesity, socioeconomic level, and education.

In this study, there was a total sample of 29 people with chronic low back pain, and women had a higher population than men. Chronic LBP consistently has a higher proportion of women than men. The number of chronic LBP subjects with high-risk work in this study was only two people, and both were male.

Based on the age of patients who experience chronic low back pain, they obtained the age with the largest population between 41-60 years that is as many as 18 people, with an average age of 44

Commented [MOU43]: Please add the table title

Commented [MOU44]: "mild" change to "Mild"

Commented [MOU45]: "moderate" change to "Moderate"

Commented [MOU46]: "severe" change to "Severe"

Commented [MOU47]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

Commented [MOU48]: Please pay attention to the writing table format, remove horizontal lines

Commented [MOU49]: "Graphic" change to "Fig"

Commented [MOU50]: Put space between these words

Commented [MOU51]: Put space between these words

Commented [MOU52]: Should show the percentage ratio

Commented [MOU53]: It would be good to add explanation as to why women tend to have a higher proportion of chronic LBP than men

years. According to the National Institute of Neurological Disorders and Stroke, the first attack of low back pain occurs at the age of 30-50 years, and lower back pain becomes more common with age because increasing age is associated with decreased bone density, reduced elasticity and muscle tone, flexibility intervertebral discs are reduced. Chronic LBP subjects was 13 people obese, and 16 people were not obese. Chronic LBP is strongly influenced by obesity because obesity causes an emphasis on the intervertebral discs, the greater cartilage.

In this study, more subjects were not obese, chronic LBP occurred due to multifactorial influence, so it is possible that the cause of chronic LBP is by other factors.

Based on pain intensity assessed using a visual analog scale (VAS) score, it was found that the most subjects experienced moderate pain intensity as many as 12 people. In contrast, the intensity of mild pain was ten people, and severe pain was seven people, then subjects were also subjected to subjective sleep quality using the PSQI questionnaire. Poor sleep quality with more prevalence than good sleep quality. In this study, the prevalence of poor sleep quality was higher than good sleep quality. This number is following several studies that showed a higher prevalence of sleep disorders in patients with chronic low back pain.

The relationship between sleep quality and pain intensity test using chi-square and statistically significant, which is $P = 0.017$. In the group that had poor sleep quality tended to have moderate and severe pain intensity with a moderate pain population of 47.8%, severe pain 30.4%, and mild pain 21.7%. While the group with good sleep quality tends to have mild and moderate pain intensity with a population of mild pain 83.3% and moderate pain 16.7%. The effect of sleep quality on pain intensity is strengthened by the absence of subjects with good sleep quality who have severe pain intensity.

There is increasing evidence that poor sleep quality affects increasing mortality in certain diseases and susceptibility to infections. Acute and chronic reduction in the duration and quality of sleep has been shown to induce excessive expenditure from proinflammatory cytokines. IL-6 is one of the most critical cytokines that mediate the rapid interaction between the immune system and the central nervous system function. Exogenous administration of IL-6 has been shown to have a somnogenic effect in studies conducted on experimental animals, besides activating hypothalamic-pituitary-adrenal (HPA), which causes nonphysiological hypercortisolemia during the first hour during sleep which explains the decline in sleep quality. Whereas IL-6 increases pain intensity in neuropathic pain. In this study, subjects with poor sleep quality had moderate to severe pain intensity, while subjects with good sleep quality had mild to moderate pain intensity. Statistically has a significant relationship between sleep quality and pain intensity in chronic LBP cases, with a p-value <0.05 ($p = 0.017$).

This study is a preliminary study to see the relationship between sleep quality and pain intensity in chronic LBP cases. The limited number of samples and subjective sleep quality measurement tools in the form of PSQI questionnaires are the weaknesses of this study. Subsequent studies can use direct IL-6 serum levels, which influence pain intensity and sleep quality.

Conclusion

There is a relationship between sleep quality and pain intensity in chronic low back pain patients. Poor sleep quality is associated with an increase in pain intensity in chronic low back pain patients.

References

1. Kumar VM. Sleep and sleep disorders. Indian J Chest Dis Allied Sci. 2008;50:129.

Commented [MOU54]: Should be "subjects were"

Commented [MOU55]:

Commented [MOU56]: What is the number of subjects with good and poor sleep quality ?

Commented [MOU57]: This sentence does not have any verb, please check

Commented [MOU58]: We recommend adding some research result that can support this sentence.

Commented [MOU59]: An explanation of the relationship between poor sleep quality and IL-6 levels and how to manage it is important to discuss after this sentence

Commented [MOU60]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

2. Filip I, Tidman M, Saheba N, et al. Public health burden of sleep disorders: underreported problem. *J Public Health (Bangkok)*. 2017;25:243–8.
3. Seng EK, Cervoni C, Lawson JL, et al. The burden of sleep problems: A pilot observational study in an ethnically diverse urban primary care setting. *J Prim Care Community Health*. 2016;7:276–80.
4. Gofir A, WR I. *Panduan Tatalaksana Gangguan Tidur*. Jakarta, Indonesia: Kelompok studi gangguan tidur PERDOSSI; 2017. 41–62 p.
5. Empitu MA, Kadariswantiningsih IN, Thaha M, et al. Determiner of Poor Sleep Quality in Chronic Kidney Disease Patients Links to Elevated Diastolic Blood Pressure, hs-CRP, and Blood-count-based Inflammatory Predictors. *Indones Biomed J*. 2019;11:100–6.
6. Effendie MI. *Metoda Biologi Perikanan*. Bogor: Yayasan Dewi Sri; 1979. 112 p.
7. Chattu VK, Manzar MD, Kumary S, et al. The global problem of insufficient sleep and its serious public health implications. In: *Healthcare. Multidisciplinary Digital Publishing Institute*; 2019. p. 1.
8. Alsaadi SM, McAuley JH, Hush JM, et al. Prevalence of sleep disturbance in patients with low back pain. *Eur Spine J*. 2011;20:737–43.
9. Sezgin M, Hasaneffendioğlu EZ, Sungur MA, et al. Sleep quality in patients with chronic low back pain: a cross-sectional study assessing its relations with pain, functional status and quality of life. *J Back Musculoskelet Rehabil*. 2015;28:433–41.
10. Heffner KL, France CR, Trost Z, et al. Chronic low back pain, sleep disturbance, and interleukin-6. *Clin J Pain*. 2011;27:35.
11. O'Donoghue GM, Fox N, Heneghan C, et al. Objective and subjective assessment of sleep in chronic low back pain patients compared with healthy age and gender matched controls: a pilot study. *BMC Musculoskelet Disord*. 2009;10:122.
12. Chung EJ, Hur Y-G, Lee B-H. A study of the relationship among fear-avoidance beliefs, pain and disability index in patients with low back pain. *J Exerc Rehabil*. 2013;9:532.

Commented [MOU61]: Please check and use the correct format in showing a reference according to the template

Commented [MOU62]: Please check that all references are relevant to the contents of the manuscript

Revised version with track changes

RELATIONSHIP BETWEEN SLEEP QUALITY AND PAIN INTENSITY IN PATIENTS WITH CHRONIC LOW BACK PAIN

Andi Kurnia Bintang*, Ivan Santosa, Yudy Goysal, Muhammad Akbar, Susi Aulina

Department of Neurology, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia

*Corresponding author

Email address: a.kurnia_b@yahoo.co.id; pmc@agri.unhas.ac.id

Abstract

The general objective of this study was to determine the relationship between sleep quality and pain intensity in chronic low back pain patients. Cross-sectional analytic study with consecutive sampling. Chronic patients who met the inclusion criteria at clinic neurology Wahidin Sudirohusodo Makassar. Independent variable: sleep quality, measured by the Pittsburgh Sleep Quality Index (PSQI) score. Dependent variable: pain intensity, measured by the Visual Analog Scale (VAS) score. Data analysis using a Chi-Square test. A total of 29 samples met our inclusion criteria and divided into two groups, 23 samples of poor sleep quality, and six samples of good sleep quality. Within the poor sleep quality group, five patients (21.7%) had mild pain intensity, 11 patients (47.8%) had moderate pain intensity, and seven patients (30.4%) had severe pain intensity. In good sleep quality, five patients (83.3%) had mild pain intensity, one patient (16.7%) had moderate pain intensity, and no samples with severe pain intensity. A significant relationship found between sleep quality and pain intensity ($p=0.017$). There is a relationship between sleep quality and pain intensity. Poor sleep quality is associated with increased pain intensity in patients with chronic low back pain.

KEYWORDS: Sleep quality, PSQI, pain intensity

Introduction

Sleep is defined by the Sleep Disorders Management Guide (2017) by the Sleep Disorders Study Group of the Indonesian Neurologist Specialist Association (PERDOSSI). Sleep is defined by the Sleep Disorders Management Guide (2017), the Sleep Disorders Study Group of the Indonesian Neurologist Specialist Association (PERDOSSI) is a reversible decrease in consciousness that is a physiological and recurrent form, usually, a decline in cognitive function globally, so the brain does not respond to surrounding stimuli. The function of sleep can be seen by the fact that people spend about a third of their lives sleeping. Sleep quality has several components that involve a variety of domains, including assessments of sleep duration, sleep latency, sleep efficiency, sleep dysfunction, and the use of sleeping pills, if one or more of the disrupted domains will result in decreased sleep quality. Poor sleep quality has been associated with increasing age, low socioeconomic status, poor general health, and poor lifestyle behavior. Changes in terms of quality, quantity, and sleep patterns cause sleep disturbance. Sleep disorders that occur continuously and repeatedly are important predisposing

Commented [MOU1]: Should be "SLEEP QUALITY AND PAIN INTENSITY..."

Commented [User2R1]: Thank you for your comment, we have revised

Deleted: ,

Commented [MOU3]: The affiliation of this paper must include city and country of the authors

Commented [User4R3]: Thank you for your comment, we have revised

Commented [MOU5]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Commented [MOU6]: Please add keywords consisting of 3-5 words after the abstract.

Commented [User7R6]: Thank you for your comment, we have added

Commented [MOU8]: Abstract format is not suitable, it should be structured with the sections: Objective, Method, Result, Conclusion

Formatted: Space After: 0 pt

Commented [MOU9]: Should be "Introduction"

Commented [User10R9]: Thank you for your comment, we have revised

Deleted: m

Commented [MOU11]: You must first provide the full name

Commented [User12R11]: Thank you for your comment, we have revised

Commented [MOU13]: "live sleep" change to "live sleeping"

Commented [User14R13]: Thank you for your comment, we have revised

Commented [MOU15]: Add "and" between these words

Commented [User16R15]: Thank you for your comment, we have revised

Commented [MOU17]: The side effects of sleep disturbance on health are also very important in this section.

Commented [User18R17]: Thank you for your comment, we have added

factors for the development of chronic diseases, such as heart disease, diabetes mellitus, obesity, depression, cancer, stroke, chronic back pain, and decreased quality of life. Sleep disturbance is proven to increase the stress response so that it can delay the healing process, causing sequelae that are detrimental to the cardiovascular system, metabolism, and endocrine. Moreover, it can cause hyperalgesia and contribute to the dysregulation of emotional reactivity.

In the United States, there are 50-70 million adults who have sleep disorders with the proportion of insomnia of 6-10% and sleep apnea of 10-25%. The Center on Sleep Disorders Research estimates that 38,000 deaths occur per year for cardiovascular cases due to sleep disorders. Another study conducted in the Netherlands with a total of 20,000 patients aged 12 years or older showed an alarming prevalence, with 21.2% of men and 33.2% of women having some type of sleep disorder.^{3,7}

Based on the Alsaadi et al. study, data for 1936 patients were taken from 13 other author studies between 2001-2009, found the prevalence of sleep disorders in patients with low back pain by 58.9%. Another study conducted by Franca et al., in 51 patients with chronic low back pain found 82.35% of patients with sleep disorders. According to research conducted by Donoghue et al., mentioned that patients with chronic low back pain (chronic NPB) have significantly poor sleep quality, both subjectively and objectively. This study also showed a statistically significant relationship between low back pain with disability levels and subjective sleep quality.⁸

Sleep disturbance has a considerable economic impact. The economic impact of the annual cost of treating moderate-severe sleep disorders in the United States is 165 billion US dollars, far higher than other non-communicable diseases such as heart failure, stroke, hypertension, asthma (20-80 billion US dollars).²

Chronic pain and sleep disorders have a reciprocal relationship and are often found together. Sleep deprivation of eight hours each night is considered to be of reduced sleep duration and can cause long-term disruption in sleep patterns. Reduced sleep duration and poor sleep quality can reduce pain threshold in subjects experiencing pain and mental capacity to cope with pain, and vice versa i.e., chronic pain can cause a decrease in sleep quality. Sleep disturbance is a common problem that is often found as much as 50-70% in patients with chronic non-malignant pain. Sleep disorders in patients with chronic pain such as chronic LBP cases, include a variety of factors and are characterized by reduced sleep efficiency, sleep duration, increased sleep latency, daytime sleepiness. Difficulty in starting and maintaining sleep is a symptom that is often found in the general population. Difficulty in going to sleep, maintaining sleep, waking up earlier has been found in chronic pain patients. Chronic LBP is one of the most common symptoms of chronic pain. Decreased slow-wave sleep appears to be responsible for increased sensitivity to pain.^{9,10}

Based on several studies that show a relatively high prevalence and sizable economic impact for cases of chronic low back pain with sleep disorders, the researchers aim to study there is a

- Commented [MOU19]: Should be merged "1-6"
- Commented [User20R19]: Thank you for your comment, we have revised
- Deleted: .
- Deleted: 2,3,4,5.
- Commented [MOU21]: The period is missed
- Commented [MOU22]: "netherlands" change to "Netherlands"
- Commented [User23R22]: Thank you for your comment, we have revised
- Deleted: n
- Commented [MOU24]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.
- Commented [User25R24]: Thank you for your comment, we have revised
- Deleted: .
- Deleted: .
- Commented [MOU26]: "Mentioned" change to "mentioned"
- Commented [User27R26]: Thank you for your comment, we have revised
- Deleted: M
- Formatted: Indonesian
- Commented [MOU28]: This sentence is so large, please summarize it
- Commented [User29R28]: Thank you for your comment, we have revised
- Deleted: Sleep disturbance is a pervasive issue that affects a substantial proportion of the population and has a significant impact on society. The economic implications of this condition are staggering, with the annual cost of treating moderate-severe sleep disorders in the United States alone estimated to be a whopping 165 billion US dollars. To put this into perspective, this figure is considerably higher than the costs associated with treating other non-communicable diseases, such as heart failure, stroke, hypertension, and asthma, which range from
- Deleted: to
- Deleted: .
- Deleted: Given the profound economic burden of sleep disturbances, it is essential to invest in effective interventions and treatments that can alleviate the symptoms and improve the quality of life for those affected by this condition
- Formatted: Indonesian
- Commented [MOU30]: "has" change to "have"
- Deleted: s
- Deleted: 8
- Deleted: d
- Commented [MOU32]: This sentence does not have any verb, please check
- Commented [User33R32]: Thank you for your comment, we have revised
- Deleted: are
- Commented [MOU34]: Please revise this sentence, there is an error in grammar
- Commented [User35R34]: Thank you for your comment, we have revised
- Deleted: ind

relationship between sleep quality with pain intensity in chronic low back pain patients. Subjective sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI). PSQI is an effective instrument for measuring sleep quality and patterns in adults, which can distinguish between "poor" and "good" sleep quality through 7 components. Pain intensity assessed by visual analog scale (VAS) score, VAS is an instrument for valid and reliable pain assessment.

Method

This study is a type of observational analytic study using cross-sectional studies. The study was conducted at the Neurology Polyclinic of the Wahidin Sudirohusodo Education General Hospital and the Network Hospital, in April-May 2019. The study population was all patients with chronic low back pain who sought treatment at the Poly Neurology of Wahidin Sudirohusodo Education Hospital and the Network Hospital, in the month of April-May 2019. The sample of this study was chronic low back pain sufferers who met the inclusion and exclusion criteria. The sample obtained by a consecutive sampling method. The inclusion criteria used (1) Patients aged 18-65 years, both male and female with significant complaints of low back pain that have been experienced for more than 12 weeks (3 months) and visited the Neurology Wahidin Sudirohusodo General Hospital and Network Hospital in April-May 2019. (2) Samples are willing to be included in this study by giving signatures for informed consent and filling out research questionnaires. Subjects were excluded from the study if: (1) Patients who have other musculoskeletal disorders, (2) Patients with low back pain due to disorders of the visceral organs such as infection and kidney stones, (3) Patients who get serious illnesses, such as malignancy or other complications, (4) Patients who get other intracranial disorders.

Result

Characteristics of subjects with chronic low back pain

This study was conducted at Wahidin Sudirohusodo General Hospital and Network Hospital in April-May 2019. Table 1 shows, a total sample of 29 people was obtained with a higher number of women, 19 of them (65.5%), and as many as men ten people (34.5%). Based on education and employment, patients with chronic low back pain who received elementary school education were three people (10.3%), junior high school as many as three people (10.3%), high school as many as 11 people (37.9%), and Diploma- There were 12 scholars (41.3%). While in terms of work divided into high-risk work and low risk of chronic low back pain. Heavy and rough work is considered as a job with a high risk of 2 people (6.9%), and low-risk jobs of 27 people (93.1%). Based on the data, diplomas-scholars have the most chronic low back pain, while many low-risk jobs experience chronic low back pain.

Baseline data of the subjects showed the distribution of the age group, the group of patients aged 21-40 years as many as eight people (27.6%), the group of patients aged 41-60 years as many as 18 people (62.1%), the group of patients with age > 60 years amounted to 3 people (10.3%). While the duration of pain three months - 1 year has the most subjects experiencing chronic low back pain as many as 16 people (55.2%), duration of 1 year-2 year by three people (10.3%), and duration > 2 years of 10 people (34.5%). Obese patients with chronic low back pain were 13 people (44.8%), and not obese as many as 16 people (55.2%).

Based on the Visual Analog Scale (VAS) score, the number of chronic low back pain patients who had mild pain intensity was ten people (34.5%), the most intensity was moderate pain by 12 people (41.4%),

Deleted: .

Commented [MOU36]: You must first provide the full name
Commented [User37R36]: Thank you for your comment, we have added

Commented [MOU38]: It is important to add the research objectives to this section

Commented [User39R38]: Thank you for your comment, we have added

Formatted: Indonesian

Commented [MOU40]: It is better to add the research location and time of research implementation.

Commented [User41R40]: Thank you for your comment, we have added

Commented [MOU42]: It is better to add an explanation/category included in the inclusion and exclusion criteria in the selection of research samples.

Commented [User43R42]: Thank you for your comment, we have added

Commented [MOU44]: how many samples ?

Commented [User45R44]: Thank you for your comment, we have added

Commented [MOU46]: "3 people" change to "three people"

Commented [User47R46]: Thank you for your comment, we have revised

Deleted: 3

Deleted: 3

Commented [MOU49]: "has" change to "have"

Deleted: s

Commented [MOU50]: "amount" change to "amounted"

Commented [User51R50]: Thank you for your comment, we have revised

Commented [MOU52]: It is better if this sentence also includes the percentage of the number who experience back pain based on duration

Commented [User53R52]: Thank you for your comment, we have added

Commented [MOU54]: Put space

Commented [User55R54]: Thank you for your comment, we have revised

and severe pain as much as seven people (24.1%). The PSQI questionnaire assessed the sleep quality of chronic low back pain patients. Chronic low back pain subjects with good sleep quality were six people (20.7%), while poor sleep quality were 23 people (79.3%).

Table 1. Characteristic data of chronic low back pain subjects

Variable		Total Sample (N=29)	Frequency (%)
Gender	Male	10	34.5
	Female	19	65.5
Age	21-40 years	8	27.6
	41-60 years	18	62.1
	>60 years	3	10.3
Education	Elementary school	3	10.3
	Junior high school	3	10.3
	Senior high school	11	37.9
	Diploma-bachelor	12	10.3
Occupation	Low risk	27	93.1
	High risk	2	6.9
Duration	Three months – 1 year	16	55.2
	>1 year-2 year	3	10.3
	>2 year	10	34.5
Body mass index	No obesity	16	55.2
	Obesity	13	44.8
Visual Analog Scale (VAS)	Mild	10	34.5
	Moderate	12	41.4
	Severe	7	24.1
PSQI	Good	6	20.7
	Poor	23	79.3

Commented [MOU56]: Please add the table title

Formatted: Font: Not Bold

Commented [MOU57]: "VARIABLE" change to "Variable"

Commented [User58R57]: Thank you for your comment, we have revised

Commented [MOU59]: What is the unit?

Commented [User60R59]: Thank you for your comment, we have revised

Formatted Table

Deleted: ARIABLE

Commented [MOU61]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Commented [MOU62]: Should be "Junior high school"

Deleted: H

Deleted: ,

Commented [MOU63]: Should be "Senior high school"

Deleted: H

Deleted: S

Deleted: ,

Commented [MOU64]: Should be "Diploma-bachelor"

Deleted: B

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Commented [MOU65]: "Body Mass Index" change to "Body mass index"

Commented [MOU66]: "No Obesity" change to "No obesity"

Deleted: M

Deleted: Index

Deleted: O

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Total	29	100
-------	----	-----

The relationship between sleep quality and pain intensity

In table 2 shows the number of subject groups of good and poor sleep quality on pain intensity. In subjects with good sleep quality, they have mild pain intensity as many as five people (83.3%), moderate pain one person (16.7%), and there were no subjects with severe pain intensity. Whereas the subjects with poor sleep quality have mild pain intensity as many as five people (21.7%), moderate pain as many as 11 people (47.8%), and severe pain as many as seven people (30.4%), with a P-value = 0.017

Table 2. The relationship between sleep quality (PSQI score) and pain intensity (VAS score)

PSQI		VAS			Total	P-value
		mild	moderate	severe		
Good	N	5	1	0	6	0.017
	%	83.3%	16.7%	0.0%	100.0%	
Poor	N	5	11	7	23	
	%	21.7%	47.8%	30.4%	100.0%	
Total	N	10	12	7	29	
		34.5%	41.4%	24.1%	100.0%	

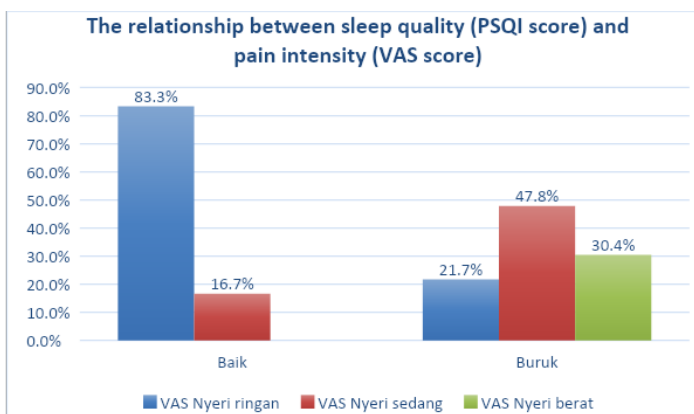


Fig. 1. Relationship between Sleep Quality (PSQI score) and Pain Intensity (VAS score) in Chronic LBP patients

Discussion

Chronic pain that is most often complained of by people is chronic low back pain. The effects of chronic LBP include considerable clinical, social, and economic aspects throughout the world.

Commented [MOU67]: Please pay attention to the writing table format, remove horizontal lines

Commented [MOU68]: "Relationship" change to "The relationship"

Commented [User69R68]: Thank you for your comment, we have revised

Deleted: R

Commented [MOU70]: Please add the table title

Formatted: Indent: Hanging: 0.75 cm

Formatted: Font: Not Bold

Formatted: Centred

Formatted Table

Commented [MOU71]: "mild" change to "Mild"

Commented [MOU72]: "moderate" change to "Moderate"

Commented [MOU73]: "severe" change to "Severe"

Commented [MOU74]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Deleted: ,

Commented [MOU76]: "Graphic" change to "Fig"

Deleted: Graph

Deleted: c

Commented [MOU77]: Put space between these words

Commented [User78R77]: Thank you for your comment, we have revised

Chronic LBP has multifactorial causes such as work or physical activity, body mass index associated with obesity, socioeconomic level, and education.

In this study, there was a total sample of 29 people with chronic low back pain, and women had a higher population than men at 65.5% and 34.5%. Chronic LBP consistently has a higher proportion of women than men. One reason for this is that women are shown to have lower pain perception thresholds, and menstrual cycle fluctuations affect pain sensitivity, but if chronic LBPs related to work, the proportion of men is higher. The number of chronic LBP subjects with high-risk work in this study was only two people, and both were male.

Based on the age of patients who experience chronic low back pain, they obtained the age with the largest population between 41-60 years that is as many as 18 people, with an average age of 44 years. According to the National Institute of Neurological Disorders and Stroke, the first attack of low back pain occurs at the age of 30-50 years, and lower back pain becomes more common with age because increasing age is associated with decreased bone density, reduced elasticity and muscle tone, flexibility intervertebral discs are reduced. Chronic LBP subjects were 13 people obese, and 16 people were not obese. Chronic LBP is strongly influenced by obesity because obesity causes an emphasis on the intervertebral discs, the greater cartilage.

In this study, more subjects were not obese, chronic LBP occurred due to multifactorial influence, so it is possible that the cause of chronic LBP is by other factors.

Based on pain intensity assessed using a visual analog scale (VAS) score, it was found that the most subjects experienced moderate pain intensity as many as 12 people. In contrast, the intensity of mild pain was ten people, and severe pain was seven people, then subjects were also subjected to subjective sleep quality using the PSQI questionnaire. Poor sleep quality with more prevalence than good sleep quality, as many as 23 people and six people. In this study, the prevalence of poor sleep quality was higher than good sleep quality. This number is following several studies that showed a higher prevalence of sleep disorders in patients with chronic low back pain.

The relationship between sleep quality and pain intensity was tested using chi-square and statistically significant, which is $P = 0.017$. In the group that had poor sleep quality tended to have moderate and severe pain intensity with a moderate pain population of 47.8%, severe pain 30.4%, and mild pain 21.7%. While the group with good sleep quality tends to have mild and moderate pain intensity with a population of mild pain 83.3% and moderate pain 16.7%. The effect of sleep quality on pain intensity is strengthened by the absence of subjects with good sleep quality who have severe pain intensity. These results are consistent with the study of Marin et al. (2006), which states that sleep disturbance is a common finding in cases of chronic low back pain, an increase in pain intensity in patients with chronic low back pain influenced by poor sleep quality.

There is increasing evidence that poor sleep quality affects increasing mortality in certain diseases and susceptibility to infections. Acute and chronic reduction in the duration and quality of sleep has been shown to induce excessive expenditure from proinflammatory cytokines. IL-6 is one of the most critical cytokines that mediate the rapid interaction between the immune system and the central nervous system function. Poor sleep quality causes a significant increase and peak of IL-6 levels the next day. This level can be reduced if the patient sleeps during the day. Exogenous administration of IL-6 has been shown to have a somnogenic effect in studies conducted on experimental animals, besides activating hypothalamic-pituitary-adrenal (HPA), which causes nonphysiological hypercortisolemia during the first hour during sleep which explains the decline in sleep quality. Whereas IL-6 increases pain intensity in neuropathic pain. In this study, subjects with poor sleep quality had moderate to severe pain intensity, while subjects with good sleep quality had mild to moderate pain intensity. Statistically has a significant relationship between sleep quality and pain intensity in chronic LBP cases, with a p-value <0.05 ($p = 0.017$).

Commented [MOU79]: Put space between these words

Commented [User80R79]: Thank you for your comment, we have revised

Commented [MOU81]: Should show the percentage ratio

Commented [User82R81]: Thank you for your comment, we have added

Commented [MOU83]: It would be good to add explanation as to why women tend to have a higher proportion of chronic LBP than men

Commented [User84R83]: Thank you for your comment, we have added

Deleted: .

Commented [MOU85]: Should be "subjects were"

Deleted: as

Commented [MOU86]: What is the number of subjects with good and poor sleep quality ?

Commented [User87R86]: Thank you for your comment, we have added

Deleted: .

Commented [MOU88]: This sentence does not have any verb, please check

Commented [User89R88]: Thank you for your comment, we have revised

Commented [MOU90]: We recommend adding some research result that can support this sentence.

Commented [User91R90]: Thank you for your comment, we have added

Commented [MOU92]: An explanation of the relationship between poor sleep quality and IL-6 levels and how to manage it is important to discuss after this sentence

Commented [User93R92]: Thank you for your comment, we have added

Commented [MOU94]: Please be careful in writing numbers, use commas (,) for thousands and periods (.) for decimals.

Commented [User95R94]: Thank you for your comment, we have revised

Deleted: .

Deleted: .

This study is a preliminary study to see the relationship between sleep quality and pain intensity in chronic LBP cases. The limited number of samples and subjective sleep quality measurement tools in the form of PSQI questionnaires are the weaknesses of this study. Subsequent studies can use direct IL-6 serum levels, which influence pain intensity and sleep quality.

Conclusion

There is a relationship between sleep quality and pain intensity in chronic low back pain patients. Poor sleep quality is associated with an increase in pain intensity in chronic low back pain patients.

References

1. Kumar VM. Sleep and sleep disorders. *Indian J Chest Dis Allied Sci.* 2008;**50**(1):129.
2. Filip I, Tidman M, Saheba N, Bennett H, Wick B, Rouse N, et al. Public health burden of sleep disorders: underreported problem. *J Public Health (Bangkok).* 2017;**25**(3):243-8.
3. Seng EK, Cervoni C, Lawson JL, Oken T, Sheldon S, McKee MD, et al. The burden of sleep problems: A pilot observational study in an ethnically diverse urban primary care setting. *J Prim Care Community Health.* 2016;**7**(4):276-80.
4. Gofir A, WR I. Panduan Tatalaksana Gangguan Tidur. Jakarta, Indonesia: Kelompok studi gangguan tidur PERDOSSI; 2017.
5. Empitu MA, Kadariswantiningsih IN, Thaha M, Nugroho CW, Putri EAC, El Hakim Z, et al. Determiner of Poor Sleep Quality in Chronic Kidney Disease Patients Links to Elevated Diastolic Blood Pressure, hs-CRP, and Blood-count-based Inflammatory Predictors. *Indones Biomed J.* 2019;**11**(1):100-6.
6. Effendie MI. Metoda Biologi Perikanan. Bogor: Yayasan Dewi Sri; 1979.
7. Chattu VK, Manzar MD, Kumary S, Burman D, Spence DW, Pandi-Perumal SR. The global problem of insufficient sleep and its serious public health implications. Healthcare, vol. 7. Multidisciplinary Digital Publishing Institute; 2019. p. 1.
8. Alsaadi SM, McAuley JH, Hush JM, Maher CG. Prevalence of sleep disturbance in patients with low back pain. *Eur Spine J.* 2011;**20**(5):737-43.
9. Sezgin M, Hasanefendioğlu EZ, Sungur MA, Incel NA, Cimen ÖB, Kanık A, et al. Sleep quality in patients with chronic low back pain: a cross-sectional study assessing its relations with pain, functional status and quality of life. *J Back Musculoskelet Rehabil.* 2015;**28**(3):433-41.
10. Heffner KL, France CR, Trost Z, Ng HM, Pigeon WR. Chronic low back pain, sleep disturbance, and interleukin-6. *Clin J Pain.* 2011;**27**(1):35.
11. O'Donoghue GM, Fox N, Heneghan C, Hurley DA. Objective and subjective assessment of sleep in chronic low back pain patients compared with healthy age and gender matched controls: a pilot study. *BMC Musculoskelet Disord.* 2009;**10**(1):122.
12. Chung EJ, Hur Y-G, Lee B-H. A study of the relationship among fear-avoidance beliefs, pain and disability index in patients with low back pain. *J Exerc Rehabil.* 2013;**9**(6):532.

Deleted: ¶

Commented [MOU97]: Please check that all references are relevant to the contents of the manuscript

Commented [User98R97]: Thank you for your comment

- Deleted: 1. ◦ Kumar VM. Sleep and sleep disorders. Indian J Chest Dis Allied Sci. 2008;50:129. ¶
2. ◦ Filip I, Tidman M, Saheba N, et al. Public health burden of sleep disorders: underreported problem. J Public Health (Bangkok). 2017;25:243-8. ¶
3. ◦ Seng EK, Cervoni C, Lawson JL, et al. The burden of sleep problems: A pilot observational study in an ethnically diverse urban primary care setting. J Prim Care Community Health. 2016;7:276-80. ¶
4. ◦ Gofir A, WR I. Panduan Tatalaksana Gangguan Tidur. Jakarta, Indonesia: Kelompok studi gangguan tidur PERDOSSI; 2017. 41-62 p. ¶
5. ◦ Empitu MA, Kadariswantiningsih IN, Thaha M, et al. Determiner of Poor Sleep Quality in Chronic Kidney Disease Patients Links to Elevated Diastolic Blood Pressure, hs-CRP, and Blood-count-based Inflammatory Predictors. Indones Biomed J. 2019;11:100-6. ¶
6. ◦ Effendie MI. Metoda Biologi Perikanan. Bogor: Yayasan Dewi Sri; 1979. 112 p. ¶
7. ◦ Chattu VK, Manzar MD, Kumary S, et al. The global problem of insufficient sleep and its serious public health implications. In: Healthcare. Multidisciplinary Digital Publishing Institute; 2019. p. 1. ¶
8. ◦ Alsaadi SM, McAuley JH, Hush JM, et al. Prevalence of sleep disturbance in patients with low back pain. Eur Spine J. 2011;20:737-43. ¶
9. ◦ Sezgin M, Hasanefendioğlu EZ, Sungur MA, et al. Sleep quality in patients with chronic low back pain: a cross-sectional study assessing its relations with pain, functional status and quality of life. J Back Musculoskelet Rehabil. 2015;28:433-41. ¶
10. ◦ Heffner KL, France CR, Trost Z, et al. Chronic low back pain, sleep disturbance, and interleukin-6. Clin J Pain. 2011;27:35. ¶
11. ◦ O'Donoghue GM, Fox N, Heneghan C, et al. Objective and subjective assessment of sleep in chronic low back pain patients compared with healthy age and gender matched controls: a pilot study. BMC Musculoskelet Disord. 2009;10:122. ¶
12. ◦ Chung EJ, Hur Y-G, Lee B-H. A study of the relationship among fear-avoidance beliefs, pain and disability index in patients with low back pain. J Exerc Rehabil. 2013;9:532. ¶
- ... [2]

Process Producing Accepted Article (24-02-2021)

Hemos iniciado la producción de su artículo [MCP_100208]
para Medicina Clínica Práctica

Feb 24, 2021, 5:47 PM

Nuestra referencia: MCP 100208

Referencia del artículo:

Título del

artículo: RELATIONSHIP BETWEEN SLEEP QUALITY AND PAIN INTENSITY IN P
ATIENTS WITH CHRONIC LOW BACK PAIN

Se publicará en: Medicina Clínica Práctica

Estimado/a Dr. Bintang:

Gracias por elegir publicar en Medicina Clínica Práctica. Por favor, lea este mensaje detenidamente ya que contiene información importante.

FINALIZAR LA PUBLICACIÓN DE SU ARTÍCULO:

Nos esforzamos al máximo para publicar los artículos de nuestros autores con la mayor rapidez y eficiencia posible y, por tanto, ya hemos iniciado el proceso de producción de su artículo aceptado. Para asegurar que su artículo se publica de acuerdo a sus deseos, por favor, complete los formularios que encontrará aquí:

<http://authors.elsevier.com/authorforms/MCP100208/d982a7eab0b7bc87a27dde8e1c353881>

Si este enlace no funciona copie la dirección URL completa en su navegador. Tenga en cuenta que es posible que la dirección ocupe varias líneas en este mensaje. Tendrá que acceder con la contraseña de su Elsevier Profile, que debió crear en el momento en que envió su artículo.

REVISE SUS DATOS DE CONTACTO:

Por favor, revise los siguientes datos de contacto para que podamos ponernos en contacto con usted si es necesario:

Dr. Andi Kurnia Bintang
Hasanuddin University
Neurology
Indonesia

Teléfono: not available

Fax: not available

Correo electrónico: a.kurnia_b@yahoo.co.id; pmc@agri.unhas.ac.id

SU NÚMERO DE REFERENCIA:

Por último, para que podamos ofrecerle el mejor servicio, tome nota del número de referencia de su artículo (MCP 100208) e inclúyalo en todos sus mensajes cuando contacte con nosotros.

Muchas gracias por su colaboración. Por favor, no dude en ponerse en contacto con nosotros si tiene alguna consulta.

Atentamente,

Mr Sachin Sachin
Data Administrator
Elsevier

Correo electrónico: S.Yadav1@elsevier.com

Publishing Agreement Completed (25-02-2021)

Publishing Agreement completed for your article [MCP_100208]

Thu, Feb 25, 2021, 6:31 PM

ELSEVIER

Dear Dr. Bintang,

Thank you for completing the Publishing Agreement Form for your article *RELATIONSHIP BETWEEN SLEEP QUALITY AND PAIN INTENSITY IN PATIENTS WITH CHRONIC LOW BACK PAIN*. Please find attached a copy of the "Journal Publishing (License) Agreement" which you completed online on February 25, 2021.

If you have any questions, please do not hesitate to contact us. To help us assist you, please quote our article reference MCP_100208 in all correspondence.

Now that your article has been accepted, you will want to maximize the impact of your work. Elsevier facilitates and encourages authors to share their article responsibly. To learn about the many ways in which you can share your article whilst respecting copyright, visit: www.elsevier.com/sharing-articles.

We are committed to publishing your article as quickly as possible.

Kind regards,
Elsevier Researcher Support



Proofs (04-03-2021)

Proofs of [MCP_100208]

Thu, Mar 4, 2021, 8:40 PM

P-authorproof-ESES_Eng_v14(a)

PLEASE DO NOT ALTER THE SUBJECT LINE OF THIS E-MAIL

Dear Author

The proof of your article, to be published in *MEDICINA CLÍNICA PRÁCTICA*, is attached to this e-mail as a PDF file. Also attached are instructions on the annotation of PDF files (notas.pdf). A 'Query Form' is also included as the front page of the proof, detailing any questions regarding your article that have arisen during the preparation of the proof.

We will do everything possible to get your article published quickly and accurately; to do this we need your cooperation. Please respond promptly (48 hours), even if you have no corrections: the sooner we hear from you, the sooner your corrected article will appear online. Please note that any delay in returning your corrections could result in a delay in publication and that any significant changes to the article as accepted for publication will only be considered at this stage with the permission of the Editor.

Please note that proof corrections can now be annotated on-screen, which allows you to mark directly in the PDF file, and return the marked file as an e-mail attachment. See the attached instructions for further information.

Alternative methods of returning proof corrections:

If you do not wish to use the PDF annotations function, you may list the corrections (including replies to the Query Form) in an e-mail and return them to us using the 'reply' button to this e-mail. Please list your corrections quoting line number.

If, for any reason, this is not possible, mark the corrections and any other comments (including replies to the Query Form) on a printout of your proof and fax this to the number given below, or scan the pages and return them by e-mail.

We prefer to receive your corrections by e-mail or fax so that we can process your article quickly and efficiently. However, if you wish to return your corrections by post then please contact us and we will provide the full postal address.

Please use this proof for checking the typesetting, editing, completeness and correctness of the text, tables and figures.

If you submitted usable colour figures with your article they will appear, at no extra charge, in colour on the web if reproduced in colour in the attached PDF proof of your article. In the printed issue, colour reproduction depends on journal policy and whether or not you agree to bear any costs (not applicable to journals which appear only online). Any 'supplementary' material to your article (i.e., not appearing in print) will be accessible after your corrected article is placed online; such material is not part of the proofing procedure and is therefore not attached here.

Before returning your proof corrections, please ensure that you have answered any questions raised on the Query Form and that you have indicated all corrections: this is the last opportunity to make corrections before the final publication of your article.


Kind regards,

Elsevier

E-mail corrections to: corrections.eses@elsevier.thomsondigital.com

Fax: +34 932 091 136

AUTHOR QUERY FORM

 ELSEVIER	Journal: MCP	Please e-mail your responses and any corrections to:
	Article Number: 100208	E-mail:

Dear Author,

Please check your proof carefully and mark all corrections at the appropriate place in the proof (e.g., by using on-screen annotation in the PDF file) or compile them in a separate list. Note: if you opt to annotate the file with software other than Adobe Reader then please also highlight the appropriate place in the PDF file. To ensure fast publication of your paper please return your corrections within 48 hours.

For correction or revision of any artwork, please consult <http://www.elsevier.com/artworkinstructions>.

Any queries or remarks that have arisen during the processing of your manuscript are listed below and highlighted by flags in the proof. Click on the 'Q' link to go to the location in the proof.

Location in article	Query / Remark: click on the Q link to go Please insert your reply or correction at the corresponding line in the proof
Q1	<p>Please confirm that given name and surname are correctly identified. The different colors indicate whether tagged as first or last name. Please note that proper identification is key for correct indexing of the article.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Please check this box or indicate your approval if you have no corrections to make to the PDF file <input checked="" type="checkbox"/></p> </div>

Thank you for your assistance.



Original article

Relationship between sleep quality and pain intensity in patients with chronic low back pain

Andi Kurnia Bintang*, Ivan Santosa, Yudy Goysal, Muhammad Akbar, Susi Aulina

Department of Neurology, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia

ARTICLE INFO

Article history:

Received 24 September 2020

Accepted 15 October 2020

Available online xxx

Keywords:

Sleep quality

PSQI

Pain intensity

ABSTRACT

Objective: The general objective of this study was to determine the relationship between sleep quality and pain intensity in chronic low back pain patients.

Method: Cross-sectional analytic study with consecutive sampling. Chronic patients who met the inclusion criteria at clinic neurology Wahidin Sudirohusodo Makassar. Independent variable: sleep quality, measured by the Pittsburgh Sleep Quality Index (PSQI) score. Dependent variable: pain intensity, measured by the Visual Analog Scale (VAS) score. Data analysis using a Chi-Square test.

Result: A total of 29 samples met our inclusion criteria and divided into two groups, 23 samples of poor sleep quality, and six samples of good sleep quality. Within the poor sleep quality group, five patients (21.7%) had mild pain intensity, 11 patients (47.8%) had moderate pain intensity, and seven patients (30.4%) had severe pain intensity. In good sleep quality, five patients (83.3%) had mild pain intensity, one patient (16.7%) had moderate pain intensity, and no samples with severe pain intensity. A significant relationship found between sleep quality and pain intensity ($p=0.017$).

Conclusion: There is a relationship between sleep quality and pain intensity. Poor sleep quality is associated with increased pain intensity in patients with chronic low back pain.

© 2021 The Authors. Published by Elsevier España, S.L.U. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Introduction

Sleep is defined by the Sleep Disorders Management Guide (2017) by the Sleep Disorders Study Group of the Indonesian Neurologist Specialist Association (PERDOSSI). Sleep is defined by the Sleep Disorders Management Guide (2017), the Sleep Disorders Study Group of the Indonesian Neurologist Specialist Association (PERDOSSI) is a reversible decrease in consciousness that is a physiological and recurrent form, usually, a decline in cognitive function globally, so the brain does not respond to surrounding stimuli. The function of sleep can be seen by the fact that people spend about a third of their lives sleeping. Sleep quality has several components that involve a variety of domains, including assessments of sleep duration, sleep latency, sleep efficiency, sleep dysfunction, and the use of sleeping pills, if one or more of the disrupted domains will result in decreased sleep quality. Poor sleep quality has been associated with increasing age, low socioeconomic sta-

tus, poor general health, poor lifestyle behavior. Changes in terms of quality, quantity, and sleep patterns cause sleep disturbance. Sleep disorders that occur continuously and repeatedly are important predisposing factors for the development of chronic diseases, such as heart disease, diabetes mellitus, obesity, depression, cancer, stroke, chronic back pain, and decreased quality of life. Sleep disturbance is proven to increase the stress response so that it can delay the healing process, causing sequelae that are detrimental to the cardiovascular system, metabolism, and endocrine. Moreover, it can cause hyperalgesia and contribute to the dysregulation of emotional reactivity.^{1–6}

In the United States, there are 50–70 million adults who have sleep disorders with the proportion of insomnia of 6–10% and sleep apnea of 10–25%. The Center on Sleep Disorders Research estimates that 38,000 deaths occur per year for cardiovascular cases due to sleep disorders. Another study conducted in the Netherlands with a total of 20,000 patients aged 12 years or older showed an alarming prevalence, with 21.2% of men and 33.2% of women having some type of sleep disorder.^{3,7}

Based on the Alsaadi et al. study, data for 1936 patients were taken from 13 other author studies between 2001 and 2009, found the prevalence of sleep disorders in patients with low back pain by 58.9%. Another study conducted by Franca et al., in 51 patients with chronic low back pain found 82.35% of patients with sleep disorders.

Peer-review under responsibility of the scientific committee of the Technology Enhanced Medical Education International Conference (THEME 2019). Full-text and the content of it is under responsibility of authors of the article.

* Corresponding author.

E-mail addresses: a.kurnia_b@yahoo.co.id, pmc@agri.unhas.ac.id (A.K. Bintang).

According to research conducted by Donoghue et al., Mentioned that patients with chronic low back pain (chronic NPB) have significantly poor sleep quality, both subjectively and objectively. This study also showed a statistically significant relationship between low back pain with disability levels and subjective sleep quality.⁸

Sleep disturbance has a considerable economic impact. The economic impact of the annual cost of treating moderate-severe sleep disorders in the United States is 165 billion US dollars, far higher than other non-communicable diseases such as heart failure, stroke, hypertension, asthma (20–80 billion US dollars).²

Chronic pain and sleep disorders have a reciprocal relationship and are often found together. Sleep deprivation of eight hours each night is considered to be of reduced sleep duration and can cause long-term disruption in sleep patterns. Reduced sleep duration and poor sleep quality can reduce pain threshold in subjects experiencing pain and mental capacity to cope with pain, and vice versa i.e., chronic pain can cause a decrease in sleep quality. Sleep disturbance is a common problem that is often found as much as 50–70% in patients with chronic non-malignant pain. Sleep disorders in patients with chronic pain such as chronic LBP cases, include a variety of factors and are characterized by reduced sleep efficiency, sleep duration, increased sleep latency, daytime sleepiness. Difficulty in starting and maintaining sleep is a symptom that is often found in the general population. Difficulty in going to sleep, maintaining sleep, waking up earlier has been found in chronic pain patients. Chronic LBP is one of the most common symptoms of chronic pain. Decreased slow-wave sleep appears to be responsible for increased sensitivity to pain.^{9,10}

Based on several studies that show a relatively high prevalence and sizable economic impact for cases of chronic low back pain with sleep disorders, the researchers aim to study there is a relationship between sleep quality with pain intensity in chronic low back pain patients. Subjective sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI). PSQI is an effective instrument for measuring sleep quality and patterns in adults, which can distinguish between “poor” and “good” sleep quality through 7 components. Pain intensity assessed by visual analog scale (VAS) score, VAS is an instrument for valid and reliable pain assessment.^{11,12}

Method

This study is a type of observational analytic study using cross-sectional studies. The study was conducted at the Neurology Polyclinic of the Wahidin Sudirohusodo Education General Hospital and the Network Hospital, in April–May 2019. The study population was all patients with chronic low back pain who sought treatment at the Poly Neurology of Wahidin Sudirohusodo Education Hospital and the Network Hospital, in the month of April–May 2019. The sample of this study was chronic low back pain sufferers who met the inclusion and exclusion criteria. The sample obtained by a consecutive sampling method. The inclusion criteria used (1) Patients aged 18–65 years, both male and female with significant complaints of low back pain that have been experienced for more than 12 weeks (3 months) and visited the Neurology Wahidin Sudirohusodo General Hospital and Network Hospital in April–May 2019. (2) Samples are willing to be included in this study by giving signatures for informed consent and filling out research questionnaires. Subjects were excluded from the study if: (1) Patients who have other musculoskeletal disorders, (2) Patients with low back pain due to disorders of the visceral organs such as infection and kidney stones, (3) Patients who get serious illnesses, such as malignancy or other complications, (4) Patients who get other intracranial disorders.

Table 1
Characteristic data of chronic low back pain subjects.

Variable	Total sample (N=29)	Frequence (%)
<i>Gender</i>		
Male	10	34.5
Female	19	65.5
<i>Age</i>		
21–40 years	8	27.6
41–60 years	18	62.1
>60 years	3	10.3
<i>Education</i>		
Elementary school	3	10.3
Junior high school	3	10.3
Senior high school	11	37.9
Diploma-bachelor	12	10.3
<i>Occupation</i>		
Low risk	27	93.1
High risk	2	6.9
<i>Duration</i>		
Three months–1 year	16	55.2
>1 year–2 year	3	10.3
>2 year	10	34.5
<i>Body mass index</i>		
No obesity	16	55.2
Obesity	13	44.8
<i>Visual Analog scale score (VAS)</i>		
Mild	10	34.5
Moderate	12	41.4
Severe	7	24.1
<i>PSQI</i>		
Good	6	20.7
Poor	23	79.3
<i>Total</i>	29	100

Result

Characteristics of subjects with chronic low back pain

This study was conducted at Wahidin Sudirohusodo General Hospital and Network Hospital in April–May 2019. Table 1 shows, a total sample of 29 people was obtained with a higher number of women, 19 of them (65.5%), and as many as men ten people (34.5%). Based on education and employment, patients with chronic low back pain who received elementary school education were three people (10.3%), junior high school as many as three people (10.3%), high school as many as 11 people (37.9%), and Diploma-there were 12 scholars (41.3%). While in terms of work divided into high-risk work and low risk of chronic low back pain. Heavy and rough work is considered as a job with a high risk of 2 people (6.9%), and low-risk jobs of 27 people (93.1%). Based on the data, diplomas-scholars have the most chronic low back pain, while many low-risk jobs experience chronic low back pain (Fig. 1).

Baseline data of the subjects showed the distribution of the age group, the group of patients aged 21–40 years as many as eight people (27.6%), the group of patients aged 41–60 years as many as 18 people (62.1%), the group of patients with age >60 years amounted to 3 people (10.3%). While the duration of pain three months – 1 year has the most subjects experiencing chronic low back pain as many as 16 people (55.2%), duration of 1 year-2 year by three people (10.3%), and duration > 2 years of 10 people (34.5%). Obese patients with chronic low back pain were 13 people (44.8%), and not obese as many as 16 people (55.2%).

Based on the Visual Analog Scale (VAS) score, the number of chronic low back pain patients who had mild pain intensity was ten people (34.5%), the most intensity was moderate pain by 12 people (41.4%), and severe pain as much as seven people (24.1%).

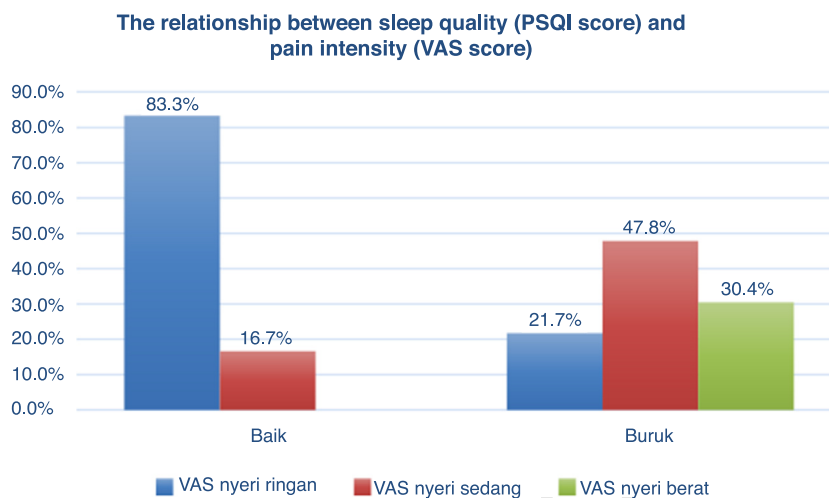


Fig. 1. Relationship between Sleep Quality (PSQI score) and Pain Intensity (VAS score) in Chronic LBP patients.

The PSQI questionnaire assessed the sleep quality of chronic low back pain patients. Chronic low back pain subjects with good sleep quality were six people (20.7%), while poor sleep quality were 23 people (79.3%).

The relationship between sleep quality and pain intensity

In Table 2 shows the number of subject groups of good and poor sleep quality on pain intensity. In subjects with good sleep quality, they have mild pain intensity as many as five people (83.3%), moderate pain one person (16.7%), and there were no subjects with severe pain intensity. Whereas the subjects with poor sleep quality have mild pain intensity as many as five people (21.7%), moderate pain as many as 11 people (47.8%), and severe pain as many as seven people (30.4%), with a P -value = 0.017.

Discussion

Chronic pain that is most often complained of by people is chronic low back pain. The effects of chronic LBP include considerable clinical, social, and economic aspects throughout the world. Chronic LBP has multifactorial causes such as work or physical activity, body mass index associated with obesity, socioeconomic level, and education.

In this study, there was a total sample of 29 people with chronic low back pain, and women had a higher population than men at 65.5% and 34.5%. Chronic LBP consistently has a higher proportion of women than men. One reason for this is that women are shown to have lower pain perception thresholds, and menstrual cycle fluctuations affect pain sensitivity, but if chronic LBP is related to work, the proportion of men is higher. The number of chronic LBP subjects with high-risk work in this study was only two people, and both were male.

Based on the age of patients who experience chronic low back pain, they obtained the age with the largest population between 41 and 60 years that is as many as 18 people, with an average age of 44 years. According to the National Institute of Neurological Disorders and Stroke, the first attack of low back pain occurs at the age of 30–50 years, and lower back pain becomes more common with age because increasing age is associated with decreased bone density, reduced elasticity and muscle tone, flexibility intervertebral discs are reduced. Chronic LBP subjects were 13 people obese, and 16 people were not obese. Chronic LBP is strongly influenced by obesity because obesity causes an emphasis on the intervertebral discs, the greater cartilage.

In this study, more subjects were not obese, chronic LBP occurred due to multifactorial influence, so it is possible that the cause of chronic LBP is by other factors.

Based on pain intensity assessed using a visual analog scale (VAS) score, it was found that the most subjects experienced moderate pain intensity as many as 12 people. In contrast, the intensity of mild pain was ten people, and severe pain was seven people, then subjects were also subjected to subjective sleep quality using the PSQI questionnaire. Poor sleep quality with more prevalence than good sleep quality, as many as 23 people and six people. In this study, the prevalence of poor sleep quality was higher than good sleep quality. This number is following several studies that showed a higher prevalence of sleep disorders in patients with chronic low back pain.

The relationship between sleep quality and pain intensity was tested using chi-square and statistically significant, which is $P=0.017$. In the group that had poor sleep quality tended to have moderate and severe pain intensity with a moderate pain population of 47.8%, severe pain 30.4%, and mild pain 21.7%. While the group with good sleep quality tends to have mild and moderate pain intensity with a population of mild pain 83.3% and moderate pain 16.7%. The effect of sleep quality on pain intensity is strengthened by the absence of subjects with good sleep quality who have severe pain intensity. These results are consistent with the study of Marin et al. (2006), which states that sleep disturbance is a common finding in cases of chronic low back pain, an increase in pain intensity in patients with chronic low back pain influenced by poor sleep quality.

There is increasing evidence that poor sleep quality affects increasing mortality in certain diseases and susceptibility to infections. Acute and chronic reduction in the duration and quality of sleep has been shown to induce excessive expenditure from proinflammatory cytokines. IL-6 is one of the most critical cytokines that mediate the rapid interaction between the immune system and the central nervous system function. Poor sleep quality causes a significant increase and peak of IL-6 levels the next day. This level can be reduced if the patient sleeps during the day. Exogenous administration of IL-6 has been shown to have a somnogenic effect in studies conducted on experimental animals, besides activating hypothalamic-pituitary-adrenal (HPA), which causes nonphysiological hypercortisolemia during the first hour during sleep which explains the decline in sleep quality. Whereas IL-6 increases pain intensity in neuropathic pain. In this study, subjects with poor sleep quality had moderate to severe pain intensity, while subjects with good sleep quality had mild to moderate pain intensity.

Table 2
The relationship between sleep quality (PSQI score) and pain intensity (VAS score).

PSQI	VAS			Total	p-Value
	Mild	Moderate	Severe		
<i>Good</i>					
N	5	1	0	6	0.017
%	83.3%	16.7%	0.0%	100.0%	
<i>Poor</i>					
N	5	11	7	23	100.0%
%	21.7%	47.8%	30.4%	100.0%	
<i>Total</i>					
N	10	12	7	29	100.0%
%	34.5%	41.4%	24.1%	100.0%	

234 Statistically has a significant relationship between sleep quality and
235 pain intensity in chronic LBP cases, with a p -value < 0.05 ($p = 0.017$).

236 This study is a preliminary study to see the relationship between
237 sleep quality and pain intensity in chronic LBP cases. The limited
238 number of samples and subjective sleep quality measurement tools
239 in the form of PSQI questionnaires are the weaknesses of this study.
240 Subsequent studies can use direct IL-6 serum levels, which influ-
241 ence pain intensity and sleep quality.

242 **Conclusion**

243 There is a relationship between sleep quality and pain intensity
244 in chronic low back pain patients. Poor sleep quality is associated
245 with an increase in pain intensity in chronic low back pain patients.

246 **Conflict of interest**

247 The authors declare no conflict of interest.

248 **References**

249 1. Kumar VM. Sleep and sleep disorders. *Indian J Chest Dis Allied Sci* 2008;50:129.
250 2. Filip I, Tidman M, Saheba N, Bennett H, Wick B, Rouse N, et al. Public health
251 burden of sleep disorders: underreported problem. *J Public Health (Bangkok)*
2017;25:243–8.

252 3. Seng EK, Cervoni C, Lawson JL, Oken T, Sheldon S, McKee MD, et al. The burden
253 of sleep problems: a pilot observational study in an ethnically diverse urban
254 primary care setting. *J Prim Care Community Health* 2016;7:276–80.
255 4. Gofir A, WR I. Panduan Tatalaksana Gangguan Tidur. Jakarta, Indonesia: Kelom-
256 pok studi gangguan tidur PERDOSSI; 2017.
257 5. Empitu MA, Kadariswantiningsih IN, Thaha M, Nugroho CW, Putri EAC, El Hakim
258 Z, et al. Determiner of poor sleep quality in chronic kidney disease patients links
259 to elevated diastolic blood pressure, hs-CRP, and blood-count-based inflamma-
260 tory predictors. *Indones Biomed J* 2019;11:100–6.
261 6. Effendie MI. *Metoda Biologi Perikanan*. Bogor: Yayasan Dewi Sri; 1979.
262 7. Chattu VK, Manzar MD, Kumary S, Burman D, Spence DW, Pandi-Perumal SR.
263 *The global problem of insufficient sleep and its serious public health implications.*
264 *Healthcare*, vol. 7. Multidisciplinary Digital Publishing Institute; 2019. p. 1.
265 8. Alsaadi SM, McAuley JH, Hush JM, Maher CG. Prevalence of sleep disturbance in
266 patients with low back pain. *Eur Spine J* 2011;20:737–43.
267 9. Sezgin M, Hasanefendioğlu EZ, Sungur MA, Incel NA, Çimen ÖB, Kanık A, et al.
268 Sleep quality in patients with chronic low back pain: a cross-sectional study
269 assessing its relations with pain, functional status and quality of life. *J Back*
270 *Musculoskelet Rehabil* 2015;28:433–41.
271 10. Heffner KL, France CR, Trost Z, Ng HM, Pigeon WR. Chronic low back pain, sleep
272 disturbance, and interleukin-6. *Clin J Pain* 2011;27:35.
273 11. O'Donoghue GM, Fox N, Heneghan C, Hurley DA. Objective and subjective assess-
274 ment of sleep in chronic low back pain patients compared with healthy age and
275 gender matched controls: a pilot study. *BMC Musculoskelet Disord* 2009;10:122.
276 12. Chung EJ, Hur Y-G, Lee B-H. A study of the relationship among fear-avoidance
277 beliefs, pain and disability index in patients with low back pain. *J Exerc Rehabil*
278 2013;9:532.

UNCORRECTED PROOF

Paper published (28-04-2021)

Comparta su artículo [MCP_100208] gratuitamente

Tue, Apr 28, 2021, 9:51 PM

ELSEVIER

¡Comparta su artículo!

Estimado/a Dr. Bintang,

Nos complace informarle de que la versión final de acceso abierto de su artículo *RELATIONSHIP BETWEEN SLEEP QUALITY AND PAIN INTENSITY IN PATIENTS WITH CHRONIC LOW BACK PAIN* ya está disponible en línea junto con las referencias bibliográficas completas.

La URL que aparece abajo es una forma fácil y rápida de compartir su trabajo con sus compañeros, co-autores y amigos. Los usuarios que hagan clic en el enlace serán redirigidos a la versión final del artículo en ScienceDirect.

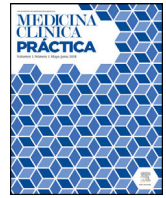


Enlace a su artículo:

<https://authors.elsevier.com/sd/article/S2603924921000185>

Haga clic en los iconos que aparecen abajo para compartirlo con su red:





Original article

Relationship between sleep quality and pain intensity in patients with chronic low back pain[☆]



Andi Kurnia Bintang^{*}, Ivan Santosa, Yudy Goysal, Muhammad Akbar, Susi Aulina

Department of Neurology, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia

ARTICLE INFO

Article history:

Received 24 September 2020

Accepted 15 October 2020

Keywords:

Sleep quality

PSQI

Pain intensity

ABSTRACT

Objective: The general objective of this study was to determine the relationship between sleep quality and pain intensity in chronic low back pain patients.

Method: Cross-sectional analytic study with consecutive sampling. Chronic patients who met the inclusion criteria at clinic neurology Wahidin Sudirohusodo Makassar. Independent variable: sleep quality, measured by the Pittsburgh Sleep Quality Index (PSQI) score. Dependent variable: pain intensity, measured by the Visual Analog Scale (VAS) score. Data analysis using a Chi-Square test.

Result: A total of 29 samples met our inclusion criteria and divided into two groups, 23 samples of poor sleep quality, and six samples of good sleep quality. Within the poor sleep quality group, five patients (21.7%) had mild pain intensity, 11 patients (47.8%) had moderate pain intensity, and seven patients (30.4%) had severe pain intensity. In good sleep quality, five patients (83.3%) had mild pain intensity, one patient (16.7%) had moderate pain intensity, and no samples with severe pain intensity. A significant relationship found between sleep quality and pain intensity ($p=0.017$).

Conclusion: There is a relationship between sleep quality and pain intensity. Poor sleep quality is associated with increased pain intensity in patients with chronic low back pain.

© 2021 The Authors. Published by Elsevier España, S.L.U. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Introduction

Sleep is defined by the Sleep Disorders Management Guide (2017) by the Sleep Disorders Study Group of the Indonesian Neurologist Specialist Association (PERDOSSI). Sleep is defined by the Sleep Disorders Management Guide (2017), the Sleep Disorders Study Group of the Indonesian Neurologist Specialist Association (PERDOSSI) is a reversible decrease in consciousness that is a physiological and recurrent form, usually, a decline in cognitive function globally, so the brain does not respond to surrounding stimuli. The function of sleep can be seen by the fact that people spend about a third of their lives sleeping. Sleep quality has several components that involve a variety of domains, including assessments of sleep duration, sleep latency, sleep efficiency, sleep dysfunction, and the use of sleeping pills, if one or more of the disrupted domains will result in decreased sleep quality. Poor sleep quality has been associated with increasing age, low socioeconomic

status, poor general health, poor lifestyle behavior. Changes in terms of quality, quantity, and sleep patterns cause sleep disturbance. Sleep disorders that occur continuously and repeatedly are important predisposing factors for the development of chronic diseases, such as heart disease, diabetes mellitus, obesity, depression, cancer, stroke, chronic back pain, and decreased quality of life. Sleep disturbance is proven to increase the stress response so that it can delay the healing process, causing sequelae that are detrimental to the cardiovascular system, metabolism, and endocrine. Moreover, it can cause hyperalgesia and contribute to the dysregulation of emotional reactivity.¹⁻⁶

In the United States, there are 50–70 million adults who have sleep disorders with the proportion of insomnia of 6–10% and sleep apnea of 10–25%. The Center on Sleep Disorders Research estimates that 38,000 deaths occur per year for cardiovascular cases due to sleep disorders. Another study conducted in the Netherlands with a total of 20,000 patients aged 12 years or older showed an alarming prevalence, with 21.2% of men and 33.2% of women having some type of sleep disorder.^{3,7}

Based on the Alsaadi et al. study, data for 1936 patients were taken from 13 other author studies between 2001 and 2009, found the prevalence of sleep disorders in patients with low back pain by 58.9%. Another study conducted by Franca et al., in 51 patients with chronic low back pain found 82.35% of patients with sleep disorders.

[☆] Peer-review under responsibility of the scientific committee of the Technology Enhanced Medical Education International Conference (THEME 2019). Full-text and the content of it is under responsibility of authors of the article.

^{*} Corresponding author.

E-mail addresses: a.kurnia.b@yahoo.co.id, pmc@agri.unhas.ac.id (A.K. Bintang).

According to research conducted by Donoghue et al., Mentioned that patients with chronic low back pain (chronic NPB) have significantly poor sleep quality, both subjectively and objectively. This study also showed a statistically significant relationship between low back pain with disability levels and subjective sleep quality.⁸

Sleep disturbance has a considerable economic impact. The economic impact of the annual cost of treating moderate-severe sleep disorders in the United States is 165 billion US dollars, far higher than other non-communicable diseases such as heart failure, stroke, hypertension, asthma (20–80 billion US dollars).²

Chronic pain and sleep disorders have a reciprocal relationship and are often found together. Sleep deprivation of eight hours each night is considered to be of reduced sleep duration and can cause long-term disruption in sleep patterns. Reduced sleep duration and poor sleep quality can reduce pain threshold in subjects experiencing pain and mental capacity to cope with pain, and vice versa i.e., chronic pain can cause a decrease in sleep quality. Sleep disturbance is a common problem that is often found as much as 50–70% in patients with chronic non-malignant pain. Sleep disorders in patients with chronic pain such as chronic LBP cases, include a variety of factors and are characterized by reduced sleep efficiency, sleep duration, increased sleep latency, daytime sleepiness. Difficulty in starting and maintaining sleep is a symptom that is often found in the general population. Difficulty in going to sleep, maintaining sleep, waking up earlier has been found in chronic pain patients. Chronic LBP is one of the most common symptoms of chronic pain. Decreased slow-wave sleep appears to be responsible for increased sensitivity to pain.^{9,10}

Based on several studies that show a relatively high prevalence and sizable economic impact for cases of chronic low back pain with sleep disorders, the researchers aim to study there is a relationship between sleep quality with pain intensity in chronic low back pain patients. Subjective sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI). PSQI is an effective instrument for measuring sleep quality and patterns in adults, which can distinguish between “poor” and “good” sleep quality through 7 components. Pain intensity assessed by visual analog scale (VAS) score, VAS is an instrument for valid and reliable pain assessment.^{11,12}

Method

This study is a type of observational analytic study using cross-sectional studies. The study was conducted at the Neurology Polyclinic of the Wahidin Sudirohusodo Education General Hospital and the Network Hospital, in April–May 2019. The study population was all patients with chronic low back pain who sought treatment at the Poly Neurology of Wahidin Sudirohusodo Education Hospital and the Network Hospital, in the month of April–May 2019. The sample of this study was chronic low back pain sufferers who met the inclusion and exclusion criteria. The sample obtained by a consecutive sampling method. The inclusion criteria used (1) Patients aged 18–65 years, both male and female with significant complaints of low back pain that have been experienced for more than 12 weeks (3 months) and visited the Neurology Wahidin Sudirohusodo General Hospital and Network Hospital in April–May 2019. (2) Samples are willing to be included in this study by giving signatures for informed consent and filling out research questionnaires. Subjects were excluded from the study if: (1) Patients who have other musculoskeletal disorders, (2) Patients with low back pain due to disorders of the visceral organs such as infection and kidney stones, (3) Patients who get serious illnesses, such as malignancy or other complications, (4) Patients who get other intracranial disorders.

Table 1
Characteristic data of chronic low back pain subjects.

Variable	Total sample (N=29)	Frequence (%)
<i>Gender</i>		
Male	10	34.5
Female	19	65.5
<i>Age</i>		
21–40 years	8	27.6
41–60 years	18	62.1
>60 years	3	10.3
<i>Education</i>		
Elementary school	3	10.3
Junior high school	3	10.3
Senior high school	11	37.9
Diploma-bachelor	12	10.3
<i>Occupation</i>		
Low risk	27	93.1
High risk	2	6.9
<i>Duration</i>		
Three months–1 year	16	55.2
>1 year–2 year	3	10.3
>2 year	10	34.5
<i>Body mass index</i>		
No obesity	16	55.2
Obesity	13	44.8
<i>Visual Analog scale score (VAS)</i>		
Mild	10	34.5
Moderate	12	41.4
Severe	7	24.1
<i>PSQI</i>		
Good	6	20.7
Poor	23	79.3
<i>Total</i>	29	100

Result

Characteristics of subjects with chronic low back pain

This study was conducted at Wahidin Sudirohusodo General Hospital and Network Hospital in April–May 2019. Table 1 shows, a total sample of 29 people was obtained with a higher number of women, 19 of them (65.5%), and as many as men ten people (34.5%). Based on education and employment, patients with chronic low back pain who received elementary school education were three people (10.3%), junior high school as many as three people (10.3%), high school as many as 11 people (37.9%), and Diploma-there were 12 scholars (41.3%). While in terms of work divided into high-risk work and low risk of chronic low back pain. Heavy and rough work is considered as a job with a high risk of 2 people (6.9%), and low-risk jobs of 27 people (93.1%). Based on the data, diplomas-scholars have the most chronic low back pain, while many low-risk jobs experience chronic low back pain (Fig. 1).

Baseline data of the subjects showed the distribution of the age group, the group of patients aged 21–40 years as many as eight people (27.6%), the group of patients aged 41–60 years as many as 18 people (62.1%), the group of patients with age >60 years amounted to 3 people (10.3%). While the duration of pain three months – 1 year has the most subjects experiencing chronic low back pain as many as 16 people (55.2%), duration of 1 year-2 year by three people (10.3%), and duration > 2 years of 10 people (34.5%). Obese patients with chronic low back pain were 13 people (44.8%), and not obese as many as 16 people (55.2%).

Based on the Visual Analog Scale (VAS) score, the number of chronic low back pain patients who had mild pain intensity was ten people (34.5%), the most intensity was moderate pain by 12 people (41.4%), and severe pain as much as seven people (24.1%).

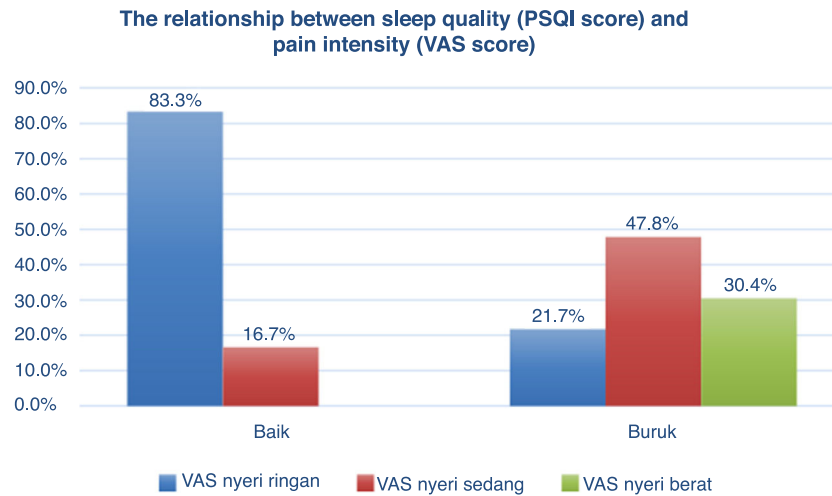


Fig. 1. Relationship between Sleep Quality (PSQI score) and Pain Intensity (VAS score) in Chronic LBP patients.

Table 2
The relationship between sleep quality (PSQI score) and pain intensity (VAS score).

PSQI	VAS			Total	p-Value
	Mild	Moderate	Severe		
<i>Good</i>					0.017
N	5	1	0	6	
%	83.3%	16.7%	0.0%	100.0%	
<i>Poor</i>					
N	5	11	7	23	
%	21.7%	47.8%	30.4%	100.0%	
<i>Total</i>					
N	10	12	7	29	
%	34.5%	41.4%	24.1%	100.0%	

The PSQI questionnaire assessed the sleep quality of chronic low back pain patients. Chronic low back pain subjects with good sleep quality were six people (20.7%), while poor sleep quality were 23 people (79.3%).

The relationship between sleep quality and pain intensity

In Table 2 shows the number of subject groups of good and poor sleep quality on pain intensity. In subjects with good sleep quality, they have mild pain intensity as many as five people (83.3%), moderate pain one person (16.7%), and there were no subjects with severe pain intensity. Whereas the subjects with poor sleep quality have mild pain intensity as many as five people (21.7%), moderate pain as many as 11 people (47.8%), and severe pain as many as seven people (30.4%), with a P-value = 0.017.

Discussion

Chronic pain that is most often complained of by people is chronic low back pain. The effects of chronic LBP include considerable clinical, social, and economic aspects throughout the world. Chronic LBP has multifactorial causes such as work or physical activity, body mass index associated with obesity, socioeconomic level, and education.

In this study, there was a total sample of 29 people with chronic low back pain, and women had a higher population than men at 65.5% and 34.5%. Chronic LBP consistently has a higher proportion of women than men. One reason for this is that women are shown to have lower pain perception thresholds, and menstrual cycle

fluctuations affect pain sensitivity, but if chronic LBP is related to work, the proportion of men is higher. The number of chronic LBP subjects with high-risk work in this study was only two people, and both were male.

Based on the age of patients who experience chronic low back pain, they obtained the age with the largest population between 41 and 60 years that is as many as 18 people, with an average age of 44 years. According to the National Institute of Neurological Disorders and Stroke, the first attack of low back pain occurs at the age of 30–50 years, and lower back pain becomes more common with age because increasing age is associated with decreased bone density, reduced elasticity and muscle tone, flexibility intervertebral discs are reduced. Chronic LBP subjects were 13 people obese, and 16 people were not obese. Chronic LBP is strongly influenced by obesity because obesity causes an emphasis on the intervertebral discs, the greater cartilage.

In this study, more subjects were not obese, chronic LBP occurred due to multifactorial influence, so it is possible that the cause of chronic LBP is by other factors.

Based on pain intensity assessed using a visual analog scale (VAS) score, it was found that the most subjects experienced moderate pain intensity as many as 12 people. In contrast, the intensity of mild pain was ten people, and severe pain was seven people, then subjects were also subjected to subjective sleep quality using the PSQI questionnaire. Poor sleep quality with more prevalence than good sleep quality, as many as 23 people and six people. In this study, the prevalence of poor sleep quality was higher than good sleep quality. This number is following several studies that showed a higher prevalence of sleep disorders in patients with chronic low back pain.

The relationship between sleep quality and pain intensity was tested using chi-square and statistically significant, which is $P=0.017$. In the group that had poor sleep quality tended to have moderate and severe pain intensity with a moderate pain population of 47.8%, severe pain 30.4%, and mild pain 21.7%. While the group with good sleep quality tends to have mild and moderate pain intensity with a population of mild pain 83.3% and moderate pain 16.7%. The effect of sleep quality on pain intensity is strengthened by the absence of subjects with good sleep quality who have severe pain intensity. These results are consistent with the study of Marin et al. (2006), which states that sleep disturbance is a common finding in cases of chronic low back pain, an increase in pain intensity in patients with chronic low back pain influenced by poor sleep quality.

There is increasing evidence that poor sleep quality affects increasing mortality in certain diseases and susceptibility to infections. Acute and chronic reduction in the duration and quality of sleep has been shown to induce excessive expenditure from proinflammatory cytokines. IL-6 is one of the most critical cytokines that mediate the rapid interaction between the immune system and the central nervous system function. Poor sleep quality causes a significant increase and peak of IL-6 levels the next day. This level can be reduced if the patient sleeps during the day. Exogenous administration of IL-6 has been shown to have a somnogenic effect in studies conducted on experimental animals, besides activating hypothalamic-pituitary-adrenal (HPA), which causes nonphysiological hypercortisolemia during the first hour during sleep which explains the decline in sleep quality. Whereas IL-6 increases pain intensity in neuropathic pain. In this study, subjects with poor sleep quality had moderate to severe pain intensity, while subjects with good sleep quality had mild to moderate pain intensity. Statistically has a significant relationship between sleep quality and pain intensity in chronic LBP cases, with a p -value <0.05 ($p=0.017$).

This study is a preliminary study to see the relationship between sleep quality and pain intensity in chronic LBP cases. The limited number of samples and subjective sleep quality measurement tools in the form of PSQI questionnaires are the weaknesses of this study.

Subsequent studies can use direct IL-6 serum levels, which influence pain intensity and sleep quality.

Conclusion

There is a relationship between sleep quality and pain intensity in chronic low back pain patients. Poor sleep quality is associated with an increase in pain intensity in chronic low back pain patients.

Conflict of interest

The authors declare no conflict of interest.

References

1. Kumar VM. Sleep and sleep disorders. *Indian J Chest Dis Allied Sci* 2008;**50**:129.
2. Filip I, Tidman M, Saheba N, Bennett H, Wick B, Rouse N, et al. Public health burden of sleep disorders: underreported problem. *J Public Health (Bangkok)* 2017;**25**:243–8.
3. Seng EK, Cervoni C, Lawson JL, Oken T, Sheldon S, McKee MD, et al. The burden of sleep problems: a pilot observational study in an ethnically diverse urban primary care setting. *J Prim Care Community Health* 2016;**7**:276–80.
4. Gofir A, WR I. Panduan Tatalaksana Gangguan Tidur. Jakarta, Indonesia: Kelompok studi gangguan tidur PERDOSSI; 2017.
5. Empitu MA, Kadariswantiningsih IN, Thaha M, Nugroho CW, Putri EAC, El Hakim Z, et al. Determiner of poor sleep quality in chronic kidney disease patients links to elevated diastolic blood pressure, hs-CRP, and blood-count-based inflammatory predictors. *Indones Biomed J* 2019;**11**:100–6.
6. Effendie MI. *Metoda Biologi Perikanan*. Bogor: Yayasan Dewi Sri; 1979.
7. Chattu VK, Manzar MD, Kumary S, Burman D, Spence DW, Pandi-Perumal SR. *The global problem of insufficient sleep and its serious public health implications. Healthcare, vol. 7. Multidisciplinary Digital Publishing Institute; 2019. p. 1.*
8. Alsaadi SM, McAuley JH, Hush JM, Maher CG. Prevalence of sleep disturbance in patients with low back pain. *Eur Spine J* 2011;**20**:737–43.
9. Sezgin M, Hasanefendioğlu EZ, Sungur MA, Incel NA, Çimen ÖB, Kanık A, et al. Sleep quality in patients with chronic low back pain: a cross-sectional study assessing its relations with pain, functional status and quality of life. *J Back Musculoskelet Rehabil* 2015;**28**:433–41.
10. Heffner KL, France CR, Trost Z, Ng HM, Pigeon WR. Chronic low back pain, sleep disturbance, and interleukin-6. *Clin J Pain* 2011;**27**:35.
11. O'Donoghue GM, Fox N, Heneghan C, Hurley DA. Objective and subjective assessment of sleep in chronic low back pain patients compared with healthy age and gender matched controls: a pilot study. *BMC Musculoskelet Disord* 2009;**10**:122.
12. Chung EJ, Hur Y-G, Lee B-H. A study of the relationship among fear-avoidance beliefs, pain and disability index in patients with low back pain. *J Exerc Rehabil* 2013;**9**:532.