Sleep Quality and Depression in Patients with Migraine

นิพนธ์ต้นฉบับ

Original Article

สุภาภรณ์ บุญส่งสวัสดิ์[1] และ ธนศักดิ์ เทียกทอง[2]*

[1] บัณฑิตวิทยาลัย

[2] ภาควิชาเภสัชกรรมปฏิบัติ คณะเภสัชศาสตร์

[1-2] มหาวิทยาลัยนเรศวร อ.เมือง จ.พิษณุโลก 65000

* **ติดต่อผู้นิพนธ์:** thanasakte@nu.ac.th

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Supaporn Boonsongsawat[1]* and Thanasak Teaktong[2]*

[1] Graduate School

[2] Department of Pharmacy Practice, Faculty of Pharmaceutical Sciences

[1-2] Naresuan University, Phitsanulok, 65000, Thailand

* **Corresponding author:** thanasakte@nu.ac.th

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บทคัดย่อ

วัตถุประสงค์: เพื่อสำรวจคุณภาพการนอนหลับและภาวะซึมเศร้าในผู้ป่วยโรคไมเกรน และทดสอบความสัมพันธ์ระหว่างปัจจัยต่าง ๆ กับคุณภาพการนอนหลับและภาวะซึมเศร้า **วิธีการศึกษา:** การวิจัยเชิงพรรณนาแบบภาคตัดขวางที่ศึกษาในผู้ป่วยโรคไมเกรน 200 รายที่รับการรักษาที่แผนกผู้ป่วยนอก โรงพยาบาลเอกชล จังหวัดชลบุรี ระหว่างวันที่ 26 สิงหาคม ถึง 26 พฤศจิกายน 2559 โดยใช้แบบสอบถามข้อมูลส่วนบุคคล แบบสัมภาษณ์ปัจจัยรบกวนการนอนหลับด้านสิ่งแวดล้อม แบบประเมินคุณภาพการนอนหลับฉบับภาษาไทย แบบประเมินความเครียดของโรงพยาบาลสวนปรุง แบบคัดกรองภาวะซึมเศร้า 2 คำถาม (2Q) แบบ 9 คำถาม (9Q) ของกรมสุขภาพจิต กระทรวงสาธารณสุข โดยสถิติที่ใช้วิเคราะห์ข้อมูล คือความถี่พร้อมร้อยละ และค่าเฉลี่ยพร้อมส่วนเบี่ยงเบนมาตรฐาน และสถิติไคสแควร์สำหรับทดสอบความสัมพันธ์ระหว่างตัวแปรแบบกลุ่ม และค่าสัมประสิทธิ์สหสัมพันธ์สเปียร์แมนสำหรับตัวแปรแบบเลขต่อเนื่อง **ผลการศึกษา**: ผู้ป่วยส่วนมากมีคุณภาพการนอนหลับที่ไม่ดี (ร้อยละ 78.0) ส่วนมากมีภาวะซึมเศร้าระดับน้อย (ร้อยละ 49.0) พบว่าความถี่ของอาการปวดศีรษะ ระยะเวลาเป็นไมเกรน และรูปแบบการสั่งใช้ยาสัมพันธ์กับคุณภาพการนอนหลับอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 ความถี่ของอาการปวดศีรษะ ระยะเวลาเป็นไมเกรน และปัจจัยกระตุ้นอาการปวดศีรษะสัมพันธ์กับภาวะซึมเศร้าอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 ความเครียดและปัจจัยรบกวนการนอนหลับด้านสิ่งแวดล้อมสัมพันธ์กับคุณภาพการนอนหลับและภาวะซึมเศร้าอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01 และ 0.05 ตามลำดับ ส่วนอาการที่เกิดร่วมกับอาการปวดศีรษะ ประวัติโรคไมเกรนในครอบครัว ระยะเวลาปวดศีรษะ ระดับความปวดศีรษะโดยเฉลี่ย การดื่มเครื่องดื่มที่มีคาเฟอีน การสูบบุหรี่ การดื่มเครื่องดื่มที่ผสมแอลกอฮอล์ไม่สัมพันธ์กับคุณภาพการนอนหลับและภาวะซึมเศร้า **สรุป**: กลุ่มตัวอย่างผู้ป่วยโรคไมเกรนส่วนใหญ่มีคุณภาพการนอนหลับไม่ดี และมีภาวะซึมเศร้าระดับต่ำร่วมด้วย จากความสัมพันธ์ที่พบสามารถนำไปใช้เป็นแนวทางในการวางแผน ดูแล และแก้ไขปัญหาคุณภาพการนอนหลับและภาวะซึมเศร้าในผู้ป่วยโรคไมเกรนต่อไป

คำสำคัญ: ไมเกรน, คุณภาพการนอนหลับ, ภาวะซึมเศร้า

Abstract

Objective: To determine sleep quality and level of depression in migraine patients and to examine association between various factors and sleep quality and depression. **Method**: This cross-sectional descriptive study recruited 200 migraine patients at the outpatient department of Aikchol Hospital, Chonburi, from 26th August to 26th November, 2016. The participants were asked to fill the questionnaires for demographic information, precipitating factors of sleep disturbance, Thai version of Pittsburg Sleep Questionnaire (PSQI), Suanprung Stress Test-20 (SPST-20), the 2Q and 9Q Depression Screening tests developed by the Department of Mental Health, Ministry of Public Health. The data were analyzed using frequency with percentage, and mean with standard deviation. Chi-square test and Spearman's rank correlation coefficient were used to test associations between categorical and continuous variables, respectively. **Results**: Most patients had a poor sleep (78.0%) and low level of depression (49.0%). Frequency of migraine attack, duration since migraine diagnosis and pattern of drug prescribing were significantly correlated with sleep quality (P-value < 0.05). Frequency of migraine attack, duration since migraine diagnosis and stimulating factors of headache were significantly correlated with depression (P-value < 0.05). Stress and precipitating factors of sleep disturbance were significantly correlated with sleep quality and depression (P-value < 0.01 and < 0.05, respectively). Comorbidity of migraine, family history of migraine, duration of headache, mean score of pain severity, caffeinated beverage intake, cigarette smoking, and alcoholic beverage consumption were not correlated with sleep quality or depression. **Conclusion**: Most patients with migraine a poor sleep quality and a low depression level. The relationships found could be used to plan, manage and resolve sleep quality and depression in migraine patients.

Keywords: migraine, sleep quality, depression

Introduction

Migraine is the most common neurological disorder as the World Health Organization (WHO) has estimated to be as high as 90% of neurological cases.[1] With an estimate of about 12% of population worldwide, about 6 million Thais suffer from migraine.[2] In the US, among persons with severe headache, 4 out of 100 had migraine. In Asia, 66% of the patients with the headache-related out-patient department (OPD) visits had migraine and usually did not receive a proper care.[1] The annual incidence of migraine is three-fold higher in women (18%) than men (6%). In children, it is about 4%.[3] In women, it occurs most frequently in the age range of 24 – 45 years.[4]

In a retrospective study at Aikchol Hospital, a private hospital in Chonburi province, Thailand, a number of OPD prescriptions relating to migraine has increased from 3,646 prescriptions in 2011 to 5,159 in 2012 and 6,372 in 2013. In

these prescriptions, hypnotics, sleep aids such as anxiolytics, and analgesics were also given. The most common sleep aids included benzodiazepines such as lorazepam and diazepam. In 2011, there were 1,753 prescriptions with hypnotics and/or sleep-aid drugs which accounted for 48.08% of all prescriptions for migraine treatment. The number of such prescriptions has increased to 2,905 (56.31%) in 2012 and 4,024 (63.15%) in 2013. Based on these findings, such increasing trend is expected over the recent years.

Migraine is a chronic headache with no clear etiology. It has been speculated that the excessive constriction and dilation of blood vessels in the brain causes a sudden and intense headache accompanied with nausea and vomiting, and in some cases, blurred vision, and flashing light. Migraine not only puts a physical, but also psychological, and socio-economical distress on the patient. Their quality of life has been negatively affected.[2] Negative impact on the patients and their family members is inevitable. Work loss, decreased activity of daily living and lessened interpersonal interaction have been observed. Even though not life-threatening, migraine is considered by WHO as a chronic illness that could cause a disability and should be prevented and treated like other chronic diseases.[5] In treating migraine, its comorbidities should also be identified and managed properly.

Depression is one of the comorbidities of migraine. Patel and colleagues found that, among various abnormalities, depression was commonly reported both in young adults and elderly individuals with an incidence of 28%.[6] Since pain causes both physical and psychological distress, the patient's mood is negatively affected. As a result, depression has been prevalent among patients with chronic pain. The co-existence of pain and depression usually results in a poor daily living and a decrease in quality of life. Since about 50% of patients with chronic pain also experienced depression, it has been known that the two illnesses are highly related.[7]

Sleep problem is frequently found among patients with headache. More than 50% of migraine patients faced difficulty falling a sleep and disrupted sleep. More than 38 of migraine patients had less than 6 hours of sleep and more than 71% woke up in pain. Since sleeping could alleviate migraine headache, 85% of migraine patients need a sleep once facing the headache.[8] As a basic human need, sleep allows for brain rest, restores moods, and nourishes learning and memory.[9] Abnormal sleep could therefore affect body and mind. Negative psychological effects brought by a poor sleep could potentially lead to depression.[10] Based on the study by Jalilian and co-workers, migraine patients had a poorer sleep score when compared with multiple sclerosis patients with a statistical signicance.[11] They also found that sleep score was significantly correlated with depression score (P-value < 0.001). It was therefore concluded that migraine patients were more likely to experience sleep problem and depression.[11] Vgontzas, Cui and Merikangas studied sleep problem among 80 migraine patients aged 18 years or older, and found that migraine and sleep problem was significantly associated.[12] They found that these adult patients with migraine encountered a long-term sleep problem, difficulty falling asleep, and on-going nightmare. Sleep quality is obviously an indicator of sleep problem and should be taken seriously for migraine patients.

With the need to understand sleep problem and depression among migraine patients in Thailand, this study aimed to determine the extent of sleep problem and depression in this group of patients. We also tested the association of various factors including environmental sleep disturbing factors, treatment regimens and stress, with sleep quality and depression. The findings could be used to take care of migraine patients with sleep problem and depression. It could be also used to prevent depression among these patients.

In this study, sleep quality was defined as perceived adequacy of and satisfaction on the sleep of the individuals within the last month. Sleep quality included the overall quality of the sleep, sleep latency time (minutes), duration of sleep (hours), sleep efficiency, sleep disturbance, the use of hypnotics or sleep aids, and the impacts of sleep on daily activities. Depression was defined as disturbances in affects, cognition, motivation and physical status. Symptoms included bouts of the blues, negative thoughts, self-blame, worthlessness, hopelessness, social isolation, lost interest in activities usually enjoyed, suicidal ideation, loss of appetite, and insomnia.

Methods

In this descriptive cross-sectional study, sleep quality and depression were determined among migraine patients by means of a survey. Factors associating with sleep quality

and depression were also determined. We studied seven factors about migraine headache including duration since migraine diagnosis, duration of the headache episode, frequency of headache, symptoms accompanying the headache, headache triggers, family history of migraine, and level of the pain. Another three lifestyle factors were caffeinated beverage consumption, cigarette smoking, and alcohol intake. We studied stress as a psychological factor. In terms of environmental disturbance, sleep disturbing factors were also studied. In terms of treatment, migraine headache therapy option was investigated. Finally sleep quality and depression were determined.

A purposive sampling was used to recruit OPD patients of Aikchol Hospital, Chonburi, who were diagnosed with migraine and followed up during August 26, 2016 to November 26, 2016. The sample size was based on the formula of Thorndike[13], $N \geq 10K + 50$, where N was the desired sample size and K was the number of variables. With 15 variables studied, 200 patients were needed.

The inclusion criteria were as follows. Individuals diagnosed with migraine regardless of their gender were included. They had to be followed up for their migraine at least two visits at the recruitment. The last visit had to be less than one month to correspond to the time-frame of sleep quality questionnaire. Participants needed to be 20 years of age or older, and had no celebrovascular disorders, hypertension, epilepsy, drug abuse, head or brain injury, headaches other than migraine, or other psychological illnesses except depression. They were able to communicate in Thai and be contacted by phone call.

Data collection instruments

Five parts of questionnire were used. The first part of questionnaire collected demographic information of the participants and migraine treatment they received from the hospital. This part was created by the researcher and tested for content validity by three experts. All questions were accepted by all three experts with the perfect average score of the content validity index (CVI) of 1. In the second part of the questionnaire, environmental sleeping disturbing factors were modified from the interview form of the sleep disturbing factors of Leksawasdi et al.[14] Each question asked how much each factor disturbed the participant's sleep with a five-level response scale of 1-not at all disturbing, 2-slightly disturbing, 3-moderately disturbing, 4-highly disturbing and 5-extremely disturbing. Based on the three experts, all questions had a perfect content validity with CVIs of 1. In terms of reliability, the questionnaire had an acceptable internal consistency reliability with a Cronbach's alpha coefficient of 0.788.

The third part of the questionnaire was the Thai version of the Pittsburgh Sleep Quality Index (PSQI) which was translated into Thai language by Jirapramukpitak and Tanchaisawat (1997).[15] PSQI had an acceptable internal consistency reliability with a Cronbach's alpha coefficient of 0.764. With a possible total score range of 0 – 21 points, a total score of 5 or less was defined as a quality sleep while a total score of more than 5 indicated a poor sleep quality. Based on the time-frame of last month, the questionnaire had seven components. In the first component, subjective sleep quality, a question evaluated how well the participant slept with a response scale of 0 "very well," to 1 "well," 2 "not well," and 3 "not very well" where a higher score indicated a poorer sleep quality. In the second component, sleep latency, a question asked how long did it take to fall a sleep with a response scale of 0 'less than 15 minutes," to 1 "16 – 30 minutes," 2 "31 – 60 minutes," and 3 "more than 60 minutes." Another question asked how often the participant had been falling asleep in more than 30 minutes with a response scale of 0 "not at all," to 1 "less than once a week," 2 "1 – 2 times per week," and 3 "3 times per week or higher." The scores from the two questions were summed to a possible total score range of 0 to 6. These total score of 0 point was further categorized as "0," while 1 – 2 points as "1," 3 – 4 points as "2," and 5 – 6 points as "3." It was obvious that the higher score indicated a poorer sleep quality. In the third component, the nightly sleep hours on average was evaluated with a response scale of 0 "more than 7 hours," to 1 "6 – 7 hours," 2 "5 – 6 hours," and 3 "less than 5 hours." In the fourth component, the participant's answers to the three questions were recalculated as follows. The reported number of sleep hours divided by the numbers of hours spent in bed (which was calculated from the wake-up time subtracted by the time going to bed) and multiplied by 100%. The resulting % was further categorized as 0 "more than 85%," to 1 "75 – 85%," 2 "65 – 74%," and 2 "less than 65%," where a higher score indicated a poorer sleep quality. In the fifth component, two questions asked the participant how often their sleep was disturbed with a response scale of 0 "none," to 1 "less than once a week," 2

"1 – 2 times per week," and 3 "3 or more per week." The scores of the two questions were summed and further categorized as 0 "0 points," to 1 "1 – 9 points," 2 "10 – 18 points," and 3 "19 – 27 points," where a higher score suggested a poorer sleep quality or more sleep disturbance. A single question in the sixth component asked the participant how often they used hypnotics or sleep aids with a response scale of 0 "never," to 1 "less than 1 time per week," 2 "1 – 2 times per week," and 3 "3 times or more per week." In the seventh component, a question asked how often the participant were sleepy or falling a sleep while performing daily activities with a response scale of 0 "never," to 1 "less than 1 time per week," 2 "1 – 2 times per week," and 3 "3 times or more per week." Another question asked how much the problem had it been for the participant to keep up enthusiasm to get things done with a response scale of 0 "not at all," to 1 "slightly," 2 "moderately," and 3 "a lot." Scores of the two questions were summed up and further categorized as 0 "0 point" to 1 "1 – 2 points," 2 "3 – 4 points," and 3 "5 – 6 points," where a higher score indicated a more negative impact of sleep problem on the participant's energy.

The fourth part of the questionnaire evaluated stress using the Suanprung Stress Test (1997) which was developed by the Department of Mental Health, Ministry of Public Health of Thailand.[16] With a total of 20 questions, the response scale of this questionnaire ranged from 1-not stressed at all, to 2-slightly stressed, 3-moderately stressed, 4-highly stressed and 5-extremely stressed. With a possible total score range of 20 – 100 points of stress, a total score of 20 – 23 points was categorized as low level of stress, while 24 – 41 as moderate, 42 – 61 as high and 62 - 100 as extreme level of stress. Suanprung Stress Test had a high internal consistency reliability with a Cronbach's alpha coefficient of 0.848.

In the fifth part of the questionnaire, the 2Q depression screening questionnaire and the 9Q depression questionnaire developed by the Department of Mental Health, Ministry of Public Health, were used.[17] Based on the 2Q depression screening questionnaire, depression was preliminarily screened by the two statements: 1) feeling down, depressed or hopeless and 2) feeling bored or not enjoying things usually enjoyed, within the last two weeks. If the answer was "yes" to either or both of the two statements, the participant was considered at a certain risk of depression and was subject to further evaluation of depression using the 9Q questionnaire. As suggested by its name, nine questions asked the participant how often they felt that way in the last two weeks with a response scale of 0-never, to 1-sometimes (1 – 7 days). 2-frequent (more than 7 days), and 3-all the time (everyday). With a possible total score range of 0 – 27 points, a total score of 0 – 6 points was further categorized as no depression, while 7 – 12 points as a low level of depression, 13 – 18 as moderate, and 19 – 27 as severe level of depression. This 9Q questionnaire had a high internal consistency reliability with a Cronbach's alpha coefficient of 0.917.

Data collection procedure

This study was approved by the Ethics Committee of Faculty of Pharmaceutical Sciences, Naresuan University (approval numbers: 170/59, approval date: August 9, 2016). Before data collection was proceeded, the researcher provided the potential participants the study objectives and asked for their participation. They were assured for anynomity and voluntary nature of the participation. Once agreeing to participate, they were asked to provide a written informed consent. Participants were asked to complete the questionnaire by themselves. However, history of migraine diagnosis and treatment of the participants were extracted from the medical records by the researcher. All data were verified and completed before statistical analysis.

Statistical analysis

Demographic and health status information of the participants were presented as frequency with percentage, mean with standard deviation, and median with interquartile range as appropriate. Quality of sleep and depression were tested for association with factors of categorical nature including frequency of headache, symptoms accompanying the headache, headache triggers, family history of migraine, therapy prescribed, and environmental sleep disturbing factor by Chi-square tests and contingency coefficients. Factors that were continuous variables including duration since migraine diagnosis, duration of the headache episode, level of the pain, caffeinated beverage consumption (cups per day), cigarette smoking (per day), alcohol intake (drinks per month), and stress score were tested for associations with sleep quality and depression using Spearman's rank

correlation coefficients since these factors were not normally distributed.

Results

Among 200 participants, it was found that 47.5% of them had the duration since diagnosis of migraine of less than 24 months with a median of 36 months (interquartile range, or IQR, of 60 months). The shortest and longest durations were 2 months and 20 years, respectively. The majority (51.5%) had their headache episode last at hours or less with a median of 24 hours (IQR = 28 hours). The shortest and longest durations of headache episode were 0.5 hours and 10 days, respectively. More than three quarters of the participants (78.5%) had a frequency of the episode of less than 15 days per month. Family history of migraine was found in 30.0% of the participants.

About two-thirds had a pain level of 7 – 9 points (68.5%). The most common symptoms accompanying the headache were fatigue (84.5%), followed by nausea (67.0%), abnormal vision (60.0%) and vomiting (51.0%). Most of these symptoms were in moderate severity level. The most common triggering factors included somnolence or insomnia (75.5%), followed by stress, anxiety, anger or sadness (67.5%), and menstruation (35.5%). For physical triggers, the extreme hot or cold weather or temperature change was the most common trigger (78.0%), followed by staring the bright light (54.5%), and unpleasant odor (38.0%). Regarding foods, caffeinated beverages (7.0%), followed by red wine or alcohol consumption (5.0%), and chocolate (2.0%) were the common triggers. In terms of lifestyle, the majority (74.0%) drank a cup of coffee daily, did not smoke (94.5%), and 70.0% had not drunk any alcoholic beverages within the last month. For the treatment, slightly more than half of the participants were prescribed prophylactic treatments (57.0%) while the rest 43.0% were given non-prophylactic, or abortive, regimens.

In terms of environmental disturbing factors, the participants reported their sleep were disturbed by bright light, loud noise, and extreme hot or cold weather with the moderate level of disturbance. It was found that unpleasant odor, uncomfortable bed, roommates, insects and other animals did not disturb their sleep.

Sleep quality of the participants

More than three quarters of the participants (78.0%) reported poor sleep (PSQI total score > 5 points); while the rest 22.0% had a quality sleep (Table 1). Among participants with poor sleep, the score of sleep latency of 5 – 6 points in 43.6% of the participants indicated that it took more than 30 minutes to fall asleep with more than 3 times per week. The number of nightly sleeping hours of 6 – 7 hours was found in 35.9% of those with poor sleep. The majority (76.9%) had a low sleep efficiency (> 85%). A total score of sleep disturbance of 1 – 9 points in 50.0% of participants with poor sleep suggested that they experienced various kinds of disturbance such as being awake after 30 minutes of bedtime, waking up in the middle of the night, waking up too early, waking up to use the restroom, disrupted breathing, coughing, snoring, loud noise, feeling too cold or too hot, nightmare, and body ache. In terms of the use of hypnotics or sleep aids, the majority (66.3%) never used any. A total score of the impact on daily activities of 5 – 6 points in 53.8% indicated the majority were sleepy or falling asleep while doing daily activities and less enthusiastic to get things done (Table 1).

Among participants with quality sleep, 97.7% of them reported they slept well with a latency time of less than 15 minutes and no awakening after 30 minutes of the bedtime (0 point) in 75.0% (Table 1).

The majority (65.9%) had more than 7 hours of sleep. However, plow sleep efficiency (> 85%) was found in 97.7% of them which was higher than those with poor sleep (76.9%). Sleep disturbance with score of 1 – 9 points was found in 88.7% which was also higher than those with poor sleep (50.0%). The majority of participants with quality sleep (93.2%) never used hypnotics or sleep aids. It was found that 68.2% of them had a score of impact on daily activities of 3 – 4 points which suugested that they had less problem than those with poor sleep regarding feeling sleepy or falling a sleep while doing daily activities or feeling less enthusiastic to get things done.

Table 1 Sleep quality of the participants based on seven components of PSQI (N = 200).

Component of PSQI	N (%) by sleep quality			
	Having poor sleep (n = 156)		Having quality sleep (n = 44)	
Component 1: Subjective sleep quality				
Very well	0	0	0	0
Well	44	28.2	43	97.7
Not well	94	60.3	1	2.3
Not very well	18	11.5	0	0
Component 2: Sleep latency (total score of the two questions)				
0	16	10.2	33	75.0
1 – 2	26	16.7	11	25.0
3 – 4	46	29.5	0	0
5 - 6	68	43.6	0	0
Component 3: Nightly sleep hours				
> 7 hours	51	32.7	29	65.9
6 – 7 hours	56	35.9	15	34.1
5 – 6 hours	39	25.0	0	0
< 5 hours	10	6.4	0	0
Component 4: Sleep efficiency				
> 85%	120	76.9	43	97.7
75 – 84 %	31	19.9	1	2.3
65 – 74 %	5	3.2	0	0
< 65%	0	0	0	0
Component 5: Sleep disturbance (total score of the two questions)				
0	4	2.6	2	4.5
1 – 9	78	50.0	39	88.7
10 – 18	71	45.5	3	6.8
19 - 27	3	1.9	0	0
Component 6: The use of hypnotics or sleep aids				
Never	103	66.0	41	93.2
< 1 time per week	2	1.3	2	4.5
1 – 2 times per week	37	23.7	1	2.3
3 times of more per week	14	9.0	0	0
Component 7: Impact on daily activities (total score of the two questions)				
0	0	0	0	0
1 – 2	2	1.3	13	29.5
3 – 4	70	44.9	30	68.2
5 - 6	84	53.8	1	2.3

Depression and stress levels of the participants

In terms of depression, most participants had no and low level of depression, 44.0% and 49.0%, respectively (Table 2). The mean score was 6.91 points. For stress, as high as 75.0% of participants had high stress level with 13.0% and 12.0% with moderate and extreme level of stress, respectively. Their mean score of stress was 51.45 points.

Table 2 Depression and stress levels of the participants (N = 200).

	N	%
Depression level (score) by 9Q Depression Questionnaire (mean = 6.91)		
No depression (0 – 6)	88	44.0
Low (7 – 12)	98	49.0
Moderate (13 – 18)	14	7.0
Severe (19 - 27)	0	0
Stress level (score) by Suanprung Stress Test (mean = 51.45)		
Low (20 – 23)	0	0
Moderate (24 – 41)	26	13.0
High (42 – 61)	150	75.0
Extreme (62 – 100)	24	12.0

The associations between categorical variables and sleep quality and depression

It was found that frequency of migraine headache (*P*-value = 0.023), treatment regiment (*P*-value = 0.017) and environmental disturbing factor (*P*-value = 0.005) were associated with sleep quality with statistical significance (Table 3). For depression, it was fund to significantly associated with frequency of migraine headache (*P*-value = 0.019), having triggers for migraine headache (*P*-value = 0.001) and environmental disturbing factor (*P*-value = 0.005) (Table 4).

Table 3 The associations between categorical variables and level of sleep quality (N = 200).

	N (%) by sleep quality		χ^2	Contingency coefficient	*P*-value
	Poor sleep (n = 156)	Quality sleep (n = 44)			
Frequency of migraine headache					
< 15 days per month	117 (75.0)	40 (90.9)	5.147	0.158	0.023
15 days or more per month	39 (25.0)	4 (9.1)			
Having symptoms accompanying the migraine headache					
No	2 (1.3)	2 (4.5)	1.865	0.096	0.172
Yes	154 (98.7)	42 (95.5)			
Having triggers for migraine headache					
No	1 (0.6)	0 (0)	0.283	0.038	0.594
Yes	155 (99.4)	44 (100.0)			
Family history of migraine					
No	112 (71.8)	28 (63.6)	1.088	0.074	0.297
Yes	44 (28.2)	16 (36.4)			
Treatment regimen					
Non-prophylactic	74 (47.4)	12 (27.3)	5.693	0.166	0.017
Prophylactic	82 (52.6)	32 (72.7)			
Environmental disturbing factor					
No	10 (6.4)	9 (20.5)	7.874	0.195	0.005
Yes	146 (93.6)	35 (79.5)			

Table 4 The associations between categorical variables and level of depression (N = 200).

	N (%) by depression level			χ^2	Contingency coefficient	*P*-value
	No depression (n = 88)	Low depression (n = 98)	Moderate depression (n = 14)			
Frequency of migraine headache						
< 15 days / month	76 (86.4)	73 (74.5)	8 (57.1)	7.942	0.195	0.019
15 days or more / month	12 (13.6)	25 (25.5)	6 (42.9)			
Having symptoms accompanying the migraine headache						
No	3 (3.4)	1 (1.0)	0 (0)	1.657	0.091	0.437
Yes	85 (96.6)	97 (99.0)	14 (100.0)			
Having triggers for migraine headache						
No	0 (0)	0 (0)	1 (7.1)	13.352	0.250	0.001
Yes	88 (100.0)	98 (100.0)	13 (92.9)			
Family history of migraine						
No	58 (65.9)	70 (71.4)	12 (85.7)	2.443	0.110	0.295
Yes	30 (34.1)	28 (28.6)	2 (14.3)			
Treatment regimen						
Non-prophylactic	37 (42.0)	41 (41.8)	8 (57.1)	1.229	0.078	0.541
Prophylactic	51 (58.0)	57 (58.2)	6 (42.9)			
Environmental disturbing factor						
No	15 (17.0)	3 (3.1)	1 (7.1)	10.644	0.225	0.005
Yes	73 (83.0)	95 (969)	13 (92.9)			

The associations between continuous variables and sleep quality and depression

Among various continuous variables of participant's demographic characteristics and health status, only duration since migraine diagnosis was positively correlated with sleep quality score (*P*-value = 0.016) (Table 5). For mental status, stress score was positively correlated with sleep quality (*P*-value < 0.001). Similar to the sleep score, depression score was found positively correlated with duration since migraine diagnosis (*P*-value = 0.018) and stress (*P*-value < 0.001) (Table 5).

Table 5 The associations between continuos variables and sleep quality score and depression score (N = 200).

Factors	Sleep quality score		Depression score	
	ρ*	*P*-value	ρ*	*P*-value
Duration since migraine diagnosis	0.170*	0.016	0.167	0.018
Duration of each headache episode	0.013	0.852	0.012	0.869
Average pain level	0.017	0.807	0.133	0.061
Caffeinated beverage intake (cups per day)	-0.108	0.130	- 0.017	0.808
Smoking (cigarettes per day)	-0.065	0.360	0.042	0.551
Alcohol intake (drinks per month)	0.022	0.754	- 0.058	0.411
Stress	0.290	< 0.001	0.522	< 0.001

* Spearman's rho correlation coefficient.

Discussions and Conclusion

Our study found that majority of migraine patient participants had a poor sleep (78.0%). This was consistent with the study of Sadeghniiat and colleagues which found that most migraine patients had poor sleep (PSQI score of 5 or higher).[19] Once each component of PSQI was considered, the subjective sleep quality in most participants was problematic. In addition, with a sleep latency score of 5 – 6 points, most participants spent a long time to fall asleep. They needed more than 30 minutes to fall asleep. The more the latency time, the less the sleep hours. A poor sleep could be a result.[20] Other sleep disturbance could be due to the change in sleep-wake pattern, discomforts, lifestyle change, insomniar or somnolence, waking up in the middle of the night, waking too early, making a trip to the restroom, difficulty breathing, cough, snoring, feeling too hot or too cold, nightmare, and body pain.[20] Our findings was in line with the study of Gori and co-workers revealing that migraine patients had a lower sleep wuality and longer sleep latency compared with healthy participants.[21] These patients also face sleep disturbances such as midnight and early waking up. Our findings also agreed with the study of Sadeghniiat and colleagues reporting that migraine patients had poor slep, long sleep latency, taking more than 30 minutes to fall asleep, midnight and early waking up, nightmare, body pain, hypnotics use, difficulty resuming sleep, and lost interest in activities.[19] They also found daytime activities were affected by consequnces of poor sleep including sleepiness, increased daytime napping, loss of energy to work, lethargy, fatigue, decreased pain tolerance, depression, irritability, indifference, poor decision making, confusion, and increased stress.[10]

In terms of depression, most participants had a low level of depression which was consistent with the study of Sadeghniiat et al. reporting that about one out of three migraine patients had depression.[19] This is because pain is highly associated with moods. Those with pain are more likely to have a negative affect and mental instability. Psychological health issues frequently found include depression, insomnia, over anxiety over their illness, lethargy, and constant fatigue. The intensity of these mental problems is proportional to pain severity, duration of pain, and precipitating factors. Depression is a result of these mental instabilities.[23] The abnormal vascular dilation and constriction in migraine could be in part due to the imbalance of serotonin[24] as a result of various triggers. Stress and inadequate sleep could cause a reduced level of serotonin in the brain.[25] Migraine pain could cause depression with a probably similar mechanism. In depression, an over reuptake of serotonin back to the post-synaptic neuron leaves a deficient amount of serotonin in the synaptic cleft. This reduced level of serotonin is believed to cause depressive symptoms including feeling or being sad, blues, discouraged, bored, unhappy, hopeless, sleepless, waking up in the middle of the night, and having frequent nightmare. These symptoms affect efficiency of daily activities. In the long run, clinical depression is established.[26]

Our study found that frequency of migraine headache was significantly associated with slep quality and depression (*P*-value < 0.05). This is consistent with the study of Sadeghniiat and colleagues reporting that those with more monthly episodes of migraine attack had a lower sleep quality than those with less frequent episodes, and those with 8 days or more per month had a longer sleep latency than their counterpart.[19] Our finding was in agreement with the study of Seidel and colleagues which found that the

more frequent the migraine episodes, the less the sleep quality, and the longer the sleep latency.[27] They revealed that poor sleep was found the most prevalent among patients with 8 days of headache or more per month, followed by those with 5 - 7 days per month, 1 – 4 days per month and those with less than 6 days per year, respectively.

In addition, frequent migraine episodes lead to depression which was also seen in the study of Seidel et al.[27] They found that more episodes were associated with a higher level of depression as measured by Beck Depression Inventory score.[27] Specifically, patients with 8 days of headache per month had the highest depression level, followed by those with 5 – 7 days, 1 – 4 days per month, and those with less than 6 days per year, respectively. Frequent migraine episodes cause detrimental physical and mental well-being. With the cognitive and behavioral alteration caused by the frequent pain, the patients are continuously obsessed with the repeated pain. Later on their moods change and their mental defects such as depression are evident.

Unlike the internal factors of migraine including genetic make-up, physiological stress, and hormonal change which are unmodifiable, external factors are considered promoting factors which could be prevented or avoided. These include a lack of sleep, long-hour work, lack of rest, psychological stress, alcohol intake, contraceptive medications, and certain medications. These factors could alter the balance of serotonin which usually potentiallu causes vascular vasodilation and constriction in the brain, and that leads to migraine headache.[18] It has been relatively inconclusive about some triggering factors of migraine attack. However, based on medical history of migraine patients, some shared lifestyles and consumptions are suggestive as triggers of migraine.[25] The strongest lifestyle and physiological trigger of migraine is insomnia and somnolence, followed by psychological stress, anxiety, anger, depressed mood, and menstruation, respectively. The most influencing environmental trigger of migraine is extreme temperature, followed by brightlight and strong odor, respectively. Physiologically, insomnia, stress, and extreme temperature stimulate the hormonal and/or neurological changes. As a result, the biological production of amine substances is altered. If the level of serotonin, an amine substance, is reduced especially in the brain, migraine could happen. This is serotonin controls pain and vascular dilation and contriction in the brain. Menstruation causes a rise of estrogen hormone, insulin and amine substances.[25] For diets, caffeine in tea and coffee is the most triggering factor of migraine, followed by red wine and alcoholic beverages. Once the habit of regular caffeine consumption is formed, any fluctuation of caffeine intake, either higher or lower than usual, could trigger the migraine attack. Red wine and alcoholic beverages contain tyramine and flavonoids which could also trigger migraine headache. In individual pateints, certain triggers such as strong perfume, strong odor, brightlight, flickering light, extreme temperature, and certain foods should avoided to lessen the frequency of migraine attacks.[18]

In our study, migraine trigger factors were not associated with sleep quality. In terms of distribution of triggers in our sample, number of triggers in individual patients ranged from zero to as high as seven which was found in one patient. Interestingly, patients with no triggers had no sleep problem. On the other hand, 44 of those with the triggers had a quality sleep. We thus concluded that sleep quality depends on many factors other than migraine triggering factors. However, we found that migraine triggers were significantly associated with depression. This could be due to the fact that the patients perceived the triggers as real but unavoidable, hence the frustration could lead to the subsequent psychological suffering, and the resulting depression.

Treatment of migraine could be classified into non-prophylaxis which is an abortive treatment and the prophylaxis one to prevent the attack. The non-prophylactic treatment is based on various medications including ibuprofen, naproxen, diclofenac, meloxicam plus paracetamol, etoricoxib plus floctafenine, ibuprofen plus ergotamine + caffeine combined formula (eg., Cafergot(R)), and etoricoxib plus eletriptan. The goal of non-prophylactic treatment is to abort the pain and restore daily living as soon as possible.[28] For prophylactic treatment, the regimens included etoricoxib plus flunarizine, naproxen plus flunarizine and amitriptyline, etoricoxib plus floctafenine and nortriptyline, etoricoxib plus propranolol, Cafergot® plus flunarizine, etoricoxib plus Cafergot® and flunarizine, and naproxen plus topiramate. The goal of prophylactic treatment is to reduce the frequency, severity and duration of pain episodes, and improve effectiveness of the abortive

treatment, alleviate headache-related disability or suffering, and decrease cost of treatment.[29] It was found that treatment regimen was significantly associated with sleep quality but nnot depression. All treatment regimens usually contain analgesics therefore the pain relief could offer the patient a better sleep.[30] In addition, prophylactic treatments included flunarizine, amitriptyline and topiramate, which usually cause sedation and drowsiness.[18] These treatments hence affected the sleep quality. No associated between treatment regimens and depression could be due to the fact that most drugs for migraine were not related to serotonin level, except for Cfergot® and triptan drugs such as eletriptan, and tricyclic antidepressants (TCAs) such as amitriptyline and nortriptyline. Triptans act on the 5-HT_{1B} and 5-HT_{1D} receptors and TCAs on the re-uptake of serotonin and norepinephrine to neurons.[18,24] Other groups of drugs including NSAIDs, paracetamol, flunarizine and topiramate are not related with serotonin, therefore the use of these drugs were not associated with depression.

Duration of migraine since diagnosis was significantly associated. The longer the duration, the more the discomfort and sleep disturbance. Constant pain could cause the stimulation of sympathetic nervous system and the secretion of cathecholamine, glucagon and cortisol. These sympathetic stimulations cause central nervous system excitation and hence the insomnia.[31] A longer duration of migraine therefore leads to poor sleep, poor mental status, and suffering. All detrimental effects of migraine could lead to depression, and suicidal ideation.[23] We also found taht pain level was not associated with sleep quality or depression. This was different from the study of Sadeghniiat et al. revealing that pain intensity score was positively correlated with PSQI sleep quality score and depression score as measured by Beck Depression Inventory.[19] The study by Wiriyawong also found a low positive relationship between pain level and depression (*P*-value 0.05).[37] Our negative finding could be due to the use of numeric rating scale which was relied heavily on subjective judgment of individual patients. The scale did not correspond well with the actual pain level and had a low clinical significance. To determine the pain level using this numeric pain scale was therefore limited. It could be used in a comparison of pain at different time points such as before and during hospital admission and at discharge.[32]

It was found that stress as measured by Sunprung Stress test was associated with sleep quality and depression (*P*-value < 0.01). The use of Suanprung Stress test was however a generic measure of stress, not a cause-specific one.[16] We therefore could not figure out the pain-related stress from other causes. Stress is usually correlated with sleep quality. The study of Jirapramukpitak and Tanchaisawat in healthy nurses found that stress was related with poor sleep.[15] A study by Wiriyawong also found that, in patienst with osteoarthritis, stress was significantly correlated with depression.[37] Stress is a non-specific reponse of the organism to stimuli.[33] Illnesses cause physical stress which in turn allows sympathetic nervous system to act. As a result, more epinephrine, norepinephrine and cortisol are released to cause alertness, dilated iris, and increased heart rate and blood pressure.[34] The stress causes loss of appetite, weight loss, lethargy, fatigue, discomfort, and insomnia.[35] For sleep, stress causes sudden waking up and difficulty resuming the sleep, and subsequent poor sleep.[36] Regarding depression, stress interferes neurons metabolism leading to a disruption of production and degradation of neurotransmitters. Imbalance of neurotransmitters results in a decrease in biogenic amines especially serotonin which could lead to depresson. A decreases in serotonin is associated with a lower positive affect. Stress also disrupts neurotransmissions so that the decreased sensation, motivatio and appetite, and sleep abnormality, decreased concentration, and depression eventually.[38] To prevent and lessen these stress-related problems, there is a need for stress management and relaxation technique such as maintaining sleep hygiene and regular sleep-wake cycle, meditation, exercise, yoga, breathing exercise, and leisure activities of choices. The need for pain medications could also be reduced.[18]

Environmental sleep disturbing triggers including brightlight, loud noise, extreme temperature, unpleasant odor, bedroom discomfort, disturbing roommate, and pests and insects were significantly associated with sleep quality at a significance level of 0.05. This finding was consistent with the study of Rakim and colleagues reporting that environmental sleep disturbing factors in the medical wards were significantly associated with sleep quality.[39] They reported that the most disturbing factors was higher temperature in the medical ward, noises of the officers, other patients, and devices, and constant brightlight. As in the

study of Jauntateero, environmental sleep disturbing factors were signfificantly positively associated with sleep quality at a significance level of 0.05 with extreme temperature as the most disturbing factor, followed by noises. This is also consistent with the study of Ramsiri.[41] Brightlight affects sleep latency time since sleep-wake cycle is controlled by darkness and brighness.[42] Brightlight inhibits sympathetic nervous system and further disrupts the melatonin secretion and hence poor and inadequate sleep.[43] Noises interfere sympathetic nervous system causing the secretion of adrenaline. As a result, vascular constriction leads to increased diastolic blood pressure, dilated iris, and contracted muscle. All of these effects wake the person up and disrupted and poor sleep is a result.[44] Extreme temperature causes restlessly moving in bed and frequent wake up.[22] Specifically, the temperature of 29.3 degree celcius or higher causes more wake-up and toss-and-turn[45] while a temperature of 12.2 degree celcius or lower causes discomfort and disrupted sleep.[46] Unpleasant odor irritates the person and causes discomfort, difficulty falling a sleep, and poor sleep.[47] Too hard or too soft beds causes more movement while sleeping, less deep sleep, and poor overall sleep quality.[48] Sleep partners also cause sleep disturbance including snoring, moving, talking in the sleep, grinding the teeth, and tossing and turning.[49] pests and insects could bite and cause the release of pain mediated substances including bradykinin, antihistamine and substance P. The pain signal to the central nervouse system causes pain and hence disrupted sleep.[50]

In addition, our study found environmental sleep disturbing factors were significantly associated with depression. This was consistent with the study of Sadeghniiat et al.[19] reporting that sleep quality was positively associated with depression (*P*-value < 0.001). Poor sleep could therefore indirectly lead to depression.

This study has some limitations. Since external factors were controlled in this study, their effects, either direct or indirect, could not be determined. The study was conducted in an OPD of a private hospital, generalizability to a wider population is somewhat limited.

In terms of recommendation, the findings could be used in part for planning the care regarding quality sleep for migraine patients. Future research should focus on management on problems and factors affecting sleep quality and depression in migraine patients. Experimental studies comparing effectiveness of treatment regimens should be conducted. More understanding on factors influencing sleep quality and depression among migraine patients should be acquired.

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