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Research Article

The effects of lower back pain due to herniated disc on sleep, quality of life and depression symptoms

Bel fıtığına bağlı bel ağrısının uyku, yaşam kalitesi ve depresyon belirtileri üzerine olan etkileri

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Abstract

Introduction: This study aims to evaluate the relationship between herniated disc-related low back pain and depression, sleep, and quality of life.
Methods: A control group consisting of 28 patients with herniated disc-related pain and 28 healthy volunteers were included in the study. Beck Depression Inventory (BDI) and Quality of Life Index (SF-36) are applied to all groups. Pain severity was evaluated with the Visual Analogue Scale (VAS). Sleep parameters were analyzed with an actigraphy device.
Results: Depression and quality of life scores differed between the two groups, and they were observed as significantly higher in the group with herniated disc. Moreover, there was a positive correlation between pain severity and depression. On the other hand, there was a negative correlation between pain intensity and sleep efficiency. Subjects with low back pain had worse sleep quality and lower sleep efficiency (mean 71.7%) than the control group. The logistic regression analysis found a significant relationship between depression and VAS pain variables (p=0.030; 95% CI: 0.021-0.823).
Conclusions: Our study's results reveal a relationship between pain and depression in herniated disc patients. Moreover, it was concluded that the deteriorated sleep quality due to low back pain also increased the severity of depression. This relationship related to the unpleasant consequences of chronic pain should be taken into account when planning the medical treatment and follow-up of patients with herniated disc, and also when explaining their expectations from surgical treatment.
Keywords: Herniated disc, pain, sleep, depression, actigraphy.

Öz

Giriş: Bu çalışmanın amacı, bel fıtığına bağlı bel ağrısı ile, depresyon, uyku ve yaşam kalitesi arasındaki ilişkinin değerlendirilmesidir.
Yöntem: Bel fıtığına bağlı ağrısı olan 28 olgu ile gönüllü sağlıklı 28 bireyden oluşan kontrol grubu çalışmaya dahil edildi. Tüm gruplara Beck Depresyon Envanteri (BDI) ve Yaşam Kalite İndeksi (SF-36) uygulandı. Ağrı şiddeti Görsel Analog Skalası ile değerlendirildi. Uyku parametreleri ise aktigrafi cihazı ile analiz edildi.
Bulgular: Depresyon ve yaşam kalitesi skorları; iki grup arasında farklılık gösterdi ve bel fıtığı olan hastalarda anlamlı düzeyde yüksek olduğu görüldü. Bununla birlikte ağrı şiddeti ile depresyon arasında pozitif bir korelasyon vardı. Buna karşın ağrı şiddeti ve uyku etkinliği arasında ise negatif korelasyon olduğu görüldü. Bel ağrısı olan olgular, kontrol grubundan daha kötü uyku kalitesi ve düşük uyku etkinliğine (ortalama %71.7) sahipti. Bulguların lojistik regresyon analizinde, depresyon ile Görsel Analog Skala değişkenleri arasında anlamlı bir ilişki olduğu saptandı. (p=0,030; 95% CI:0,021-0,823).
Sonuç: Çalışmamızın sonuçları, bel fıtığı hastalarında, ağrı ile depresyon arasındaki pozitif yönde bir ilişkinin varlığını ortaya koymaktadır. Bununla birlikte, bel ağrısı nedeni ile bozulan uyku kalitesinin de depresyonun şiddetini arttırdığı sonucuna ulaştık. Kronik ağrının hoş olmayan sonuçlarına yönelik bu ilişki, bel fıtığı hastalarının medikal tedavisi ve takibinin planlanmasında ayrıca hastalara cerrahi tedaviden beklentileri anlatılırken de dikkate alınmalıdır.
Anahtar Kelimeler: Bel fıtığı, ağrı, uyku, depresyon, aktigrafi.

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Introduction

Lower back pain is a widespread public health problem. Its incidence is 70-85% throughout life, and its annual incidence varies between 15-45% [1,2]. Lower back pain, one of the leading causes of activity limitation and loss of workforce in many parts of the world, constitutes a severe social and economic loss to society [3]. One of the common causes of chronic low back pain is a herniated disc [4]. Pain is an unpleasant sensory and emotional experience associated with tissue damage on any body part. It is often described as a multidimensional subjective experience mediated by emotions, attitudes, and other perceptual effects. Pain, in proportion to its intensity and duration, causes evident psychosocial and behavioral changes in the lives of individuals, including daily activity limitations [5]. Additionally, individuals with chronic pain are more likely to have psychiatric disorders, especially depression. Persistence of pain for a long time can lead to deterioration in patients' quality of life and sleep, causing sadness and helplessness and leading to psychiatric signs and symptoms. Increasing evidence shows that depression, sleep disturbance, and other psychiatric symptoms are closely related to pain severity. The presence of depression, sleep problems, and other psychiatric symptoms accompanying the pain that limits the individual's life also worsens functionality. They make it difficult for patients to comply with treatment and achieve effective management [6,7]. On the other hand, sleep disruption and depressive mood also reduce pain tolerance and worsen the patient's quality of life [7]. This situation also constitutes one of the difficulties in the treatment of herniated disc-related pain. Impairment in quality of life and mood also reduces the positive response to treatment. The occurrence mechanism by which sleep disturbance, depression, and other psychiatric symptoms accompanying chronic pain is not precisely known. Although it is suggested that accompanying psychiatric disorders usually develop due to pain, the cause-effect relationship is open to debate. This study compares patients with lumbar hernia pain and a control group of healthy individuals with similar age and sex ranges. This case-control study used self-report scales and an actigraphy device. Actigraphy was also used to analyze sleep rhythm patterns and the character of sleep disorders in individuals with insomnia. One of its common uses was sleep disorders related to depression [8]. We aimed to reveal the relationship between chronic pain experienced by patients with herniated discs and the presence of depression. In addition to this relationship, we aimed to investigate whether the coexistence of pain and depression was affected by the quality of life and sleep disorder with the help of the actigraphy data.

Methods

Participants

The study population consisted of 28 patients and a control group of 28 people under the study protocol. Patients who applied to the neurosurgery outpatient clinic in 2021 and agreed to participate in the study were included. Cases diagnosed clinically and radiologically with lumbar hernia constituted the patient group. The patients were given preliminary information about their sleep patterns, and their sleep was monitored regularly during the three-day study. Patients' treatment protocols for lumbar hernia were not interfered with during the study. 14 patients who did not meet the study criteria were excluded from the study, and the data of 28 cases, 14 male and 14 female were statistically evaluated. A total of 28 volunteers in a similar age range, without a herniated disc history were included in the study as the control group in compliance with the study protocol. The control group was composed of 14 female and 14 male individuals similar to the demographics of the herniated disc group. This study was conducted prospectively in a single center in the university hospital department of neurosurgery and psychiatry. Ethics committee approval (06.05.2021 date and decision no: 05-09) was obtained from the same place. This study was conducted per the ethical standards in the Declaration of Helsinki, and informed consent was obtained from the patients before participation.

Exclusion criteria were determined by considering mood disorders due to lumbar hernia, operations on the lumbar region, diagnoses with cancer, traumatic spine disease, structural spine disorders, and other causes unrelated to lumbar hernia that may lead to sleep disturbance, deterioration in the quality of life, and physical, cognitive and emotional disorders. Patients with primary sleep disorders that may affect the continuity of sleep, drug and substance use, sleep-related respiratory disorders, major systemic diseases with a risk of worsening quality of life, and chronic neuropsychiatric diseases were excluded. Measurements were made to determine whether there was a tendency to depression and also the quality level of daily activity in the lumbar hernia diagnosis and the control group. An actigraphy device and program were used to measure daily activity, and the Visual Analog Scale for Pain (VAS Pain) was used to measure the severity of pain. Additionally, the Beck Depression Inventory (BDI) was used to determine the risk for depression and to measure the level and severity of depressive symptoms. The method of these measurements and the result analysis were conducted per the instructions of the scales and actigraphy.

Measurements and methods

The demographic interview form, a structured form evaluating the demographic characteristics of the patients, was applied to the patients. Actigraphy device and program: The objective data of the patients regarding sleep parameters were obtained through the motion-sensitive (32Hz), portable, wrist-shaped, and photosensored Actiwatch-Spectrum device produced by Philips Respironics/Holland. The device was attached to the non-dominant wrist, and it recorded for at least three consecutive days. The recording of activity, rest, and removal of the device from the wrist were made by programming the device in automatic mode. The quantitative data obtained from the patients were transferred to the computer environment and analyzed with the Philips Actiware-6 program. The device was programmed and used on the computer to evaluate bedtime and wake-up times, total bedtime (TBT), total sleep time (TST), sleep latency (SL), sleep efficiency (SE%), number of awakenings (awakenings #), and wakefulness after sleep onset (WASO) for each patient. In addition, the analyzes and clinician reports were transferred to the computer. The device and the program were used throughout the study, considering the clinical use of actigraphy and parameters of American Academy of Sleep Medicine [8].

Visual Analog Scale for Pain (VAS Pain): VAS Pain is a method that allows the quantitative measurement of pain, which is a subjective concept. Scoring is made by measuring the left end distance from the point marked by the patient. Besides being simple and easy to use, VAS is a reliable scale accepted in the scientific literature [9].

36-item Short-Form Health Survey (SF-36): SF-36 is a commonly used generic scale that provides comprehensive measurement in evaluating health status. This scale examines 8 sub-dimension models of health with 36 items such as physical function, social function, bodily pain, general

mental health, vitality (energy and burnout), general health perception, and role restrictions due to emotional and physical problems. Subscales provide an evaluation between 0 and 100, a higher score indicating better health. The Turkish reliability and validity study of the scale was carried out by Kocyigit et al. [10], and the normative values for the population in Turkey were determined by Demiral et al. [11].

Beck Depression Inventory (BDI): BDI is a self-report scale developed to determine the risk for depression and to measure the level of depressive symptoms and changes in severity. The scale consists of 21 items, and each item gets progressively increasing points between 0 and 3 with a four-point Likert-type Scale. The total score ranges from 0 to 63, and higher scores indicate the severity of depression [12]. In our study, we used the scale of which Turkish reliability and validity studies were conducted by Hisli with a cut-off of 17 [13].

Statistical analysis

The data obtained in the study were evaluated with the IBM SPSS (Version 21) Windows package program. Descriptive statistics (arithmetic mean ± standard deviation and frequency) were analyzed for numerical and categorical variables. The conformity of the variables to the normal distribution was examined by the Shapiro-Wilk tests. In the comparisons between groups, continuous variables with normal distribution were analyzed by the Student's t-test, and skewed continuous variables were analyzed with the Mann-Whitney U test. The Pearson or Spearman correlation test was used according to the normal distribution to determine the relationships between the variables. In addition, logistic regression analysis was applied to investigate the effect of various variables on depression.

Considering the power analysis related to the sample to be reached in this research, no sample calculation was made at the beginning of the research to provide saturation as a priori. The reason for this is the limited number of patients that can be reached. When the research was completed and the data were obtained, the Mann-Whitney U test was calculated for comparison analysis, and the Spearman's correlation coefficient was calculated for correlation analysis. After the analyses were completed and the effect sizes were calculated, the power generated at the end of the study was calculated by using the compromise module of the free GPower software. Power levels calculated in this study were reported in tables and analyses. The statistical significance level was accepted as $p<0.05$ in all analyzes.

Results

The mean age of 28 patients included in the study was 57.3±8.6 years; 14 were male, and 14 were female. In the proportional distribution of education levels, 23 (82.1%) were primary school graduates, 4 (14.3%) were high school graduates, and 1 (3.6%) was a university graduate. As a career-wise, 11 (39.3%) were housewives, 8 (28.6%) were retired, 6 (21.4%) were workers, and 3 (10.7%) were self-employed. The mean BDI scores of the patients were 41±17.3 and were significantly higher than the control group ($p<0.001$). The mean score for women in the depression group was 47.1, which was significantly higher than men's score of 35.1 ($p=0.027$). In the actigraphy analysis findings, the average sleep efficiency (SE%) of the cases (71.7%) was significantly lower than the control group (84.7%) ($p<0.001$). In addition, total sleep latency (SL) ($p<0.001$) in the cases was significantly higher than in the control group. However, the number of night awakenings was similar in both groups ($p>0.05$) (Table 1).

Table 1. Comparison of the cases with the control group over BDI, VAS pain, and actigraphy findings

Variables	Lumbar disc patient group (n=28)		Control group (n=28)		Student T test *	Effect size	Power
	Mean	SD	Mean	SD	p		%
Age	57.3	8.6	53.6	9.7	<0.094	0.261	46
Beck Depression Inventory (BDI)	41.1	17.3	3.5	3.5	<0.0001	0.923	91
VAS Pain	7.9	0.9					
Time spent in bed (TBT) (min)	561.6	122.7	526.2	68.8	<0.255	0.179	39
Total sleep time (TST) (min)	402.3	89.4	442.8	59.6	<0.071	0.282	48
Sleep latency (SL) (min)	85.6	89.4	22.6	16.0	<0.0001	0.770	84
Sleep efficiency (SE) (%)	71.7	10.8	84.7	5.0	<0.0001	0.753	84
Wake After Sleep Onset (WASO) (min)	45.4	21.9	31.5	17.1	<0.009	0.407	59
The number of awakenings after falling asleep. Awakening.	51.9	26.8	44.8	16.9	0.629	0.076	35

Significance test of the difference between two means $^{\beta}$(Student t test), SD: Standard deviation. $^{\alpha}$Mann-Whitney U test.

The sub-dimension scores of SF-36 physical function, social function, bodily pain, general mental health, vitality, perception of health, and role restrictions related to emotional and physical problems of the cases and control group are shown in Table 2. All sub-dimension scores were significantly higher in the patients compared to the control group ($p<0.001$). There was a significant positive correlation between VAS and BDI scores ($r=0.870$, $p<0.001$). A moderate significantly positive correlation was found between VAS and WASO values ($r=0.488$, $p<0.001$). Additionally, there was a moderate significantly negative correlation between SE and BDI scores ($r=-0.592$, $p<0.001$) (Table 3). The logistic regression analysis of the effect of the independent variables VAS Pain, age, sleep activity, and sex on depression determined that the VAS pain variable had a predictive effect on depression (Table 4).

Table 2. Distribution of the SF-36 scores among cases and controls

SF-36 Scale	Lumbar herniation (n=28)		Control group (n=28)	
	Mean	SS	Mean	SS
Physical Functioning	23.2	15.4	93.0	10.3
Physical Role Functioning	33.0	16.3	94.6	12.5
Bodily Pain	28.2	11.1	95.1	8.5
General Health Perception	33.0	9.9	75.9	14.2
Energy / Vitality	42.1	14.8	79.8	14.3
Social Functioning	26.6	18.7	88.4	16.3
Emotional Role Functioning	29.4	16.5	85.7	21.1
Mental Health	34.2	15.9	80.9	13.2

SD: Standard deviation, Mann-Whitney U test p<0.001

Table 3. Evaluation of the relationship between age, gender, WASO, BDI, SE, and VAS and actigraphy findings

	Age	Sex	WASO	BDI	SE (%)	VAS
Age$^{\alpha}$	1					
Sex$^{\alpha}$	0.113 (43%) p=0.407	1				
WASO$^{\alpha}$	0.091 (40%) p=0.504	-0.52 (36%) p=0.704	1			
BDI$^{\alpha}$	**0.361** (84%)** p=0.006	**-0.243 (67%)** p=0.072	**0.404** (89%)** p=0.002	1		
SE (%)$^{\beta}$	**-0.188 (57%)** p=0.165	**-0.03 (34%)** p=0.827	-0.369** (85%) p=0.005	**-0.592** (99%)** p=0.000	1	
VAS$^{\alpha}$	0.318 (79%) p=0.17	**-0.038** (35%) p=0.782	**0.488** (95%)** p=0.000	**0.870**** (99%) p=0.000	-0.795** (99%) p=0.000	1

* p<0.05, ** p<0.01, $^{\beta}$: Pearson correlation test, $^{\alpha}$: Spearman's rho test.

Table 4. Logistic regression analysis results regarding the variables' effect on depression

	Unstandardized Coefficients B (Standard Error)	β	p	95% CI for EXP(B)	
				Lower	Upper
Constant	14.725				
Sleep efficiency	-0.035 (0.078)	0.966	0.654	0.828	1.126
VAS Pain	-2.018 (0.930)	0.133	0.030	0.021	0.823
Sex	-1.475 (1.586)	0.229	0.352	0.010	5.119
Age	0.037 (0.064)	1.038	0.563	0.915	1.178

a. Dependent variable: Depression, Beta indicates the standardized partial regression coefficients. VAS Pain, age, and sleep efficiency independent variables were analyzed with logistic regression (Backward), and the most suitable model was used. CI: Confidence Interval

Discussion

According to the results of our study, depression scores were significantly higher in those with low back pain due to herniated disc. On the other hand, the quality-of-life scores were lower in the same group. Although there was a positive correlation between pain severity and the presence of depression, there was a negative correlation between pain severity and sleep efficiency. The severity of pain and the quality of sleep had a determining role in the increase in depressive symptoms. The sleep quality and sleep efficiency of the subjects participating in the study were lower than of the control group. On the other hand, there was a close relationship between pain and depression.

There was a significant increase in depression in the examination of gender-independent BDI scores of patients with low back pain [14]. Moreover, treatments for depressive symptoms and depression in individuals with chronic pain help improve low back pain [15]. In contrast, 50% to 88% of this patient population have sleep problems [16]. On the other hand, as with the relationship between chronic pain and sleep disturbance, the relationship between pain and depression is complex and open to different causal interpretations. It has been shown that individuals who have symptoms of depression have a higher risk of having an attack of low back pain in the future [17]. In the same study, it was reported that there had been a linear relationship between the risk of experiencing pain attacks and the severity of depression. A study of patients diagnosed with rheumatoid arthritis showed a significant association between pain and sleep problems [18]. This study also evaluated the role of pain and sleep problems in increasing depression [18]. Detailed analyzes have shown that pain can exacerbate sleep-related problems, and both factors may contribute to depression over time [18]. The relationship between pain and sleep disturbance is bidirectional. Pain causes sleep disturbance, and sleep disturbance also increases the perception of pain by reducing its tolerance [19]. In this study, we concluded that the pain caused by a herniated disc is a determining factor in patients' increased risk of depression. Another result of our study is that the state of pain and depression is closely related to sleep quality and effectiveness. The pain variable associated with depression was significant in logistic regression. On the other hand, there was no relationship between sleep quality and the presence of depression. We think that the deterioration in sleep quality does not directly cause depression but it is one of the factors that aggravate the level of depression.

In another study with a long follow-up period, it was stated that depression could have a strong role in the connection between sleep and pain concerning the severity of pain in patients with osteoarthritis. In the same study, it was shown that sleep disturbance at low pain levels was not associated with mood and that sleep problems that occur when the severity of pain increased exacerbated depression [20]. On the other hand, evidence shows a reciprocal relationship between pain severity and depression. It was stated that the change in pain intensity was a strong predictor of the severity of subsequent depression, and similarly, the change in the severity of depression was a strong predictor of the severity of subsequent pain. In addition, it was shown that the comorbidity of these two conditions adversely affected the quality of life [21,22]. In our study, it is noteworthy that pain is one of the important predictors of depression and that the severity of pain and the increase in depression scale scores are closely related. Increasing evidence have been supporting a direct relationship between chronic herniated pain and comorbidity of depression [23,24]. Studies conducted on individuals with chronic pain showed that patients' sleep quality and activity were low. It was also demonstrated that actigraphy was useful in measuring these parameters objectively [25].

Limitations

Our study should be evaluated with some limitations. First, the small sample size reduces the statistical power of our study. Due to the cases' cross-sectional evaluation, the causality direction cannot be determined precisely. In addition, our pain sample consists of patients with a lumbar hernia, and it is unlikely to represent the general patient group with chronic pain. Therefore, longitudinal studies with larger samples are needed to confirm the obtained data and establish any causality between pain symptoms and other variables.

Conclusion

This study reveals that sleep quality is significantly reduced in patients with lumbar herniated pain. An actigraphy device was used to measure sleep and activity. It has also been shown that pain, depression, and sleep quality are associated with activity levels. According to the results we reached the evaluation of the quality of life, it is seen that the quality of life is significantly impaired in the painful patient group. Compared to the control group, the sleep efficiency of the subjects is lower, the total sleep time is shorter, and sleep onset latency is increased. The similarity of the number of awakenings with the control group in the actigraphy analyses of patients with pain (bed partner, sleep-related movement disorders, artifacts in device recording, etc.) may be due to many reasons. Therefore, we think the duration of awakening is more decisive than the number of awakenings in patients with pain. Our results are significant in terms of demonstrating the reciprocal relationship between pain and depression. Our study shows that the severity of pain, a condition that has not been demonstrated in the literature before, is an important factor for both depression and sleep and that pain in herniated disc patients may be related to depression.

Conflict of interest: None

Author Contributions		**Author Initials**
SCD	Study Conception and Design	ÜAM
AD	Acquisition of Data	ÜAM
AID	Analysis and Interpretation of Data	ÜAM
DM	Drafting of Manuscript	ÜAM
CR	Critical Revision	ÜAM

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References

1. Andersson GB. Epidemiological features of chronic low-back pain. Lancet. 1999 Aug 14;354(9178):581-5. https://doi.org/10.1016/S0140-6736(99)01312-4
2. Hoy D, Brooks P, Blyth F, Buchbinder R. The Epidemiology of low back pain. Best Pract Res Clin Rheumatol. 2010;24(6):769-81. https://doi.org/10.1016/j.berh.2010.10.002
3. Katz JN. Lumbar disc disorders and low-back pain: socioeconomic factors and consequences. J Bone Joint Surg Am. 2006;88 Suppl 2:21-4. https://doi.org/10.2106/JBJS.E.01273
4. Bogduk N. The lumbar disc and low back pain. Neurosurg Clin N Am. 1991;2(4):791-06.
5. Hart RP, Martelli MF, Zasler ND. Chronic pain and neuropsychological functioning. Neuropsychol Rev. 2000;10(3):131-49. https://doi.org/10.1023/a:1009020914358
6. Hagen EM, Svensen E, Eriksen HR, Ihlebaek CM, Ursin H. Comorbid subjective health complaints in low back pain. Spine (Phila Pa 1976). 2006;31(13):1491-5. https://doi.org/10.1097/01.brs.0000219947
7. Ataoglu S, Ozcetin A, Ataoglu A, Icmeli C, Makarc S, Yagli M. The relationship pain intensity, anxiety, and depression in patients with fibromyalgia and rheumatoid arthritis. Anatolian J Psychiatry 2002;3(4):223-6
8. Morgenthaler T, Alessi C, Friedman L, Owens J, Kapur V, Boehlecke B, et al. Standards of Practice Committee; American Academy of Sleep Medicine. Practice parameters for the use of actigraphy in the assessment of sleep and sleep disorders: an update for 2007. Sleep. 2007;30(4):519-29. https://doi.org/10.1093/sleep/30.4.519
9. Scrimshaw SV, Maher C. Responsiveness of visual analogue and McGill pain scale measures. J Manipulative Physiol Ther. 2001;24(8):501-4. https://doi.org/10.1067/mmt.2001.118208
10. Kocyigit H, Aydemir O, Fisek G, Olmez N, Memis A. Reliability and Validity of the Turkish Version of Short Form-36 (SF-36). Ilac ve Tedavi J 1999;12:102-6.
11. Demiral Y, Ergor G, Unal B, Semin S, Akvardar Y, Kivircik B, et al. Normative data and discriminative properties of short form 36 (SF-36) in Turkish urban population. BMC Public Health. 2006;6:247. https://doi.org/10.1186/1471-2458-6-247

12. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. Arch Gen Psychiatry. 1961;4:561-71. https://doi.org/10.1001/archpsyc.1961.01710120031004
13. Hisli N. Use of the Beck Depression Inventory with Turkish university students: reliability, validity and factor analysis. J Psychol 1989;7:3-13.
14. Lopez-Lopez D, Vilar-Fernandez JM, Calvo-Lobo C, Losa-Iglesias ME, Rodriguez-Sanz D, et al. Evaluation of Depression in Subacute Low Back Pain: A Case Control Study. Pain Physician. 2017;20(4):E499-E505.
15. Wong JJ, Tricco AC, Côté P, Rosella LC. The association between depressive symptoms of depression and health outcomes in adults with low back pain with or without radiculopathy: protocol of a systematic review. Syst Rev. 2019;8(1):267. https://doi.org/10.1186/s13643-019-1192-4
16. Smith MT, Huang MI, Manber R. Cognitive behavior therapy for chronic insomnia occurring within the context of medical and psychiatric disorders. Clin Psychol Rev. 2005;25(5):559-92. https://doi.org/10.1016/j.cpr.2005.04.004
17. Pinheiro MB, Ferreira ML, Refshauge K, Ordoñana JR, Machado GC, Prado LR, et al. Symptoms of Depression and Risk of New Episodes of Low Back Pain: A Systematic Review and Meta-Analysis. Arthritis Care Res (Hoboken). 2015;67(11):1591-603. https://doi.org/10.1002/acr.22619
18. Nicassio PM, Wallston KA. Longitudinal relationships among pain, sleep problems, and depression in rheumatoid arthritis. J Abnorm Psychol. 1992;101(3):514-20. https://doi.org/10.1037//0021-843x.101.3.514
19. Koffel E, Kroenke K, Bair MJ, Leverty D, Polusny MA, Krebs EE. The bidirectional relationship between sleep complaints and pain: Analysis of data from a randomized trial. Health Psychol. 2016;35(1):41-9. https://doi.org/10.1037/hea0000245
20. Parmelee PA, Tighe CA, Dautovich ND. Sleep disturbance in osteoarthritis: linkages with pain, disability, and depressive symptoms. Arthritis Care Res (Hoboken). 2015;67(3):358-65. https://doi.org/10.1002/acr.22459
21. Kroenke K, Wu J, Bair MJ, Krebs EE, Damush TM, Tu W. Reciprocal relationship between pain and depression: a 12-month longitudinal analysis in primary care. J Pain. 2011;12(9):964-73. https://doi.org/10.1016/j.jpain.2011.03.003
22. Currie SR, Wang J. Chronic back pain and major depression in the general Canadian population. Pain. 2004;107(1-2):54-60. https://doi.org/10.1016/j.pain.2003.09.015
23. Ong KS, Keng SB. The biological, social, and psychological relationship between depression and chronic pain. Cranio. 2003;21(4):286-94. https://doi.org/10.1080/08869634.2003.11746264
24. Meana M, Cho R, DesMeules M. Chronic Pain: The Extra Burden on Canadian Women. BMC Womens Health. 2004;4 Suppl 1:S17. https://doi.org/10.1186/1472-6874-4-S1-S17
25. Martin JL, Hakim AD. Wrist actigraphy. Chest. 2011;139(6):1514-27. https://doi.org/10.1378/chest.10-1872