ORIGINAL ARTICLE

AHI EVRAN MEDICAL JOURNAL
E-ISSN: 2619 - 9203

The Role of Disease Activity as a Determinant of Central Sensitivity and Body Awareness in Fibromyalgia Patients: A Cross-Sectional Study

Fibromiyalji Hastalarında Merkezi Duyarlılık ve Vücut Farkındalığının Belirleyicisi Olarak Hastalık Aktivitesinin Rolü: Kesitsel Bir Çalışma

***Yasemin MİRZA*[1] *Adem KÜÇÜK*[1]**

ÖZ

Amaç: Bu çalışmanın amacı fibromiyalji sendromu (FMS) hastalarında hastalık aktivitesinin santral sensitizasyon ve vücut farkındalığı üzerine etkisini belirlemektir.
Araçlar ve Yöntem: Bu kesitsel çalışmaya FMS'li 45 hasta (ortalama yaş: 45.9 (6.9) yıl, ortanca hastalık süresi: 3 (2-6) yıl) katıldı. Hastalık aktivitesi, Fibromiyalji Etki Anketi (FEA) kullanılarak değerlendirildi ve daha yüksek puan yüksek hastalık aktivitesi olarak kabul edildi. Santral sensitizasyonu değerlendirmek için Santral Sensitizasyon Ölçeği (SSÖ) uygulandı. Vücut farkındalığı seviyeleri Vücut Farkındalığı Anketi (VFA) ile değerlendirildi. Ağrı şiddetini belirlemek için Görsel Analog Skala (GAS) kullanıldı. Hastalık aktivitesini hangi bağımsız değişkenin açıklayabileceğini araştırmak için basit doğrusal regresyon analizleri kullanıldı.
Bulgular: Ortalama FEA ve VFA puanları sırasıyla 53.4 ve 90 dı. Ortanca GAS ve SSÖ puanları sırasıyla 8 ve 52 idi. Tüm hastaların %82.2'sinde santral sensitizasyon pozitifti. FEA, GAS skoruyla orta düzeyde ilişkiliydi (r=0.445, R2=0.198, p=0.002) ve SSÖ ile yüksek düzeyde ilişkiliydi (r=0.539, R2=0.291, p<0.001). FEA ve VFA arasında ise anlamlı bir korelasyon saptanmadı (p=0.791). Basit doğrusal regresyon analizinin sonuçları, GAS'ın hastalık aktivitesinin %19.8'ini açıkladığını gösterdi. FEA (r=0.445, p=0.002) ağrı şiddetini anlamlı şekilde tahmin etti. Ayrıca SSÖ hastalık aktivitesinin %29.1'ini açıklarken, FEA (r=0.539, p<0.001) santral sensitizasyonu anlamlı şekilde öngörüldü.
Sonuç: Yüksek hastalık aktivitesi FMS'li hastalarda santral sensitizasyon ve vücut farkındalığını olumsuz bir şekilde etkilemektedir. Klinisyenler yüksek hastalık aktivitesi olan hastaların yönetiminde rutin tedavilere ek olarak multimodal biyopsikososyal bakış açısını da göz önünde bulundurmalıdır.

Anahtar Kelimeler: beden farkındalığı; fibromiyalji sendromu; hastalık aktivitesi; santral sensitizasyon

ABSTRACT

Purpose: The present study aimed to identify the influence of disease activity on central sensitization (CS) and body awareness in fibromyalgia syndrome (FMS) patients.
Materials and Methods: Forty-five patients with FMS (mean age: 45.9 (6.9) years, median disease duration: 3 (2-6) years) were participated this cross-sectional study. Disease activity was assessed using the Fibromyalgia Impact Questionnaire (FIQ) and higher score was considered high disease activity. The Central Sensitization Inventory (CSI) was performed for central sensitivity. Body awareness levels were evaluated with the Body Awareness Questionnaire (BAQ). Visual Analogue Scale (VAS) was used to identify pain severity. Simple linear regression analyses were used to determine which independent variables could explain disease activity.
Results: The mean FIQ and BAQ were 53.4 and 90 points, respectively. The median VAS and CSI were 8 cm and 52 point, respectively. The CS is positive in 82.2% of all patients. FIQ was moderately correlated with the VAS score (r=0.445, R2=0.198, p=0.002) and is highly correlated with CSI (r=0.539, R2=0.291, p<0.001). There was no significant correlation between FIQ and BAQ (p=0.791). The results of the simple linear regression analysis presented that VAS explained 19.8% of the the disease activity. FIQ (r=0.445, p=0.002) significantly predicted pain severity. Additionally, The CSI explained 29.1% of the disease activity and FIQ (r=0.539, p<0.001) significantly predicted CS.
Conclusion: High disease activity negatively impacts CS and body awareness in FMS patients. Clinicians should consider a multimodal biopsychosocial perspective in addition to routine treatments in the management of patients with high disease activity.

Keywords: body awareness; central sensitization; fibromyalgia syndrome, disease activity

Received: 14.08.2024; Accepted: 06.11.2024

[1]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Necmettin Erbakan University, Konya, Turkey.
[2]Division of Rheumatology, Department of Internal Medicine, Faculty of Medicine, Necmettin Erbakan University, Konya, Turkey.
Corresponding Author: Yasemin Mirza, Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Necmettin Erbakan University, Konya, Turkey. e-mail: yakkubak@gmail.com

How to cite: Mirza Y, Küçük A. The role of dısease actıvıty as a determınant of central sensıtıvıty and body awareness in fibromyalgıa patıents: A cross-sectıonal study. Ahi Evran Med J. 2025;9(1):30-36. DOI: 10.46332/aemj.1533118

INTRODUCTION

Fibromyalgia syndrome (FMS) is a chronic disease characterized by widespread pain and tender points, accompanied by many symptoms such as sleep disturbance, morning stiffness, fatigue and psychiatric disorders.[1] The prevalence of FMS in the European population is 4.7%, with a higher prevalence in women than in men.[2] Currently, the most commonly used patient-based outcome measure to evaluate disease activity in FMS patients is the Fibromyalgia Impact Questionnaire (FIQ). FIQ evaluates factors such as pain, fatigue, stiffness, physical impairment, number of days feeling good, ability to do work, anxiety and depressive symptoms.[3] Evaluation of disease activity in FMS patients is very important in the management of the disease, follow-up of patients and prediction of prognosis.

Although the etiopathogenesis of FMS is unclear, central sensitization (CS) causing changes in pain modulation may explain widespread musculoskeletal pain.[4] CS is defined as increased response of nociceptive neurons in the central nervous system to various peripheral stimuli such as temperature, light, pressure and medication.[5] This central hyperactivity induces allodynia, hyperalgesia, and chronic widespread pain.[6] Through previous studies, CS has been shown to occur in a number of specific chronic pain populations, including FMS.[6-8] Furthermore, previous researches have demonstrated chronic musculoskeletal pain, emotional status and cognitive impairment associated with body awareness.[9,10] However, there is little knowledge about body awareness and CS in patients with FMS and its association with disease activity.

Body movements are key concepts for rehabilitation and the evaluation of body movements and awereness are crucial.[11] Body awareness is defined as focusing on internal body sensations, being aware of them, and perceiving movement responses with environmental and relational conditions.[12] Body awareness occurs through the integration of many sensory inputs such as interoceptive, exteroceptive, proprioceptive and vestibular and includes biopsychosocial mechanisms.[13] These complex cortical connections help the perception of body position, the relationship between body parts, and the ability to recognize one's own body.[14] Body awareness is thought to be related to body structure/functions and pain within the scope of the biopsychosocial mechanism.[15] Earlier studies have showed that there is a relationship between pain, depression level, functional status and body awareness in FMS patients.[16,17] In addition, preliminary evidences suggest that body awareness therapy may provide significant benefits in reducing pain and improving health-related quality of life in patients with FMS.[18,19]

The presence of CS may be the underlying cause of persistant pain experience in FMS patients despite routine treatment. Furthermore, our knowledge about CS and body awareness in FMS, which is characterized by chronic musculoskeletal pain, fatigue and other symptoms, is limited. Additionally, disease activity, which is frequently assessed in the clinical setting, may affect both CS and body awareness. So, we aimed to assess the impact of disease activity on CS and body awareness in FMS patients. The first hypothesis suggests that high disease activity is related to impaired body awareness. The second hypothesis proposes that disease activity is a determining factor on body awareness and CS.

MATERIALS and METHODS

This study was approved by Necmettin Erbakan University Drug and Non-Medical Device Research Ethics Committee (dated 01.03.2024 and numbered 2024/4831). All patients were informed about the study and then their written consent was obtained. The study was performed in regarding the Declaration of Helsinki's principles. This study was designed as a descriptive and cross-sectional study. Participants evaluated at Necmettin Erbakan University Hospital, Department of Rheumatology between April 2024 and July 2024.

Participants

Patients who were between the ages of 18 and 65, diagnosed with FMS by a specialized rheumatologist with 20 years of experience at Necmettin Erbakan University Hospital, Department of Rheumatology in line with the American College of Rheumatology's 2010 diagnostic criteria[20] and had chronic musculoskeletal pain for more than 3 months were included in this study. Patients were excluded if they had any neurological, cardiovascular and inflam-

matory joint diseases, musculoskeletal surgery, neuropsychiatric medical treatment, the presence of active malignancy, visual and hearing problems, pregnancy and regular exercise habit.

Outcome Measures

Information about sociodemographic, disease duration and medications were recorded. To assess self-reported pain severity was performed visual analog scale (VAS).[21] It consists of a solid line defined as 0 = "no pain" and 10 = "worst pain". Participants described their pain level on a line.

Disease Activity

The Turkish version of Fibromyalgia Impact Questionnaire (FIQ) was used to evaluate the degree of FMS symptoms and disease activity.[3] This self-reported questionnaire consists of 21 items evaluating physical impairment, well-being, work missed, and anxiety and depression. The total score was obtained from the sum of all subscales (general affect, activity level, and severity of symptoms); where higher scores indicated a high disease activity (0–100).

Central Sensitization

The Turkish version of Central Sensitivity Inventory (CSI) was used to evaluate the presence and severity of CS.[22] The questionnaire included 25 items assessing current symptoms related to CS. Each item is scored from 0 (never) to 4 (always). The total score is 100 points, with higher scores reflecting greater severity of symptoms. The cut-off point of CSI is 40 points.

Body Awareness

The Body Awareness Questionnaire (BAQ) includes four subgroups (changes in body processes, sleep-wake cycle, prediction at the onset of the disease, prediction of body reactions) and a total of 18 statements, aiming to determine the normal or abnormal sensitivity level of body composition. The patient is asked to give a score between 1 (not true for me at all) and 7 (completely true for me) for each statement. The total score varies between 18 and 126. A higher score indicates better body awareness. Turkish validity and reliability studies of this scale were conducted by Karaca et al.[23]

Statistical Analysis

The required sample size was determined using G Power software (Version 3.1.9.2, Franz Faul, University of Kiel, Kiel, Germany). The sample size of at least 41 individuals was found to have a power of 0.90, an effect size of 0.42 (medium effect d≥0.3), correlation test r2= 0.18, and an alpha value of 0.05 (one-tailed). The participant rate was calculated to be 10% higher in order to compensate for data losses in research process or statistical analysis process. As a result, 45 patients were participated in this study.

IBM SPSS (Statistical Package for the Social Sciences, ver. 22.0) was performed for statistical analyses. Shapiro Wilk test, probability plots and histograms were used to determine whether variables were normally distributed. Normally distributed variables were given as mean± standard deviation (SD), non-normal distributions were given as median (IQR), and non-numerical data were shown as frequency and percentage. The relationship between FIQ-VAS, CSI and BAQ was determined with Pearson's correlation analysis due to parametric conditions. The size of correlation coefficient was interpreted as following, very high; between 0.90 -1.00, high; between 0.90 and 0.71, good; between 0.70 and 0.51, moderate; 0.50 and 0.31, negligible; 0.3 or less.[24] Simple linear regression analyses were used to determine which of the independent variables (VAS, CS) could explain the dependent variables (FIQ) in presence of the significant correlations. P value <0.05 was accepted for statistical significance level.

RESULTS

Forty-five patients with FMS (mean age: 45.9 (6.9) years, median disease duration: 3 (2-6) years) were completed this study. Patients' demographic and clinical features are presented in Table 1. The median VAS score of all patients was 8 (5-8) cm. Twenty-four patients (53.3%) used analgesic medicine, eight patients (17.7%) used anti-depressant, and thirteen patients (29%) don't used any medicine prior to the study. The mean FIQ score of all patients was

53.4 (12.2) points. Patient' CSI score was 52 (41.5-57). The CS is positive in 82.2% of all patients. The mean BAQ score of all patients was 90 (9.6) points (Table 1).

Table 1. The demographic and clinical features of patients with fibromyalgia syndrome.

Variables		FMS (n=45)
Age (year), mean±SD)		45.9±6.9
BMI (kg/m^2), median (IQR)		28.7 (25.5-32)
Disease duration (year), median (IQR)		3 (2-6)
History of smoking, n (%)	None	40 (88.9)
	Active	5 (11.1)
Education (year), median (IQR)		8 (5-12)
Drug use (yes/no)		32/13
VAS (cm), median (IQR)		8 (5-8)
FIQ, mean±SD)		53.4±12.2
CS positive, n (%)		37 (82.2)
CSI (point), median (IQR)		52 (41.5-57)
BAQ (point), mean±SD)		90±9.6)

FMS: Fibromyalgia Syndrome, BMI: Body Mass Index, IQR: Iinterquartile Range, VAS: Visual Analogue Scale, FIQ: Fibromyalgia Impact Questionnaire, CS: Central Sensitization, CSI: Central Sensitivity Inventory, BAQ: Body Awareness Questionnaire.

Table 2. Linear regression analysis between the disease activity, central sensitization and pain severity of fibromyalgia syndrome patients.

					CSI				
Variables	**r**	**R^2**	**P**	**F**	**B coefficient**	**Std. error**	**β**	**t**	**p**
Constant					22.678	7.484	-	3.030	0.004*
Disease activity	0.539	0.291	<0.001*	17.650	0.618	0.147	0.539	4.201	<0.001*
					VAS				
Constant					33.052	6.473	-	5.106	<0.001*
Disease activity	0.445	0.198	0.002*	10.610	3.008	0.923	0.445	3.257	0.002*

CSI: Central Sensitization Inventory, VAS: Visual Analogue Scale, * Linear regression analysis.

FIQ is moderately correlated with the VAS score (r=0.445, R2=0.198, p=0.002) and is highly correlated with CSI (r=0.539, R2=0.291, p<0.001). There is no significant correlation between FIQ and BAQ (p=0.791). The simple linear regression analysis between the disease activity, central sensitization and pain severity is presented in Table 2. The VAS score is explained 19.8% of the variance and FIQ (r=0.445, p=0.002) significantly predicted pain severity. The CSI score is explained 29.1% of the variance and FIQ (r=0.539, p<0.001) significantly predicted CS (Figure 1).

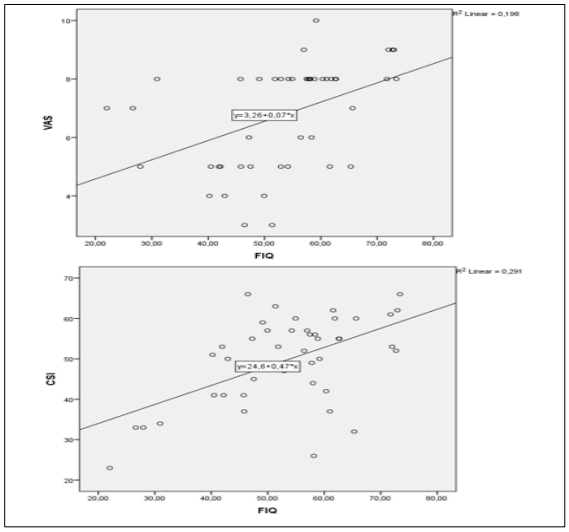

Figure 1. Scatter plots of disease activity, central sensitization, and pain severity.

DISCUSSION

The lack of understanding of the exact pathogenesis of FMS makes the diagnosis and treatment of this illness very difficult. This study purposed to to investigate the influence on disease activity on CS and body awareness in patients with FMS. We found that high disease activity adversely affected CS and pain severity. Moreover, disease activity is an important determinant of CS in patients with FMS. As the disease activity increased, pain intensity and CS deteriorated.

In a study conducted with healthy individuals, it was reported that the level of body awareness was directly related to pain and emotional state related to the musculoskeletal system.[25] Apaydın et al. reported that axial spondyloarthritis patients with high disease activity have poorer body awareness compared to low disease activity.[10] Previous studies suggested that body image perception may also be disturbed in chronic painful conditions.[26] Akkaya et al. reported that body image is deteriorated in patients with FMS compared to healthy individuals.[16] Additionally, it was found that body image was associated with FIQ and pain severity. Another study reported that FIQ associated with body image in patients with FMS.[27] Unlike previous

studies, our findings indicate that there is no significant association between FIQ and body awareness. In previous studies, body image was assessed using the Body Image Scale. However, we evaluated body awareness with BAQ. The contents of these two evaluation measurements differ from each other. Moreover, in this study, disease duration, disease activity and mean age of the patients and the sample size were lower. A recent systematic review suggests that body awareness therapies are holistic, body-focused interventions that enhance physical, mental and emotional well-being by promoting awareness of the body's function, behaviour and interactions with oneself and others. Moreover, this systematic review showed positive results in favor of body awareness treatments as adjunctive therapy to usual care in patients with FMS.[11] For this reason, adding body awareness exercises to the rehabilitation process in FMS patients might be effective in improving disease activity and pain.

In FMS, earlier studies already presented evidence for CS as the cause of chronic widespread pain.[6,8] Additionally, previous studies reported that CS was higher in patients with FMS than in healthy individuals.[28,29] Another study reported that mean CSI score of FMS patients was 70.7.[30] Moreover, Casas-Barragán et al. found that mean CSI score in FMS patients was 67.73.[28] In a study involving different rheumatic diseases, it was reported that CS syndromes were present in 94% of fibromyalgia patients, 41% of rheumatoid arthritis, 45% of axSpA patients, patients, and 62% of osteoarthritis patients.[31] In line with the literature, in this study presented clinical CS in 82.2% of patients with FMS. However, we found mean CSI score of patients as 52. Cultural differences and the smaller number of participants in our study may explain the lower CSI score. The presence of CS is a very common condition in patients with FMS and should be taken into account in the evaluation process, treatment management and patient follow-up.

Valera-Calero et al. showed that anxiety, depression and pain during daily living activities were all independently associated with CS in FMS.[30] Another study reported that clinical symptoms like pain, fatigue, and insomnia are adversely affects CS in patients with FMS.[32] Moreover, earlier studies demonstrated that years with pain and pain during daily life activities were positively associated with CS.[33,34] Salaffi et al. stated that worse disease activity, more pain, and symptom severity independently predict the development of CS in FMS.[35] Our results of the regression analysis presented that CS and pain were moderately associated. In addition, CS were highly correlated with disease activity. The pain severity and disease activity may predict the presence and severity of CS in patients with FMS, which is consistent with the previous studies. As the pain and disease activity increases, the severity of CS is also increased.

Limitation

The study has some limitations. Firstly, due to the cross-sectional design of our study, causal conclusions can not be drawn. Secondly, current study is included only women because the higher frequency of FMS among women. Therefore, our study results cannot be generalized to all FMS patients. Thirdly, the psychological status of the patients was not evaluated in this study, but body awareness and CS may be influenced by psychological factors. Lastly, patients' neuropathic pain profiles were not evaluated, which may be affect CS. An important strength of our study is the detailed investigation of the relationship of disease activity with FMS to body awareness and CS. Further studies are needed to confirm the findings shown here. In addition, future studies may evaluate the effects of body awareness therapies on disease activity, CS, psychological and emotional status and health-related quality of life.

Conclusion

To summarize, our study points out comprehensive evidence of the relationship between disease activity, pain, CS and body awareness in FMS patients. The present study focused on body awareness, CS and disease activity in patients with FMS, which are missing in the literature. Detection impaired CS and body awareness early in the disease would help in FMS treatment planning and management. In combination with routine pharmacological treatments and non-pharmacological treatments such as exercise and cognitive behavioral therapies, body awareness therapy can decrease pain, symptoms, and CS and improve body awareness. We suggest that body awareness and

breathing therapies, especially in addition to postural control exercises, may be beneficial in terms of CS, pain and disease activity in FM patients. In conclusion, clinicians should consider a multimodal biopsychosocial perspective in addition to routine treatments in the management of patients with high disease activity.

Conflict of Interest

The authors declare that there is not any conflict of interest regarding the publication of this manuscript.

Ethics Committee Permission

This study was approved by Necmettin Erbakan University Drug and Non-Medical Device Research Ethics Committee (dated 01.03.2024 and numbered 2024/4831).

Authors' Contributions

Concept/Design: YM, AK. Data Collection and/or Processing: YM, AK. Data analysis and interpretation: YM, AK. Literature Search: YM. Drafting manuscript: YM, AK. Critical revision of manuscript: YM, AK.

REFERENCES

1. Häuser W, Ablin J, Fitzcharles M, et al. Fibromyalgia. Nat Rev Dis Primers. 2015;1(15022):1-16.
2. Cabo A, Cerdá G, Trillo J. Fibromyalgia: Prevalence, epidemiologic profiles and economic costs. Med Clin. 2017;149(10):441-448.
3. Sarmer S, Ergin S, Yavuzer G. The validity and reliability of the Turkish version of the Fibromyalgia Impact Questionnaire. Rheumatol Int. 2000;20(1):9-12.
4. Russell IJ, Larson AA. Neurophysiopathogenesis of fibromyalgia syndrome: a unified hypothesis. Rheum Dis Clin North Am. 2009;35(2):421-435.
5. Nijs J, Meeus M, Van Oosterwijck J, et al. In the mind or in the brain? Scientific evidence for central sensitisation in chronic fatigue syndrome. Eur J Clin Invest. 2012;42(2):203-212.
6. Meeus M, Nijs J. Central sensitization: a biopsychosocial explanation for chronic widespread pain in patients with fibromyalgia and chronic fatigue syndrome. J Clin Rheumatol. 2007;26(4):465-473.
7. Williams DA, Gracely RH. Biology and therapy of fibromyalgia. Functional magnetic resonance imaging findings in fibromyalgia. Arthritis Res Ther. 2006; 8(224):1-8.
8. Cagnie B, Coppieters I, Denecker S, Six J, Danneels L, Meeus M. Central sensitization in fibromyalgia? A systematic review on structural and functional brain MRI. Semin Arthritis Rheum. 2014;44(1):68-75.
9. Baskan E, Yagci N, Cavlak U. Factors affecting body awareness in older adults with chronic musculoskeletal pain. Arch Med Sci. 2021;17(4):934-939.
10. Apaydın H, Apaydın ZB. The role of disease activity as a determinant of body awareness and central sensitization in patients with axial spondyloarthritis: a cross-sectional study. J Health Sci Med. 2023;6(5): 1022-1028.
11. Bravo C, Skjaerven LH, Sein-Echaluce LG, Catalan-Matamoros D. Effectiveness of movement and body awareness therapies in patients with fibromyalgia: a systematic review and meta-analysis. Eur J Phys Rehabil Med. 2019;55(5):646-657.
12. Skjaerven LH, Mattsson M, Catalan-Matamoros D, Parker A, Gard G, Gyllensten AL. Consensus on core phenomena and statements describing Basic Body Awareness Therapy within the movement awareness domain in physiotherapy. Physiother Theory Pract. 2019;35(1):80-93.
13. Durlik C, Cardini F, Tsakiris M. Being watched: The effect of social self-focus on interoceptive and exteroceptive somatosensory perception. Conscious Cogn. 2014;25(2014):42-50.
14. Gyllensten AL, Hui-Chan CW, Tsang WW. Stability limits, single-leg jump, and body awareness in older Tai Chi practitioners. Arch Phys Med Rehabil. 2010;91(2):215-220.
15. Erden A, Altuğ F, Cavlak U. Investigation of the relationship between body awareness, pain, emotional status, and quality of life among healthy people. J Kartal TR. 2013;24(3):145-150.
16. Akkaya N, Akkaya S, Atalay NS, Balci CS, Sahin F. Relationship between the body image and level of pain, functional status, severity of depression, and quality of life in patients with fibromyalgia syndrome. Clin Rheumatol. 2012;31(6):983-988.
17. Tahran Ö, Ersöz Hüseyinsinoğlu B, Yolcu G, Karadağ Saygı E. Internet-based basic body awareness therapy in fibromyalgia syndrome: A report of three cases. Modern Mod Rheumatol Case Rep. 2023;7(2): 464-469.
18. Courtois I, Cools F, Calsius J. Effectiveness of body awareness interventions in fibromyalgia and chronic fatigue syndrome: a systematic review and meta-analysis. J Bodyw Mov Ther. 2015;19(1):35-56.
19. Gunel M, Yağli NV, Kerem Günel M, et al. Effect of body awareness therapy on fibromyalgia syndrome in women: a randomized controlled trial. J Exercise Ther Rehabil. 2014;1(2):43-48.
20. Wolfe F, Clauw DJ, Fitzcharles MA, et al. The American College of Rheumatology preliminary diagnostic criteria for fibromyalgia and measurement of symptom severity. Arthritis Care Res (Hoboken) 2010;62(5):600-610.
21. Begum MR, Hossain MA. Validity and reliability of visual analogue scale (VAS) for pain measurement JMCRR 2019;2(11):394-402.
22. Keleş ED, Birtane M, Ekuklu G, et al. Validity and reliability of the Turkish version of the central sensitization inventory. Arch Rheumatol. 2021;36(4):518-526.
23. Karaca S, Bayar B. Turkish version of body awareness questionnaire: validity and reliability study. Turk J Physiother Rehabil. 2021;32(1):44-50.
24. Mukaka MM. A guide to appropriate use of correlation coefficient in medical research. Malawi Med J. 2012;24(3):69-71.
25. Kalkışım ŞN, Erden A, Kanber Uzun Ö, Ertemoğlu Öksüz C, Zihni NB, Çan MA. Relationship between body awareness level and musculoskeletal pain complaints, physical activity level and emotional status in healthy people. Acta Neurol Belg. 2023;123(5):1789-1796.
26. Kieselbach K, Fauler I, Abberger B. Patients With Chronic Pain: The Aspect Of Negative Body Image. Psychother Psychosom Med Psychol. 2024;74(9-10): 369-375.
27. Van Overmeire R, Vesentini L, Vanclooster S, Muysewinkel E, Bilsen J. Body Image, Medication Use, and Mental Health among Women with Fibromyalgia in Flanders, Belgium. Int J Environ Res Public Health. 2022;19(1418):1-8.

28. Casas-Barragán A, Molina F, Tapia-Haro RM, García-Ríos MC, Correa-Rodríguez M, Aguilar-Ferrándiz ME. Association of core body temperature and peripheral blood flow of the hands with pain intensity, pressure pain hypersensitivity, central sensitization, and fibromyalgia symptoms. Ther Adv Chronic Dis. 2021;12:1-17.
29. Lima D, Pacheco-Barrios K, Slawka E, et al. The role of symptoms severity, heart rate, and central sensitization for predicting sleep quality in patients with fibromyalgia. Pain Med. 2023;24(10):1153-1160.
30. Valera-Calero JA, Úbeda-D'Ocasar E, Arias-Buría JL, Fernández-de-las-Peñas C, Gallego-Sendarrubias GM, Cigarán-Méndez M. Convergent validity of the central sensitization inventory in women with fibromyalgia: Association with clinical, psychological and psychophysical outcomes. European Journal of Pain. 2022;26(10):2141-2151.
31. Guler MA, Celik OF, Ayhan FF. The important role of central sensitization in chronic musculoskeletal pain seen in different rheumatic diseases. Clin Rheumatol. 2020;39(1):269-274.
32. Garcia-Hernandez A, de la Coba P, Reyes Del Paso G. Central sensitisation pain and autonomic deficiencies in fibromyalgia. Clin Exp Rheumatol. 2022;40(6): 1202-1209.
33. Cigarán-Méndez M, Úbeda-D'Ocasar E, Arias-Buría J, et al. Pain extent is associated with Central Sensitization Inventory but not widespread pressure pain sensitivity or psychological variables in women with fibromyalgia. Scand J Rheumatol. 2023;52(3):268-275.
34. Rehm S, Sachau J, Hellriegel J, et al. Pain matters for central sensitization: sensory and psychological parameters in patients with fibromyalgia syndrome. Pain Rep. 2021;6(1):901.
35. Salaffi F, Farah S, Mariani C, Sarzi-Puttini P, Di Carlo M. Validity of the Central Sensitization Inventory compared with traditional measures of disease severity in fibromyalgia. Pain Pract. 2022;22(8):702-710.