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The Relationship Among Psychological and Psychophysiological Characteristics of Fibromyalgia Patients

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Abstract: **This study examined the relationship of psychophysiological response patterns in fibromyalgia with psychological characteristics and comorbid mental disorders. Surface electromyographic data, systolic and diastolic blood pressure, heart rate (HR), and skin conductance levels were recorded continuously during baseline, stress, and relaxation tasks. Cluster analysis revealed 4 subgroups of patients who differed on pain characteristics and cognitive, affective, and behavioral responses to pain and stress. The largest group (46.7%) was characterized by elevated blood pressure levels and stress reactivity (a disposition assumed to be a vulnerability factor for the development of diseases) associated with pain, anxiety, physical interference, low activity, and pain behaviors. A second group (41.6%) showed low baseline blood pressure and reactivity, and high activity and stress. A third group (9.2%) displayed high baseline skin conductance level, reactivity, and depression, and a fourth small group (2.5%) displayed elevated baseline electromyographic response and reactivity with high levels of anxiety and depression. These data suggest that unique psychophysiological response patterns are associated with psychological coping and mental disorders in fibromyalgia patients. The identification of the mechanisms that contribute to these group differences will further our understanding of the mechanisms involved in the development and maintenance of fibromyalgia and suggest differential treatment strategies.**

Perspective: ***This article presents psychological characteristics and comorbidity with mental disorders of psychophysiological subgroups of fibromyalgia patients. This mechanistic analysis will assist scientific identification of systems-based pathways that contribute to autonomic and stress mechanisms that mediate chronic pain. Demonstration of distinct, homogeneous subgroups is an important step towards personalized, mechanism-oriented treatments.***

Key words: *Fibromyalgia, psychophysiology, stress, activity, psychological variables.*

Fibromyalgia (FM)[61,62] is characterized by widespread pain and hyperalgesia and a diverse set of additional physical and psychological symptoms. Abnormal responses to stress have been suggested as one important pathophysiological mechanism that contributes to FM.[11] Results of studies that have examined the influence of a dysregulated stress system in FM have been inconsistent.[3,24,43] Based on a cluster analysis of psychophysiological recordings during baseline and stress conditions, we identified 4 different psychophysiological response patterns to emotional stressors.[52] Cluster 1 was characterized by high blood pressure (BP) and heart rate (HR) along with stable skin conductance levels (SCLs) and reduced electromyographic (EMG) responses. Cluster 2 showed reduced BP,

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HR, SCL, and EMG. Cluster 3 showed increased SCLs, BP, and HR and reduced EMG responses. In contrast, Cluster 4 displayed an elevated EMG response but stable BP, HR, and SCL responses.[52] Inconsistencies related to mechanisms and response to treatment reported in the FM literature may be due to heterogeneity of patients characterized by these different response patterns.[47,58]

Subgroups of chronic pain patients have also been reported based on psychological characteristics. For example, using the Multidimensional Pain Inventory (MPI),[31] 3 different patterns of responses to the presence of persistent pain have been identified and replicated in numerous samples with diverse medical diagnoses.[12,22,35,57] The Dysfunctional group reported the highest pain intensity, interference, emotional distress, solicitous spouse behaviors, and the lowest sense of control and activity levels. The Adaptive Coper group reported the lowest levels of pain and interference and high activity levels connected with distracting significant other behaviors. The Interpersonally Distressed patients reported more negative spouse responses to pain and showed high levels of affective distress.[53,56] Variability in the nature and extent of emotional problems such as depression and anxiety across studies (ie, 28.6–70%) also suggests heterogeneity among FM patients.[15,33,53]

In a previous study, we used k-means cluster analysis and identified 4 psychophysiological response patterns associated with baseline differences and reactivity to emotional stress.[52] The present study investigated the extent to which psychophysiological-based subgroups of FM[52] differ on psychosocial characteristics (MPI)[12,22,56] and comorbidity with mental disorders. Based on the observation that the inverse relationship between BP and pain observed in healthy pain-free controls is not found in chronic pain patients,[37,39] we hypothesized that the group with high BP (Cluster 1) would show elevated pain intensity,[16] pain-related interference, low fitness,[32] and lower activity levels. We also expected higher levels of anxiety and catastrophizing in this group.[53] In contrast, we predicted that patients in Cluster 2, who are characterized by low baseline BP, would have lower pain intensity[16,39] and interference, and higher activity levels.[32] Based on the findings that low BP combined with increased sudomotor response in chronic pain is associated with high emotional distress,[13] we also expected elevated stress levels and diminished adaptive coping as a consequence of the increased activity levels in Cluster 3. Fear of pain has been shown to be accompanied by heightened EMG levels[1]; thus, we expected the highest level of anxiety in patients with elevated muscle tension levels (Cluster 4).

Participants and Methods

Participants

One hundred twenty female FM patients recruited from a pain clinic, rheumatologic outpatient departments, and a hospital in Germany participated in the study. All patients met the American College of Rheumatology FM classification criteria.[61,62] Exclusion criteria included presence of inflammation; neurologic complications; pregnancy; concomitant disease such as diabetes or cancer; use of muscle relaxants, gabapentin, pregabalin, duloxetine, milnacipran, or opioids at the time of testing; psychotic symptoms; and inadequate command of the German language. The study was approved by the local institutional review board and adhered to the Declaration of Helsinki. Informed consent was obtained from all study participants. Table 1 contains demographic and clinical information about the patients including painful regions reported in the pain interviewing. The present sample included the 90 FM patients of the study by Thieme and Turk[50] supplemented with an additional 30 FM patients added to expand the sample size and to

Table 1. Demographic and Clinical Variables of the FM Patients

Variable	*Cluster 1 (n = 56)*	*Cluster 2 (n = 50)*	*Cluster 3 (n = 11)*	*Cluster 4 (n = 3)*	P
Age (y)	45.18 (10.72); 22–64	47.43 (9.41); 31–66	42.71 (11.60); 21–55	55.33 (10.50); 45–66	ns
Duration of the pain (y)	8.30 (6.64); .50–26	10.74 (11.74); 1–43	5.33 (2.55); 2–10	8.00 (3.00); 5–11	ns
Number of painful regions	7.00 (2.18); 3–10	6.79 (2.18); 3–10	7.57 (1.27); 6–9	7.33 (2.08); 5–9	ns
Number of tender points	15.36 (2.35); 11–17	16.38 (2.62); 11–18	18.00 (.00); 18–18	15.20 (3.41); 11–18	ns
Mean tender point pain severity*	4.76 (1.76); 2.1–8.10	4.16 (1.89); 1.57–8.24	4.09 (2.29); 1.55–7.19	5.74 (1.73); 4.69–8.33	ns
Use of antidepressant medication: amitriptyline (25 mg) (mean number)	.38 (.79); 0–3	.28 (.60); 0–3	.60 (1.07); 0–3	.60 (.55); 0–1	ns
Married, n (%)	56 (100%)	36 (72%)	9 (81.8%)	2 (66.6%)	
Occupational status, n (%)					
Working	18 (31.0)	28 (56.0)	2 (18.2)	1 (33.0)	ns
Unemployed	24 (41.4)	11 (22.0)	4 (36.4)	2 (66.0)	
Workers' compensation	11 (19.0)	7 (14.0)	1 (9.0)	0 (.0)	
Retired	3 (5.2)	4 (8.0)	4 (36.4)	0 (.0)	
Student	2 (3.4)	0 (.0)	0 (.0)	0 (.0)	

NOTE. Values are mean (standard deviation) and range unless otherwise noted.
*Visual analog scale ranges from 0 = no pain to 10 = most intense pain.