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Research Article

Psychological Fibromyalgianess Exists on a Continuous Spectrum

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Abstract

Objective: To determine if key psychological factors associated with the fibromyalgia (FM) phenotype, herein termed psychological fibromyalgianess, exist on a spectrum with asymptomatic persons at one end and those with FM at the other.

Methods: Ninety-eight women with FM, diagnosed according to ACR 1990 criteria, and 35 female healthy controls without pain were studied. Applied questionnaires included the following: Big 5 personality scale, Perceived Stress scale, Fibromyalgia Impact Questionnaire, Perceived control of internal states, Mastery scale, Optimism scale and the profile of mood states scale.

Results: Normality plots showed key psychological variables of FM subjects and HCs to be in the same population. These variables showed a gradient effect with lower levels in controls and higher levels in FM subjects, all associating with the FM phenotypic features of sleep and cognitive change and fatigue ($p<0.001$), with pain showing a ceiling effect. Both the psychological factors and the FM-related symptoms were of a much lesser degree in controls compared to patients with FM.

Conclusions: Selected key psychological factors in females that associate with the FM clinical phenotype are also present in healthy controls and exist on a spectrum, with lower levels seen in asymptomatic non-FM women and higher levels seen in those with FM. Variation in the extent of certain psychological factors (psychological fibromyalgianess) links to clinical features of FM, consistent with these factors being key contributors to FM.

Keywords: Psychological variables; Fibromyalgia; Fibromyalgianess; Pain; Spectrum; Normality

Introduction

The robust and characteristic clinical phenotype of fibromyalgia [FM] is reflected in the key items that contribute to the ACR 2010 Preliminary Clinical Diagnostic Criteria [1] and the 2011 Fibromyalgia Research Criteria [2]. These comprise symptoms of widespread pain, high levels each of fatigue, poor quality sleep and cognitive dysfunction, as well as a mix of other somatic complaints. Wide spread abnormal tenderness is also present in FM [3], more clearly reflecting changes in central pain-related control mechanisms.

It has been suggested that the "volume control" of central sensory systems, including pain, is increased in FM, with stimulus-response curves for many modalities (pain, noise, light etc.) being shifted to the left [4-6]. The key clinical sign of tenderness also exemplifies this [7]. Patients with fibromyalgia are found to the right of the normal "bell-shaped" curve of tenderness across a population [8].

We have previously shown that a number of psychological factors associate with the clinical phenotype of FM. Strong links are present between personality, attitude, types of control style and stress and the pain, fatigue, sleep and cognitive changes found in FM [9-12]. We have also found similar associations, of a lesser absolute amount but still of significant degree, between these same psychological variables and the same FM clinical phenotypic characteristics in healthy controls without criteria for FM. Higher versus lower levels of these key psychological variables associate with higher or lower levels respectively of the FM clinical phenotypic features in both those with FM and healthy controls.

In this study we explore the proposal that the psychological variables associated with the clinical features of FM, so-called psychological fibromyalgianess, exist on the same spectrum in FM patients as those of healthy pain free controls. If this were so increasing the "gain" in putative upstream psychological processes, particularly those that relate to stress, would then increase downstream symptoms that provide the substrate to define the FM phenotype. The model used to guide this study is shown in Figure 1.

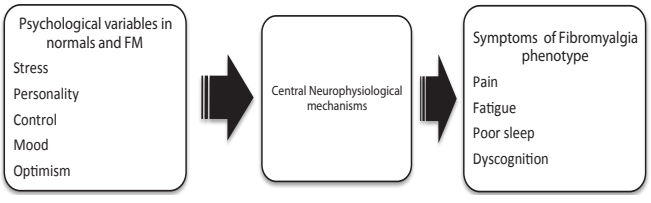

Figure 1: The model used in this study proposes that increasing levels of certain psychological factors will cause increased levels of symptoms associated with fibromyalgia in both normal people and fibromyalgia patients and that these processes exist on the same spectrum.

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This would then imply that when psychological situations in persons without fibromyalgia reach certain threshold levels then changes occur in central pain-related control processes and pathways that in turn result in the characteristic symptoms that define the clinical phenotype of FM. We use the term "psychological fibromyalgianess" to describe this tendency of certain psychological factors to associate with the clinical phenotypic features of fibromyalgia.

Materials and Methods

Ethics: Ethics approval was obtained through relevant committees of Monash University and Monash Medical Centre, Melbourne, Australia.

Subjects: The participants in this study consisted of volunteer women who were sourced from variety of areas including: a FM self-management program, notices in local newspapers, a fibromyalgia treatment clinic and local rheumatologists. Ninety-eight female FM patients fulfilling ACR 1990 classification criteria [3] and 35 female healthy controls (HC), all healthy women with no pain condition and recruited by word of mouth, were identified.

Procedures: All participants were sent written information regarding the study along with consent form which, when signed, was followed by a series of questionnaires. These included the following:

1) Fibromyalgia Impact Questionnaire (FIQ) [13]: A validated 20 item functional ability questionnaire, which measures how an individual's symptom characteristics impact their daily functioning for the preceding week. Individual subscales include pain, sleep, fatigue, depression and anxiety and use a 0 to 10 cm visual analogue scale (VAS), measuring left of line for "no impact of subscale" through to the far right, "worst possible impact".

2) The Big 5 Personality Inventory (BFI) [14]: A validated 44-item personality scale, scored as 1 (disagree strongly) through to 5 (agree strongly) to indicate the extent of agreement with the items. The 44 items comprise 5 subscales of extraversion, agreeableness, conscientiousness, neuroticism and openness. We only selected neuroticism for analysis in the study as we previously only found significant differences between the controls and FM patients with this personality variable [10].

3) Perceived Stress Scale (PSS) [15]: A validated scale that assesses the degree an individual experiences feelings of being overwhelmed by stressful life events over the past month. The scale is a 10 item, 5 point likert scale ranging from 0 (never) to 4 (very often) with scores ranging from 0 -40.

4) Profile of Mood States (POMS) subscale [21]: A validated scale that measures individual aspects of mood as well as a total overall mood score. The POMS identifies adjective words that describe feelings that are indicative of mood states. The questionnaire asks individuals to rate on a scale from zero (not at all) to four (extremely) which best describes how they have felt over the past week. The scale includes a total of 65 definitions that represent the 6 subscales that include: Tension – Anxiety, Depression –Dejection, Anger- Hostility, Vigour, Fatigue and Confusion. A total mood score is obtained by summing all subscale scores, with vigour inversed. The subscale of confusion was used to represent the cognitive dysfunction seen in FM. The single word items that reflect confusion include, "bewildered, confused, unable to concentrate, forgetful, uncertain and efficient (score reversed)".

5) The Perceived Control of Internal States Scale (PCOISS) [16] measures the degree to which individuals feel they have control of their thoughts, emotions, and physical reactions, which, in turn, moderates the impact of events on their wellbeing. A 5-point Likert scale, rated from 1=strongly agree to 5=strongly disagree, is used to assess 14 items. High scores indicate a high level of perceived control.

6) The Mastery Scale [17] rates the patients' beliefs in their ability to control situations and to deal with possible difficulties and challenges. A 4-point Likert scale is used, with patients rating their agreement to the states from 1= strongly agree to 4=strongly disagree to assess seven items. High scores indicate a high level of mastery.

7) The life optimism scale (LOT) [18] is a six-item scale where individuals are asked to rate negative and positive statements on a 5-point likert scale, with 1 representing strongly disagree through to 5 strongly agree. High scores indicate high levels of optimism.

Statistical Analysis

Initial descriptive analysis was conducted, along with normality checks (Shapiro-Wilks), using SPSS (PASW version 18). T tests, means and standard deviations were used to explore the differences between groups in symptom characteristics and stability of personality traits. T tests were performed to compare the differences between the variables of both the FM group and the normal control group and then scatter plots were used to depict the relationships.

Table 1: Demographic details of fibromyalgia patients and healthy controls.

N		FM% 98	HC% 35
AGE	18-29	8.7	42.9
	30-49	18.5	34.3
	40-49	22.8	11.4
	50-59	31.5	11.4
	60-69	18.5	0.00
Marital Status	Single	6.5	32.8
	Married/defacato/Significient relationship	78.5	59.3
	Seperated/Divorced	13.0	7.9
Education	Secondary	43.5	22.9
	Tertiary	41.4	28.5
	Higher degree	14.1	48.6
Work Status	Full time	17.6	68.5
	Part time	34.8	28.6
	Casual	7.6	2.9
Occupation	Semi professional	25.0	11.4
	Professional	20.7	54.3
	Self employed	3.3	5.7
	Retired	14.1	0.00
	Unemployed	3.3	0.00
	Home/caring	19.6	2.9
	Student	4.3	22.9
Income: (AUS)	<$20,000	38.6	17.1
	$20-40,000	33.7	25.7
	$41-60,000	14.5	34.3
	$61-80,000	3.6	11.4
	+$100,000	6	0.00

Abbreviations: FM= Fibromyalgia; HC= Health Controls

Table 2: Means and standard deviations of key components of fibromyalgia phenotype in fibromyalgia patients and healthy controls.

		Domains of fibromyalgia			
		Pain	**Fatigue**	**Sleep**	**Dyscognition**
FM [n=92]	Mean	6.35	7.94	7.74	9.88
	SD	2.41	2.04	2.13	5.08
HC [n=35]	Mean	0.19	2.73	3.46	6.03
	SD	0.47	2.28	2.73	5.46
T test	T (df)	14.31 127	12.33 128	9.44 130	3.75 126
Significance	p	.001	.001	.001	.001

FM = fibromyalgia, HC = healthy controls, SD= standard deviation

Results

The demographics of the FM and HC groups are shown in Table 1. These data have been previously published [11, 12].

The controls are largely young single women with higher education, jobs, and income, where as the patient group is married, older, less educated, poorer women.

The level of the key symptoms contributing to the fibromyalgia phenotype, namely pain, fatigue, sleep and confusion are shown for the fibromyalgia and healthy control groups in Table 2. The means of the FM group shown in Table 2 are significantly higher than the HC group.

Normality tests between the key symptoms that define FM showed no significant differences between FM and HCs [data not shown here]. The FM patients had symptom levels at the higher end of the total subject group while HCs had symptoms that were at the lower end.

The means of selected psychological factors in FM and HCs are shown in Table 3. The fibromyalgia patients had significantly different means compared to healthy controls for all examined psychological variables except neuroticism. When subjects, FM versus HCs, matched for age less than 39 years were compared a higher level of neuroticism was found in the FM group [10].

Using Shapiro-Wilk test for normality none of the selected psychological factors showed a significant difference between the FM group and the HCs except for optimism (p=0.03). This suggests that these psychological factors are also present within the same spectrum of normality. Figure 2 shows the overall normality curves for each of the examined psychological factors, with the FM and healthy controls shown separately.

We then compared the level of each selected psychological factor in the FM and HC groups to the level of stress in the same individual (Figure 3). We used stress as a comparator because we have found it to have the strongest associations with the clinical phenotypic features of FM in our group [12]. In both the FM group and the HC group there was an almost identical significant relationship between these variables. When the FM and HC groups are plotted together this relationship is also significant [data not shown, p<0.001]. Table 4 shows the correlations between the FM patients and healthy control groups with stress.

Discussion

FM is a predictable and easily recognizable clinical syndrome. Core features comprise widespread pain and wide spread abnormal tenderness, as well as high levels of fatigue, poor quality sleep and cognitive dysfunction [2]. A number of other somatic symptoms usually accompany FM and mood disturbances, particularly anxiety and depression, are common co-morbidities. The American College of Rheumatology 2011 diagnostic criteria for FM focus on many of these core symptoms and have been shown to essentially capture the same population defined by the 1990 American College of Rheumatology classification criteria [2].

Within the construct of the 2011 diagnostic criteria a numerical score is designated based on the estimate of widespread pain and severity of key selected symptoms that define the FM phenotype. Specifically, these are fatigue, sleep disturbance, cognitive dysfunction and other common somatic symptoms, particularly headache, abdominal pain and depression. The score of over 13 has a high specificity and sensitivity for designating FM [2]. However, it is recognized that these symptoms occur on a continuum. Patients with symptom scores of less than 13 may still score high on a number of items that otherwise are typical of FM. It has been suggested that this contributes a "fibromyalgianess" score, implying a spectrum of symptoms occurring to different degrees in different persons and when that cumulative spectrum on this particular index exceeds 13 then the diagnosis of FM may be applied, assuming there are no other causes for that persons symptoms.

We have previously identified a number of psychological factors that also associate with the symptoms contributing to the "fibromyalgianess" score in HCs, without any pain. In this study we propose that these HC sexist on the same spectrum, in regard to psychological factors as those with defined FM, except that the healthy controls do not reach the thresholds of symptoms required for the diagnosis of FM.

Table 3: Means and standard deviations of selected psychological variables in fibromyalgia patients and healthy controls.

Group		Stress	Neuroticism	Mastery	Internal control	Anxiety	Depression	Optimism
FM [n=92]	Mean	28.16	25.95	16.72	57.41	4.40	3.74	19.83
	SD	5.99	5.22	3.27	9.99	2.86	2.79	3.58
HC [n=35]	Mean	24.89	23.91	18.54	63.83	1.86	1.51	20.85
	SD	7.04	6.04	3.22	10.83	2.25	2.56	4.18
T test	T (df)	3.32 (128)	1.89 (129)	-2.82 (127)	-3.13 (120)	4.76 (130)	4.14 (130)	-1.36 (124)
Significance	p	.001	NS	.01	.004	0.001	0.001	NS

FM = Fibromyalgia; HC = Healthy Controls, SD= Standard Deviation

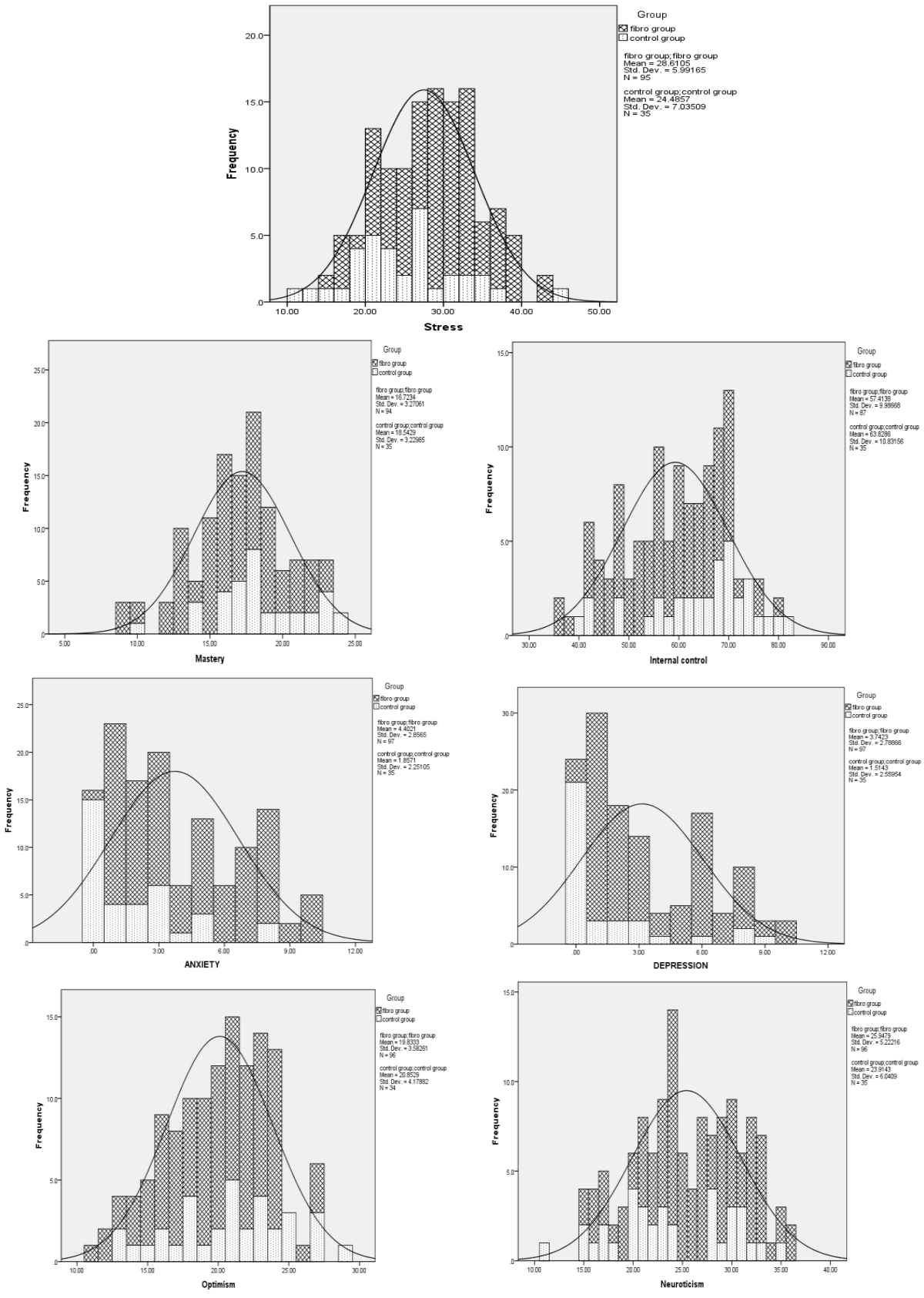

Figure 2: Stacked histograms with overall normality curve for key psychological symptoms contributing to fibromyalgia.

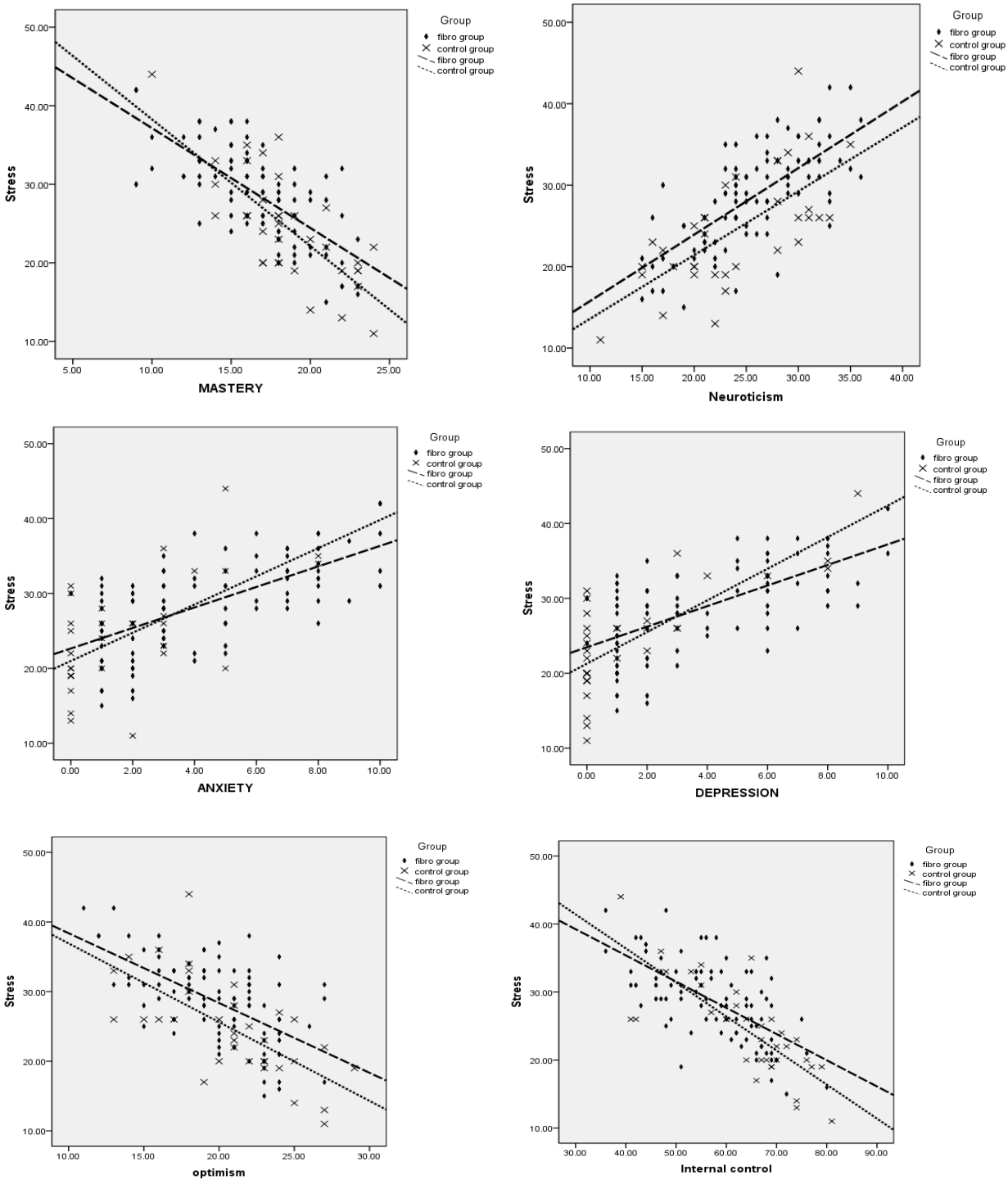

Figure 3: Scatterplots for stress versus psychological elements for individuals with fibromyalgia and healthy controls. Circle = fibromyalgia, cross= healthy control

In this study HCs had significantly reduced key symptoms, namely pain, fatigue, sleep disturbance and cognitive dysfunction, compared to those with FM. However, when these same symptoms were examined for normality, it is seen that they fall in the same distribution as the FM group.

Additionally, a number of key psychological factors showed a similar distribution with normal patients having lesser degrees of these symptoms than the FM patients but still falling within the same normal population.

We chose stress as a specific variable to compare to our selected psychological factors in both the HCs and the FM subjects. Stress had the strongest association with all psychological and clinical variables

Table 4: Correlations between FM and healthy control groups with stress.

Stress	Control	Anxiety	Mastery	Depression	Neuroticism	Optimism
Fibromyalgia	0.65**	0.64**	0.72**	-0.60**	-0.64**	-0.70**
Healthy Controls	0.60**	0.77**	0.67**	-0.67**	-0.77**	-0.74**

** = p<0.001

studied in this group [12] and we felt that this core variable would allow for appropriate comparison of other psychological variables in FM and HC groups. We found almost identical distributions and associations between these variables in both populations. This implies that the psychological variables exist on the same spectrum in HCs and in FM and represent the psychological "fibromyalgianess" of an individual in contrast to the clinical "fibromyalgianess" [19]. This implies that increasing levels of psychological fibromyalgianess will also increase FM phenotype symptom levels.

We found that HCs and FM patients have the same psychological factors present but these factors are of a lesser degree in the HCs and contribute to FM-related symptoms in a lesser way. Indeed, although the association between the psychological factors and the FM-related symptoms is present in the healthy controls, both the psychological factors and the FM-related symptoms are of a much lesser degree than seen in the FM population.

We propose that psychological factors are important in FM. Increased levels of such factors are thought to interact with the neurophysiological processes that contribute to FM [4]. It is likely that this would happen through interaction with the descending pain modulatory influences that originate in the peri-aqueduct grey matter and associated areas and influence sensory modulation, including that which relates to pain, in the dorsal horn of the spinal cord [20]. In turn, it is likely that psychological factors influence emotion-important brain areas, such as the medial frontal and cingulate cortex, which in turn have links to the aforementioned mid brain pain modulatory centers.

Our study cannot identify which of the psychological factors are key to this process. It may be that a number of these factors operate through increasing psychological stress and perhaps this is the important mediator which links a number of these processes [4,12,21].

Our study has some limitations. The mean age of the control group and the fibromyalgia group was not identical and the socio-economic background of our subjects differed. Many of our fibromyalgia patients were not in full employment, for instance. However, the subjects appear representative of other studies with university educated, married women between the ages of 50 and 55 years who are working and/ or housewives [22,23]. Thus our population was not primarily derived from a tertiary care setting that might otherwise favour higher levels of stress-related symptoms [4]. The cross-sectional data collection of this study only allows for identification of associations between psychological and clinical variables, however the purpose was to look at associations between groups, namely HCs and FM patients. We feel that this allows valid observations and conclusions regarding the hypothesis of the study. We did not have complete clinical data in the total group to allow for accurate calculation of the fibromyalgianess score [2].

Conclusions

The findings in this study indicate that in the group taken as a whole the HCs exist at the lower end of a spectrum of psychological responses that is continuous with those responses of the FM group, who exist at the upper end of that spectrum. This relationship is also seen in the symptoms of FM suggesting there may be a link between these two observations. Psychological "fibromyalgianess", or the tendency of specific psychological factors to predict development of clinical "fibromyalgianess" needs to be further explored.

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