



Journal of
Health Psychology

Emotional intelligence impairments in women with fibromyalgia: associations with widespread pain

Journal:	<i>Journal of Health Psychology</i>
Manuscript ID	Draft
Manuscript Type:	Article
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Abstract:	<p>This study aimed at testing differences in emotional intelligence ability between women with fibromyalgia and age-matched non-fibromyalgia control women, and analysing associations between emotional intelligence abilities and chronic widespread pain in fibromyalgia. A total of 133 women with fibromyalgia and 77 control women from the general population participated in this cross-sectional study. All participants performed the Mayer-Salovey-Caruso Emotional Intelligence Test. Women with fibromyalgia also completed the Pain Catastrophizing Scale and Widespread Pain Index. Control women outperformed women with fibromyalgia on emotion understanding. After accounting for pain catastrophizing and the remaining emotional intelligence dimensions, only emotion perception and management were significantly associated with widespread pain; $\beta = -.24$ and $-.18$, both p's $\geq .04$. To conclude, women with fibromyalgia may experience difficulties in understanding emotional information. In fibromyalgia, higher emotion perception and management abilities were independently related to lower widespread pain. Experimental research addressing the causality of our findings is warranted.</p>

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5 **widespread pain**
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10 **Abstract**
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13 with fibromyalgia and age-matched non-fibromyalgia control women, and analysing
14 associations between emotional intelligence abilities and chronic widespread pain in
15 fibromyalgia. A total of 133 women with fibromyalgia and 77 control women from the
16 general population participated in this cross-sectional study. All participants performed
17 the Mayer-Salovey-Caruso Emotional Intelligence Test. Women with fibromyalgia also
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19 outperformed women with fibromyalgia on emotion understanding. After accounting for
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23 difficulties in understanding emotional information. In fibromyalgia, higher emotion
24 perception and management abilities were independently related to lower widespread
25 pain. Experimental research addressing the causality of our findings is warranted.
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44 **Keywords:** Adaptation (psychological), Cognition, Intelligence, Rheumatic and
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INTRODUCTION

Fibromyalgia is a chronic disease which is remarkably more common in women (Arout et al., 2018; Mas et al., 2008). Although it has well-defined criteria and is recognised as a disease by the World Health Organisation (WHO), fibromyalgia is often stigmatised by society (Briones-Vozmediano et al., 2017). Indeed, fibromyalgia is considered as a low-prestige disease (Album and Westin, 2008). A number of factors may contribute to the stigmatisation of fibromyalgia such as its heterogeneous and unpredictable symptomatology (Estévez-López et al., 2017; Vincent et al., 2016) and the absence of objective markers of the disease (Fitzcharles et al., 2014). Particularly worrisome is that the common invalidation and lack of understanding of this disease may reflect an extension of the prejudices that women have traditionally suffered from society (Briones-Vozmediano et al., 2017; Kool et al., 2009). In fact, in the literature, a negative wording has been used by for instance referring to fibromyalgia as the disease of the complaining women (Briones-Vozmediano et al., 2017).

In the earliest criteria, the diagnosis of fibromyalgia was based solely on the presence of chronic widespread musculoskeletal pain (Wolfe et al., 1990). In addition to pain, people with fibromyalgia experience an array of symptoms including, but not limited to, increased fatigue and poor mental health (Segura-Jiménez et al., 2015; Wolfe et al., 1990). The polysymptomatic nature of fibromyalgia was recognised in later updates of the original diagnostic criteria (Wolfe et al., 2016). Interestingly, only pain is included in all of the set of available criteria (Wolfe, 2017); emphasising the importance of pain in this condition. In the most updated fibromyalgia criteria, pain is identified as chronic widespread pain (Wolfe et al., 2016).

Previous research has suggested that emotions are related to pain. Early studies followed a ‘which and how much’ or emotional states approach, while more recently

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3 literature has moved to a ‘how and why’ or emotional processes approach (Lumley,
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5 2010). From the latter approach, research has studied the role of specific emotional
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7 processes in the experience of pain. For instance, in comparison to non-chronic pain
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9 peers, people with chronic pain have poorer emotional awareness/appraisal (Di Tella and
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11 Castelli, 2016; Zunhammer et al., 2015). Previous studies on the impact of these
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13 emotional deficits in people with chronic pain are inconclusive (Di Tella and Castelli,
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15 2016). A number of studies have demonstrated that maladaptive strategies of emotion
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17 regulation are related to increased pain (Baker et al., 2016), while others did not find such
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19 an association (Hamilton et al., 2007). Although some research has been conducted in
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21 people with chronic pain, there is limited work exploring the relationship between
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23 emotion and fibromyalgia. In the fibromyalgia population, we identified only one
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25 previous study in which higher anger inhibition and lower anger expression were related
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27 to more pain, which suggested a relationship between a specific emotional process (i.e.,
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29 emotion regulation) and pain but this was limited to a particular emotion (i.e., anger) (van
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31 Middendorp et al., 2010).

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38 As opposed to the study of specific emotional processes in isolation, emotional
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40 intelligence is a more comprehensive construct that jointly takes account of diverse
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42 emotional processes, which is of interest in the perception of chronic pain. Emerging
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44 evidence suggests differences between people with and without chronic pain (i.e., cases
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46 and controls, respectively) in specific dimensions, but not in general levels, of emotional
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48 intelligence (Costa, Petrides, & Tillmann, 2014). The impaired dimensions of emotional
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50 intelligence may differ across chronic pain populations. People with inflammatory
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52 diseases scored worse in well-being and sociability (Costa et al., 2014). These deficits in
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54 emotional intelligence may have an impact in people with chronic pain. For instance,
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56 higher emotional intelligence is associated with lower pain (Burri, Lachance, et al., 2015;
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3 Costa et al., 2017) and prevents the onset of chronic pain (Burri, Ogata, et al., 2015).
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5 Indeed, past studies concluded that emotional intelligence is more strongly related to
6
7 chronic pain than genetic (Burri, Ogata, et al., 2015) or other emotional factors (Doherty
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9 et al., 2017).
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12 Due the current state-of-the-art in the field, there are only very few studies
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14 analysing the association of either isolated emotional processes or emotional intelligence
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16 with chronic pain, which precludes to suggest conclusions. Furthermore, the co-existence
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18 of several theoretical models for studying emotional intelligence and diverse approaches
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20 for assessing emotional intelligence make difficult to compare previous studies. Overall,
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22 there are two different approaches, namely, the ability models and the mixed/trait models
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24 (Cherniss, 2010; Mayer et al., 2000). Emotional intelligence, from the ability models, is
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26 the skill to perceive and express emotion, assimilate emotion in thought, understand and
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28 reason with emotion, and regulate emotion in the self and others (John D. Mayer et al.,
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30 2016). Emotional intelligence is considered as a *hot*-type of intelligence (John D. Mayer
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32 et al., 2016) involving the management of the most significant information to a person:
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34 his/her sense of social acceptance, identity coherence, and emotional well-being. Failures
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36 in these aspects result in psychic pain, which is processed within the same brain regions
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38 that process physical pain (Eisenberger, 2015).
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44 Although the personality and dispositional attributes, as targeted by the
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46 mixed/trait models, also contribute to reason and solve problems, they should not be
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48 confused with emotional intelligence understood as a (discrete and measurable) mental
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50 ability (John D Mayer et al., 2008). Another common caveat in the literature is to assess
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52 emotional intelligence ability by relying on self-reported assessments, which can give
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54 inaccurate results (Brackett et al., 2006) by, for example, including non-intellectual
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56 features (e.g., self-confidence, self-esteem, misunderstandings of what is involved in
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3 successful reasoning, or wishful thinking (John D. Mayer et al., 2016). Previous research
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5 which measured emotional intelligence as an ability, demonstrated robust associations
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7 with health (mental and physical) (Martins et al., 2010) in several environments, such as
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9 social, academic and work (John D. Mayer et al., 2008). In chronic pain, research has
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11 been focused on specific or diverse emotional processes, the latter under the umbrella
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13 term of emotional intelligence, and has always used self-reported measures and mostly
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15 from mixed/trait models. There is therefore a paucity of knowledge of the role of
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17 emotional intelligence ability in people with chronic pain. Only two previous studies
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19 assessed emotional processes with an ability measure in people with chronic pain, these
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21 studies excluded those with fibromyalgia (Doherty et al., 2017; Zunhammer et al., 2015).
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26 Therefore, the aims of the present study were, for the first time, (i) to test
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28 differences in emotional intelligence ability between women with fibromyalgia and their
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30 age-matched non-fibromyalgia counterparts, and (ii) to analyse the association between
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32 emotional intelligence ability, as a *hot* intelligence, and widespread pain in women with
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34 fibromyalgia.
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40 **METHODS**

41 ***Participants***

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43 In the present case-control cross-sectional study, we recruited people with fibromyalgia
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45 mainly from local fibromyalgia associations in southern Spain (Andalusia). Additional
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47 participants were recruited via e-mail, letter, telephone, and mass-media advertisements.
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49 We also asked people with fibromyalgia taking part in the study to recruit a pairwise non-
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51 fibromyalgia control. The inclusion criteria for fibromyalgia participants were (i) to be
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53 previously diagnosed of fibromyalgia by a rheumatologist and (ii) to meet the 1990
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55 American College of Rheumatology (ACR) fibromyalgia criteria (Wolfe et al., 1990), as
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3 corroborated by the research team. The inclusion criterion for control participants was (i)
4 to report not having fibromyalgia and (ii) not to meet the 1990 American College of
5 Rheumatology (ACR) fibromyalgia criteria (Wolfe et al., 1990), as corroborated by the
6 research team. A total of 220 people with fibromyalgia (i.e., cases) and 97 people without
7 fibromyalgia (i.e., controls) showed interested in partaking in the present study. In order
8 to match both groups, the present study only included women aged between 37 and 61
9 years old. All the interested participants ($n = 317$) gave their written informed consent
10 after receiving detailed information about the study aims and procedures. The present
11 study was reviewed and approved by the Ethics Committee of the *Virgen de las Nieves*
12 Hospital (Granada, Spain). The ethical guidelines of the Declaration of Helsinki were
13 followed.

24 **Measures**

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30 *Emotional intelligence* by the Spanish adaptation of the Mayer-Salovey-Caruso
31 Emotional Intelligence Test Version 2 (MSCEIT V2.0) (John D Mayer et al., 2016). The
32 MSCEIT is a 141-item questionnaire assessing the abilities of (i) perceiving emotions
33 (emotion perception), (ii) using or facilitating emotions (emotion facilitation), (iii)
34 understanding emotions (emotion understanding), and (iv) managing or regulating
35 emotions (emotion management). The MSCEIT asks participants to either perform or
36 solve emotional tasks by choosing among a number of plausible solutions, each potential
37 answer was ranked according to an expert consensus. Scores are computed as empirical
38 percentiles (mean = 100 and standard deviation = 15) with higher scores representing
39 higher levels of ability.

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54 *Pain catastrophizing* by the Spanish adaptation of the Pain Catastrophizing Scale (PCS)
55 (García Campayo et al., 2008). The PCS is a 13-item questionnaire in which patients are
56 asked to reflect on past painful experiences and indicate their thoughts or feelings about
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3 pain, on a 5-point scale. For this study, the total score (range 0–52) was used, where
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5 higher scores represent a more negative appraisal of pain.
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7 *Widespread pain* by the Spanish adaptation of the Widespread Pain Index (Segura-
8 Jiménez et al., 2014). Participants graded whether (or not) they had pain or tenderness
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10 over the previous week in 19 body areas; i.e., shoulder girdle, hip, jaw, upper arm, upper
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12 leg, lower arm and lower leg, on the right and the left side of the body, separately, and
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14 additionally neck, chest, abdomen, upper back and lower back. The scores of this
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16 questionnaire is the total number of painful body areas, which ranges from 0 to 19.
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19 ***Statistical analyses***

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21 To confirm that both fibromyalgia and control groups were age-matched, age was
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23 compared using unpaired samples *t*-test. Then, multivariate analysis of variance
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25 (MANOVA) was conducted to compare the mean scores of fibromyalgia and control
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27 groups on the MSCEIT. MANOVA allows dependent variables to be correlated and is
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29 more powerful than ANOVA for detecting group differences. One-way MANOVA was
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31 conducted on five dependent variables corresponding to the overall emotional
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33 intelligence, emotion perception, and emotion facilitation, emotion understanding and
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35 emotion management.
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39 A set of analyses was carried out to analyse the association of emotional intelligence and
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41 widespread pain in people with fibromyalgia. First, preliminary bivariate correlations of
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43 age with widespread pain were conducted to identify their role as potential confounders.
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45 Age was not correlated with widespread pain and therefore was not included as potential
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47 confounders in the analyses; $r = .15$, $p = .133$. Second, the individual unadjusted
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49 association of emotional intelligence with widespread pain was tested by bivariate
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51 correlation. Given that pain catastrophizing may confound the associations under study
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53 (Quartana et al., 2009), in additional analyses, the individual association of emotional
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3 intelligence (predictor variable) with widespread pain (criterion variable) were adjusted
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5 for pain catastrophizing using separate hierarchical regression models for each variable
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7 of emotional intelligence and with *enter* methods. Finally, to test for the independent
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9 association of pain catastrophizing as well as of emotion perception, facilitation,
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11 understanding, and management with widespread pain, a linear regression model using
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13 *forward stepwise* methods was performed.
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19 RESULTS

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21 Figure 1 shows the flowchart of participants through the study and the characteristics of
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23 the 210 participants included in the study are presented in Table 1. Fibromyalgia ($n =$
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25 133) and non-fibromyalgia (i.e., controls, $n = 77$) participants were matched on age; $t =$
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27 1.03, $p = .306$.
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30 *Differences between fibromyalgia and controls in emotional intelligence*

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32 A significant effect of group emerged on emotional intelligence; $V = 0.11$, $F(5, 204) =$
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34 4.81, $p = 0.001$. Table 1 shows that control participants outperformed participants with
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36 fibromyalgia on emotion understanding; $F(1, 208) = 15.71$, $p < .001$, mean differences =
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38 7.1, the effect size of the difference was medium. No between groups differences emerged
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40 on overall emotional intelligence, emotion perception, emotion facilitation and emotion
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42 management; $F(1, 208) = 1.31$, $p = .254$, $F(1, 208) = 2.64$, $p = .106$, $F(1, 208) = 0.06$, p
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44 = .805, and $F(1, 208) = 17.71$, $p = .093$, respectively.
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49 *Association of emotional intelligence and widespread pain*

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51 The bivariate correlation between emotion understanding and widespread pain was not
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53 significant; $r = -.08$, $p = .372$. However, the remaining dimensions, as well as overall
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55 emotional intelligence, significantly correlated with widespread pain; $r = -.23$ to $-.24$, all
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57 $p \leq .007$. The significance of these associations was similar on regression models when
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controlling for pain catastrophizing; Table 2. The amount of the variance of widespread pain explained by pain catastrophizing and emotional intelligence was similar; 4% and 3%, respectively. It is noteworthy that the contribution of emotional intelligence was over and above pain catastrophizing.

Table 3 shows the independent association of pain catastrophizing and the dimensions of emotional intelligence with widespread pain using forward stepwise methods. Emotion perception entered in the first step ($t = 2.82, p = .006$) and emotion management in the second step ($t = 2.10, p = .038$). Pain catastrophizing, emotion facilitation, and emotion understanding was not entered in the regression model (data not presented). Overall, the potential contribution of emotion perception and management on widespread pain was 7%.

DISCUSSION

The present case-control cross-sectional study yields three key findings. First, emotion understanding ability was worse among women with fibromyalgia (i.e., cases) than in age-matched women from the general population (i.e., controls). Second, in fibromyalgia, higher overall emotional intelligence ability and all its dimensions, except emotion understanding, were individually associated with lower widespread pain; even when taking in to account pain catastrophizing. Third, emotion perception and emotion management abilities were independently related to widespread pain; even when pain catastrophizing, emotion facilitation, and emotion understanding were accounted for.

Previous cases-controls studies suggested that people living with chronic pain have deficits in specific emotional processes (e.g., awareness/appraisal) (Di Tella and Castelli, 2016; Zunhammer et al., 2015) but not in general levels of emotional intelligence (Costa et al., 2014). Most of the previous research omitted the study of fibromyalgia (as

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3 a particular chronic pain-related disease), or included a mixed chronic pain sample
4 including different diseases (Baker et al., 2016). Only one previous study in fibromyalgia
5 (based on a mixed/trait model) showed an association of higher anger inhibition and lower
6 anger expression with more pain in women with fibromyalgia (van Middendorp et al.,
7 2010). In the present study and in line previous literature on chronic pain, we observed
8 that women with fibromyalgia performed worse in emotion understanding than their age-
9 matched non-fibromyalgia counterparts, but not in general emotional intelligence.
10 Emotion understanding, along with emotion management, is part of strategic emotional
11 intelligence (John D. Mayer et al., 2016). Thus, our findings seem to point out that people
12 with fibromyalgia experience deficits on their ability to deliberately and deeply process
13 emotional information, which in turn may hampers their ability to make strategic
14 judgements (MacCann et al., 2014).

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31 Although still under debate, the main hypothesis for the pathogenesis of
32 fibromyalgia is the existence of central aberrations (Baek et al., 2016; de la Coba et al.,
33 2018). Chronic pain may lead to impaired emotional processing due to changes at
34 different levels, such as, morphological, neurochemical, and gene expression (Cao et al.,
35 2009; Lumley et al., 2011). In the present study, the differences between fibromyalgia
36 and non-fibromyalgia women in emotion understanding ability might be also
37 consequence of central nervous system impairments. Further, alterations in the white
38 matter microstructure might be related to worse emotion understanding ability (Pisner et
39 al., 2017). Additional changes in the neurons from the amygdala to the hypothalamus
40 might drive emotionally maladaptive responses to coping with pain (as a threatening
41 stimuli), which may perpetuate pain (Bartley et al., 2009). The experience of chronic pain
42 might have a negative impact on emotion understanding ability, while poorer ability in
43 strategic emotional intelligence might lead to inappropriate pain coping strategies and,
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3 consequently, to higher pain (Costa et al., 2017; Di Tella and Castelli, 2016). Another
4 possibility is that there is interplay between the chronic pain experienced by women with
5 fibromyalgia and their emotional processes (Lumley et al., 2011).
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10 The literature suggests that, in people with chronic pain specific emotional
11 processes are not related to their pain (Di Tella and Castelli, 2016; Hamilton et al., 2007).
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13 When emotional processes are jointly considered in the construct of emotional
14 intelligence, however, higher levels of general emotional intelligence are associated with
15 lower pain (Burri, Lachance, et al., 2015; Costa et al., 2017). The findings of the present
16 study have demonstrated that, in line with chronic pain literature, women with
17 fibromyalgia with higher emotional intelligence experience lower widespread pain.
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19 According to our findings, interventions for improving emotional intelligence may be not
20 only related to benefits for women with fibromyalgia but also to decrease the costs of
21 healthcare systems (Mikolajczak and Van Belleghem, 2017).
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33 It is well-known that catastrophizing, which is the tendency to focus on and
34 magnify pain experiences and to feel helpless during pain episodes (García Campayo et
35 al., 2008), is a contributing factor to pain, particularly in fibromyalgia (Ellingson et al.,
36 2018). Interestingly, over and above pain catastrophizing, the single association of each
37 specific dimension of emotional intelligence explained an additional 3% of the
38 widespread pain in our sample of women with fibromyalgia; one exception was emotion
39 understanding, which was not significantly related to widespread pain. Furthermore,
40 independently of pain catastrophizing and the other dimensions of emotional intelligence,
41 we found that higher emotion perception and emotion management were associated with
42 lower widespread pain. Thus, the findings of the present study corroborate the importance
43 of emotional processes in the understanding of the experience of pain in fibromyalgia. It
44 may be the case that the ability of perceiving and managing emotions might impact on
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3 pain through the same pathways that catastrophizing does; i.e., directly through
4 alterations of neural processes involved in pain perception and attention and indirectly
5 via promoting negative emotions and maladaptive responses to pain (Lumley et al., 2011).
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10 In relation to the first (direct) pathway underpinning the association of emotion
11 perception and emotion management with pain, it should be born in mind that the sensory-
12 discriminative aspect of pain (Melzack and Casey, 1968) is assessed in the widespread
13 pain index. Thus, deficits in emotional awareness/appraisal may be related to poor
14 emotion perception and consequently to somatosensory amplification (Lumley et al.,
15 2011). It may be the case that a state of pain exacerbation exists in which painful and non-
16 painful stimuli are confused leading to increases widespread pain in women with
17 fibromyalgia with poor emotion perception (Lane et al., 2009).
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28 Deficits in the sensory-discriminative aspect of pain and the close relationship
29 between emotion management ability and several psychological outcomes (Côté et al.,
30 2011; Wranik et al., 2007), may result in poorer emotion management driving negative
31 emotions and maladaptive responses to pain in fibromyalgia (Lumley et al., 2011). It has
32 been demonstrated that the association of higher emotional intelligence and lower pain is
33 mediated by negative affect; as higher emotional intelligence is related to lower negative
34 affect and the latter to lower pain (Ruiz-Aranda et al., 2011). Defined as the ability to
35 perceive and reverse negative emotions (which is a type of emotion management), higher
36 emotional repair is associated with both lower negative affect and pain (Ruiz-Aranda et
37 al., 2010). Emotion management may suppress or reverse negative emotions (Mayer and
38 Salovey, 1997) and consequently improve the experience of pain.
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54 Another potential mechanism behind the association identified in the present
55 study between emotion management and widespread pain is the social aspects of pain.
56 Higher levels of emotional intelligence are related to better social interaction and can
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3 promote positive social functioning by helping individuals to detect others' emotion
4 states, adopt others' perspectives, enhance communication, and regulate behaviour
5 (Brackett et al., 2011). It is well-known that social factors, e.g., social support (Montoya
6 et al., 2004), are related to the experience of pain. Emotion management ability, for
7 example, is associated with secure attachment styles (Kafetsios, 2004), and with a
8 perception of increased levels of emotional support (Lopes et al., 2005).
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11 Before drawing conclusions, several limitations of the present work should be
12 mentioned. First, we did not include a non-fibromyalgia chronic pain sample, which
13 precluded testing whether our findings are specific to women with fibromyalgia or
14 generalizable to other chronic pain diseases. Second, the features of fibromyalgia might
15 differ between genders. Thus, replication of our study in men with fibromyalgia is
16 warranted. The main strengths of the present study are the relatively large sample size,
17 and the fact that emotional intelligence was assessed by means of an ability measure
18 instead of a self-reported assessment (Estévez-López et al., 2018). In our analysis we also
19 adjusted for pain catastrophizing, a traditional and well-known pain-related cognition,
20 when testing the associations of emotional intelligence with widespread pain.
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24 To conclude, the present study showed that, in comparison to age-matched women
25 from the general population (i.e., controls), women with fibromyalgia have worse
26 emotion understanding ability. In women with fibromyalgia, higher overall emotional
27 intelligence ability and all its dimensions, except emotion understanding, were
28 individually associated with lower widespread pain; even when account of pain
29 catastrophizing was taken. Emotion perception and emotion management abilities were
30 related to widespread pain; even when pain catastrophizing, emotion facilitation, and
31 emotion understanding were accounted for. Further experimental research to address the
32 causality of our findings is warranted. It would be of particular interest to test whether
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3 intervention programmes enhancing levels of emotion management, as part of the *hot*
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5 intelligences, are effective in reducing widespread pain in women with fibromyalgia.
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For Peer Review

REFERENCES

- Album D and Westin S (2008) Do diseases have a prestige hierarchy? A survey among physicians and medical students. *Social science & medicine (1982)* 66(1): 182–8. DOI: 10.1016/j.socscimed.2007.07.003.
- Aroust CA, Sofuoglu M, Bastian LA, et al. (2018) Gender Differences in the Prevalence of Fibromyalgia and in Concomitant Medical and Psychiatric Disorders: A National Veterans Health Administration Study. *Journal of women's health (2002)* 27(8): 1035–1044. DOI: 10.1089/jwh.2017.6622.
- Baek S-H, Seok HY, Koo YS, et al. (2016) Lengthened Cutaneous Silent Period in Fibromyalgia Suggesting Central Sensitization as a Pathogenesis. Paul F (ed.) *PloS one* 11(2): e0149248. DOI: 10.1371/journal.pone.0149248.
- Baker KS, Gibson S, Georgiou-Karistianis N, et al. (2016) Everyday Executive Functioning in Chronic Pain. *The Clinical Journal of Pain* 32(8): 673–680. DOI: 10.1097/AJP.0000000000000313.
- Bartley EJ, Rhudy JL and Williams AE (2009) Experimental assessment of affective processing in fibromyalgia. *The journal of pain : official journal of the American Pain Society* 10(11): 1151–60. DOI: 10.1016/j.jpain.2009.04.008.
- Brackett MA, Rivers SE, Shiffman S, et al. (2006) Relating emotional abilities to social functioning: A comparison of self-report and performance measures of emotional intelligence. *Journal of Personality and Social Psychology* 91(4): 780–795. DOI: 10.1037/0022-3514.91.4.780.
- Brackett MA, Rivers SE and Salovey P (2011) Emotional Intelligence: Implications for Personal, Social, Academic, and Workplace Success. *Social and Personality Psychology Compass* 5(1). Wiley/Blackwell (10.1111): 88–103. DOI:

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4

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6 Briones-Vozmediano E, Öhman A, Goicolea I, et al. (2017) 'The complaining women':
7
8 health professionals' perceptions on patients with fibromyalgia in Spain. *Disability*
9
10 *and rehabilitation* 0(0). Informa UK Ltd.: 1–7. DOI:
11
12 10.1080/09638288.2017.1306759.
13
14

15 Burri A, Lachance G and Williams F (2015) A Discordant Monozygotic-Twin
16
17 Approach to Potential Risk Factors for Chronic Widespread Pain in Females. *Twin*
18
19 *Research and Human Genetics* 18(02). Cambridge University Press: 188–197.
20
21 DOI: 10.1017/thg.2015.7.
22
23

24
25 Burri A, Ogata S, Vehof J, et al. (2015) Chronic widespread pain. *PAIN* 156(8): 1458–
26
27 1464. DOI: 10.1097/j.pain.000000000000182.
28
29

30 Cao H, Gao Y-J, Ren W-H, et al. (2009) Activation of Extracellular Signal-Regulated
31
32 Kinase in the Anterior Cingulate Cortex Contributes to the Induction and
33
34 Expression of Affective Pain. *Journal of Neuroscience* 29(10): 3307–3321. DOI:
35
36 10.1523/JNEUROSCI.4300-08.2009.
37
38

39 Cherniss C (2010) Emotional Intelligence: Toward Clarification of a Concept.
40
41 *Industrial and Organizational Psychology* 3(02). Wiley/Blackwell (10.1111): 110–
42
43 126. DOI: 10.1111/j.1754-9434.2010.01231.x.
44
45

46
47 Costa J, Marôco J, Pinto-Gouveia J, et al. (2017) Depression and physical disability in
48
49 chronic pain: The mediation role of emotional intelligence and acceptance.
50
51 *Australian Journal of Psychology* 69(3). Wiley/Blackwell (10.1111): 167–177.
52
53 DOI: 10.1111/ajpy.12131.
54
55

56
57 Costa S, Petrides KV and Tillmann T (2014) Trait emotional intelligence and
58
59 inflammatory diseases. *Psychology, Health & Medicine* 19(2): 180–189. DOI:
60

1
2
3 10.1080/13548506.2013.802356.
4

5
6 Côté S, DeCelles KA, McCarthy JM, et al. (2011) The Jekyll and Hyde of Emotional
7 Intelligence. *Psychological Science* 22(8): 1073–1080. DOI:

8
9 10.1177/0956797611416251.
10
11

12
13 de la Coba P, Bruehl S, Galvez-Sánchez CM, et al. (2018) Slowly Repeated Evoked
14 Pain as a Marker of Central Sensitization in Fibromyalgia: Diagnostic Accuracy
15 and Reliability in Comparison With Temporal Summation of Pain. *Psychosomatic*
16 *medicine* 80(6): 573–580. DOI: 10.1097/PSY.0000000000000599.
17
18
19

20
21
22 Di Tella M and Castelli L (2016) Alexithymia in Chronic Pain Disorders. *Current*
23 *Rheumatology Reports* 18(7): 41. DOI: 10.1007/s11926-016-0592-x.
24
25

26
27 Doherty EM, Walsh R, Andrews L, et al. (2017) Measuring Emotional Intelligence
28 Enhances the Psychological Evaluation of Chronic Pain. *Journal of Clinical*
29 *Psychology in Medical Settings* 24(3–4): 365–375. DOI: 10.1007/s10880-017-
30 9515-x.
31
32
33
34
35

36
37 Eisenberger NI (2015) Social pain and the brain: controversies, questions, and where to
38 go from here. *Annual review of psychology* 66: 601–29. DOI: 10.1146/annurev-
39 psych-010213-115146.
40
41
42
43

44
45 Ellingson LD, Stegner AJ, Schwabacher IJ, et al. (2018) Catastrophizing Interferes with
46 Cognitive Modulation of Pain in Women with Fibromyalgia. *Pain medicine*
47 *(Malden, Mass.)* 19(12): 2408–2422. DOI: 10.1093/pm/pny008.
48
49
50

51
52 Estévez-López F, Segura-Jiménez V, Álvarez-Gallardo ICIC, et al. (2017) Adaptation
53 profiles comprising objective and subjective measures in fibromyalgia: the al-
54 Ándalus project. *Rheumatology (Oxford, England)* 56(11). England: 2015–2024.
55
56
57
58
59
60 DOI: 10.1093/rheumatology/kex302.

- 1
2
3 Estévez-López F, Álvarez-Gallardo IC, Segura-Jiménez V, et al. (2018) The
4
5 discordance between subjectively and objectively measured physical function in
6
7 women with fibromyalgia: association with catastrophizing and self-efficacy
8
9 cognitions. The al-Ándalus project. *Disability and rehabilitation* 40(3). England:
10
11 Informa UK Ltd.: 329–337. DOI: 10.1080/09638288.2016.1258737.
12
13
14
15 Fitzcharles M-A, Ste-Marie PA, Mailis A, et al. (2014) Adjudication of fibromyalgia
16
17 syndrome: challenges in the medicolegal arena. *Pain research & management*
18
19 19(6): 287–92. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25479148>
20
21 (accessed 16 May 2019).
22
23
24
25 García Campayo J, Rodero B, Alda M, et al. (2008) [Validation of the Spanish version
26
27 of the Pain Catastrophizing Scale in fibromyalgia]. *Medicina clínica* 131(13): 487–
28
29 92. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/19007576> (accessed 28
30
31 April 2015).
32
33
34
35 Hamilton NA, Zautra AJ and Reich J (2007) Individual Differences in Emotional
36
37 Processing and Reactivity to Pain Among Older Women With Rheumatoid
38
39 Arthritis. *The Clinical Journal of Pain* 23(2): 165–172. DOI:
40
41 10.1097/AJP.0b013e31802b4f58.
42
43
44
45 Kafetsios K (2004) Attachment and emotional intelligence abilities across the life
46
47 course. *Personality and Individual Differences* 37(1). Pergamon: 129–145. DOI:
48
49 10.1016/J.PAID.2003.08.006.
50
51
52
53 Kool MB, van Middendorp H, Boeije HR, et al. (2009) Understanding the lack of
54
55 understanding: invalidation from the perspective of the patient with fibromyalgia.
56
57 *Arthritis and rheumatism* 61(12): 1650–6. DOI: 10.1002/art.24922.
58
59
60
60

1
2
3 Psychosomatic Medicine, Part II: Clinical Applications and Implications for
4
5 Research. *Psychosomatic Medicine* 71(2): 135–151. DOI:
6
7 10.1097/PSY.0b013e318198a11f.
8
9

10 Lopes PN, Salovey P, Côté S, et al. (2005) Emotion Regulation Abilities and the
11
12 Quality of Social Interaction. Petty RE (ed.) *Emotion* 5(1): 113–118. DOI:
13
14 10.1037/1528-3542.5.1.113.
15
16

17 Lumley MA (2010) The two views of emotion in psychosomatic research. *Journal of*
18
19 *psychosomatic research* 68(3). Elsevier: 219–21. DOI:
20
21 10.1016/j.jpsychores.2010.01.017.
22
23

24 Lumley MA, Cohen JL, Borszcz GS, et al. (2011) Pain and emotion: a biopsychosocial
25
26 review of recent research. *Journal of clinical psychology* 67(9): 942–68. DOI:
27
28 10.1002/jclp.20816.
29
30

31 MacCann C, Joseph DL, Newman DA, et al. (2014) Emotional intelligence is a second-
32
33 stratum factor of intelligence: Evidence from hierarchical and bifactor models.
34
35 *Emotion* 14(2): 358–374. DOI: 10.1037/a0034755.
36
37

38 Martins A, Ramalho N and Morin E (2010) A comprehensive meta-analysis of the
39
40 relationship between Emotional Intelligence and health. *Personality and Individual*
41
42 *Differences* 49(6): 554–564. DOI: 10.1016/j.paid.2010.05.029.
43
44

45 Mas AJ, Carmona L, Valverde M, et al. (2008) Prevalence and impact of fibromyalgia
46
47 on function and quality of life in individuals from the general population: results
48
49 from a nationwide study in Spain. *Clinical and experimental rheumatology* 26(4).
50
51 2008/09/19.: 519–26.
52
53

54 Mayer JD and Salovey P (1997) What is emotional intelligence? In: Salovey P and
55
56 Sluyter DJ (eds) *Emotional Development and Emotional Intelligence: Educational*
57
58
59
60

1
2
3 *Implications BT - Emotional Development and Emotional Intelligence:*

4
5 *Educational Implications*. Basic Books, New York, NY, p. 3–34, Chapter xvi, 288

6
7
8 Pages.

9
10 Mayer JD, Caruso DR and Salovey P (2000) Selecting a measure of emotional
11
12 intelligence: The case for ability scales. In: *The Handbook of Emotional*
13
14 *Intelligence: Theory, Development, Assessment, and Application at Home, School,*
15
16 *and in the Workplace*. San Francisco, CA, US: Jossey-Bass, pp. 320–342.

17
18
19
20 Mayer John D, Salovey P and Caruso DR (2008) Emotional intelligence: New ability or
21
22 eclectic traits? *American Psychologist* 63(6). Department of Psychology,
23
24 University of New Hampshire, Durham, NH, US jack.mayer@unh.edu;
25
26 Department of Psychology, Yale University, New Haven, CT, US ; Mayer, John
27
28 D., 10 Library Way, Durham, US, 03824, Department of Psychology, University of
29
30 New Hampshire, ja: American Psychological Association: 503–517. DOI:
31
32 <http://dx.doi.org/10.1037/0003-066X.63.6.503>.

33
34
35
36 Mayer John D., Roberts RD and Barsade SG (2008) Human Abilities: Emotional
37
38 Intelligence. *Annual Review of Psychology* 59(1). Annual Reviews : 507–536.
39
40 DOI: 10.1146/annurev.psych.59.103006.093646.

41
42
43
44 Mayer John D, Salovey P, Caruso DR, et al. (2016) [*The Spanish language adaptation*
45
46 *of the Mayer-Salovey-Caruso emotional intelligence test, MSCEIT*]. Madrid: Tea.

47
48
49 Mayer John D., Caruso DR and Salovey P (2016) The Ability Model of Emotional
50
51 Intelligence: Principles and Updates. *Emotion Review* 8(4). SAGE
52
53 PublicationsSage UK: London, England: 290–300. DOI:
54
55 10.1177/1754073916639667.

56
57
58 Melzack R and Casey KL (1968) Sensory, motivational and central control
59
60

- determinants of pain: a new conceptual model. *The skin senses* 1. Springfield, IL.
- Mikolajczak M and Van Belleghem S (2017) Increasing emotional intelligence to decrease healthcare expenditures: How profitable would it be? *Personality and Individual Differences* 116: 343–347. DOI: 10.1016/j.paid.2017.05.014.
- Montoya P, Larbig W, Braun C, et al. (2004) Influence of social support and emotional context on pain processing and magnetic brain responses in fibromyalgia. *Arthritis & Rheumatism* 50(12): 4035–4044. DOI: 10.1002/art.20660.
- Pisner DA, Smith R, Alkozei A, et al. (2017) Highways of the emotional intellect: white matter microstructural correlates of an ability-based measure of emotional intelligence. *Social Neuroscience* 12(3): 253–267. DOI: 10.1080/17470919.2016.1176600.
- Quartana PJ, Campbell CM and Edwards RR (2009) Pain catastrophizing: a critical review. *Expert Review of Neurotherapeutics* 9(5): 745–758. DOI: 10.1586/ern.09.34.
- Ruiz-Aranda D, Salguero JM and Fernández-Berrocal P (2010) Emotional regulation and acute pain perception in women. *The journal of pain : official journal of the American Pain Society* 11(6): 564–9. DOI: 10.1016/j.jpain.2009.09.011.
- Ruiz-Aranda D, Salguero JM and Fernández-Berrocal P (2011) Emotional intelligence and acute pain: the mediating effect of negative affect. *The journal of pain : official journal of the American Pain Society* 12(11): 1190–6. DOI: 10.1016/j.jpain.2011.06.008.
- Segura-Jiménez V, Aparicio VA, Álvarez-Gallardo IC, et al. (2014) Validation of the modified 2010 American College of Rheumatology diagnostic criteria for fibromyalgia in a Spanish population. *Rheumatology (Oxford, England)* 53(10).

1
2
3 England: 1803–11. DOI: 10.1093/rheumatology/keu169.
4

5
6 Segura-Jiménez V, Álvarez-Gallardo IC, Carbonell-Baeza A, et al. (2015) Fibromyalgia
7
8 has a larger impact on physical health than on psychological health, yet both are
9
10 markedly affected: the al-Ándalus project. *Seminars in arthritis and rheumatism*
11
12 44(5): 563–70. DOI: 10.1016/j.semarthrit.2014.09.010.
13
14

15
16 van Middendorp H, Lumley MA, Moerbeek M, et al. (2010) Effects of anger and anger
17
18 regulation styles on pain in daily life of women with fibromyalgia: a diary study.
19
20 *European journal of pain (London, England)* 14(2). England: 176–182. DOI:
21
22 10.1016/j.ejpain.2009.03.007.
23
24

25
26 Vincent A, Whipple MO and Rhudy LM (2016) Fibromyalgia Flares: A Qualitative
27
28 Analysis. *Pain medicine (Malden, Mass.)* 17(3): 463–468. DOI:
29
30 10.1111/pme.12676.
31

32
33 Wolfe F (2017) Criteria for fibromyalgia? What is fibromyalgia? Limitations to current
34
35 concepts of fibromyalgia and fibromyalgia criteria. *Clinical and experimental*
36
37 *rheumatology* 35 Suppl 1(3): 3–5. Available at:
38
39 <http://www.ncbi.nlm.nih.gov/pubmed/28406762> (accessed 15 February 2019).
40
41

42
43 Wolfe F, Smythe HA, Yunus MB, et al. (1990) The American College of Rheumatology
44
45 1990 Criteria for the Classification of Fibromyalgia. Report of the Multicenter
46
47 Criteria Committee. *Arthritis and rheumatism* 33(2). 1990/02/01.: 160–172. DOI:
48
49 10.1002/art.1780330203.
50

51
52 Wolfe F, Clauw DJ, Fitzcharles M-A, et al. (2016) 2016 Revisions to the 2010/2011
53
54 fibromyalgia diagnostic criteria. *Seminars in Arthritis and Rheumatism* 46(3): 319–
55
56 329. DOI: 10.1016/j.semarthrit.2016.08.012.
57
58

59
60 Wranik T, Barrett LF and Salovey P (2007) Intelligent emotion regulation. *Handbook of*

1
2
3 *emotion regulation*. Guilford: 393–428.
4

5
6 Zunhammer M, Halski A, Eichhammer P, et al. (2015) Theory of Mind and Emotional
7

8 Awareness in Chronic Somatoform Pain Patients. Montazeri A (ed.) *PLOS ONE*
9

10 10(10). Public Library of Science: e0140016. DOI: 10.1371/journal.pone.0140016.
11
12
13
14
15
16
17
18
19
20
21
22
23
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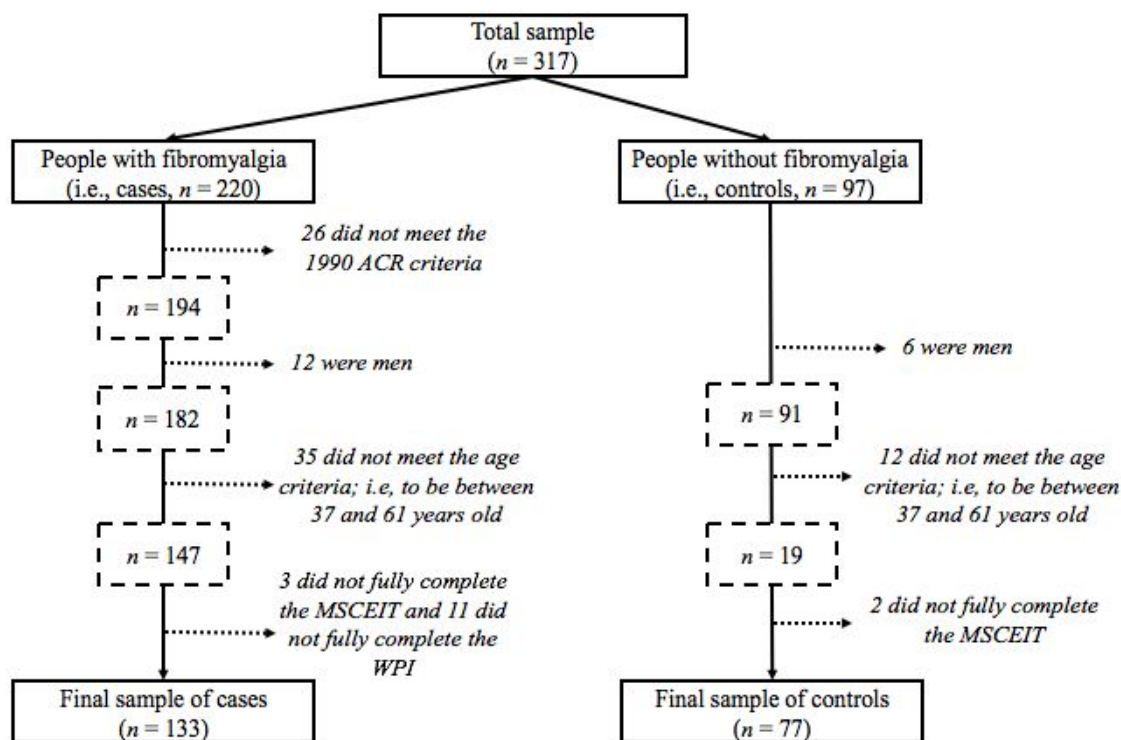


Figure 1. Participants' flowchart of the present study

ACR, American College of Rheumatology; MSCEIT, the Mayer-Salovey-Caruso

Emotional Intelligence Test; WPI, Widespread Pain Index

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Table 1. Characteristics of the participants (n = 210)

Characteristics	Fibromyalgia (n = 133)		Controls (n = 77)		p-value	Effect size
Age (years old) [37-61]	50.9	(6.2)	50.1	(5.3)	.306	.14
Emotional intelligence (MSCEIT) [65-135]						
Overall emotional intelligence	104.8	(20.8)	108.2	(20.3)	.254	.17
Emotion perception	104.4	(14.5)	100.9	(15.2)	.106	.23
Emotion facilitation	100.7	(21.0)	100.0	(17.6)	.805	.04
Emotion understanding	88.1	(11.7)	95.2	(14.6)	< .001	.57
Emotion management	94.4	(16.0)	98.1	(14.6)	.093	.24
Widespread pain (WPI) [0-19]	13.7	(3.5)				
Pain catastrophizing (PCS) [0-52]	24.4	(11.9)				

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4 Means (standard deviations) are presented unless otherwise indicated. p -value based on t -test (continuous data) or χ^2 (categorical data). Effect
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6 size based on Cohen's d . MSCEIT, the Mayer-Salovey-Caruso Emotional Intelligence Test; WPI, the Widespread Pain Index; PCS, the Pain
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Table 2. Individual associations of emotional intelligence (MSCEIT) and widespread pain (WPI) in people with fibromyalgia (n = 133)

Criterion variable	<i>b</i>	SE	β	Δ Adj. R^2
Overall emotional intelligence [65-135]	-0.03	0.02	-.19 *	.03 *
Emotion perception [65-135]	-0.05	0.02	-.19 *	.03 *
Emotion facilitation [65-135]	-0.03	0.02	-.19 *	.03 *
Emotion understanding [65-135]	-0.01	0.03	-.04	-.01
Emotion management [65-135]	-0.05	0.02	-.21 *	.04 *

All the analyses were adjusted for Pain Catastrophizing (by means of the PCS, the Pain Catastrophizing Scale [0-52]), which was entered in a first step ($b = 0.07$, $SE = 0.03$, $\beta = .22$, $p = 0.01$, Δ Adj. $R^2 = .04$, $p = 0.01$).

b, unstandardized regression coefficient; β , standardized regression coefficient with significance levels of *t*; SE, standard error; Δ Adj. R^2 , change in adjusted R^2 with significance levels on *F*-change; MSCEIT, the Mayer-Salovey-Caruso Emotional Intelligence Test; WPI, Widespread Pain Index.

* $p < .05$.

Table 3. Independent associations of emotional intelligence (MSCEIT) and widespread pain (WPI) in people with fibromyalgia (n = 133)

Criterion variable	<i>b</i>	SE	β	Δ Adj. R^2
Step 1				
Emotion perception [65-135]	-0.06	0.02	-.24 **	.05 **
Step 2				
Emotion management [65-135]	-0.04	0.02	-.18 *	.02 *

Pain catastrophizing and emotional intelligence (i.e. perception, facilitation, understanding, and management) were entered as independent variables using forward stepwise methods. *b*, unstandardized regression coefficient; β , standardized regression coefficient with significance levels of *t*; SE, standard error; Δ Adj. R^2 , change in adjusted R^2 with significance levels on *F*-change; MSCEIT, the Mayer-Salovey-Caruso Emotional Intelligence Test; WPI, Widespread Pain Index.

* $p < .05$; ** $p < .01$.