The potential buffering role of soothers on the association between threats and the severity of somatic symptoms in individuals with fibromyalgia

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Master thesis Clinical Psychology

February 3rd, 2021

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Word count: 4165

Abstract

Introduction: According to the integrative model of fibromyalgia by Pinto et al. (2020b) that is based on the affect regulation model of Paul Gilbert, fibromyalgia is a result of an imbalance between the 'threat' and 'soothing' system. Literature suggests that threats can aggravate pain severity and that soothers may alleviate pain severity. The aim of this study was to examine whether threats and soothers, and the interaction between the two were associated with the severity of physical symptoms in fibromyalgia patients. It was predicted that threats would be positively associated with the severity of physical symptoms, that soothers would be negatively associated with the severity of physical symptoms and the effect of threats on the severity of physical symptoms would be reduced with a higher level of soothers.

Methods: In total, 427 patients participated in this study, 404 female and 23 male with a mean age of 49.3 years of which 380 patients were included in the analyses because of missing values. Factor analysis was used to obtain a structured overview of the soothers and threats that were measured with a newly developed questionnaire. Multiple regression analyses was used to measure the association between the severity of symptoms measured by Patient Health Questionnaire (PHQ-15) scores and the threats and soothers. Age was included as a covariate. A moderation analysis was conducted to examine whether the association between threats and somatic symptom severity was moderated by soothers.

Results: A positive association between threats and the severity of physical symptoms was found. There was no association between soothers and the severity of physical symptoms. In addition, soothers did not moderate the relationship between threats and the severity of physical symptoms.

Conclusion: The current study provides support for the relationship between threats and somatic symptom severity. However, there is no support for the association between soothers and the severity of somatic symptoms or a buffering role of soothers in the relationship between threats and somatic symptom severity. More work needs to be done researching this clinically relevant potential buffering role of soothers in the relationship between threats and somatic symptom severity in individuals with fibromyalgia.

Keywords: fibromyalgia, somatic symptoms, soothers, threats

1. Introduction

Fibromyalgia (FM) is a chronic rheumatic pain disorder, characterized by diffuse tenderness and widespread musculoskeletal pain and often accompanied by impaired cognitive, emotional, and physical functioning (Vago & Nakamura, 2011; Weissbecker et al., 2002). The Central Nervous System (CNS) seems to play a crucial role in fibromyalgia (Feliu-Soler et al., 2016). Chronic widespread pain, the defining feature of fibromyalgia is considered neurogenic in origin. As a result of neurochemical imbalances in the CNS that lead to central amplification of pain perception characterized by heightened sensitivity to stimuli that are not normally painful and can increase response to painful stimuli (Clauw et al., 2011; Casale et al., 2019). Despite their limited advantages, medications are often prescribed as a treatment for FM (Perez-Aranda et al., 2019). Given the lack of effective treatments available for patients with FM, other factors, like psychosocial factors may play important roles in pain (Cherkin et al., 2016). Neuropsychological studies indicate that psychosocial factors can amplify physical symptoms (Pinto et al., 2020b) and that positive psychosocial factors can mitigate physical symptoms by dampening the sensitized brain. Therefore, a framework that integrates these psychosocial factors to guide the development of effective interventions, is needed.

Pinto et al. (2020b) provided such a theoretical framework based on Gilbert's model of affect regulation (2005), which states that there are three affect regulation systems that seem to modulate the neural activity of somatic symptoms. These include threats, drive, and soothing systems. The threat system detects impending threats quickly and promotes defensive actions to potentially threatening stimuli. When the threat system is activated, we tend to focus more on negative emotions (Gilbert, 2014). The drive system is a motivational system that drives us towards the things we want or need (Gilbert, 2014). The soothing system is associated with feelings of safety, calm, peace, and content (Gilbert, 2014). Pinto et al. (2020b) propose that fibromyalgia is the result of an imbalance between an overactive threat system and an underactive soothing system. The current study will focus only on the threat and soothing systems.

Threats can vary in nature and source and include social, sensory, external, and internal threat signals (Gilbert, 2005). These are vulnerability factors such as distress, trauma, fear, and catastrophizing (Clauw et al., 2019). They can aggravate pain and pain-related outcomes. Stress is a threat (or perceived threat) caused by a stressor to the equilibrium (Van Houdenhove, 2005). Some researchers consider stress to play an important role in the

maintenance and or exacerbation of fibromyalgia (Malin, 2016; Van Houdenhove et al., 2004). There are tentative findings that support the notion that widespread pain in fibromyalgia can be augmented by stress (Pinto, 2020b). This is supported by a study of Zautra and colleagues (1999). They argue that perceived stress in women with fibromyalgia was associated with more pain. Psychological distress has been shown to precede musculoskeletal pain (Bergman, 2005). Also, pain severity was higher when patients had a more negative affect and catastrophize (Kermit et al., 2000). In the current study, this association between the severity of threats and the severity of physical symptoms will be investigated in relation to the strength of soothers.

Soothers are resilience factors that have a protective factor that makes people less vulnerable to future adverse life events (Casale et al., 2019). The same stressor can have different effects on people with different resilience factors. In the current study, resilience is defined as ability of people with FM to adapt to threats. Potential soothers are optimism, cognitive reappraisal, active coping, humor, perceived social support, pro-social behavior, religiousness, and mindfulness (Casale et al., 2019). Literature suggests that these may diminish pain and pain-related outcomes (Clauw et al., 2019). A lot of research has been done concerning social support and mindfulness. Mindfulness has been indicated to reduce pain and symptom severity (Vago & Nakamura, 2011). For example, mindfulness improved pain and somatic complaints (Rosenzweig, 2010). Pinto and colleagues (2020b) found an association between social support and the severity of physical symptoms. Moreover, Che and colleagues (2018) stated that social support is associated with less pain experience. Social support has positive effects on the severity of pain (Gündüz et al., 2019). So, threats and soothers might influence the severity of physical symptoms in fibromyalgia. This study will not only focus on social support and mindfulness but soothers in general. The idea behind this is that there are individual differences between patients and people differ in which factors are soothing for them.

Buffers, like soothers, lessen the perception of threat and may reduce the stress response. This may lead to less symptom severity (Kermit et al., 2000). There is evidence that probably through its soothing influence, social support has a buffering effect against the severity of physical symptoms (Pinto et al., 2020b). Moreover, the interaction between stress and (social) support is also associated with less pain (Ché et al., 2018). Many patients with fibromyalgia are considered to have limited ability to recruit adaptive resources, such as active coping, optimism, and social support (Pinto et al., 2020b; Estévez-López et al., 2017). Given the lack of effective pharmacological treatment for chronic pain conditions like

fibromyalgia, there is a need for new therapeutic interventions focused on soothing factors instead of threats (Pinto et al., 2020a). Soothing factors are important targets in interventions since they may be less rooted and more adjustable (Clauw et al., 2019). The soothing system may weaken the toxic effects of threats and thereby plays a crucial role in coping and threat appraisal (Gilbert, 2014). Therefore, it is important to investigate if soothers are potentially buffering factors in the effects of threats on the severity of physical symptoms.

Preliminary studies about threats and soothers were conducted in the previous research group. This study consisted of an online study and a concept mapping study where 40 threats, 40 soothers, and 40 drives were derived that may influence persistent physical symptoms (Geenen et al., 2020). However, a study is needed in which participants score the strength of threats, soothers and drives at a questionnaire. This makes it possible to derive coherent dimensions that differentiate between individuals. The taxonomy can then be used to screen patients for factors that might be relevant targets in therapy. In this study, there will be the first exploration of the validity of a newly developed questionnaire to measure threats and soothers.

This research aims to investigate the association of perceived strength of soothers and severity of threats with the severity of physical symptoms in people with fibromyalgia, to expand research addressing concepts of threat and soothing and their relevance in patients with fibromyalgia. The following research questions will be answered in this thesis: Are the strengths of threats and soothers associated with the severity of physical symptoms? Can soothers buffer the association between threats and the severity of symptoms? Based on the literature, the following hypothesis have been drawn up. First, it was hypothesized that threats are positively associated with the severity of physical symptoms. Secondly, it was predicted that soothers are negatively associated with the severity of physical symptoms. Lastly, it was predicted that the association of threats with the severity of physical symptoms will be lower if the level of soothers is higher. This means that while there may be a strong relationship between the severity of threats and the severity of physical symptoms among those with low levels of soothers, among those with a high level of soothers, the effect of threats on the severity of physical symptoms may be reduced.

2. Methods
2.1. Procedure and design

This study builds on a concept mapping done by a project group at Utrecht University (Geenen et al., 2020). This research group did an online survey study and a concept mapping study where 40 threats, 40 soothers and 40 drives were derived that may influence persistent physical symptoms. These threats, soothers, and drives were sorted in clusters and the participants had to indicate how important the threat, soother, or drive was for them. This forced sorting procedure, where even numbers of 8 cards had to be placed on the 5 importance piles, could not be used to derive dimensions.

The design of the current study is cross-sectional and observational. The study was approved by the Ethics Committee of the Faculty of Social and Behavioural Sciences of Utrecht University (20-0295). Participants were invited for an online survey via recruitment through social media such as Facebook and internet pages of different patient associations. The data of this research is collected from November 11th, 2020 until December 4th, 2020. The data collection continued beyond this date.

2.2. Participants

Participants in this study were individuals with fibromyalgia. There were two inclusion criteria: all participants had to be 18 years of older and participants needed to have chronic pain, fatigue or other persistent physical symptoms. This was tested by self-report questionnaires. Recruitment was done through social media, such as Facebook and websites of patient associations. Participants could click on a link, which brought them to the Qualtrics questionnaire. They had to read the information letter and give informed consent before starting the questionnaire. Participation was fully anonymous, and they could stop the questionnaire at any point if they desired. The research group consisted of eight master students Clinical Psychology and Prof. Dr. Rinie Geenen.

2.3. Instruments/measures

Demographics

Participants filled in diverse demographic basics such as, gender, age, relationship status, education level, diagnosis of disease, who diagnosed the disease and if the participant had any other diseases.

Threats, soothers and drives

For measuring the threats, soothers and drives, a questionnaire was composed: the TSD-questionnaire. This questionnaire consists of three separate questionnaires about soothers, threats and drives and consisted of 40 items each. These questionnaires were based on the results of a preliminary study (Geenen et al., 2020). In the current study, only the questionnaires about the threats and soothers were used. The participants had to indicate to what extend the following drives, threats and soothers influenced their life on a 4-point Likert scale, ranging from 1 ("not"), 2 ("a little"), 3 ("moderate") and 4 ("a lot"). The internal consistency of the questionnaires for "threats" and "soothers" in current study were $\alpha = .94$ and $\alpha = .92$, respectively (across 40 items of the questionnaire).

Severity of somatic symptoms

Severity of somatic symptoms was measured with the PHQ-15 questionnaire (Kroenke, Spitzer & Williams, 2002). The PHQ-15 consists of 15 somatic symptoms that account for more than 90% of the physical symptoms reported in the outpatient setting. The participants were asked to rate the severity of each symptom during the past four weeks as 0 ("not bothered at all"), 1 ("bothered a little") and 2 ("bothered a lot"). The total score range of 0 to 30. The cut-off points are 5, 10, and 15, which are represented for low, medium and high somatic symptom severity (Kroenke et al., 2002). In the current study a cut off score of ≥ 10 was used to reflect medium and high somatic symptom severity. The PHQ-15 is a valid and reliable questionnaire, with a test-retest reliability of .80 (Van Ravesteijn et al., 2009). The Cronbach's coefficient in the current study was $\alpha = .68$.

2.4. Data analysis

All data was analyzed using the Statistical Package for the Social Sciences (SPSS, version 26). A $p < .05$ was considered significant for all test statistics conducted in this study. Before the analyses, missing data values were excluded. Then descriptive statistics were computed. Principal axis factoring with a skewed rotation (direct oblimin) was used to derive the factors of the threats and soothers. The number of factors was determined using the minimum eigenvalue criterion > 1, the scree plot of eigenvalues, and the pattern of factor loadings (Field, 2009). Criteria for excluding an item from the questionnaire was a factor loading < .45 on any single factor or a loading > .32 on two or more factors (Van Leeuwen et al., 2016). The internal consistencies of the final dimensions of the soothers and threats were calculated using Cronbach's α coefficients.

Prior to interpreting the results of the regression analysis, it was checked with Pearson's correlation whether potential covariates (i.e., sex, age, educational level, relationship status) were significantly associated with PHQ-15 scores. The covariate age was included in the regression analyses, because it was significantly associated with PHQ-15 scores. Dummy variables were created for age (Table 1). The dummy created for 'young' was used for patients with an age equal or lower than 30 years. The dummy created for 'middle' was used for patients with an age between 31 and 60. Lastly, a dummy was created for 'old' for patients with an age higher than 60 years. The 'middle' category was used as reference and not included in the analyses. The assumptions of multicollinearity, normality, linearity and homoscedasticity of residuals were evaluated for each analysis.

To estimate the association between threats and somatic symptom severity as measured by total PHQ-15 score, a multiple regression analysis was performed in the patients with fibromyalgia. Also, a multiple regression analysis was performed to estimate the association between soothers and somatic symptom severity as measured by total PHQ-15 score. To test the hypothesis whether the association between threats and somatic symptom severity is moderated by soothers, a moderation analysis using the PROCESS Macro Model v3.4 (Hayes, 2013) was conducted.

Table 1

Frequencies for dummy variables of age

	F (0)	F (1)	N
D_1 young	398	29	427
D_2 middle	101	326	427
D_3 old	355	72	427

Note. F(0) = number of participants not included in the dummy, F(1) = number of participants included in the dummy.

3. Results

3.1 Participants

In total 520 participants participated in this study of which 427 participants with fibromyalgia were selected for analysis. Only 380 participants participated in the factor analysis because of missing values. The demographic characteristics of participants are shown in Table 2. The average age of the participants was 49.3 years old (*SD* = 11.93). The PHQ-15 results for individuals with fibromyalgia showed a minimum score of 4 (low severity) and a maximum of 25 (high severity). The mean PHQ-15 score was 13.94 (*SD* = 3.99), which is closer to high than medium symptom severity (Kroenke et al., 2002).

Table 2

Characteristics of participants with fibromyalgia (*N* = 427)

Age, mean (*SD)* years	49.3 (11.93)
Sex, *n* (%)	
Female	404 (94.6)
Male	23 (5.4)
Education level, *n* (%)	
Low	122 (28.6)
Not low	298 (69.8)
Other	7 (1.6)
Relationship status, *n* (%)	
Single	103 (24.1)
In a relationship	318 (74.5)
Other	6 (1.4)
Diagnosis by, *n* (%)	
Medical specialist	394 (92.3)
General practitioner	24 (5.6)
Other health professional	5 (1.2)
Myself	2 (0.5)
Other	2 (0.5)
PHQ-15 score, mean (*SD*)	13.94 (3.99)

3.2 Factor analyses

Factor analysis of the 40 items for the soothers and threats questionnaires was performed in the fibromyalgia group. The factor analysis yielded a Kaiser-Meyer-Olkin measure (KMO) of .908 for the soothers and .930 for the threats. This indicated that the factor analysis yields distinct and reliable factors (Field, 2009). The Bartlett's test of sphericity was significant for both soothers ($\chi^2 = 5367.08$, $p < .001$) and threats ($\chi^2 = 7353.95$, $p < .001$). Thus, factor analyses were appropriate. Table 3 shows the factor loadings (pattern matrix) for the threats of the individuals with fibromyalgia. The scree plot of eigenvalues for the threats was ambiguous and showed inflexions that would justify retaining either 1 or 4 factors. We retained four, because of the large sample size and the convergence of the scree plot and Kaiser's criterion on this value. Four factors had eigenvalues over Kaiser's criterion of 1 and in combination explained 47.49% of the variance. The four factors were labelled Social threats, Weather, Physical demands and Exceeding boundaries. 15 of the 40 items were deleted, because of the factor loadings < .45 or cross loadings > .32. The psychometric properties of the final 25-item questionnaire for the threats are shown at the bottom of Table 3. For the four dimensions the Cronbach's α were ≥ .73, which was considered acceptable (Cronbach, 1951).

Table 4 shows the results for the principal axis factoring of the soothers of the individuals with fibromyalgia. The scree plot of eigenvalues showed inflexion that would justify retaining 1 – 5 factors. However, choosing more than four factors resulted in one of the factors having no items with factor loadings > .45. Because of this reason four factors were retrained for the soothers. The four factors had eigenvalues over Kaiser's criterion of 1 and in combination explained 40.22% of the variance. The four factors were labelled Balanced life, Social support, Self-care and Mindfulness. Twenty-one of the 40 items were deleted, because of the factor loadings < .45 or cross loadings > .32. The psychometric properties of the final 19-item questionnaire for the soothers are shown at the bottom of Table 4. For one of the four dimensions the Cronbach's α was .55. This was considered poor. The other three factors had a Cronbach's α ≥ .73, which was considered acceptable (Cronbach, 1951).

Table 3

Pattern Matrix Threats (*N = 380*)

Items	Factor loadings			
	Factor			
	1	2	3	4
Social threats				
14) Memory of a negative past event	**.87**	.02	.03	.22
32) A negative thought	**.85**	-.10	-.01	.08
23) A negative life event	**.81**	-.03	-.04	.06
16) Feeling sad or helpless	**.81**	-.03	-.10	.10
24) Being angry	**.79**	-.05	.01	-.05
12) Having worries	**.68**	.06	.08	-.17
18) Getting negative judgments or comments	**.67**	-.00	-.02	-.08
27) An argument	**.66**	-.04	.07	-.23
29) Feeling lonely	**.65**	-.03	-.12	.07
07) A situation that triggers irritation or anger	**.61**	.09	-.04	-.08
33) An expectation that I cannot live up to	**.61**	-.05	-.19	-.06
19) Lack of understanding from others	**.54**	.05	-.14	-.06
17) Social pressure	**.54**	-.05	-.11	-.25
40) Being perfectionistic*	.41	.06	.02	-.18
31) Doing nothing*	.36	.01	.04	-.18
15) Stimuli, such as noises, scents, bright lights or radiation*	.31	.03	-.16	-.19
08) Food that is not good for me*	.30	.11	.04	-.05
11) Being physically not active*	.23	.15	-.06	-.18
37) Substances such as alcohol, cigarettes of softdrugs*	.13	.05	-.10	-.11
Weather				
06) An abrupt change in weather	-.08	**.92**	.02	-.03
20) A weather circumstance, such as temperature or humidity	-.04	**.89**	-.08	.03
Physical demands				
36) A common physical activity such as walking or cycling	-.08	.05	**-.76**	.15
22) Physical effort	-.14	.01	**-.72**	-.16
30) A task at work or in the household, or an administrative task	.15	-.07	**-.56**	-.10
01) A social activity outside the home	-.03	-.05	**-.48**	-.20

Items				
39) Getting visitors at home*	.20	-.11	-.42	-.18
35) A change in daily routine*	.35	.01	-.40	.03
38) A physical symptom such as pain, fatigue or stiffness*	.04	.13	-.38	.01
09) Being unable to keep up in a group activity*	.17	.12	-.36	-.09
21) Getting inadequate care*	.21	.04	-.35	-.15
04) Using medication*	.13	.08	-.35	.13
34) Being out of energy*	.15	.06	-.26	-.20
Exceeding boundaries				
10) Little time to rest	-.04	.09	.02	**-.68**
26) Exceeding my limits	.14	.01	-.07	**-.58**
28) Having multiple activities scheduled	.03	-.06	-.21	**-.56**
13) Poor sleep	.05	.05	.04	**-.51**
03) Holding a certain posture for long	-.02	.03	-.09	**-.46**
02) Being stressed or tense	.32	-.06	-.01	**-.45**
05) Time pressure*	.33	.03	-.02	-.35
25) An inflammation, infection, flu or other disease activity*	.12	.17	-.07	-.33
Statistics final questionnaire				
Eigenvalue	12.88	2.54	1.97	1.62
% of variance explained	32.2	6.3	4.9	4.1
α	.94	.91	.73	.78

Note. Items with bold factor loadings were included in the factor. Extraction method:

principal axis factoring. Rotation method: Oblimin with Kaiser Normalization.

*items deleted because of a too low factor loading or too high cross loadings.

Table 4

Pattern Matrix Soothers (*N*= 370)

Items	Factor loadings			
	Factor			
	1	2	3	4
Balanced life				
33) To be in a secure and trusted environment	**.68**	-.20	-.13	-.10
15) A calm surrounding such as nature, one's own house, pleasurable sound and light	**.67**	-.01	-.09	.22
34) To remain within my limits or boundaries	**.60**	-.02	.17	-.12

16) A good balance between activities and relaxation	**.58**	-.02	.07	.16
08) Having the freedom to do something in the way I want to do it myself	**.56**	-.03	.01	.18
09) Consistency and structure	**.54**	.05	-.17	.09
22) To take a rest or a break	**.51**	-.04	.04	.18
30) Taking a comfortable posture	**.48**	-.18	.15	-.16
18) Healthy or good nutrition	**.47**	-.11	-.08	.21
37) Feeling recognized, understood, respected, loved, liked or important*	.44	-.19	.28	-.13
31) Being in a good mood*	.44	-.37	.07	-.10
36) Sleeping*	.44	.13	.33	-.02
32) Physical activity such as walking, cycling, gardening, Tai Chi or Qigong*	.40	-.09	.05	.16
28) Expressing myself to others and knowing that I'm not alone in all of this*	.31	-.30	.22	-.05
12) Understanding my disease*	.30	-.20	.16	-.06
35) Nice weather*	.30	-.06	.26	-.08
27) Being accompanied by or caring for pets*	.25	-.01	.12	-.02
02) Aids*	.18	-.16	.15	.03
Social support				
04) Doing a fun thing with family or friends	-.15	**-.77**	.02	.03
06) To be surrounded by lovely people	.00	**-.71**	-.05	.12
26) Receiving physical affection such as being caressed or getting a hug	.11	**-.53**	.27	-.04
05) A leisure activity	.12	**-.50**	-.21	.30
17) Having a good or positive conversation	.30	**-.47**	.03	.14
20) Seeing that people in my environment are happy and healthy*	.25	-.40	-.08	.08
23) Intimacy*	.13	-.37	.22	-.01
24) Having a positive mindset*	.31	-.34	.03	.09
11) Getting help from other people, such as kins or specialists*	.17	-.27	.18	.01
38) Drinking a yummy beverage, eating a treat or smoking a cigarette*	.18	-.26	.04	-.06
Self-care				
13) Getting a massage	-.08	.01	**.63**	.04
39) An activity in water	.03	-.08	**.48**	.01
29) Professional help	-.06	-.21	**.46**	.07
19) An alternative medicine such as osteopathy and reiki*	.07	.09	.39	.31
07) Warm temperature*	.23	.03	.35	.09
25) Talking to and sharing experiences with fellow sufferers*	.00	-.25	.25	.18

03) Medication that reduces disease activity or symptoms*	-.00	.01	.15	.03
Mindfulness				
21) A relaxation or breathing exercise such as yoga or meditation	.15	.07	.28	**.62**
01) Mindfulness	.23	-.02	.05	**.53**
40) Performing a spiritual or religious activity such as going to church or praying*	.02	-.08	.11	.27
14) Supplements*	.13	.02	.15	.24
10) Something that cools me down*	-.03	-.07	-.01	.17
Statistics final questionnaire				
Eigenvalue	10.67	1.96	1.78	1.68
% of variance	26.7	4.9	4.5	4.2
α	.85	.81	.55	.73

Note. Items with bold factor loadings were included in the factor. Extraction method: principal axis factoring. Rotation method: Oblimin with Kaiser Normalization.

*items deleted because of a too low factor loading or too high cross loadings.

3.2 Correlation analyses

Pearson's correlation indicated that only age had an association with the severity of physical symptoms (r = -.16, p = 001). Neither gender (r = .03, p = .63), education level (r = -.00, p = .94) nor relationship status (r = -.08, p = .13) were significantly associated with the severity of physical symptoms. So only age was included as a covariate in the regression analyses.

3.3. Association mean total threat scores and somatic symptom severity (PHQ-15)

Only the relationship between total PHQ-15 scores and age was significant, so age was included as a covariate. The assumption of multicollinearity, normality, linearity and homoscedasticity of residuals were met. A multiple regression analysis using the "enter" method showed that threats and 'young' and 'old' explained a significant amount of the variance in the severity of somatic symptoms ($F(3,367) = 27.021$, $p < .001$, with an R^2 of .177. A young age did not significantly predict the value of somatic symptom severity (b= .07, t (379) = 1.489, p = .137). Likewise, an older age did not significantly predict the value of somatic symptom severity (b = -.034, t (379) = -.714, p = .475). The level of threats did significantly predict somatic symptom severity (b = .401, t (379) = 8.370, $p < .001$). A higher level of threats was related to higher levels of somatic symptom severity.

3.4. Association mean total soother scores and somatic symptom severity (PHQ-15)

The assumption of multicollinearity, normality, linearity and homoscedasticity of residuals were met. A multiple regression analysis using the "enter" method showed that soothers and 'young' and 'old' explained a significant amount of the variance in the severity of somatic symptoms ($F(3,366) = 2.921$, $p = .034$, with an R^2 of .023. The analysis showed that a young age did not significantly predict the value of somatic symptom severity ($b = .094$, $t(369) = 1.811$, $p = .071$). However, an older age did significantly predict the value of somatic symptom severity ($b = -.105$, $t(369) = -2.005$, $p = .046$. The level of soothers did not significantly predict the somatic symptom severity ($b = -.017$, $t(369) = -.331$, $p = .741$). This indicated that soothers were not a significant predictor of somatic symptom severity.

3.5. Association threats and somatic symptom severity (PHQ-15) moderated by soothers

In moderator analysis, the main effect for threats was significant, indicating that the higher the threat value, the higher the severity of somatic symptoms ($b = 2.86$, $t(365) = 8.786$, $p < .001$). The main effect for soothers was also significant, indicating that the higher the soothing value, the lower the severity of somatic symptoms ($b = -.882$, $t(365) = -2.465$, $p = .014$). The interaction effect was not significant, which means that the association between threats and the severity of somatic symptoms is not moderated by soothers ($b = -.59$, $t(365) = -1.038$, $p = .30$). The control variables were also not significant. The results are showed in Table 5. Figure 1 shows this interaction.

Table 5

Linear model of predictors of somatic symptom severity

	B		SE B	t	p
Constant	13.88	[13.45, 14.32]	.22	63.33	$p < .001$
Mean_T*	2.86	[2.22, 3.50]	.33	8.79	$p < .001$
Mean_S*	-.88	[-1.59, -.18]	.36	-2.47	$p = .014$
Interaction T x S	-.59	[-1.70, .53]	.57	-1.04	$p = .30$
Young**	.94	[-.53, 2.42]	.75	1.26	$p = .21$
Old**	-.15	[-1.18, .87]	.52	-.29	$p = .77$

Note. $R^2 = .44$.

*T= Threats, S= Soothers

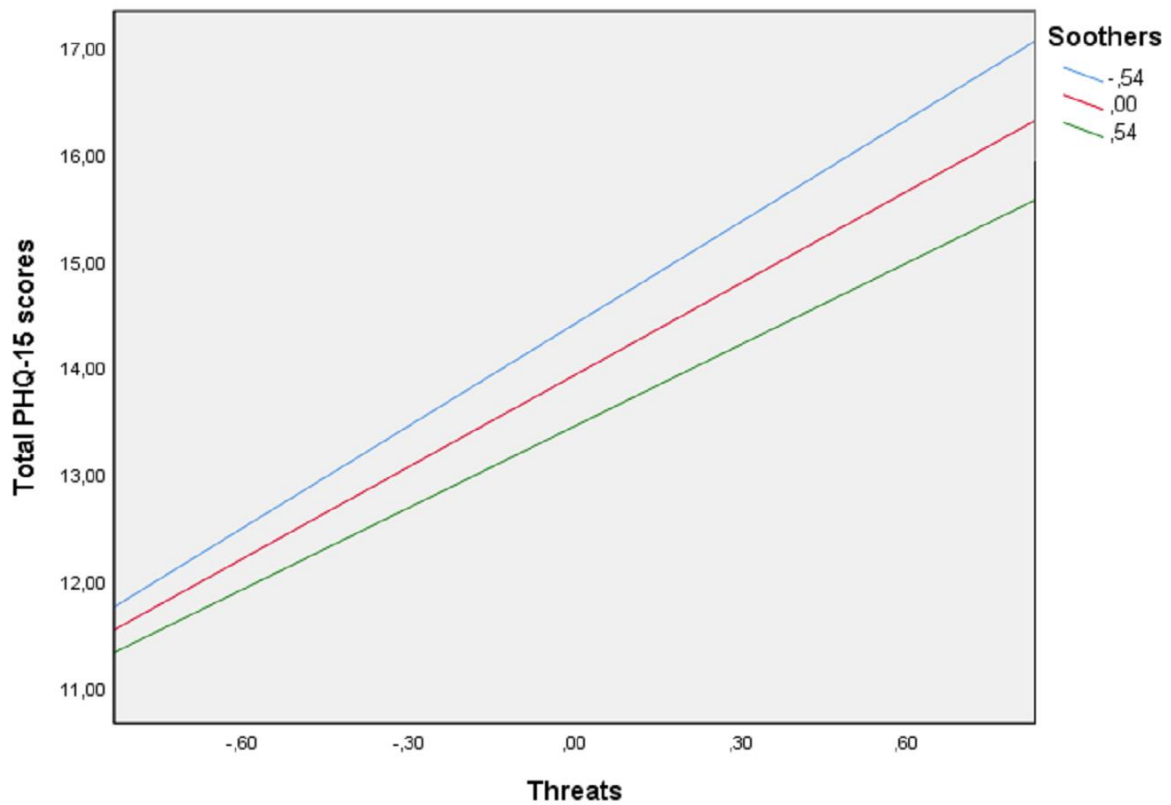** Young = ≤30 years, Old = > 60 years

Figure 1

Plot of the severity of somatic symptoms (PHQ-15) as a function of scores on threats and low (blue), mean (red) and high (green) scores on soothers.

Note. This figure suggests that participants who have a low threat score and a high soother score have a lower symptom severity (PHQ-15) than participants who have high threats score and a lower soother score. However, the interaction was not significant.

4. Discussion

This study investigated the association of perceived strength of soothers and severity of threats with the severity of physical symptoms in people with fibromyalgia. Multiple regression analysis showed that threats were significantly associated with the severity of physical symptoms, whereby a higher level of threats was associated with a lower level of symptom severity. The level of soothers was not significantly associated with symptom severity. A moderation analysis showed that the association between threats and the severity of physical symptoms was not moderated by soothers. Therefore, the hypothesis that soothers might buffer the adverse effects of threats on the severity of physical symptoms was rejected.

Consistent with research into the association between threats and pain severity, the current study predicted and found that with a higher level of threats, patients with fibromyalgia have a higher physical symptom severity (Pinto et al., 2020b; Zautra et al., 1999). A suggestion for future research is that it should be investigated which threat dimensions specifically are related to somatic symptom severity as the current study only looked at the mean total threat score of patients with fibromyalgia.

Previous research into soothers and pain severity suggests that a higher level of soothers is associated with lower symptom severity (Casale et al., 2019; Clauw et al., 2019; Vago & Nakamura, 2011). Contrary to these results, no significant association between soothers and the severity of physical symptoms were shown. Therefore, the hypothesis was rejected. A possible explanation for this could be that the items included in the total questionnaire of the soothers may account for the lack of effect. Not all items were included in the final soother questionnaire and a dimension with a relatively low Cronbach's alpha was included in the analysis. Also, perhaps if separate dimensions of soothers dimensions were examined in relation to the somatic symptom severity, the results would be different. The dimensions that emerged of the factor analysis of the soothers were "balanced life", "social support", "mindfulness" and "self-care". From the literature, it is already known that social support has positive effects on the severity of pain (Che et al., 2018; Günduz et al., 2019). Also, mindfulness has been indicated to reduce symptom severity (Vago & Nakamura, 2011). The dimension "self-care" consistent with items that had to do with massage and activity in water. According to literature exercise therapy with warm water has been indicated to diminish pain in women with fibromyalgia (Jiménez et al., 2013). Aqua therapy is considered to be an ideal exercise for patients with fibromyalgia because the warm water is soothing to tired, tense, and sore muscles (Morris et al., 2005). Also, massage was linked to small

improvements in fibromyalgia symptoms (Flynn, 2020). However, the Cronbach's alpha of the "self-care" dimension in this study was low. Perhaps, if we would have focused on the association between the soother dimensions separately and somatic symptom severity and if we would have included more of these kinds of items, the results may be different. Replication of the study is needed for more reliable and generalizable conclusions. According to the results from the current study, there is no reason to focus on soothers for new therapeutic interventions to increase the adaptiveness of patients with fibromyalgia.

For clinical practice it is important to get a better understanding of soothers and their dimensions, because these are changeable mechanisms that can be targeted in treatment, to curb the effect of less easily changeable threats on the development and maintenance of fibromyalgia. Therefore, more work needs to be done researching the potential buffering role of soothers in the relationship between threats and somatic symptom severity.

A strength of the current study is that we used a relatively large sample size. A larger sample size gives more reliable results with greater precision and power (Littler, 2018). Also, this study used a quantitative measurement with questionnaires for the first time to measure the level of soothers and threats. These questionnaires consisted of relatively high Cronbach's alpha. This was an improvement compared to the forced sorting task used in the previous project group, where Cronbach's alpha was low. Another strength that is related to this, is that this study did not only focus on soothers like social support and mindfulness, but also took into account other factors that could be possibly soothing to patients with fibromyalgia.

Nevertheless, this study also has a few limitations. Firstly, this study consisted of a heterogeneous sample. Participants of the current study are mostly females with fibromyalgia (94.6%). Therefore, the results could not be generalized to anyone other than female patients with fibromyalgia. Secondly, the current study had a cross-sectional design, meaning that causal conclusions cannot be drawn from these results. Further studies must confirm the possible directions of the associations in the current study. To investigate this, experimental research is needed to test the proposed directions of causality between variables. For example, a (clinical) experimental study can be used whether different soothers will lead to a diminution of symptom severity. Lastly, the current study used a new questionnaire, this means that this measurement has not been tested yet and that the validity is unknown. Further research on this questionnaire should be done to several aspects of validity.

In conclusion, the current study confirms the association between threats and the severity of somatic symptoms. However, there is little support for the association between soothers and the severity of somatic symptoms. In addition, there is also little support that

soothers can reduce the effects of threats on the severity of somatic symptoms. More research is necessary to further investigate these results. Also, replication of the current study is needed for more reliable and generalizable conclusions. This is necessary because the focus in research and treatment has been too much on reducing threats instead of facilitating factors that could be soothing for individuals with fibromyalgia.

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