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Childhood abuse and health outcomes in patients with fibromyalgia: a cross-sectional exploratory study of the moderating effects of pain catastrophizing and mindfulness

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Abstract

Background Childhood abuse has been linked to poorer health outcomes in individuals with fibromyalgia (FM), and this relationship may be affected by cognitive processes such as pain catastrophizing and mindfulness.

Objective This study investigated the impact of childhood abuse on pain-related symptoms and functioning in individuals with (FM) and examined how the critical psychosocial constructs of pain catastrophizing and mindfulness might moderate this relationship. We hypothesized that childhood abuse would be linked to greater physical symptoms and lower functioning, with pain catastrophizing and mindfulness influencing these associations.

Methods The study sample consisted of 113 women with FM. Correlational analyses were conducted to examine the relationship between childhood abuse and health outcomes (pain severity, pain interference, fibromyalgia impact, and physical functioning). Moderation analyses were conducted to examine the impact of pain catastrophizing and mindfulness on the relationship between childhood abuse and health outcomes.

Results As expected, catastrophizing was generally associated with elevated pain-related symptomatology and reduced functioning, and higher levels of mindfulness were associated with reduced pain impact. However, contrary to our hypothesis, childhood abuse was not directly associated with pain severity, pain interference, fibromyalgia impact, or physical functioning. Pain catastrophizing and mindfulness were significant moderators of the relationship between childhood abuse and health outcomes. Specifically, childhood abuse was related to higher pain interference only at low levels of catastrophizing and was associated with greater fibromyalgia impact and reduced physical functioning only at high levels of mindfulness.

Conclusion Our findings suggest that while childhood abuse did not directly impact pain-related outcomes in this sample of fibromyalgia patients, cognitive factors like pain catastrophizing and mindfulness play significant roles in moderating these effects. These results underscore the importance of assessing for cognitive and psychological factors in the management of fibromyalgia, especially for patients with a history of childhood abuse. Further

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research is needed to explore these relationships in more diverse samples and to develop personalized and targeted interventions for this patient population.

Keywords Child abuse, Fibromyalgia, Psychosocial factors, Catastrophizing

Introduction

Background

Fibromyalgia (FM) is a prevalent and complex chronic pain condition characterized by widespread musculoskeletal pain, fatigue, and a range of other symptoms including sleep disturbance, cognitive difficulties, anxiety, and depression [1, 2, 3]. The specific etiology of FM is not fully understood; however, a growing body of research highlights the intricate interplay between psychosocial factors and physical health in the development and maintenance of the condition [1, 4]. One important psychosocial area of interest is the influence of adverse childhood experiences (ACEs) on the symptomatology and functioning of individuals with FM. ACEs, encompassing experiences such as physical or emotional abuse in childhood, have been linked to a spectrum of negative health outcomes, including chronic pain conditions like FM [5, 6, 7].

The presence of childhood abuse and trauma has been identified as a salient risk factor for the development of FM in adulthood, with adverse experiences reported more frequently by FM patients than by healthy controls [5, 8]. In some samples, as many as 71% of FM patients report a history of abuse [2]. A systematic review including eighteen studies found that adult FM is significantly related to childhood physical abuse to a greater extent than other ACEs [9]. Further, metanalytic evidence supports the significant association between both physical and sexual abuse and adult fibromyalgia, although physical abuse was more strongly related [10]. Studies have also shown that FM patients with a history of trauma report a greater number of pain sites and somatic symptoms, more severe pain and other physical symptoms, and worse pain interference and physical functioning than FM patients without a history of trauma [2, 5].

Exposure to ACEs increases susceptibility to biological, psychosocial, and social risk factors for chronic pain. Biologically, early life stressors, such as abuse and neglect, can profoundly alter brain circuitry and stress response systems, including the hypothalamic-pituitary-adrenal (HPA) axis and limbic structures like the amygdala and hippocampus [11, 12, 13, 14]. These changes can result in heightened stress reactivity, impaired emotional regulation, and altered pain processing, which persist into adulthood and contribute to the development and maintenance of chronic pain conditions like FM [11, 12, 13, 14]. Regarding psychological functioning, FM patients exposed ACEs report greater affective distress and disability, including higher levels of depression, anxiety, and

pain catastrophizing, which contribute to the onset and persistence of chronic pain [2, 10, 11, 15, 16]. Socially, individuals with a history of ACEs often face challenges such as relational difficulties and reduced social support, which can exacerbate pain and diminish protective factors [8, 11, 17]. Together, these interconnected pathways illustrate how childhood abuse and adversity can exert a lasting impact on pain perception and functioning. However, understanding how these early life adversities translate into physical symptoms and functional impairments in FM patients requires an examination of related psychological processes.

Cognitive processes play a pivotal role in the experience and management of chronic pain. Among these, pain catastrophizing—a set of cognitive processes characterized by ruminating about pain, feeling helpless, and magnifying the threat value of pain—has been shown to exacerbate pain perception and interfere with pain management [18, 19, 20]. Unsurprisingly, psychosocial trauma has been linked with greater pain catastrophizing. For example, in patients with chronic pain, those who report a greater number of traumatic or adverse experiences report higher pain catastrophizing than individuals who report less or no traumatic experiences [7, 21, 22, 23]. Conversely, resilience cognitive processes, such as mindfulness, have been shown to play a role in mitigating the psychological and physiological changes associated with trauma and adverse experiences [24]. Mindfulness, defined as the practice of maintaining a nonjudgmental awareness of the present moment, may help individuals cope with traumatic events by increasing acceptance of trauma-related experiences, and decreasing trauma-related negative affect and avoidance of trauma reminders [25]. Mindfulness has also been linked with reduced pain sensitivity and improved psychological well-being in individuals with pain [26]. In FM patients specifically, lower mindfulness is associated with more severe FM impact [27], and higher mindfulness is associated with lower pain interference and better quality of life [28]. Both pain catastrophizing and mindfulness are cognitive processes that may interact with the effects of childhood trauma and abuse, influencing how individuals with FM perceive and cope with their pain. Thus, more work is needed to understand the dynamic interplay between these cognitive processes, trauma exposure, and physical health and functioning.

Objectives

The current study aimed to examine the impact of childhood abuse on pain-related symptoms and functioning in individuals with FM and how the psychosocial constructs of pain catastrophizing and mindfulness might moderate this relationship. We hypothesized that (1) childhood abuse would be associated with greater pain catastrophizing and pain-related physical symptoms, and lower mindfulness and physical functioning; (2) higher pain catastrophizing and lower mindfulness would be associated with more symptoms and lower functioning; (3) pain catastrophizing would moderate the relationship between childhood abuse and health symptoms such that the association would be strongest among patients with high pain catastrophizing; and (4) mindfulness would moderate the relationship between childhood abuse and health symptoms such that the association would be strongest among patients with low mindfulness. Importantly, this work aims to elucidate the role of malleable psychological factors on the pain experience. By identifying cognitive processes that may be connected to both childhood abuse and pain among FM patients, we can develop more targeted and personalized treatments for individuals with this common comorbidity.

Method

Study design

The data utilized in the current study was obtained at baseline from patients participating in a randomized, controlled trial of non-pharmacologic treatment for chronic pain [Clinical Trial Number: NCT01345344; registration date: May 2, 2011] [29]. The baseline study visit included informed consent, confirmation of study eligibility, and completion of self-report questionnaires using Research Electronic Data Capture (REDCap). Demographic information included age, race, marital status, educational status, current employment status, and annual income. The current study is a cross-sectional data analysis using the baseline data from the randomized trial.

Setting

Participants were recruited through the pain management center at an outpatient healthcare facility, where all study procedures were completed. Study procedures received approval by the Brigham and Women's Hospital Institutional Review Board (IRB), conducted in accordance with the Declaration of Helsinki, and written informed consent was obtained from all participants.

Participants

Patients eligible for participation in the study were women diagnosed with fibromyalgia and who fulfilled the diagnostic criteria proposed by the American College of

Rheumatology, which require the presence of widespread pain as well as several physical and cognitive symptoms (3). The inclusion criteria were as follows: (1) 18 to 75 years old (2), female (3), meet the Wolfe et al. revised fibromyalgia criteria for at least 1 year (4), pain severity of at least 3 out of 10 on average (5), English language proficiency, and (6) able to provide written informed consent. The exclusion criteria included (1) comorbid acute pain or comorbid chronic pain condition more painful than FM (2), current use of stimulant medications (3), pregnant or planning to become pregnant (4), severe psychiatric disorder or prior psychiatric hospitalization in the past 6 months (5), current or recent substance use disorder (6), active suicidal ideation, and (7) recent lower-limb vascular surgery (this exclusion criterion was included because such surgery is a contraindication for some of the lower-body sensory testing procedures that were included in the original randomized trial—these findings are reported elsewhere [30]).

Predictor and moderator measures

Childhood abuse

Exposure to childhood abuse was assessed using a subset of items from the modified version of the Adverse Childhood Events questionnaire focusing on verbal and physical abuse during childhood [31]. Given that the originally study from which these data were obtained was designed to assess non-pharmacologic treatments for fibromyalgia, and the primary focus was not on ACEs, a brief 3-item measure was employed to assess key domains of childhood abuse (verbal and physical) without administering the full 10-item ACE questionnaire. This decision was made to minimize participant burden while still capturing some aspects of childhood abuse relevant to chronic pain and psychological functioning. This 3-item self-report measure consisted of asking participants to rate how often they had experienced the following 3 items on a scale of 0 (*never*) to 4 (*very often*): [1] “In your first 18 years of life, how often did a parent, stepparent, or adult living in your home swear at you, insult you, or put you down?”; [2] “In your first 18 years of life, how often did a parent, stepparent, or adult living in your home act in a way that made you afraid that you might be physically hurt?”; [3] “In your first 18 years of life, how often did a parent, stepparent, or adult living in your home push, grab, slap, or throw something at you?” Responses were summed, and higher scores indicate higher frequency of verbal and physical abuse during childhood and adolescence.

Pain catastrophizing

This was assessed using the 13-item Pain Catastrophizing Scale (PCS) [32], which measures the extent of catastrophic thinking due to pain according to 3 components:

rumination, magnification, and helplessness. Items are rated on a 5-point scale of 0 (*not at all*) to 4 (*all the time*). Item scores were summed, with higher scores indicating higher pain catastrophizing. The PCS demonstrates good reliability and validity in both pain and non-pain samples [33, 34].

Mindfulness

This was assessed using the 24-item short form of the Five-Facet Mindfulness Questionnaire (FFMQ) [35]. The FFMQ examines five aspects of mindfulness, including observing, describing, acting with awareness, detachment to inner experience, and non-judging of inner experience. Items were rated on a five-point scale with answer choices ranging from 1 (*never or very rarely true*) to 5 (*very often or always true*). Item scores were summed, with higher scores indicating greater levels of mindfulness. The FFMQ has been validated in both meditating and nonmeditating individuals [36].

Outcome measures

Pain severity and interference

The 15-item Brief Pain Inventory (BPI) [37] was used to assess patients' level of pain severity and pain interference. The BPI assesses pain severity on a scale of 0 (*no pain*) to 10 (*pain as bad as you can imagine*) as well as the degree to which the pain interferes with daily activities, mood, and enjoyment of life on a scale of 0 (*does not interfere*) to 10 (*completely interferes*). Responses were averaged, yielding a pain severity and a pain interference subscale score for each participant; higher scores indicate higher severity or interference.

Fibromyalgia impact

The 21-item revised Fibromyalgia Impact Questionnaire (FIQ-R) [38] was utilized to assess the impact of participants' fibromyalgia symptoms. The FIQ-R items are rated on an 11-point numeric rating scale (0–10), with 10 being "worst." Total scores were utilized, with higher scores indicating greater impact of fibromyalgia symptoms on a participant's life. The revised FIQR has good psychometric properties [38].

Physical function

This was assessed using the 4-item physical function subscale of the Patient-Reported Outcomes Measurement Information System-29 (PROMIS-29) questionnaire [39]. Items were rated on a scale of 1 (*unable to do*) to 5 (*without any difficulty*) and summed, and higher scores represent better functioning. The PROMIS measures demonstrate good reliability and validity in pain populations [40].

Study size

Power calculations from the original randomized trial [29] concluded that a sample of 80 participants was needed to provide sufficient power for the trial. Thus, a total of 140 patients were screened for the inclusion and exclusion criteria via phone or in-person screenings, and a total of 114 were enrolled in the trial. However, a final sample of 113 participants with data on childhood abuse were included in the current study analyses (1 participant was excluded due to missing data on the childhood abuse measure).

Statistical methods

Descriptive and correlational analyses were performed using SPSS version 29. The univariate associations of the predictors with the outcome measures were examined using Pearson correlation analyses. Before conducting moderation analyses, data were screened, and continuous variables were examined for normality, linearity, and multicollinearity. Outliers were identified using standard criteria (± 3 SD from the mean) and evaluated to determine their potential influence; no outliers were excluded as their impact was negligible. Missing data were minimal ($\leq 6\%$) and addressed using pairwise deletion. Moderation analyses were conducted using Hayes' PROCESS macro (MODEL 1) [41] to examine whether pain catastrophizing and mindfulness moderated the relationship between childhood abuse and health outcomes (pain severity and interference, fibromyalgia impact, and physical function). All variables were mean-centered prior to analysis to reduce multicollinearity. To test for significance of effects, 95% bias-corrected bootstrapped confidence intervals based on 1,000 bootstrapped samples were obtained. Significant ($p < .05$) and marginally significant ($p < .10$) interactions were probed by testing the conditional effects of the predictor at three levels of the moderator (mean and ± 1 SD). Significant interactions were further illustrated by plotting the interaction.

Results

Participants' demographic characteristics are presented in Table 1. The average age of participants was 41.72 years ($SD = 12.39$), and all participants were female. Participants' average endorsed frequency of childhood verbal and physical abuse was 4.23 ($SD = 3.43$, Range = 0–12). Table 2 presents the bivariate correlations among all study variables. Childhood abuse was not significantly correlated with any of the study variables, whereas pain catastrophizing was significantly inversely related to mindfulness and physical function, and positively related to all other pain-related outcome measures (pain severity, pain interference, and fibromyalgia impact). Mindfulness was significantly inversely related to pain interference and fibromyalgia impact.

Table 1 Demographic and study variables

| Demographic Variables | | N = 113 |
|------------------------------------|--------|---------------|
| Age (M, SD) | | 41.72 (12.39) |
| Race | | |
| African American | | 7.0% |
| Caucasian | | 75.5% |
| Hispanic/Latinx | | 7.0% |
| Other | | 10.5% |
| Married | | 31.9% |
| Education (college degree & above) | | 61.1% |
| Employed | | 53.1% |
| Annual income above \$45,000 | | 60.2% |
| Study Variables | | Score Range |
| Childhood abuse (n = 113) | 0–12 | 4.23 (3.43) |
| Pain Catastrophizing (n = 113) | 0–52 | 23.55 (12.21) |
| Mindfulness (n = 109) | 24–120 | 76.20 (12.11) |
| Pain Severity (n = 112) | 0–10 | 5.09 (1.81) |
| Pain Interference (n = 112) | 0–10 | 5.68 (2.37) |
| Fibromyalgia Impact (n = 110) | 0–100 | 56.25 (16.85) |
| Physical Function (n = 108) | 4–20 | 12.80 (3.38) |

Table 2 Correlations among study variables (n = 108–113)

| | Variable | | | | | |
|-------------------------|----------|---------|--------|---------|---------|---------|
| | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Childhood abuse | –0.09 | –0.15 | –0.01 | 0.02 | 0.04 | –0.05 |
| 2. Pain Catastrophizing | | –0.45** | 0.50** | 0.58** | 0.58** | –0.35** |
| 3. Mindfulness | | | –0.12 | –0.39** | –0.33** | 0.15 |
| 4. Pain Severity | | | | 0.72** | 0.67** | –0.39** |
| 5. Pain Interference | | | | | 0.77** | –0.52** |
| 6. Fibromyalgia Impact | | | | | | –0.65** |
| 7. Physical Function | | | | | | |

Note. ** $p < .01$ **Moderation analyses****Pain catastrophizing**

Pain catastrophizing did not moderate the relationship between childhood abuse and *pain severity*, ($b = -0.002$, $SE = 0.004$, 95% CI $[-0.01, 0.01]$, $t(107) = -0.57$, $p = .57$); however, catastrophizing significantly moderated the relationship of childhood abuse to *pain interference* ($b = -0.01$, $SE = 0.004$, 95% CI $[-0.02, -0.01]$, $t(107) = -2.51$, $p = .01$). As shown in Fig. 1, childhood abuse was predominantly associated with higher pain interference at low levels of pain catastrophizing, with attenuated associations at moderate or high levels of pain catastrophizing. Participants with both low pain catastrophizing scores and low levels of childhood abuse reported substantially lower pain interference than any other group (see Fig. 1). Pain catastrophizing did not moderate the relationship between childhood abuse and fibromyalgia impact, ($b = -0.05$, $SE = 0.03$, 95% CI $[-0.11, 0.01]$, $t(107) = -1.55$, $p = .12$), or the relationship between childhood abuse and physical function, ($b = 0.01$, $SE = 0.01$, 95% CI $[-0.01, 0.02]$, $t(105) = 1.18$, $p = .24$).

Mindfulness

Mindfulness did not moderate the relationship between childhood abuse and pain severity, ($b = 0.003$, $SE = 0.003$, 95% CI $[-0.004, 0.009]$, $t(104) = 0.86$, $p = .39$), or the relationship between childhood abuse and pain interference, ($b = 0.01$, $SE = 0.004$, 95% CI $[-0.003, 0.014]$, $t(104) = 1.21$, $p = .23$). Mindfulness significantly moderated the relationship between childhood abuse and fibromyalgia impact, ($b = 0.06$, $SE = 0.03$, 95% CI $[0.00, 0.12]$, $t(104) = 2.02$, $p = .04$). As shown in Fig. 2, childhood abuse was associated with higher fibromyalgia impact only at high levels of mindfulness, but not at moderate or low levels of mindfulness. Participants reporting high levels of mindfulness and low levels of childhood abuse reported reduced fibromyalgia impact relative to other groups (see Fig. 2). Finally, mindfulness significantly moderated the relationship between childhood abuse and physical function, ($b = -0.02$, $SE = 0.01$, 95% CI $[-0.03, -0.01]$, $t(105) = -2.70$, $p = .01$). As shown in Fig. 3, childhood abuse was associated with *lower* physical functioning only at high levels of mindfulness, but not at moderate or low levels of mindfulness, with the highest

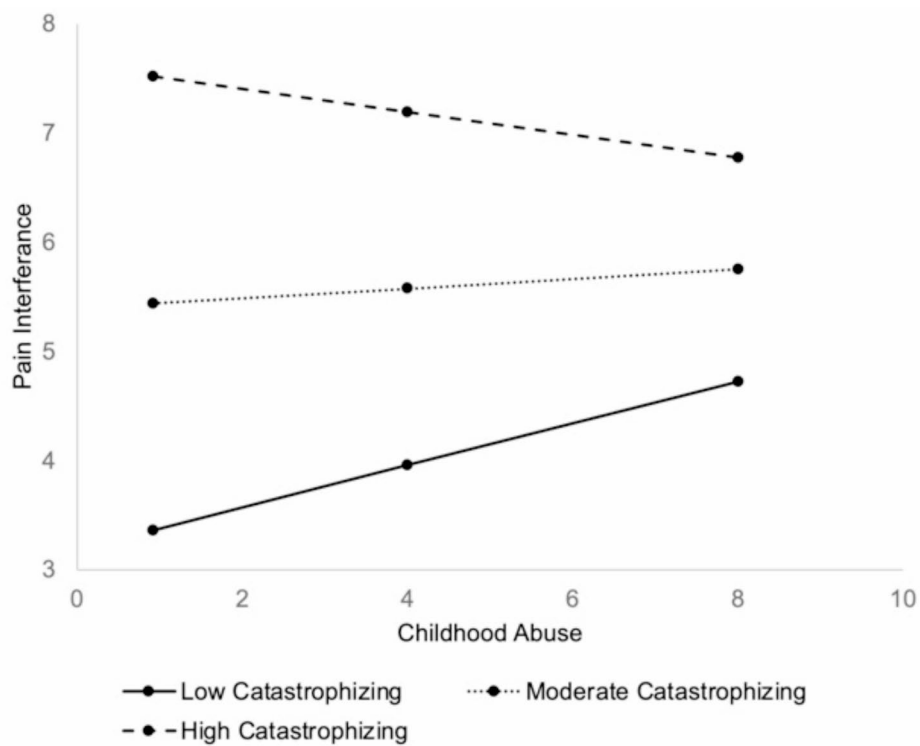


Fig. 1 Pain catastrophizing moderates the relationship between childhood abuse and pain interference

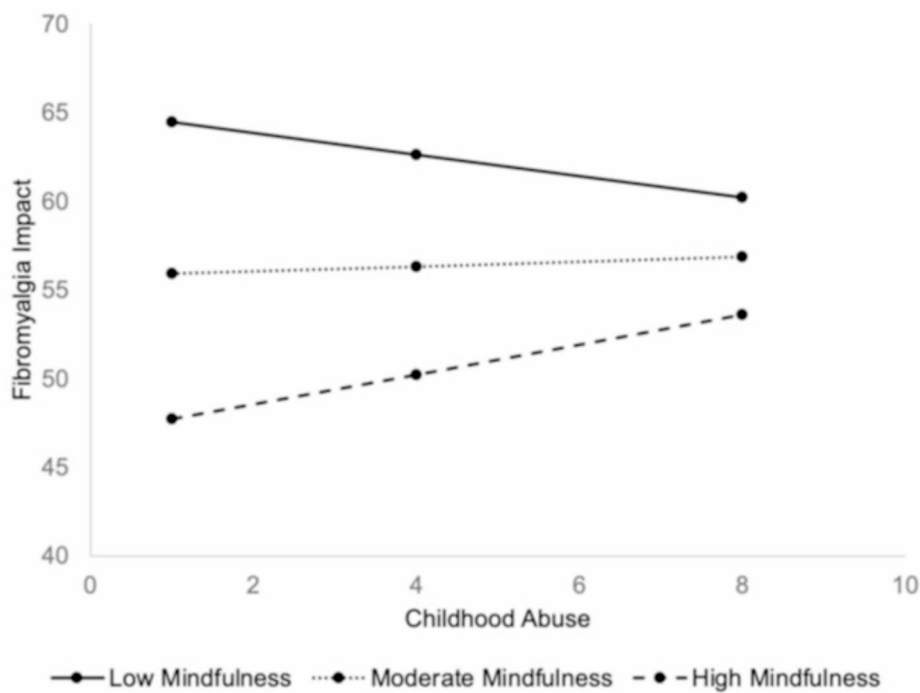


Fig. 2 Mindfulness moderates the relationship between childhood abuse and fibromyalgia impact

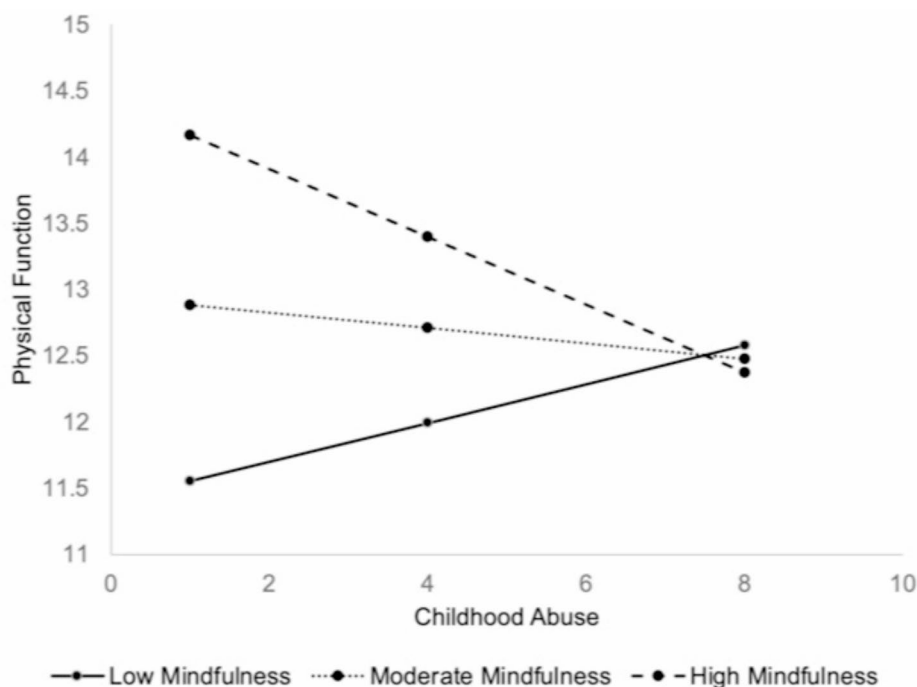


Fig. 3 Mindfulness moderates the relationship between childhood abuse and physical function

levels of physical functioning observed in those who were both high in mindfulness and low in childhood abuse.

Discussion

The purpose of the current study was to examine the relationship between childhood abuse and health symptoms in people with FM, and to test the impact of pain catastrophizing and mindfulness on the relationship between childhood abuse and symptoms and functioning in patients with FM. Contrary to our first hypothesis, childhood abuse was not directly associated with any measures of cognitive processes (pain catastrophizing and mindfulness), pain symptoms, or functioning in this sample of FM patients, including pain severity, pain interference, fibromyalgia impact, and physical functioning. Consistent with our second hypothesis, pain catastrophizing was inversely related to physical function, and positively related to all other pain-related outcomes (pain severity, pain interference, and fibromyalgia impact). Mindfulness was inversely related to pain interference and fibromyalgia impact but was not related to pain severity or physical functioning.

Pain interference, as measured by the Brief Pain Inventory (BPI), focuses on the extent to which general pain disrupts various aspects of daily life, such as mood, sleep, work, and social activities, reflecting the functional and emotional consequences of pain. Fibromyalgia impact as measured by the Fibromyalgia Impact Questionnaire Revised (FIQR), by contrast, provides a broader assessment of the global impact of fibromyalgia symptoms,

encompassing physical function, overall symptom severity, and the degree to which symptoms affect daily activities, including cognitive difficulties and fatigue. Finally, physical function as measured by the PROMIS Physical Function subscale specifically evaluates an individual's capability to perform physical tasks, such as mobility, upper extremity activities, and self-care, offering a targeted measure of functional ability rather than the broader emotional or symptom-related disruptions captured by the BPI and FIQR.

Regarding the moderation analyses, we found that pain catastrophizing influenced the relationship between childhood abuse and pain interference but did not affect the relationship between childhood abuse and pain severity, fibromyalgia impact, or physical function. Unexpectedly, childhood abuse was linked to increased pain interference at low levels of pain catastrophizing, whereas this association diminished at moderate or high levels of pain catastrophizing.

Mindfulness did not influence the relationship between childhood abuse and either pain severity or pain interference. However, it did moderate the relationship between childhood abuse and both fibromyalgia impact and physical function. Contrary to our hypothesis, childhood abuse was related to greater fibromyalgia impact only when mindfulness levels were high, not at moderate or low levels. Similarly, childhood abuse was linked to reduced physical functioning exclusively at high levels of mindfulness, with no significant effects at moderate or low mindfulness levels.

Some of the present findings are relatively unsurprising and are consistent with our general understanding of pain-related risk factors. Catastrophizing and mindfulness showed generally moderate associations with pain symptomatology and physical functioning, in the expected directions [18, 26] (i.e., higher catastrophizing scores were related to more severe and functionally disabling pain, while higher mindfulness scores were associated with less pain-related symptom impact). Further, when assessing interactions with abuse history, those individuals endorsing low levels of catastrophizing, high levels of mindfulness, and less frequent verbal and physical abuse during childhood also reported the lowest levels of pain-related functional impact. But other aspects of the interactions were surprising. In general, the strongest relationships between adverse childhood experiences and pain-related outcomes were observed in the lower-risk participants (i.e., those with lower catastrophizing and higher mindfulness scores). This finding, while unexpected, is consistent with several other studies in various settings that have also found significant interactions that are not synergistic in nature, but which suggest that “lower-risk” participants may show the strongest detrimental impact of trauma symptomatology. For example, Zhang and colleagues [42] reported that, among depressed adults, anxious attachment moderated the association between trauma and pain; those with low levels of anxious attachment showed a strong relationship between the degree of reported childhood trauma and adult levels of pain intensity while those with higher anxious attachment showed no association [42]. Conceptually similar findings emerged in a sample of youth with history of ACEs, in which the strongest association between trauma exposure and pain sensitivity emerged among the lower-risk members of the sample (i.e., those with lower post-traumatic symptoms) [43].

One possible explanation is that individuals with high levels of mindfulness might be more aware of and attentive to their internal experiences, including past traumas, which could exacerbate the perception of fibromyalgia impact and functional limitations. It is also possible that the interaction between mindfulness and childhood abuse could reflect differences in how mindfulness practices are implemented or experienced by individuals with varying levels of childhood abuse [44]. Further research is needed to explore these dynamics and understand the conditions under which mindfulness might either buffer or amplify the impact of childhood abuse on FM outcomes.

While we are not able to definitively identify the mechanisms producing this pattern of findings, it is also possible that those individuals with the more pain-related risk factors (e.g., high levels of catastrophizing and low levels of mindfulness) and the most reported childhood abuse

are most likely to engage and persist in seeking treatment, which might buffer the impact of those risk factors, as was recently reported in a sample of women veterans with chronic pain [45]. Similarly, those with the highest levels of distress and catastrophizing appear to turn most frequently to social interactions when managing pain, and to benefit the most from those interactions (in terms of reducing pain-related impact) [46]. It is possible that individuals who have experienced the most childhood adversity and pain-related distress may be those who are best able to harness their social and interpersonal environments in order to buffer those adverse effects.

These findings suggest that psychotherapy for patients with FM and abuse may benefit from nuanced modifications that address both trauma-related factors and patients’ cognitive and emotional responses to pain. For example, rather than solely aiming to eliminate catastrophizing, interventions such as Acceptance and Commitment Therapy (ACT) can be utilized to foster acceptance, and reduce experiential avoidance, of difficult thoughts, including trauma-related and pain-related catastrophizing thoughts [47, 48]. Relatedly, standard mindfulness-based interventions may require adaptation for individuals with trauma histories. For example, incorporating trauma-informed mindfulness practices, which emphasize safety, gradual exposure, and emotional regulation, may better support patients with history of trauma and chronic pain [44, 49, 50].

An important consideration when interpreting our findings is the scope of the childhood abuse measure used in this study. The modified version of the ACEs questionnaire included only items assessing verbal and physical abuse, excluding other forms of adversity, such as sexual abuse or physical neglect. This is particularly relevant given that prior research has demonstrated significant associations between sexual abuse and fibromyalgia [9, 10, 51]. The exclusion of these experiences may have limited the ability to detect significant relationships between childhood abuse and health outcomes in our sample, as participants classified in the ‘low adversity’ group may have still experienced unmeasured forms of adversity with potential impacts on their symptoms. This limitation may also partially explain the unexpected patterns observed in our moderation analyses, such as the association between childhood abuse and worse outcomes at lower levels of pain catastrophizing or higher levels of mindfulness. Future research should incorporate comprehensive ACE assessments to capture the full spectrum of childhood trauma and better elucidate their complex interactions with cognitive processes and health outcomes in fibromyalgia.

Limitations

Several limitations must be considered in interpreting the findings of the current study. First, this study utilized cross-sectional analyses; therefore, findings do not support any causal relationships among childhood abuse, cognitive processes, and health outcomes in fibromyalgia patients. Longitudinal studies are needed to better understand the temporal and potential causal pathways among these variables. Second, the childhood abuse measure utilized in this study consisted of only three items modified from the ACEs questionnaire; thus, our modification of the full ACEs measure to assess childhood abuse is of unknown validity. Our use of an abbreviated ACE measure, focusing solely on verbal and physical abuse, represents a limitation of the current study. While this approach was chosen to minimize participant burden in a trial primarily designed to test fibromyalgia treatments, it may have excluded other critical forms of adversity, such as sexual abuse or neglect, which have been shown to influence fibromyalgia outcomes [9, 10]. This limitation may partly explain the lack of significant direct relationships between childhood abuse and cognitive or health outcomes observed in our sample. Future research should utilize comprehensive ACE measures to capture a broader spectrum of adverse experiences and their complex interactions with psychological and physical health in fibromyalgia and other chronic pain conditions. An additional limitation is the study sample, which consisted exclusively of women with fibromyalgia, and the participants were predominately Caucasian, and highly educated. This limits the generalizability of the results to other populations, including males, individuals from underrepresented racial groups, and individuals with lower educational and socioeconomic backgrounds. Research has shown that low educational attainment and socioeconomic status are linked to poorer health outcomes following trauma and abuse [52, 53, 54]. Therefore, future studies on pain and health outcomes in fibromyalgia should include participants from diverse educational and socioeconomic backgrounds to better capture the potential impact of these demographic factors on outcomes. Including a more diverse sample in future studies could help determine whether the observed patterns hold across different groups.

Summary

This study provides insights into the interplay between childhood abuse, pain catastrophizing, mindfulness, and health outcomes in patients with fibromyalgia. Contrary to our initial hypothesis, childhood abuse was not directly associated with pain severity, pain interference, fibromyalgia impact, or physical functioning. Instead, pain catastrophizing and mindfulness emerged as significant moderators in the relationship between childhood

abuse and health outcomes. Specifically, childhood abuse was related to higher pain interference only at low levels of catastrophizing and was associated with greater fibromyalgia impact and reduced physical functioning at high levels of mindfulness. These findings highlight the importance of assessing for important cognitive and psychological factors in the management of fibromyalgia, especially for patients with a history of childhood abuse. Future research should explore additional factors that could influence these relationships (e.g., social support) and examine how these findings generalize to other populations. By refining our understanding of these complex interactions, we can develop more targeted and effective treatments for individuals with fibromyalgia and a history of childhood adversity. Finally, it is noteworthy that the individuals in this sample with the lowest levels of pain and functional impact were those with minimal histories of childhood abuse and trauma, the lowest levels of pain catastrophizing, and the highest levels of mindfulness. To the extent that these are modifiable variables, directing interventions at these risk and resilience factors may help to improve pain-related outcomes for the many individuals experiencing (and at risk for) chronic pain conditions such as fibromyalgia.

Conclusion

Our findings suggest that while childhood abuse did not directly impact pain-related outcomes in this sample of fibromyalgia patients, cognitive factors like pain catastrophizing and mindfulness play significant roles in moderating these effects. These results underscore the importance of assessing for cognitive and psychological factors in the management of fibromyalgia, especially for patients with a history of childhood abuse. Further research is needed to explore these relationships in more diverse samples and to develop personalized and targeted interventions for this patient population.

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Author contributions

JBY analyzed and interpreted the study data and conducted the writing of the full manuscript draft; SMM contributed to data analysis, and to writing and revising the manuscript; BDD, MC, and LP contributed to data interpretation and writing; AL and MP contributed to study design and data acquisition; VN contributed to study design, data acquisition, and revision of the writing; RRE contributed to design of the study, data analysis, interpretation of data, and revision of the manuscript.

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Data availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Brigham and Women's Hospital Institutional Review Board (IRB), conducted in accordance with the Declaration of Helsinki, and informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

- Häuser W, Ablin J, Fitzcharles MA, Littlejohn G, Luciano JV, Usui C, et al. Fibromyalgia Nat Rev Dis Primer. 2015;1(1):1–16.
- Nicol AL, Sieberg CB, Clauw DJ, Hassett AL, Moser SE, Brummett CM. The association between a history of lifetime traumatic events and pain severity, physical function, and affective distress in patients with chronic pain. *J Pain*. 2016;17(12):1334–48.
- Wolfe F, Clauw DJ, Fitzcharles MA, Goldenberg DL, Häuser W, Katz RS, et al. Fibromyalgia criteria and severity scales for clinical and epidemiological studies: A modification of the ACR preliminary diagnostic criteria for fibromyalgia. *J Rheumatol*. 2011;38(6):1113–22.
- Loevinger BL, Shirtcliff EA, Muller D, Alonso C, Coe CL. Delineating psychological and biomedical profiles in a heterogeneous fibromyalgia population using cluster analysis. *Clin Rheumatol*. 2012;31(4):677–85.
- Häuser W, Galek A, Erbslöh-Möller B, Köllner V, Kühn-Becker H, Langhorst J, et al. Posttraumatic stress disorder in fibromyalgia syndrome: prevalence, Temporal relationship between posttraumatic stress and fibromyalgia symptoms, and impact on clinical outcome. *PAIN*. 2013;154(8):1216–23.
- Edwards RR, Dworkin RH, Sullivan MD, Turk DC, Wasan AD. The role of psychosocial processes in the development and maintenance of chronic pain. *J Pain*. 2016;17(9):T70–92.
- Craner JR, Lake ES, Barr AC, Kirby KE, O'Neill M. Childhood adversity among adults with chronic pain: prevalence and association with Pain-related outcomes. *Clin J Pain*. 2022;38(9):551.
- Bacon AM, White L. The association between adverse childhood experiences, self-silencing behaviours and symptoms in women with fibromyalgia. *Psychol Health Med*. 2023;28(8):2073–83.
- Häuser W, Kosseva M, Üceyler N, Klose P, Sommer C. Emotional, physical, and sexual abuse in fibromyalgia syndrome: A systematic review with meta-analysis. *Arthritis Care Res*. 2011;63(6):808–20.
- Kaleycheva N, Cullen AE, Evans R, Harris T, Nicholson T, Chalder T. The role of lifetime stressors in adult fibromyalgia: systematic review and meta-analysis of case-control studies. *Psychol Med*. 2021;51(2):177–93.
- Tidmarsh LV, Harrison R, Ravindran D, Matthews SL, Finlay KA. The Influence of Adverse Childhood Experiences in Pain Management: Mechanisms, Processes, and Trauma-Informed Care. *Front Pain Res*. 2022 [cited 2023 Sep 19];3. Available from: <https://www.frontiersin.org/articles/https://doi.org/10.3389/fpain.2022.923866>
- Agorastos A, Pervanidou P, Chrousos GP, Baker DG. Developmental Trajectories of Early Life Stress and Trauma: A Narrative Review on Neurobiological Aspects Beyond Stress System Dysregulation. *Front Psychiatry*. 2019;11 [cited 2025 Jan 12];10. Available from: <https://www.frontiersin.org/journals/psychiatry/articles/https://doi.org/10.3389/fpsyt.2019.00118/full>
- Ji RR, Nackley A, Huh Y, Terrando N, Maixner W. Neuroinflammation and central sensitization in chronic and widespread pain. *Anesthesiology*. 2018;129(2):343–66.
- Tak LM, Rosmalen JGM. Dysfunction of stress responsive systems as a risk factor for functional somatic syndromes. *J Psychosom Res*. 2010;68(5):461–8.
- Egloff N, Hirschi A, von Känel R. Traumatization and chronic pain: a further model of interaction. *J Pain Res*. 2013;6:765–70.
- Lane RD, Anderson FS, Smith R. Biased competition favoring physical over emotional pain: A possible explanation for the link between early adversity and chronic pain. *Psychosom Med*. 2018;80(9):880.
- Brooks BD, Kaniuka AR, Rabon JK, Sirois FM, Hirsch JK. Social support and subjective health in fibromyalgia: Self-Compassion as a mediator. *J Clin Psychol Med Settings*. 2022;29(2):375–83.
- Paschali M, Lazaridou A, Paschalis T, Napadow V, Edwards RR. Modifiable psychological factors affecting functioning in fibromyalgia. *J Clin Med*. 2021;10(4):803.
- Dorado K, Schreiber KL, Koulouris A, Edwards RR, Napadow V, Lazaridou A. Interactive effects of pain catastrophizing and mindfulness on pain intensity in women with fibromyalgia. *Health Psychol Open*. 2018;5(2):2055102918807406.
- Taylor SS, Davis MC, Yeung EW, Zautra AJ, Tennen HA. Relations between adaptive and maladaptive pain cognitions and within-day pain exacerbations in individuals with fibromyalgia. *J Behav Med*. 2017;40(3):458–67.
- Sansone RA, Watts DA, Wiederman MW. Childhood trauma and pain and pain catastrophizing in adulthood: A Cross-Sectional survey study. *Prim Care Companion CNS Disord*. 2013;15(4):26816.
- Zlotnick C, Grouper H, Pud D. Child abuse and the psychological dispositions of pain catastrophizing, resilience and hope. *Child Abuse Rev*. 2022;31(1):66–77.
- MacDonald TM, Fisk JD, Bernstein CN, El-Gabalawy R, Hitchon CA, Kornelsen J, et al. The association between childhood maltreatment and pain catastrophizing in individuals with immune-mediated inflammatory diseases. *J Psychosom Res*. 2021;145:110479.
- Ortiz R, Sibinga EM. The role of mindfulness in reducing the adverse effects of childhood stress and trauma. *Children*. 2017;4(3):16.
- Kachadourian LK, Harpaz-Rotem I, Tsai J, Southwick S, Pietrzak RH. Mindfulness as a mediator between trauma exposure and mental health outcomes: results from the National health and resilience in veterans study. *Psychol Trauma Theory Res Pract Policy*. 2021;13(2):223–30.
- McCracken LM, Gauntlett-Gilbert J, Vowles KE. The role of mindfulness in a contextual cognitive-behavioral analysis of chronic pain-related suffering and disability. *Pain*. 2007;131(1):63–9.
- Jones KD, Mist SD, Casselberry MA, Ali A, Christopher MS. Fibromyalgia impact and mindfulness characteristics in 4986 people with fibromyalgia. *Explore N Y N*. 2015;11(4):304–9.
- Pleman B, Park M, Han X, Price LL, Bannuru RR, Harvey WF, et al. Mindfulness is associated with psychological health and moderates the impact of fibromyalgia. *Clin Rheumatol*. 2019;38(6):1737–45.
- Lee J, Lazaridou A, Paschali M, Loggia ML, Berry MP, Ellingsen DM et al. A Randomized, Controlled Neuroimaging Trial of Cognitive-Behavioral Therapy for Fibromyalgia Pain. *Arthritis Rheumatol*. [cited 2023 Oct 3];n/a(n/a). Available from: <https://onlinelibrary.wiley.com/doi/abs/https://doi.org/10.1002/art.42672>
- Cheng JC, Anzolin A, Berry M, Honari H, Paschali M, Lazaridou A, et al. Dynamic functional brain connectivity underlying Temporal summation of pain in fibromyalgia. *Arthritis Rheumatol*. 2022;74(4):700–10.
- Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the adverse childhood experiences (ACE) study. *Am J Prev Med*. 1998;14(4):245–58.
- Osman A, Barrios FX, Kopper BA, Hauptmann W, Jones J, O'Neill E. Factor structure, reliability, and validity of the pain catastrophizing scale. *J Behav Med*. 1997;20(6):589–605.
- Osman A, Barrios FX, Gutierrez PM, Kopper A, Merrifield T, Grittmann L. The Pain Catastrophizing Scale: Further Psychometric Evaluation with Adult Samples.
- Van Damme S, Crombez G, Bijttebier P, Goubert L, Van Houdenhove B. A confirmatory factor analysis of the pain catastrophizing scale: invariant factor structure across clinical and non-clinical populations. *Pain*. 2002;96(3):19–24.

35. Bohlmeijer E, ten Klooster P, Fledderus M, Veehof M, Baer R. Psychometric properties of the five facet mindfulness questionnaire in depressed adults and development of a short form. *Assessment*. 2011;18:308–20.
36. Baer RA, Smith GT, Lykins E, Button D, Krietemeyer J, Sauer S, et al. Construct validity of the five facet mindfulness questionnaire in meditating and non-meditating samples. *Assessment*. 2008;15(3):329–42.
37. Cleeland CS, Ryan KM. Pain assessment: global use of the brief pain inventory. *Ann Acad Med Singap*. 1994;23(2):129–38.
38. Bennett R. The Fibromyalgia Impact Questionnaire (FIQ): a review of its development, current version, operating characteristics and uses.
39. Cella D, Riley W, Stone A, Rothrock N, Reeve B, Yount S, et al. The Patient-Reported outcomes measurement information system (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *J Clin Epidemiol*. 2010;63(11):1179–94.
40. Katz P, Pedro S, Michaud K. Performance of the Patient-Reported outcomes measurement information system 29-item profile in rheumatoid arthritis, osteoarthritis, fibromyalgia, and systemic lupus erythematosus. *Arthritis Care Res*. 2017;69(9):1312–21.
41. Hayes AF. Introduction to mediation, moderation, and conditional process analysis: A Regression-Based approach. Guilford Press. 2017.
42. Zhang K, Sun J, Zhang Q, Zhang J, He L, Wang Z, et al. The association between childhood trauma and pain symptoms in depressed adults: the moderating role of anxious attachment. *Clin Psychol Psychother*. 2023;30(3):679–89.
43. Levy Gigi E, Rachmani M, Defrin R. The relationship between traumatic exposure and pain perception in children: the moderating role of posttraumatic symptoms. *Pain*. 2024;165(10):2274–81.
44. Zhu J, Wekerle C, Lanius R, Frewen P. Trauma- and Stressor-Related history and symptoms predict distress experienced during a brief mindfulness meditation sitting: moving toward Trauma-Informed care in mindfulness-Based therapy. *Mindfulness*. 2019;10(10):1985–96.
45. Okvat HA, Davis MC, Mistretta EG, Mardian AS. Mindfulness-based training for women veterans with chronic pain: A retrospective study. *Psychol Serv*. 2022;19(Suppl 1):106–19.
46. Carriere JS, Lazaridou A, Martel MO, Cornelius M, Campbell C, Smith M, et al. The moderating role of pain catastrophizing on the relationship between partner support and pain intensity: a daily diary study in patients with knee osteoarthritis. *J Behav Med*. 2020;43(5):807–16.
47. Herbert MS, Malaktaris AL, Dochat C, Thomas ML, Wetherell JL, Afari N. Acceptance and commitment therapy for chronic pain: does Post-traumatic stress disorder influence treatment outcomes?? *Pain Med*. 2019;20(9):1728–36.
48. Bean RC, Ong CW, Lee J, Twohig MP. Acceptance and commitment therapy for PTSD and trauma: an empirical review. *Behav Therapist*. 2017;40(4):145–50.
49. Kelly A. Trauma-Informed Mindfulness-Based stress reduction: A promising new model for working with survivors of interpersonal violence. *Smith Coll Stud Soc Work*. 2015;85(2):194–219.
50. Duane A, Casimir AE, Mims LC, Kaler-Jones C, Simmons D. Beyond deep breathing: A new vision for equitable, culturally responsive, and trauma-informed mindfulness practice. *Middle Sch J*. 2021;52(3):4–14.
51. Gardoki-Souto I, Redolar-Ripoll D, Fontana M, Hogg B, Castro MJ, Blanch JM, et al. Prevalence and characterization of psychological trauma in patients with fibromyalgia: A Cross-Sectional study. *Pain Res Manag*. 2022;2022(1):2114451.
52. Sowder KL, Knight LA, Fishalow J. Trauma exposure and health: A review of outcomes and pathways. *J Aggress Maltreatment Trauma*. 2018;27(10):1041–59.
53. Misiak B, Stańczykiewicz B, Pawlak A, Szewczuk-Bogusławska M, Samochowiec J, Samochowiec A, et al. Adverse childhood experiences and low socioeconomic status with respect to allostatic load in adulthood: A systematic review. *Psychoneuroendocrinology*. 2022;136:105602.
54. Houtepen LC, Heron J, Suderman MJ, Fraser A, Chittleborough CR, Howe LD. Associations of adverse childhood experiences with educational attainment and adolescent health and the role of family and socioeconomic factors: A prospective cohort study in the UK. Tomlinson M, editor. *PLOS Med*. 2020;17(3):e1003031.

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