Psychology Research and Behavior Management

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Association of Pain Intensity and Sensitivity with Childhood Trauma in Adolescents with Depressive Disorder: A Multicenter Study

Qingqing Shen[1,*], Qing Zhang[2,3,*], Kai Zhang[2,3,*], Jingwen Shang[2–4], Liucheng Zheng[2], Xiaoping Yuan[2], Zhiwei Liu[5], Liang Sun[5], Feng Geng[6], Rui Tao[2], Huanzhong Liu[7]

[1]Department of Psychiatry, Fourth People's Hospital in Wuhu, Wuhu, Anhui, People's Republic of China; [2]Department of Psychiatry, Chaohu Hospital of Anhui Medical University, Hefei, Anhui, People's Republic of China; [3]Anhui Psychiatric Center, Anhui Medical University, Hefei, Anhui, People's Republic of China; [4]Department of Psychiatry, School of Mental Health and Psychological Sciences, Anhui Medical University, Hefei, Anhui, People's Republic of China; [5]Department of Psychiatry, Fuyang Third People's Hospital, Fuyang, Anhui, People's Republic of China; [6]Department of Psychology and Sleep Medicine, The Second Affiliated Hospital of Anhui Medical University, Hefei, Anhui, People's Republic of China; [7]Department of Psychiatry, Affiliated Psychological Hospital of Anhui Medical University, Hefei, Anhui, People's Republic of China

*These authors contributed equally to this work

Correspondence: Rui Tao, Department of Psychiatry, Chaohu Hospital of Anhui Medical University, Hefei, Anhui, People's Republic of China, Email 350918231@qq.com; Huanzhong Liu, Department of Psychiatry, Affiliated Psychological Hospital of Anhui Medical University, Hefei, Anhui, People's Republic of China, Email huanzhongliu@ahmu.edu.cn

Purpose: To explore the associations of pain intensity and sensitivity with childhood trauma (CT) in adolescents with depressive disorder, we examined differences in these pain-related measures between patients with adolescent depressive disorders who had experienced CT and those who had not (NCT).

Patients and Methods: A multicenter survey was conducted between August 2021 and March 2024. The Childhood Trauma Questionnaire-Short Form (CTQ-SF) assessed subjects' exposure to CT; the Numerical Rating Scale-11 measured somatic pain intensity, and the Handheld Pressure Pain Instrument was used to assess pain sensitivity in the forearm and tibia.

Results: A total of 200 adolescent patients diagnosed with depressive disorders were recruited. The results revealed that the patients who had experienced emotional neglect, sexual abuse, emotional neglect, and physical neglect reported higher pain intensity. Specifically, patients with a history of CT exhibited significantly greater pain intensity compared to those without CT, and those with sexual abuse (SA) and emotional neglect demonstrated lower pain sensitivity. The correlation and regression analyses further indicated that, among adolescents with depressive disorder, those who had experienced CT exhibited lower pain sensitivity and higher pain intensity. Additionally, more severe depression was associated with higher pain intensity and lower pain sensitivity.

Conclusion: Patients with a history of CT exhibited greater pain intensity and lower pain sensitivity than those without CT. Both CT and the severity of depression were strongly linked to increased pain intensity and decreased pain sensitivity, respectively, in patients with adolescent depressive disorders.

Keywords: adolescents, depressive disorder, pain intensity, pain sensitivity, childhood trauma

Introduction

Depressive disorders are prevalent psychiatric and psychological disorders that inflict substantial physical and psychological distress, as well as impose significant social and economic burdens on patients.[1] Adolescence, a period marked by rapid social, emotional, and cognitive development, is characterized by a high incidence of depressive disorders.[2] These disorders not only profoundly affect the physical and mental health and social functioning of adolescents but also have a heightened probability of persisting into adulthood. According to the US Epidemiologic Survey, the prevalence of depressive disorders among adolescents aged between 13 and 18 years is 11%.[3] Adolescents diagnosed with depressive disorders experience more frequent and severe pain compared to their non-depressed peers.[4] Pain, an unpleasant sensory

https://doi.org/10.2147/PRBM.S564172
Received: 30 August 2025
Accepted: 24 December 2025
Published: 13 January 2026

and emotional experience associated with actual or potential tissue damage, significantly disrupts a patient's daily life and often leads to depression and anxiety. Studies have demonstrated a bidirectional relationship between changes in pain severity and depression severity.[5] Notably, most individuals engaging in self-injury report little to no pain during the act,[6] indicating abnormal pain perception, this is, reduced pain sensitivity. Schwier et al compared the cold pain thresholds of 20 adult depressed patients and 20 controls, reporting reduced sensitivity to cold pain among patients with depressive disorders.[7] Suarez-Roca et al used ischemic stimuli to compare pain tolerance in 11 adult depressed patients and 19 controls, concluding that patients with depressive disorders exhibit elevated ischemic pain sensitivity.[8] However, most previous studies have focused on adult patients with depressive disorders and have had small sample sizes. Therefore, 200 adolescents with depressive disorders were included in this study, with a more user-friendly measure of pain sensitivity to enhance the robustness of our findings. Childhood trauma (CT) is also implicated in the development of chronic pain[9] and has profound implications for the long-term health of adolescents with depressive disorders. CT may manifest as emotional abuse (EA), physical abuse (PA), sexual abuse (SA), emotional neglect (EN), and physical neglect (PN).[10] A meta-analysis of CT and depression found that experiencing any form of abuse (statistically considered present or absent) was associated with more than a twofold increase in risk of developing depression in adulthood,[11] as well as chronic or recurrent depression. Among those with depressive disorders, the rate of CT reached 35%.[12] CT may trigger lasting neurobiological changes that predispose individuals to depression.[13] Research has established a significant correlation between stress-related epigenetic alterations and depressive disorders. Childhood exposure to chronic stressors may lead to neuroendocrine dysregulation in adulthood, manifesting as depressive symptoms, a pattern also observed in adolescents.[14,15] A growing body of literature suggests an association between CT and pain-related disorders,[16] with traumatic childhood experiences increasing the likelihood of chronic pain in adulthood.[17,18] Research has shown that the incidence of chronic pain is significantly higher in those with childhood traumatic experiences (8.7%) than in those without (4.6%),[19] and a cross-sectional study revealed that all forms of CT examined were statistically correlated with reported pain severity in adulthood.[20] Furthermore, childhood traumatic experiences increase the risk of suicidal behavior, with individuals who experience CT being 146% more likely to develop suicidal ideation in adulthood compared to those who do not.[21] Chronic pain is associated with an increased risk of suicide,[22,23] which simultaneously mediates the relationship between CT and increased suicide risk,[24] and increased pain sensitivity in individuals with mental illness who exhibit suicidal behaviors.[25] These findings suggest that patients with childhood traumatic experiences and pain are at high risk for suicide. Therefore, exploring the impact of CT on pain intensity and sensitivity in patients with depressive disorders could aid in the clinical management of pain and further reduce suicide risk.

Although previous studies have linked childhood traumatic experiences with pain symptoms in patients with depressive disorders, it remains unclear whether this connection also pertains to adolescents with depressive disorders. Furthermore, few studies have investigated the relationship between pain sensitivity and CT, as measured by the pressure–pain measure, in Chinese patients with depressive disorders, which is necessary in the adolescent population. The objective of this study is to explore the associations between pain intensity and sensitivity with CT in adolescents with depressive disorder by comparing the variables in pain intensity and sensitivity between patients with adolescent depressive disorders with and without CT. In this context, we proposed three hypotheses: 1) Patients who have experienced CT will report a higher incidence of somatic pain than those in the NCT group; 2) The severity of CT will be positively correlated with the intensity of somatic pain; and 3) The severity of CT will be negatively correlated with pain sensitivity.

Materials and Methods

Participants

Between August 2021 and March 2024, patients with depressive disorders in psychiatric outpatient and inpatient settings were recruited from Chaohu Hospital of Anhui Medical University, the Second Affiliated Hospital of Anhui Medical University, and Fuyang Third People's Hospital through consecutive enrollment. Structured clinical interviews were conducted with the patients by two professionally trained attending psychiatrists with undergraduate degrees or higher, in compliance with the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5). Following the

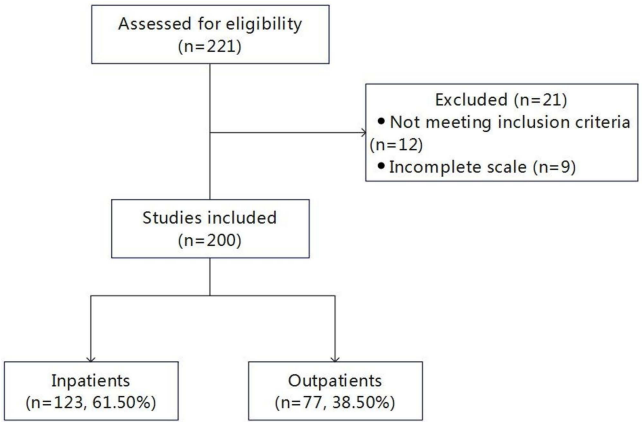

Figure 1 Flow chart.

diagnosis of depressive disorder, the subjects were assessed using a related scale. The inclusion criteria were as follows: (1) meeting the DSM-5 diagnostic criteria for depressive disorders; (2) being aged 12–18 years; and (3) understanding the questionnaire content. The exclusion criteria were as follows: (1) having severe somatic diseases, infectious diseases, or immune system diseases within the past year, such as epilepsy, tumors, heart disease, organic brain diseases, or other conditions causing somatic pain; (2) having other psychiatric disorders in the year preceding enrollment; (3) receiving painkillers, nonsteroidal anti-inflammatory drugs, or other treatments in the 2 weeks prior to the study; and (4) having broken, red, swollen, or infected skin at the test site or being unwilling or unable to cooperate. A total of 221 patients were initially recruited, with 9 excluded for failing to complete the CT Questionnaire-Short Form (CTQ-SF), and 12 excluded for not meeting the inclusion criteria (Figure 1).

Informed consent was secured from the parents, and upon obtaining approval, all participants signed an informed consent form and were thoroughly informed about the purpose of the study. The study was approved by the Ethics Committee of Chaohu Hospital of Anhui Medical University (Ethics No. KYXM-202112-010) and all study procedures were conducted in accordance with the Declaration of Helsinki.

Research Methodology

In this study, a self-administered questionnaire was utilized to collect general demographic information about the participants, including their sex, age, status as an only child, height, and weight. Depression severity in adolescents with depressive disorders was assessed via the 24-item Hamilton Rating Scale for Depression (HAMD). This scale comprises a total of 24 items, with 14 items scored on a 5-point scale ranging from 0 (absent) to 4 (very severe) and 10 items scored on a 3-point scale ranging from 0 (absent) to 2 (severe). Higher scores on the scale indicate more severe depressive symptoms, with a total score of 8 to 19 suggesting mild depression, 20 to 34 indicating moderate depression, and a score above 35 suggesting the severe depression.[26]

The CTQ-SF was utilized to assess the CT experiences of patients.[27] The questionnaire comprises 25 clinical items and 3 validity items, organized into five subscales: SA (emotional abuse), PA (physical abuse), EA (sexual abuse), PN (emotional neglect), and EN (physical neglect). Each subscale consists of five items related to childhood experiences, scored on a 5-point Likert scale ranging from 1 (never) to 5 (always). A score meeting or exceeding specific thresholds (emotional abuse $\geq$ 13, physical abuse $\geq$ 10, sexual abuse $\geq$ 8, emotional neglect $\geq$ 15, and physical neglect $\geq$ 10) indicates that the individual has suffered from CT; a higher score indicates more severe trauma. This Chinese version of the questionnaire has demonstrated good validity and reliability in previous studies.[28]

After the scale was completed, the pain of the patients was assessed by interview, the subjects were asked if they had pain lasting at least 6 weeks, with a positive response indicating the presence of pain.[29] Pain intensity was assessed via the Numerical Rating Scale-11 (NRS-11), a widely used tool for assessing chronic pain among adolescents. The subjects rated their pain on a scale from 0 to 10 (0 = no pain, 10 = maximum pain intensity).[30] The ratings were categorized into 4

levels: 0 = no pain, 1–3 = mild pain, 4–6 = moderate pain, and 7–10= severe pain.[31] The NRS-11 has demonstrated good psychometric properties with high sensitivity and stability.[32]

After completing general data collection, scale assessment and pain assessment, we tested pain sensitivity using an experimental pressure pain test method using a handheld pressure pain instrument (FPX 50, Wagner Instruments, Greenwich, Conn., USA) to assess pain thresholds (PPT) and pain tolerance (PTO). PPT refers to the minimum stimulus intensity at which an individual can perceive pain, while PTO refers to the maximum pain stimulus intensity that an individual can tolerate.[33] The test was performed using a handheld pressure pain instrument with a 1 cm^2 rubber tip (FPX50, Wagner Instruments, Greenwich, Conn., USA) to assess PPT and PTO. Four locations were selected for the pressure pain test: bilaterally at the brachioradialis muscle on the lateral forearm and bilaterally 13 cm below the patella on the medial border of the tibia.[34,35] The patients were instructed to inform the operator when they started to feel pain and when they could not tolerate the pain. The measurements were repeated three times at each site, with 10-minute intervals between each measurement. The mean PPT and PTO values for the six measurements at the lateral brachioradialis muscle of the forearms were taken bilaterally and labeled PPT-1 and PTO-1. The mean values for the pain threshold and mean pain tolerance of the six measurements at the medial border of the tibia at the 13-cm level of the infrapatellar area bilaterally were taken and labeled PPT-2 and PTO-2.[23]

Statistical Analysis

Statistical data analysis was performed with SPSS24.0. All continuous variables were summarized through standard descriptive statistics, presented as mean ± standard deviations, while categorical variables were presented as frequency distribution (%). The Mann–Whitney *U*-test was used to analyze the differences in age, BMI, and HAMD total scores, and to compare the pain intensity and pain sensitivity between patients with and without a history of CT. The Chi-square test was employed to analyze the disparities in gender, only child status, pain presence, and pain intensity grade. Spearman correlation analysis was utilized to assess the relationships between pain intensity and pain sensitivity with general data and CT. With pain intensity and pain sensitivity as dependent variables, variables of statistical significance in the correlation analysis were selected as independent variables. Multiple linear regression analysis was applied to explore the factors affecting pain intensity and pain sensitivity. The significance level was established at $P < 0.05$ (two-tailed).

Results

Comparison of the Sociodemographic and Clinical Characteristics of Adolescents with Depressive Disorders

In this study, among the 200 patients with adolescent depressive disorders, 90.5% reported somatic pain, 166 patients (83%) had a history of CT, 94 (47% of the total) had suffered from any form of childhood maltreatment, and 159 (79.5% of the total) had undergone emotional or physical neglect during childhood. The incidence of somatic pain was higher in patients with CT (92.17%) compared to those without CT (82.35%). Among the five types of CT, EN was the most prevalent of trauma (N = 134), followed by PN (N = 131), EA (N = 84), PA (N = 39), and SA (N = 20). Patients with trauma were younger than those without trauma ($Z = -2.431$, $P = 0.015$) and exhibited significantly higher HAMD scores ($Z = -3.466$, $P = 0.001$) and pain intensity ($Z = -2.140$, $P = 0.032$) than their non-traumatized counterparts. The specific results are shown in Table 1.

Comparison of Pain Intensity and Sensitivity in Depressed Adolescents with and without CT

The results of the statistical analysis revealed that patients who experienced CT, EA, SA, EN, and PN exhibited higher pain intensity than those who did not experience these conditions ($P < 0.05$). There was no statistically significant difference, however, in pain sensitivity between patients with and without CT, EA, PA, and PN ($P > 0.05$). Notably, patients who had experienced SA demonstrated significantly lower pain sensitivity (as measured by PTO-1 and PTO-2) than those who had not. The presence of EN was associated with significantly lower pain sensitivity (as measured by PPT-1, PTO-1, and PTO-2) compared to patients without EN. The specific results are shown in Table 2.

Table 1 Comparison of Sociodemographic and Clinical Characteristics of Adolescents with Depressive Disorders Based on CT

Variables	Total	Trauma	No Trauma	Statistics	
	N=200	N=166	N=34	$\chi 2/Z$	*P*
Gender [N (%)]				3.827	0.050
Male	50	37 (22.29)	13 (38.24)		
Female	150	129 (77.71)	21 (61.76)		
Only child [N (%)]				0.353	0.552
Yes	62	50 (30.12)	12 (35.29)		
No	138	116 (67.88)	22 (64.71)		
Age		15.02±1.59	15.74±1.29	−2.431	0.015*
BMI (Kg/m^2)		20.26±3.99	21.27±4.71	−0.806	0.420
HAMD		28.54±6.90	23.15±7.89	−3.466	0.001**
Presence of pain [N (%)]				5.634	0.075
Yes	181	153 (92.17)	28 (82.35)		
No	19	13 (7.83)	6 (17.65)		
Pain intensity grading [N (%)]				5.634	0.131
No pain	21	15 (9.04)	6 (17.64)		
Mild pain	61	48 (28.92)	13 (38.24)		
Moderate pain	86	73 (43.97)	13 (38.24)		
Severe pain	32	30 (18.07)	2 (5.88)		

Note: *P< 0.05; **P< 0.01.
Abbreviations: EA, emotional abuse; PA, physical abuse; SA, sexual abuse; EN, emotional neglect; PN, physical neglect.

Spearman Correlation Analysis of Pain Sensitivity and Pain Intensity with General Information and Clinical Characteristics

This study correlated general data and CT with pain sensitivity and pain intensity. The findings are as follows: pain intensity exhibited a negative correlation with age and sex, while demonstrating a positive correlation with the total HAMD score, the presence of CT, EA, SA, EN, and PN. PPT-1 was positively correlated with the total HAMD score and the presence of EN. Similarly, PPT-2 was positively correlated with the total HAMD score. PTO-1 was positively associated with the total HAMD score, the presence of SA, and EN. Finally, PTO-2 was negatively associated with being an only child but positively associated with the total HAMD score, the presence of SA, and EN. The specific results are presented in Table 3.

Multiple Linear Regression Analysis of Factors Affecting Pain Intensity and Pain Sensitivity in the Subjects

In this study, pain intensity, PPT-1, PPT-2, PTO-1, and PTO-2 were each utilized as dependent variables, while variables exhibiting statistical differences in sociodemographic characteristics and correlation analysis were incorporated as independent variables. The outcomes of the linear model analysis are as follows: 1. The model constructed with pain intensity as the dependent variable reveals a negative effect of age on pain intensity and a statistically significant positive effect of PN on pain intensity. 2. The model constructed with PTO-2 as the dependent variable demonstrates a statistically significant positive effect of having SA and EN on tibial pain tolerance. 3. The model constructed with pain intensity, PPT-1, PPT-2, and PTO-1 as dependent variables indicates that the HAMD total score has a significant positive effect on pain intensity and a significant negative effect on experimental pain sensitivity ($P < 0.05$). The specific results are given in Table 4.

Table 2 Comparison of Pain Intensity and Sensitivity in Depressed Adolescents with and without CT

Variables	PPT-1	PTO-1	PPT-2	PPT-2	Pain Intensity
CTQ					
Yes	43.71±25.34	107.91±39.91	57.74±31.13	124.99±39.86	4.15±2.42
No	37.39±28.77	96.76±44.95	49.78±26.76	111.26±42.30	3.15±2.26
P	0.081	0.085	0.104	0.088	0.032*
EA					
Yes	46.52±26.70	110.50±41.95	59.65±29.78	128.19±39.07	4.48±2.39
No	39.82±25.21	102.79±40.00	53.73±30.99	118.65±41.21	3.62±2.38
P	0.082	0.174	0.094	0.113	0.024*
PA					
Yes	45.95±28.89	113.94±41.14	58.59±30.53	129.26±39.67	4.44±2.44
No	41.83±25.27	104.11±40.74	55.64±30.63	121.05±40.66	3.87±2.41
P	0.681	0.138	0.703	0.230	0.238
SA					
Yes	46.88±28.71	126.71±43.06	64.02±37.69	145.36±46.69	5.05±2.06
No	42.18±25.69	103.71±40.24	55.24±29.64	119.84±39.21	3.85±2.43
P	0.464	0.024*	0.342	0.017*	0.041*
EN					
Yes	45.32±25.67	111.06±38.67	58.92±31.15	129.01±39.71	4.35±2.43
No	37.17±25.98	95.82±43.64	50.72±28.76	109.75±39.29	3.23±2.23
P	0.016*	0.004**	0.061	0.016*	0.002**
PN					
Yes	43.45±26.00	107.60±40.09	58.37±32.32	124.29±39.75	4.36±2.42
No	41.41±26.15	103.65±42.56	52.50±26.63	119.78±42.29	3.22±2.26
P	0.567	0.435	0.305	0.486	0.002**

Notes: *P< 0.05; **P< 0.01.
Abbreviations: EA, emotional abuse; PA, physical abuse; SA, sexual abuse; EN, emotional neglect; PN, physical neglect.

Table 3 Spearman Correlation Analysis Results of Pain Sensitivity and Pain Intensity with General Information and Clinical Characteristics

r	Pain Intensity	PPT-1	PPT-2	PTO-1	PTO-2
Age	−0.203**	−0.017	0.008	0.036	−0.033
Gender	−0.223**	−0.101	−0.058	0.063	0.010
Only child	0.006	0.101	0.038	−0.119	−0.166*
BMI	0.001	0.032	0.072	0.074	0.101
HAMD	0.324***	0.332***	0.296***	0.251***	0.183**
CT	0.152*	0.124	0.115	0.122	0.121
EA	0.160*	0.123	0.119	0.096	0.112
PA	0.084	0.029	0.027	0.105	0.085
SA	0.147*	0.052	0.068	0.161*	0.171*
EN	0.216**	0.170*	0.133	0.204**	0.227**
PA	0.215**	0.041	0.073	0.056	0.050

Notes: *P< 0.05; **P< 0.01; ***P< 0.001; r: correlation.
Abbreviations: EA, emotional abuse; PA, physical abuse; SA, sexual abuse; EN, emotional neglect; PN, physical neglect.

Discussion

The objective of this study was to further explore the associations of pain intensity and sensitivity with CT in adolescents with depressive disorder by examining the disparities in pain intensity and sensitivity between patients with adolescent

Table 4 Multiple Linear Regression of Pain Intensity and Pain Sensitivity Affecting the Subjects

Variables	Pain Intensity			PPT-1			PTO-1			PTO-2		
	β	t	*P*	β	t	*P*	β	t	*P*	β	t	*P*
Age	−0.155	−2.328	0.021*	–	–	–	–	–	–	–	–	–
Gender (Ref. Female)	−0.133	−1.939	0.054	–	–	–	–	–	–	–	–	–
Only child	0.030	0.451	0.653	–	–	–	–	–	–	−0.120	−1.726	0.086
HAMD	0.291	4.246	<0.001***	0.230	3.305	0.001**	0.194	2.760	0.006**	0.097	1.353	0.178
CT (Ref. No)	−0.057	−0.658	0.511	–	–	–	–	–	–	–	–	–
EA (Yes)	0.021	0.282	0.778	–	–	–	–	–	–	–	–	–
SA (Yes)	0.106	1.580	0.116	–	–	–	0.123	1.738	0.084	0.148	2.131	0.034*
EN (Yes)	0.071	0.937	0.350	0.091	1.274	0.204	0.124	1.711	0.089	0.207	2.969	0.003**
PN(Yes)	0.137	1.991	0.048*	–	–	–	–	–	–	–	–	–

Notes: *P< 0.05; **P< 0.01; ***P< 0.001.
Abbreviations: EA, emotional abuse; PA, physical abuse; SA, sexual abuse; EN, emotional neglect; PN, physical neglect.

depressive disorder with and without CT. The findings reveal that patients with CT exhibited higher pain intensity and reduced pain sensitivity than those without CT. Both CT and the severity of depressive symptoms are closely linked to increased pain intensity and decreased pain sensitivity, respectively, in patients with adolescent depressive disorder.

Demographic Characteristics of Adolescents with Depressive Disorders Resulting from CT

In our study, a total of 166 patients (83%) with adolescent depressive disorder were identified as having a history of CT, whereas it is estimated that only 61.6% of the general population has reported at least one CT,[36] a significantly lower percentage than that observed in those with depressive disorders. The two most prevalent types of traumatic experiences were EN and PN, while PA and SA were the least common, aligning with the findings of Xie et al.[37] It was discovered in our study that female adolescents had a markedly higher prevalence of CT compared to male, which is consistent with previous research and may be attributed to females' greater psychological vulnerability following traumatic events.[38] Patients with CT and neglect experiences are significantly younger than those without such experiences, possibly because maltreatment significantly impacts neurodevelopmental trajectories.[39] Younger patients, with relatively less developed brain functions, may be more susceptible to the negative effects of CT. Research has demonstrated that CT has long-term effects on cognitive development, potentially leading to the emergence of mood disorders, and that CT contributes to the onset or exacerbation of depressive symptoms through the development of negative cognitive styles.[40] Consistent with our findings, patients with CT exhibited significantly greater depression severity than those without CT.

Depressive Disorders with Pain

Previous studies have reported comorbidity rates of pain and depression reaching up to 80%.[41] Individuals with depressive disorders and co-occurring chronic pain or painful somatic symptoms face a higher risk of disability than those with depressive disorders without pain symptoms or those with chronic pain without depressive symptoms.[42] In the present study, the prevalence of somatic pain among adolescents with depressive disorders was found to be 90.5%. Additionally, the present study revealed a positive correlation between pain intensity, pain intensity grading, and total HAMD scores. The regression model further revealed that as depression severity increases, so do patients' pain intensity and grading, aligning with previous findings,[5,23,43] possibly attributed to increased levels of inflammatory factors in patients with adolescent depressive disorders, which promote the development of pain. Patients with depression and pain typically exhibit elevated levels of these inflammatory factors.[44,45] Notably, elevated serum P-selectin levels have emerged as the most significant predictor of pain in patients with comorbid depression.[46]

Moreover, our study identified a negative correlation between age and pain intensity in adolescent patients with depressive disorders, possibly due to neurobiological vulnerabilities during childhood and adolescence that impair

emotional regulation. Relatively younger patients have less developed brain functions, thereby increasing the risk of developing pain.[47]

CT and Pain Intensity

Traumatic childhood experiences increase the likelihood of chronic pain.[18] Meta-analyses have shown that childhood maltreatment and neglect are associated with more severe pain symptoms compared to individuals without CT experiences.[48] Consistent with these results, it was revealed in our study that patients with CT had a higher incidence of somatic pain (92.17%) than did those without CT (82.35%), and they experienced higher pain intensity. As anticipated, the regression analysis results showed a significant positive effect on pain intensity. Consistent with previous research, an increase in the number of CT experiences was associated with higher levels of psychosocial dysfunction[49] and increased CT pain intensity.[48] These findings suggest that individuals who have experienced higher levels of CT are more susceptible to adverse health outcomes.

From a psychoneuroimmunological perspective, exposure to CT during a critical period of neuroendocrine development can lead to adaptive overload when environmental stressors exceed an individual's coping capacity.[50] This overload can trigger stress reactivity, heightened physiological sensitivity to stress, and immune dysregulation.[51] Notably, stress and immune system dysregulation are significantly associated with elevated levels of inflammatory biomarkers.[52] Furthermore, early-life stress may provoke an overreaction in microglia, fostering neuroinflammation, and persistent inflammation can cause peripheral sensitization, ultimately leading to chronic widespread pain.[53] More pronounced inflammatory effects have been observed in populations with cumulative exposure to CT,[54] ie, a greater intensity of somatic pain in patients with high levels of CT. Additionally, several studies have explored the mediating and moderating roles of psychiatric disorders in the relationship between CT and pain, indicating that mood disorders may exacerbate the effects of CT on pain.[9] These findings suggest the significant contribution of CT to the somatic symptoms of adolescents with depressive disorders.

CT and Pain Sensitivity

Exposure to early-life stressors may become entrenched in one's life trajectory, leading to enduring alterations in biological systems.[55,56] In this study, patients with SA and EN exhibited significantly lower pain sensitivity than those without SA and EN, with no discernible differences in several other dimensions. However, a trend emerged indicating that patients with trauma had higher pain thresholds and tolerance than those without trauma, suggesting that a larger sample size in subsequent studies might reveal that patients with traumatic experiences have lower pain sensitivity. Meanwhile, exposure to SA and EN was negatively associated with pain sensitivity, meaning that patients with SA or EN displayed lower pain sensitivity relative to those without emotional neglect,[57] aligning with our findings. One possible explanation is that early-life events are associated with low reactivity in the stress response system,[58] potentially manifesting as a reduced perception of threat to stressful stimuli (ie, lower stress pain sensitivity).[59] Another possibility is that a potential psychological correlation of physiological pain sensitivity is dissociation. Dissociation represents a natural defense mechanism that refers to traumatized persons' tendency to experience alterations in conscious awareness on a continuum ranging from absorption and daydreaming to depersonalization, derealization, or amnesia.[60] Previous research suggests that dissociative experiences are associated with decreased pain sensitivity among healthy controls.[61] Individuals with a positive abuse history engage in more dissociation, which could dampen pain responses.[62] However, research in this area is relatively limited, making comparative analysis of results challenging.

Strengths and Limitations

Our experiment is innovative in that we are the first research team, based on the literature we could retrieve, to utilize both the forearm and the tibia as test points for assessing pain sensitivity in adolescent patients with depressive disorders. Research on adolescent populations is relatively limited, and our selection of these specific test points as study subjects is expected to provide valuable guidance for their future developmental progress. Our study aims to strengthen the emphasis on childhood traumatic experiences and pain conditions in adolescents with depressive disorders.

Conclusion

This investigation revealed that, within the group of adolescents with depressive disorders, patients with CT exhibited greater pain intensity and reduced pain sensitivity than patients without CT. A strong correlation was observed between CT and depression severity, with increased pain intensity and decreased pain sensitivity, respectively, in these patients. These findings contribute to a better understanding of the relationships among CT, pain intensity, and pain sensitivity in patients with adolescent depressive disorders. In clinical practice, psychiatrists should be attentive to the CT experienced by patients with adolescent depressive disorder and implement appropriate interventions, which are crucial for the early screening and management of pain symptoms and the prevention of suicidal behavior in this patient population.

Data Sharing Statement

The data used for this study are available from the corresponding author (huanzhongliu@ahmu.edu.cn) on reasonable request.

Ethics Approval and Informed Consent

The survey strictly followed the principles of the Helsinki Declaration and was approved by the Ethics Committee of Chaohu Hospital of Anhui Medical University (KYXM-202112-010). Before filling out the questionnaire, we informed patients and families about the purpose of this study and ensure that their personal privacy would not be disclosed. The patient and family signed informed consent.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This study was supported by Research Fund of Anhui Institute of translational medicine (2022zhyx-B01) and Anhui Health Research Project (Grant No. AHWJ2024Aa10004).

Disclosure

The authors have no potential conflicts of interest to disclose.

References

1. Malhi GS, Mann JJ. Depression. *Lancet*. 2018;392(10161):2299–2312. doi:10.1016/S0140-6736(18)31948-2
2. Hauenstein EJ. Depression in adolescence. *J Obstet Gynecol Neonatal Nurs*. 2003;32(2):239–248. doi:10.1177/0884217503252133
3. Avenevoli S, Swendsen J, He JP, Burstein M, Merikangas KR. Major depression in the national comorbidity survey-adolescent supplement: prevalence, correlates, and treatment. *J Am Acad Child Adolesc Psychiatry*. 2015;54(1):37–44.e2. doi:10.1016/j.jaac.2014.10.010
4. Murray CB, Murphy LK, Palermo TM, Clarke GM. Pain and sleep-wake disturbances in adolescents with depressive disorders. *J Clin Child Adolesc Psychol*. 2012;41(4):482–490. doi:10.1080/15374416.2012.658613
5. Kroenke K, Wu J, Bair MJ, Krebs EE, Damush TM, Tu W. Reciprocal relationship between pain and depression: a 12-month longitudinal analysis in primary care. *J Pain*. 2011;12(9):964–973. doi:10.1016/j.jpain.2011.03.003
6. Nock MK, Prinstein MJ. Contextual features and behavioral functions of self-mutilation among adolescents. *J Abnorm Psychol*. 2005;114 (1):140–146. doi:10.1037/0021-843X.114.1.140
7. Schwier C, Kliem A, Boettger MK, Bär K-J. Increased cold-pain thresholds in major depression. *J Pain*. 2010;11(3):287–290. doi:10.1016/j.jpain.2009.07.012
8. Suarez-Roca H, Piñerua-Shuhaibar L, Morales ME, Maixner W. Increased perception of post-ischemic paresthesias in depressed subjects. *J Psychosom Res*. 2003;55(3):253–257. doi:10.1016/S0022-3999(02)00498-1
9. Sachs-Ericsson NJ, Sheffler JL, Stanley IH, Piazza JR, Preacher KJ. When emotional pain becomes physical: adverse childhood experiences, pain, and the role of mood and anxiety disorders. *J Clin Psychol*. 2017;73(10):1403–1428. doi:10.1002/jclp.22444
10. Li X, Wang X, Sun L, et al. Associations between childhood maltreatment and suicidal ideation in depressed adolescents: the mediating effect of alexithymia and insomnia. *Child Abuse Negl*. 2023;135:105990. doi:10.1016/j.chiabu.2022.105990
11. Humphreys KL, LeMoult J, Wear JG, Piersiak HA, Lee A, Gotlib IH. Child maltreatment and depression: a meta-analysis of studies using the Childhood Trauma Questionnaire. *Child Abuse Negl*. 2020;102:104361. doi:10.1016/j.chiabu.2020.104361

12. Young EA, Abelson JL, Curtis GC, Nesse RM. Childhood adversity and vulnerability to mood and anxiety disorders. *Depress Anxiety*. 1997;5(2):66–72. doi:10.1002/(SICI)1520-6394(1997)5:2<66::AID-DA2>3.0.CO;2-3
13. Luo B, Yang Y, Zhang D, et al. Sleep disorders mediate the link between childhood trauma and depression severity in children and adolescents with depression. *Front Psychiatry*. 2022;13:993284. doi:10.3389/fpsyt.2022.993284
14. Suzuki A, Poon L, Papadopoulos AS, Kumari V, Cleare AJ. Long term effects of childhood trauma on cortisol stress reactivity in adulthood and relationship to the occurrence of depression. *Psychoneuroendocrinology*. 2014;50:289–299. doi:10.1016/j.psyneuen.2014.09.007
15. Horn SR, Leve LD, Levitt P, Fisher PA. Childhood adversity, mental health, and oxidative stress: a pilot study. *PLoS One*. 2019;14(4):e0215085. doi:10.1371/journal.pone.0215085
16. Scott KM, Von Korff M, Angermeyer MC, et al. Association of childhood adversities and early-onset mental disorders with adult-onset chronic physical conditions. *Arch Gen Psychiatry*. 2011;68(8):838–844. doi:10.1001/archgenpsychiatry.2011.77
17. Sherman AL, Morris MC, Bruehl S, Westbrook TD, Walker LS. Heightened temporal summation of pain in patients with functional gastrointestinal disorders and history of Trauma. *Ann Behav Med*. 2015;49(6):785–792. doi:10.1007/s12160-015-9712-5
18. You DS, Albu S, Lisenbardt H, Meagher MW. Cumulative childhood adversity as a risk factor for common chronic pain conditions in young adults. *Pain Med*. 2019;20(3):486–494. doi:10.1093/pm/pny106
19. Groenewald CB, Murray CB, Palermo TM. Adverse childhood experiences and chronic pain among children and adolescents in the United States. *Pain Rep*. 2020;5(5):e839. doi:10.1097/PR9.0000000000000839
20. 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):PCC.13m01506. doi:10.4088/PCC.13m01506
21. Dunn EC, McLaughlin KA, Slopen N, Rosand J, Smoller JW. Developmental timing of child maltreatment and symptoms of depression and suicidal ideation in young adulthood: results from the National Longitudinal Study of Adolescent Health. *Depress Anxiety*. 2013;30(10):955–964. doi:10.1002/da.22102
22. Ratcliffe GE, Enns MW, Belik S-L, Sareen J. Chronic pain conditions and suicidal ideation and suicide attempts: an epidemiologic perspective. *Clin J Pain*. 2008;24(3):204–210. doi:10.1097/AJP.0b013e31815ca2a3
23. Shen Q, Zhang Q, Liu Y, et al. Association of pain intensity and sensitivity with suicidal ideation in adolescents with depressive disorder. *Psychol Res Behav Manag*. 2024;17:3121–3131. doi:10.2147/PRBM.S473074
24. Fuller-Thomson E, Baird SL, Dhrodia R, Brennenstuhl S. The association between adverse childhood experiences (ACEs) and suicide attempts in a population-based study. *Child Care Health Dev*. 2016;42(5):725–734. doi:10.1111/cch.12351
25. Orbach I, Palgi Y, Stein D, et al. Tolerance for physical pain in suicidal subjects. *Death Stud*. 1996;20(4):327–341. doi:10.1080/07481189608252786
26. Pan S, Liu ZW, Shi S, et al. Hamilton rating scale for depression-24 (HAM-D24) as a novel predictor for diabetic microvascular complications in type 2 diabetes mellitus patients. *Psychiatry Res*. 2017;258:177–183. doi:10.1016/j.psychres.2017.07.050
27. Bernstein DP, Stein JA, Newcomb MD, et al. Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse Negl*. 2003;27(2):169–190. doi:10.1016/S0145-2134(02)00541-0
28. Wang X, Yang J, Wang P, et al. Childhood maltreatment, moral disengagement, and adolescents' cyberbullying perpetration: fathers' and mothers' moral disengagement as moderators [J]. *Computers Human Behav*. 2019;95:48–57. doi:10.1016/j.chb.2019.01.031
29. Agüera-Ortiz L, Failde I, Mico JA, Cervilla J, López-Ibor JJ. Pain as a symptom of depression: prevalence and clinical correlates in patients attending psychiatric clinics. *J Affect Disord*. 2011;130(1–2):106–112. doi:10.1016/j.jad.2010.10.022
30. Ruskin D, Lalloo C, Amaria K, et al. Assessing pain intensity in children with chronic pain: convergent and discriminant validity of the 0 to 10 numerical rating scale in clinical practice. *Pain Res Manag*. 2014;19(3):141–148. doi:10.1155/2014/856513
31. Treede RD, Rief W, Barke A, et al. Chronic pain as a symptom or a disease: the IASP Classification of Chronic Pain for the International Classification of Diseases (ICD-11). *Pain*. 2019;160(1):19–27. doi:10.1097/j.pain.0000000000001384
32. Euasobhon P, Atisook R, Bumrungchatudom K, Zinboonyahgoon N, Saisavoey N, Jensen MP. Reliability and responsivity of pain intensity scales in individuals with chronic pain. *Pain*. 2022;163(12):e1184–e1191. doi:10.1097/j.pain.0000000000002692
33. Hooley JM, Ho DT, Slater J, Lockshin A. Pain perception and nonsuicidal self-injury: a laboratory investigation. *Personal Disord*. 2010;1(3):170–179. doi:10.1037/a0020106
34. Duan G, Xiang G, Zhang X, Yuan R, Zhan H, Qi D. A single-nucleotide polymorphism in SCN9A may decrease postoperative pain sensitivity in the general population. *Anesthesiology*. 2013;118(2):436–442. doi:10.1097/ALN.0b013e31827dde74
35. Kim DJ, Blossom SJ, Delgado PL, Carbajal JM, Cáceda R. Examination of pain threshold and neuropeptides in patients with acute suicide risk. *Prog Neuropsychopharmacol Biol Psychiatry*. 2019;95:109705. doi:10.1016/j.pnpbp.2019.109705
36. Merrick MT, Ford DC, Ports KA, Guinn AS. Prevalence of adverse childhood experiences from the 2011–2014 behavioral risk factor surveillance system in 23 states. *JAMA Pediatr*. 2018;172(11):1038–1044. doi:10.1001/jamapediatrics.2018.2537
37. Xie P, Wu K, Zheng Y, et al. Prevalence of childhood trauma and correlations between childhood trauma, suicidal ideation, and social support in patients with depression, bipolar disorder, and schizophrenia in southern China. *J Affect Disord*. 2018;228:41–48. doi:10.1016/j.jad.2017.11.011
38. Brydges NM, Best C, Thomas KL. Female HPA axis displays heightened sensitivity to pre-pubertal stress. *Stress*. 2020;23(2):190–200. doi:10.1080/10253890.2019.1658738
39. Ohashi K, Anderson CM, Bolger EA, Khan A, McGreenery CE, Teicher MH. Susceptibility or resilience to maltreatment can be explained by specific differences in brain network architecture. *Biol Psychiatry*. 2019;85(8):690–702. doi:10.1016/j.biopsych.2018.10.016
40. Alloy LB, Abramson LY, Smith JM, Gibb BE, Neeren AM. Role of parenting and maltreatment histories in unipolar and bipolar mood disorders: mediation by cognitive vulnerability to depression. *Clin Child Fam Psychol Rev*. 2006;9(1):23–64. doi:10.1007/s10567-006-0002-4
41. Poole H, White S, Blake C, Murphy P, Bramwell R. Depression in chronic pain patients: prevalence and measurement. *Pain Pract*. 2009;9(3):173–180. doi:10.1111/j.1533-2500.2009.00274.x
42. Currie SR, Wang J. More data on major depression as an antecedent risk factor for first onset of chronic back pain. *Psychol Med*. 2005;35(9):1275–1282. doi:10.1017/S0033291705004952
43. Williams LS, Jones WJ, Shen J, Robinson RL, Kroenke K. Outcomes of newly referred neurology outpatients with depression and pain. *Neurology*. 2004;63(4):674–677. doi:10.1212/01.WNL.0000134669.05005.95

44. Omoigui S. The biochemical origin of pain: the origin of all pain is inflammation and the inflammatory response. Part 2 of 3 - inflammatory profile of pain syndromes. *Med Hypotheses*. 2007;69(6):1169–1178. doi:10.1016/j.mehy.2007.06.033
45. Raison CL, Capuron L, Miller AH. Cytokines sing the blues: inflammation and the pathogenesis of depression. *Trends Immunol*. 2006;27(1):24–31. doi:10.1016/j.it.2005.11.006
46. Bai Y-M, Chiou W-F, Su T-P, Li C-T, Chen M-H. Pro-inflammatory cytokine associated with somatic and pain symptoms in depression. *J Affect Disord*. 2014;155:28–34. doi:10.1016/j.jad.2013.10.019
47. Cay M, Gonzalez-Heydrich J, Teicher MH, et al. Childhood maltreatment and its role in the development of pain and psychopathology. *Lancet Child Adolesc Health*. 2022;6(3):195–206. doi:10.1016/S2352-4642(21)00339-4
48. Davis DA, Luecken LJ, Zautra AJ. Are reports of childhood abuse related to the experience of chronic pain in adulthood? A meta-analytic review of the literature. *Clin J Pain*. 2005;21(5):398–405. doi:10.1097/01.ajp.0000149795.08746.31
49. Nelson S, Simons LE, Logan D. The incidence of Adverse Childhood Experiences (ACEs) and their association with pain-related and psychosocial impairment in youth with chronic pain. *Clin J Pain*. 2018;34(5):402–408. doi:10.1097/AJP.0000000000000549
50. Guidi J, Lucente M, Sonino N, Fava GA. Allostatic load and its impact on health: a systematic review. *Psychother Psychosom*. 2021;90(1):11–27. doi:10.1159/000510696
51. 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;10:118. doi:10.3389/fpsyt.2019.00118
52. Baumeister D, Akhtar R, Ciufolini S, Pariante CM, Mondelli V. Childhood trauma and adulthood inflammation: a meta-analysis of peripheral C-reactive protein, interleukin-6 and tumour necrosis factor-α. *Mol Psychiatry*. 2016;21(5):642–649. doi:10.1038/mp.2015.67
53. Ji RR, Nackley A, Huh Y, Terrando N, Maixner W. Neuroinflammation and central sensitization in chronic and widespread pain. *Anesthesiology*. 2018;129(2):343–366. doi:10.1097/ALN.0000000000002130
54. Chen M, Lacey RE. Adverse childhood experiences and adult inflammation: findings from the 1958 British birth cohort. *Brain Behav Immun*. 2018;69:582–590. doi:10.1016/j.bbi.2018.02.007
55. Cole SW. Social regulation of human gene expression: mechanisms and implications for public health. *Am J Public Health*. 2013;103(Suppl 1): S84–S92. doi:10.2105/AJPH.2012.301183
56. Denk F, McMahon SB, Tracey I. Pain vulnerability: a neurobiological perspective. *Nat Neurosci*. 2014;17(2):192–200. doi:10.1038/nn.3628
57. Waller R, Smith AJ, O'Sullivan PB, Slater H, Sterling M, Straker LM. The association of early life stressors with pain sensitivity and pain experience at 22 years. *Pain*. 2020;161(1):220–229. doi:10.1097/j.pain.0000000000001704
58. Bunea IM, Szentágotai-Tătar A, Miu AC. Early-life adversity and cortisol response to social stress: a meta-analysis. *Transl Psychiatry*. 2017;7 (12):1274. doi:10.1038/s41398-017-0032-3
59. Vassend O, Røysamb E, Nielsen CS. Five-factor personality traits and pain sensitivity: a twin study. *Pain*. 2013;154(5):722–728. doi:10.1016/j.pain.2013.01.010
60. Macarenco MM, Opariuc-Dan C, Nedelcea C. Childhood trauma, dissociation, alexithymia, and anger in people with autoimmune diseases: a mediation model. *Child Abuse Negl*. 2021;122:105322. doi:10.1016/j.chiabu.2021.105322
61. Ağargün MY, Tekeoğlu I, Kara H, Adak B, Ercan M. Hypnotizability, pain threshold, and dissociative experiences. *Biol Psychiatry*. 1998;44 (1):69–71. doi:10.1016/S0006-3223(97)00511-8
62. Fillingim RB, Edwards RR. Is self-reported childhood abuse history associated with pain perception among healthy young women and men? *Clin J Pain*. 2005;21(5):387–397. doi:10.1097/01.ajp.0000149801.46864.39