Investigating the Association Between Traumatic Stress, Sex, and Pain Perception

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Introduction

- Posttraumatic stress disorder (PTSD) and chronic pain are disabling conditions that frequently co-occur (Asmundson & Katz, 2009).
- Traumatic stress is a necessary prerequisite for PTSD and is independently related to chronic pain.
- Shared vulnerability and mutual maintenance models propose that altered pain perception is a mechanism involved in the development of PTSD or chronic pain following a traumatic or painful event; moreover, altered pain perception is considered a vulnerability factor for developing comorbid PTSD and chronic pain (Asmundson, Coons, Taylor, & Katz, 2002; Otis, Keane, & Kerns, 2003; Sharp & Harvey, 2001).
- Current research evidence regarding altered pain perception among those who have experienced traumatic events or who are suffering from PTSD is inconclusive.
- The inconsistent findings in the precedent literature may be related to the heterogeneous methodologies employed and the diverse populations studies; in addition, past studies frequently employed restricted definitions of traumatic stress (e.g., childhood physical and sexual abuse).
- The present investigation examined the relationship between traumatic stress, sex, and pain perception in a sample of university students and community members.

Method

- A total of 95 student and community members (55% women; age 19–52; M_{age}=24.4, *SD*=7.4) participated in the current investigation.
- All participants completed an online version of the Traumatic Life Events Questionnaire (TLEQ). A detailed trauma history was gathered for each participant, including details regarding whether a particular trauma met DSM-IV-TR (2000) PTSD Criteria A1 and A2. Participants who met these criteria were classified as trauma exposed.
- Participants were assigned to one of four groups – trauma exposed women (*n*=35), non-trauma exposed women (*n*=17), trauma exposed men (*n*=21), non-trauma exposed women (*n*=22) – and run through thermal quantitative sensory testing (QST) procedures using a 3cm^2 contact thermode controlled by a PATHWAY Pain and Sensory Evaluation System – ATS Model (Medoc Advanced Medical Systems, Ltd., Ramat Yishay, Israel).
- Thermal QST procedures included both thermal threshold testing (i.e., warmth detection, cold detection, heat pain, cold pain, heat tolerance, cold tolerance) and magnitude estimation tasks.
- Magnitude estimations were conducted to elicit numeric rating scale (0–100) ratings of pain intensity and pain unpleasantness for 5 second stimulations at each of 12 temperatures (0°C, 2°C, 4°C, 6°C, 8°C, 10°C, 40°C, 42°C, 44°C, 46°C, 48°C, 50°C).

Results

- Results were analyzed with a series of 2 (trauma status) by 2 (sex) by 3 (threshold test: detection, pain, tolerance), or 6 (magnitude estimate: pain intensity or unpleasantness at each temperature), mixed model analyses of variance (ANOVA) with repeated measures for the QST variable.
- The thermal threshold data (Table 1) suggest that women exhibit increased pain sensitivity relative to men on both the heat, $F(1,91)=20.42, p<.05, \eta_p^2=.16$, and cold thresholds, $F(1,91)=9.92, p<.05, \eta_p^2=.10$. There were no significant differences between the trauma groups for heat, $F(1,91)=18.37, p>.05, \eta_p^2=.02$, or cold thresholds, $F(1,91)=.29, p>.05, \eta_p^2<.01$.
- Magnitude estimates for heat stimuli (40°C–50°C; Table 2) revealed that trauma exposed participants rate pain as more intense, $F(1,91)=4.07, p<.05, \eta_p^2=.04$, than non-trauma exposed participants, but not more unpleasant, $F(1,91)=3.03, p>.05, \eta_p^2=.03$. There were no differences based on sex for pain intensity, $F(1,91)=1.38, p>.05, \eta_p^2=.02$, or pain unpleasantness, $F(1,91)=2.25, p>.05, \eta_p^2=.02$.
- Magnitude estimates for cold stimuli (0°C–10°C; Table 3) revealed no significant differences in pain intensity ratings based on trauma group, $F(1,91)=2.36, p>.05, \eta_p^2=.03$, or sex, $F(1,91)=1.03, p>.05, \eta_p^2=.01$. No significant differences in pain unpleasantness were found based on trauma status, $F(1,91)=1.89, p>.05, \eta_p^2=.02$, or sex, $(1,91)=1.51, p>.05, \eta_p^2=.02$.

Discussion

- The results from the current study provide partial support for the existence of altered pain perception in a trauma exposed sample and, therein, partial support for the altered pain perception mechanism proposed by the shared vulnerability and mutual maintenance models.
- Participants with a history of trauma exposure reported heat stimuli as significantly more intense than participants without a history of trauma exposure, suggesting an increase in pain perception.
- Significant differences based on sex were found for heat and cold threshold tests such that, relative to men, women exhibited increased sensitivity to heat and cold pain thresholds. The differences did not extend to the magnitude estimations, suggesting that men may have maximized their threshold capacities for reasons other than altered pain perception.
- The study may have been underpowered to detect small to moderate differences in pain perception in the other QST procedures, if such differences exist.
- Future investigations of pain perception with PTSD or chronic pain samples should 1) attempt to ratify the current pattern of results in a larger sample, 2) take participants' trauma histories into consideration, and 3) take the existence of sex differences into consideration with respect to design.

Table 1: Heat and Cold Threshold Tests

	Women		Men	
	Trauma (*n* = 35)	No Trauma (*n* = 17)	Trauma (*n* = 21)	No Trauma (*n* = 22)
	Mean °C (*SD*)			
Heat Detection	34.55 (1.30)	34.13 (.61)	36.78 (3.90)	35.58 (2.41)
Heat Pain	43.78 (3.69)	42.98 (3.81)	45.97 (3.03)	44.98 (3.06)
Heat Tolerance	47.72 (2.05)	47.88 (2.34)	49.43 (1.21)	49.51 (1.44)
Cold Detection	30.73 (.62)	30.52 (.74)	30.11 (.90)	30.28 (.66)
Cold Pain	16.13 (9.60)	21.82 (8.64)	14.95 (10.57)	13.3 (10.17)
Cold Tolerance	5.30 (6.93)	5.91 (8.03)	2.45 (4.78)	0.96 (2.47)

Table 2: Heat Pain Magnitude Estimations

	Women				Men			
	Trauma (*n* = 35)		No Trauma (*n* = 17)		Trauma (*n* = 21)		No Trauma (*n* = 22)	
	Mean Pain Intensity (*SD*) / Mean Pain Unpleasantness (*SD*)							
40°C	.00 (.00)	.00 (.00)	.00 (.00)	.00 (.00)	.57 (2.20)	.71 (2.39)	.32 (1.49)	.68 (3.19)
42°C	1.29 (3.29)	1.43 (4.13)	2.12 (5.30)	2.12 (5.30)	4.38 (10.00)	4.86 (11.99)	1.32 (4.11)	1.68 (5.20)
44°C	5.37 (8.65)	6.66 (11.32)	7.41 (10.39)	6.82 (8.73)	8.33 (13.35)	8.10 (15.41)	2.86 (6.28)	1.95 (4.74)
46°C	19.49 (20.84)	20.46 (22.82)	13.88 (14.55)	15.59 (15.00)	14.57 (18.70)	14.43 (18.97)	7.91 (8.98)	7.09 (8.61)
48°C	47.60 (30.88)	47.80 (32.51)	38.59 (34.40)	42.71 (34.12)	44.67 (29.19)	44.38 (28.21)	32.05 (23.23)	31.86 (23.99)
50°C	78.63 (25.58)	77.03 (28.23)	69.53 (33.69)	72.06 (33.59)	72.14 (26.25)	70.76 (25.52)	58.14 (27.33)	56.91 (27.28)

Table 3: Cold Pain Magnitude Estimations

	Women				Men			
	Trauma (*n* = 35)		No Trauma (*n* = 17)		Trauma (*n* = 21)		No Trauma (*n* = 22)	
	Mean Pain Intensity (*SD*) / Mean Pain Unpleasantness (*SD*)							
10°C	9.63 (16.61)	9.63 (16.61)	9.63 (16.61)	9.63 (16.61)	9.48 (17.76)	9.05 (17.31)	5.55 (13.59)	5.27 (13.39)
8°C	14.34 (18.50)	14.34 (18.50)	14.34 (18.50)	14.34 (18.50)	17.00 (22.19)	16.00 (22.21)	7.86 (15.25)	7.91 (15.22)
6°C	20.23 (24.28)	20.23 (24.28)	20.23 (24.28)	20.23 (24.28)	20.81 (27.84)	20.86 (28.56)	10.05 (16.66)	10.00 (16.84)
4°C	25.60 (26.87)	25.60 (26.87)	25.60 (26.87)	25.60 (26.87)	26.10 (29.18)	25.24 (29.67)	12.14 (17.55)	12.14 (17.65)
2°C	31.77 (28.74)	31.77 (28.74)	31.77 (28.74)	31.77 (28.74)	32.62 (29.87)	32.57 (31.25)	14.45 (19.24)	14.91 (18.98)
0°C	40.34 (30.32)	40.34 (30.32)	40.34 (30.32)	40.34 (30.32)	39.76 (30.33)	37.86 (30.01)	19.36 (21.44)	19.36 (20.59)

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Poster presented at the Anxiety Disorders Association of America Annual Conference, Baltimore, 2010