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The Relationship Between Childhood Abuse and Adult Attachment Styles: The Mediator Role of Sensory Over-Responsivity

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ABSTRACT

Child abuse portrays health and well-being issues that can last for several years, including altering interpersonal behavior. Evidence has shown that these early negative experiences may cause changes in sensory modulation. This study aimed to understand if sensory over-responsivity (SOR) plays an important role in mediating the association between childhood abuse (emotional abuse, emotional neglect, sexual abuse, physical abuse, physical neglect) and attachment-related anxiety or avoidance in adult romantic relationships. An online survey was conducted to examine these associations in a Portuguese community sample ($N =$ 500) aged 18–62 years. The presented mediation models shown a higher mediation percentage for attachment-related anxiety rather than avoidance. All variables predicted the mediator, except sexual abuse which did not predict the overall model when the mediator was included. Our results have implications for individual treatment approaches regarding child abuse victims and can certainly influence intervention strategies.

Child abuse is a persistent problem in society and affects many children around the world. A review concluded that, worldwide, the overall estimated prevalence of childhood maltreatment was 127/1000 for sexual abuse, 226/ 1000 for physical abuse, 363/1000 for emotional abuse, 163/1000 for physical neglect, and 184/1000 for emotional neglect (Stoltenborgh et al., 2015). According to the Portuguese Association of Victim Support (Associação Portuguesa de Apoio à Vítima, APAV), there were 1841 abused children and adolescents in Portugal in 2020, of which 59.7% are female (APAV, 2021).

These numbers are probably an underrepresentation of the reality. Determining the exact incidence of child abuse and neglect is challenging, mostly because cases are frequently underreported or unnoticed (Gubbels et al., 2021).

Child abuse or maltreatment constitutes all forms of physical and/or emotional ill-treatment, sexual abuse, neglect or negligent treatment, and exploitation, resulting in actual or potential harm to the child's health, survival, development or dignity in the context of a relationship of responsibility, trust or power (WHO, 2022). Consequences include health problems, social and behavioral problems (mainly, attachment problems) impaired cognitive and academic performance and economic problems.

In short, physical abuse is any action that causes, or has the potential to cause, physical harm to a child. Emotional abuse includes not providing an appropriate and supportive environment and having negative attitudes toward the child. Child sexual abuse involves a child being involved in sexual activity that they are not prepared for or do not understand. Neglect is when a child's development is not supported in areas like health, education, and emotional development, despite resources being available. Commercial or other exploitation is when a child is used for someone else's benefit, such as in work (WHO, 1999).

Neglect, one of the forms of child maltreatment, can be classified into two types: physical neglect and emotional neglect. Physical neglect occurs when a caregiver fails to provide a child with basic physical necessities such as food, clothing, shelter, personal hygiene, and medical care. Emotional neglect, on the other hand, refers to a caregiver's failure to meet a child's developmental or emotional needs, such as inadequate nurturance or affection (Cohen et al., 2017).

These early traumatic experiences can negatively impact health outcomes, including long-term mental health problems such as post-traumatic stress disorder, depression, anxiety disorders, alcohol problems, antisocial behavior, aggressive behavior, anger, suicidal behavior, and persistence of medically unexplained physical symptoms (Christ et al., 2019). Moreover, these negative experiences may have a lasting impact through adulthood in the way those that suffered childhood abuse relate to other people (Rueness et al., 2020).

According to attachment theory, infancy is the time to develop cognitive models of relationships with others based on interactions with early caregivers, usually a parent or parents. Children whose needs are met, develop personal models of being competent, effective, and lovable, promoting self-esteem and coherent ego development; models of other people being predictable and trustworthy; and models of relationships as potentially rewarding and worthwhile. According to attachment theory, these children also experience a sense of security and readiness to explore the environment, while maintaining parental figures as a safety-net to whom they can return if necessary

(Bowlby, 1982). Childhood traumatic experiences regarding caregivers, are expected to evolve into insecure emotional attachment styles that are reflected in relationships with others during adolescence and even in adulthood (Unger & De Luca, 2014).

Maltreated children, especially those who have been physically abused, have been reported to have a less positive self-concept than others (Arata et al., 2005). Children who are neglected and maltreated may build relationship models characterized by a lack of responsiveness. They may withdraw from social relationships, develop relationships characterized by mistrust, leading to aggressive or defensive behaviors, that may engage in poorly controlled behavior leading to being excluded from relationships (Bacon & Richardson, 2001). Similarly, child abuse experiences have a detrimental impact on future adult romantic relationships and attachment styles (Yoon, 2020). Although the risk for negative interpersonal outcomes is high, counterintuitively it seems that the experience of childhood abuse may bring an opportunity for personal growth, prosociality, and increased empathy, that may imply different mechanisms and mediators (Greenberg et al., 2018).

Some studies found that those who have experienced physical, sexual, and emotional abuse have been related to negative functioning in adult romantic relationships (McCarthy & Taylor, 1999). Other studies suggest that participants who experienced abuse showed more insecure attachment styles than participants who had not experienced abuse (Unger & De Luca, 2014).

An intimate relationship with a partner can be classified as a secure, avoidant (withdrawn), and anxious (worried) attachment. Thus, a secure attachment in intimate relationships is characterized by trust, friendship, satisfaction, reciprocity, self-disclosure, commitment, and guidance in joint problem solving. An individual with an avoidant attachment does not appear to be invested in intimate relationships and avoids the partner in various situations; and with said anxious attachment, they may find that it is difficult to be comforted by the partner because of the uncertainty associated with insecurities (insecurity about being loved and protected, insecurity about deserving love) (Bolger et al., 1998).

In this study, we hypothesize that sensory over-responsivity (SOR) may play an important role in mediating the association between childhood abuse and attachment-related anxiety and avoidance in adult romantic relationships.

The role of sensory over-responsivity

Childhood abuse experiences can lead to future sensory challenges (Joseph et al., 2021; McGreevy & Boland, 2020). This could be due to a disorder of sensory modulation, which is a disorder of the regulatory component of

sensory processing that disrupts the ability to regulate and organize in a graded manner the magnitude, intensity, and type of response to sensory input (Dunn, 2007). When sensory input is modulated into an adaptive behavior, there should be an appropriate balance between habituation and sensitization. Habituation occurs when the central nervous system recognizes the stimuli as familiar and no longer needs to respond to them. Conversely, when the central nervous system recognizes the stimuli as harmful or important, sensitization occurs, and responding increases (Bar-Shalita & Cermak, 2020).

One of these altered responses to stimulus is referred to as SOR (Miller et al., 2012). SOR is characterized by a tendency to perceive benign sensations as threatening, distracting, or painful. SOR is most commonly characterized by intolerance to sound (auditory stimuli) and/or intolerance to touch (tactile stimuli). In a small number of individuals, negative responses occur in other sensory domains such as taste and smell (Bundy & Lane, 2019). The tendency is to react in a fight/flight manner, manifested as exaggerated avoidant and defensive behaviors that are out of sync with the environmental demands. In childhood, these extreme reactions can impact on the child's ability to perform a range of essential developmental tasks and adaptive functions, including social problem solving and overt signs of empathy (Witte et al., 2020). They can also negatively impact early relationships and positive social participation during school years (McGlone et al., 2014), which can persist into adulthood. The long-term negative effects on social relationships may include the preference for greater interpersonal distance and negative reactions to social touch (Maier, Gieling, et al., 2020).

There is some evidence that abused children experience being overresponsive to tactile sensation and auditory filtering (Joseph et al., 2021). In a neurophysiological level, individuals who have experienced early adversity or trauma show altered neural response to stimuli and hyperactive brain activity in regions that detect information, including the amygdala, the insula, the ventrolateral prefrontal cortex, and the dorsal anterior cingulate cortex, which is consistent with the experience of SOR (Maier, Heinen-Ludwig, et al., 2020). Increased bottom-up detection of stimuli may compete with the ability to recruit higher-order brain systems and may interfere with positive social relationships (Jedd et al., 2015).

Since dysregulation of trauma can alter neurochemistry of the central nervous system and integration of the brain, children who have difficulties processing sensory information often show either under reactions or overreactions, which is considered hypersensitivity, to the sensations of touch, movement, sight, sound, and smell (Whiting, 2018).
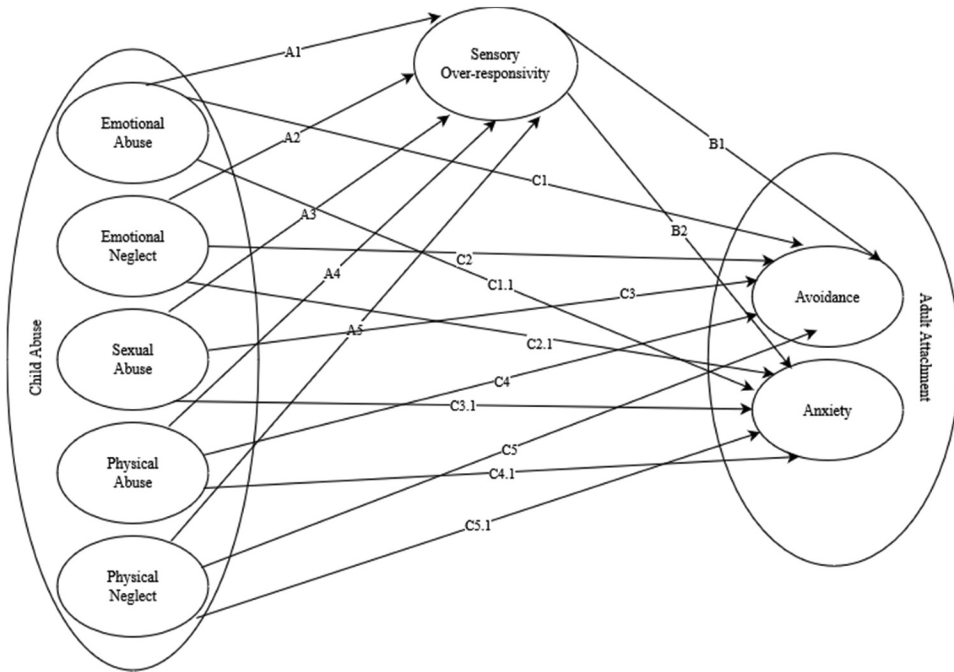
Figure 1. Conceptual diagram of the total mediation analysis.

Overview and hypotheses

The purpose of the current study was to examine if SOR is a mediator between the five types of child abuse (emotional abuse, emotional neglect, sexual abuse, physical abuse, physical neglect) and adult attachment (avoidance and anxiety). The hypothesized moderated mediation model (see Figure 1) was tested in Hayes model 4 (Hayes, 2013), using a bootstrapping approach to assess direct and indirect effects of child abuse mediated by over-responsivity, with bias-corrected 95% confidence intervals ($n = 5000$). Moderated mediation analyses test the effect of a predictor (child abuse) on an outcome variable (adult attachment, anxiety, and avoidance) via the potential mediator (SOR). Significant effects are supported by the absence of zero within the confidence intervals.

Participants

The sample consisted of 500 individuals aged 18–62 years ($M = 28.83$, SD = 7.82). The sample is predominantly female (70.6%), with a higher percentage of single individuals (76.4%). Additional demographic information can be found in Table 1.

Table 1. Sample Characteristics/Demographics (*n* = 500).

		Mean ± SD	Min - Max
Age		28.83 ± 7.82	18–62
	Groups		**n (%)**
Gender	*Male*	147 (29.4%)
	Female	353 (70.6%)
Marital Status	*Single*	382 (76.4%)
	Married/Living with a partner	104 (20.8%)
	Widower	1 (0.2%)
	Separated/Divorced	13 (2.6%)
Education	*Basic Education*	13 (2.6%)
	High School	107 (21.4%)
	Bachelor's Degree	273 (54.6%)
	Master's Degree	104 (20.8%)
	Doctoral	3 (0.6%)
Financial situation	*Much less than enough money*	71 (14.2%)
	Enough money	321 (64.2%)
	More than enough money	91 (18.2%)
	Much more than enough money	1 (0.2%)

Measures

Sensory processing

The Sensory Processing Scale (now called the Sensory Processing Three Dimensions Scale (SP3D)) consists of two parts: an inventory completed by parents, caregivers, or self, and a performance measure or assessment completed by an examiner (Mulligan et al., 2019). In this study, only the inventory was administered by self-completion. The Sensory Processing Scale Inventory (SPSI) reflects sensory reactivity, including SOR, sensory under-responsivity (SUR), and sensory craving (SC) in several sensory domains. The SOR sub-scale consists of 80 items, the SUR consists of 30 items, and the SC consists of 38 (Schoen et al., 2017). Total scores are then computed for each subtype, with higher scores reflecting a greater number of atypical sensory symptomatology. Internal consistency was strong for each subscale. Alpha coefficient for the total SOR scale was .89, .88 for the total SUR scale, and .93 for the total SC scale.

Childhood maltreatment

The Childhood Trauma Questionnaire (CTQ-SF) is a 28-item self-report instrument for abusive situations occurring up to age 15. It is a reduced version of the original questionnaire consisting of 70 items. It is classified on a 5-point Likert scale corresponding to the following values: 1 – never, 2 – a few times, 3 – sometimes, 4 – often or 5 – always. Thus, items are rated from one to five according to the frequency with which they occurred, except for the items describing a pleasant childhood (2, 5, 7, 13, 19, 26, and 28), for which the rating is inverted. The instrument assesses exposure to five types of abuse: emotional abuse (3, 8, 14, 18, 25), physical abuse (9, 11, 12, 15, and 17), sexual abuse (20, 21, 23, 24, and 27), physical neglect (1, 2, 4, 6 and 26) and emotional neglect (5, 7, 13, 19 and 28).

The CTQ-SF has good internal consistency with Cronbach's alpha values of .92 for the sexual abuse subscale (.825 our sample), .91 (.874 our sample) for emotional neglect, .87 (.844 our sample) for emotional abuse, .83 for physical abuse (.811 our sample), and .61 for physical neglect (.589 our sample) (Dias et al., 2013).

Attachment

The Experiences in Close Relationships Questionnaire (ECR) consists of 36 items that assess two dimensions of adult attachment style – avoidance (18 items) and anxiety (18 items), with odd numbers corresponding to avoidance and equals to the concern scale. This questionnaire exists in a female and a male version and the answers are given on a seven-point scale (1 – Disagree strongly, 2, 3, 4 - neutral/mixed, 5, 6, and 7 – Agree strongly) with only the items marked with the extremes and the central point. Items 3, 15, 19, 22, 25, 27, 29, 31, 33 and 35 are inverted items. Higher concordance scores indicate lower levels of avoidance and concern in romantic relationships, ranging from a maximum of 252 to a minimum of 36.

The data for the Portuguese population show a high level of precision due to internal consistency, with Cronbach's alpha coefficients of .93 (.86 our sample) for the avoidance scale and .87(.85 our sample) for the concern scale (Moreira et al., 2006).

Method

This study received approval by the Ethics Committee (name blinded). Participants were recruited through social networks and filled out an online survey using the platform LimeSurvey. To complete the questionnaires, participants were required to read the consent form, provide informed consent, and indicate that they were aware of the purpose and implications of their participation.

The study was conducted by all guidelines of the Declaration of Helsinki and general data protection regulations. The final anonymized database was transferred for statistical analysis using SPSS – Statistical Package for Social Sciences v. 26.0 (IBM-SPSS Inc-USA).

A Portuguese community sample was recruited via an online survey. Participant recruitment for this survey was completed using a non-list-based, non-probability sample. The essential sampling design was to spread the recruitment as broadly as possible, which requires several recruitment channels to be used. Thus, subjects were recruited using advertisements on social media (mainly Facebook), personal contacts, and mailing lists.

Table 2. Correlation Table.

Measure	M	SD	2	3	4	5	6	7	8
1. Emotional Abuse	7.53	0.139	,719**	,240**	,556**	,511**	,361**	,273**	,229**
2. Emotional Neglect	8.50	0.160		,132**	,503**	,568**	,385**	,226**	,145**
3. Sexual Abuse	5.38	0.060			,179**	,199**	,167**	,099*	0,40
4. Physical Abuse	5.53	0.068				,473**	,210**	,142**	,119**
5. Physical Neglect	5.94	0.082					,311**	,232**	,188**
6. Avoidance	40.66	0.847						,345**	,189**
7. Anxiety	67.68	0.809							,282**
8. Over-responsivity									

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Results

Initial examination of data

Preliminary analyses revealed that all variables in the model were significantly correlated with one another (Table 2), except sexual abuse and over-responsivity. Ten separate mediation regression analyses utilizing the PROCESS macro (model 4; Hayes, 2013) were conducted to examine whether SOR mediated the relation between the five types of child abuse (emotional abuse, emotional neglect, sexual abuse, physical abuse, physical neglect) and adult-attachment anxiety and avoidance. All five types of child abuse were entered into each regression analysis (i.e., one predictor variable controlling for the other two), attachment-related anxiety and avoidance were examined separately according to current standards within the literature (Hayes, 2009); see Figure 1 for conceptual model.

Before proceeding with the final model, several assumptions were tested. Regarding the normally distributed residuals assumption, standardized residuals displayed an approximately normal distribution for both dependent variables (skewness = 0.067; kurtosis = 0.195 for adult attachment – anxiety and skewness = 0.797; kurtosis = 0.677 for adult attachment – avoidance). One participant presented standardized residuals greater than |4.0|, suggesting that the regression equation did not accurately predict the dependent variable for these cases. Thus, these subjects were excluded from the analysis. The independence of errors assumption was not violated (Durbin–Watson statistic = 1.959 and Durbin–Watson statistic = 1.716, respectively). Finally, the scatter plot with absolute standardized residuals by standardized predicted values suggested some degree of heteroscedasticity for the adult attachment anxiety, which was further validated by the Breusch – Pagan test. Thus, the regression model was run using the wild bootstrap, which does not assume homoscedasticity (Flachaire, 2005).

Three of the categories related to the Childhood Trauma Questionnaire were over the limit for skewness and kurtosis (sexual abuse, physical abuse, and physical neglect). As such, the Hayes PROCESS Macro (Hayes, 2013) was utilized to examine the indirect effects of the mediation models through

bootstrapping procedures. There were no missing values, as all the questions were necessary to proceed with the questionnaire.

Mediation models

Attachment-related anxiety

Five separate analyses were conducted examining whether over-responsivity mediated the relation between the five types of child abuse and attachment-related anxiety. Within all five models, four of them significantly predicted the mediator, the outcome variable, and the outcome variable when the mediator

Table 3. Model expressing mediation role of over-responsivity in emotional abuse (y=attachment-related anxiety).

R	R^2	F	Df1, Df2	p
.23	.05	27.65	1.498	.000
	β	SE	t	p
Constant	7.73	.09	8.56	.000
Emotional Abuse	.58	.11	5.26	.000
Outcome: attachment-related anxiety				
.35	.13	35.63	2.497	.000
	β	se	t	p
Constant	51.21	2.13	24.03	.000
Emotional Abuse	1.28	.25	5.09	.000
Over-responsivity	.53	.10	5.39	.000
Direct effect of X on Y(c path)				
	Effect	SE	LLCI	ULCI
Emotional Abuse	1.28	.25	.78	1.77
Indirect effect of X on Y(ab path)				
Over-responsitivity	.31	.09	.15	.51

Table 4. Model expressing mediation role of over-responsivity in emotional neglect (y=attachment-related anxiety).

R	R^2	F	Df1, Df2	p
.15	.02	10.77	1.498	.000
	β	se	t	p
Constant	9.38	.90	10.40	.000
Emotional Neglect	.32	.10	3.28	.001
Outcome: attachment-related avoidance				
.34	.11	32.25	2.497	.000
	β	SE	t	p
Constant	52.05	2.17	23.96	.000
Emotional Neglect	.96	.22	4.44	.000
Over-responsivity	.58	.10	5.98	.000
Direct effect of X on Y(c path)				
	Effect	SE	LLCI	ULCI
Emotional Neglect	.19	.08	.05	.35
Indirect effect of X on Y(ab path)				
Over-responsivity	.19	.08	.05	.35

was included in the model. This indicates that child abuse significantly influences adult attachment anxiety, while mediated by over-responsivity.

Regarding attachment-related anxiety, the two models with the highest β were physical abuse and physical neglect. For either adult attachment variable, we will report the two most significant models. The remaining models are expressed in Tables 3 and 4. Physical Abuse significantly predicted the mediator ($F(1,498) = 7.19, p = <.01, R^2 = 0.01; \beta = 0.62, t(498) = 3.68, p = <.01$), the outcome, ($F(2,497) = 25.08, p = <.01, R^2 = 0.09; \beta = 1.29, t(497) = 2.55, p = <.01$), and the outcome variables when the mediator was included in the model ($F(1,498) = 10.23, p = <.01, R^2 = 0.02; b = 1.68, t(498) = 5.20, p = < .01$). This indicates that physical abuse shown statistically significant influence in attachment-related anxiety.

This model as the main predictor revealed both direct (Effect = 1.30, SE =.5097, LLCI =.0111, ULCI =.2977) and indirect (Effect = .0321, Boot SE =.0178, Boot LLCI =.0007, Boot ULCI =.0703) effects, as bias corrected bootstrap 95% confidence intervals based on 5000 bootstrap samples did not include zero: providing further evidence of mediation.

Physical neglect significantly predicted the mediator ($F(1,498) = 18.26, p = <.01, R^2 = 0.04; \beta = 0.81, t(498) = 4.27, p = <.01$), the outcome ($F(2,497) = 41.16, p = <.01, R^2 = 0.14; \beta = 2.04, t(497) = 7.85, p = <.01$), and the outcome variables when the mediator was included in the model ($F(1,498) = 28.25, p = <.01, R^2 = 0.05; \beta = 2.28, t(498) = 5.31, p = <.01$). This indicates that physical neglect shown statistically significant influence in attachment-related anxiety. This model as the main predictor revealed both direct (Effect = 1.83, SE =.4243, LLCI =.9920, ULCI = 2.656) and indirect (Effect = .4594, Boot SE =.1577, Boot LLCI =.1727, Boot ULCI =.7811) effects, as bias corrected bootstrap 95% confidence intervals based on 5000 bootstrap samples did not include zero: providing further evidence of mediation. As mentioned above, the remaining models: emotional abuse and emotional neglect, have an indirect effect of 19.5% and 16.4%, respectively.

Sexual abuse was the model that did not significantly predict the mediator ($F(1,498) = .79, p = .38, R^2 = 0.00; \beta = 0.234, t(498) = .89, p = .38$). It significantly predicted the outcome ($F(2,497) = 23.84, p = <.01, R^2 = 0.09; \beta = 1.191, t(497) = 2.05, p = .04$) and the overall model when the mediator was included ($F(1,498) = 4.94, p = .027, R^2 = 0.01; \beta = 1.34, t(498) = 2.22, p = .027$). The model with Sexual abuse has the main predictor revealed direct (Effect = 1.1915, SE =.5806, LLCI =.0407, ULCI = 2.3322) effects, but could not reveal indirect effects (Effect = .1498, Boot SE =.1460, Boot LLCI = −.1241, Boot ULCI =.54585), as the 95% confidence intervals included zero.

Attachment-related avoidance

An additional five separate analyses were conducted examining whether over-responsivity mediated the relation between the five types of child abuse and

Table 5. Model expressing medication role of over-responsivity in emotional abuse (y=attachment-related avoidance).

R	R^2	F	Df1, Df2	p
.23	.05	27.65	1.498	.000
	β	SE	t	p
Constant	7.73	.09	8.56	.000
Emotional Abuse	.58	.11	5.26	.000
Outcome: attachment-related avoidance				
.38	.14	41.16	2.497	.000
	β	SE	t	p
Constant	22.03	2.21	9.97	.000
Emotional Abuse	2.04	.26	7.85	.000
Over-responsivity	.27	.10	2.62	.000
Direct effect of X on Y(c path)				
	Effect	SE	LLCI	ULCI
Emotional Abuse	2.04	.26	.03	.33
Indirect effect of X on Y(ab path)				
Over-responsitivity	.03	.01	.00	.05

Table 6. Model expressing medication role of over-responsivity in emotional neglect (y=attachment-related avoidance).

R	R^2	F	Df1, Df2	p
.14	.02	10.77	1.498	.001
	β	se	t	p
Constant	9.38	.09	10.40	.000
Emotional Neglect	.32	.10	3.28	.001
Outcome: attachment-related avoidance				
.41	.17	49.64	2.497	.000
	β	SE	t	p
Constant	20.27	2.21	9.19	.000
Emotional Neglect	1.94	.22	8.83	.000
Over-responsivity	.33	.10	3.28	.001
Direct effect of X on Y(c path)				
	Effect	SE	LLCI	ULCI
Emotional Neglect	1.94	.22	1.50	2.37
Indirect effect of X on Y(ab path)				
Over-responsitivity	.10	.06	.02	.24

attachment-related avoidance. Within all five models, again four of them significantly predicted the mediator, the outcome variable, and the outcome variable when the mediator was included in the model. This indicates that child abuse significantly influences adult attachment avoidance, while mediated by over-responsivity.

Regarding attachment-related avoidance, again, the two models with the highest β were physical abuse and physical neglect. The remaining models are expressed in Tables 5 and 6, expressing an indirect effect of 7.11% and 5.12% for emotional abuse and emotional neglect respectively.

Once again, physical abuse significantly predicted the mediator ($F(1,498) =$ 7.19, $p = <.01$, $R^2 = 0.01$; β $= 0.62$, $t(498) = 2.68$, $p = <.01$), the outcome (F

$(2,497) = 19.06$, $p = <.01$, $R^2 = 0.07$; $\beta = 2.35$, $t(497) = 4.36$, $p = <.01$), and the outcome variables when the mediator was included in the model ($F(1,498) = 22.91$, $p = <.01$, $R^2 = 0.04$; $b = 2.60$, $t(498) = 4.79$, $p = < .01$). This indicates that physical abuse shown statistically significant influence in attachment-related avoidance. The model with physical abuse as the main predictor revealed both direct (Effect = 2.35, SE =.5393, LLCI = 1.2923, ULCI = 3.4113) and indirect (Effect = .2456, Boot SE =.1608, Boot LLCI =.0062, Boot ULCI =.6232) effects, as bias corrected bootstrap 95% confidence intervals based on 5000 bootstrap samples did not include zero: providing further evidence of mediation.

Physical neglect also significantly predicted the mediator ($F(1,498) = 18.26$, $p = <.01$, $R^2 = 0.04$; $\beta = 0.8090$, $t(498) = 4.27$, $p = <.01$), the outcome ($F(2,497) = 32.01$, $p = <.01$, $R^2 = .11$; $\beta = 2.94$, $t(497) = 6.63$, $p = <.01$), and the outcome variables when the mediator was included in the model ($F(1,498) = 53.17$, $p = < .01$, $R^2 = 0.09$; $\beta = 3.20$, $t(498) = 7.92$, $p = <.01$). This indicates that physical neglect shown statistically significant influence in attachment-related avoidance. This model as the main predictor revealed both direct (Effect = 2.94, SE =.4436, LLCI = 2.0713, ULCI = 3.8146) and indirect (Effect = .2626, Boot SE =.1240, Boot LLCI =.0608, Boot ULCI =.5413) effects, as bias corrected bootstrap 95% confidence intervals based on 5000 bootstrap samples did not include zero: providing further evidence of mediation.

Sexual abuse was the model that did not predict significantly the mediator ($F(1,498) = .79$, $p = .38$, $R^2 = 0.00$; $\beta = 0.234$, $t(498) = .89$, $p = .38$). It significantly predicted the outcome ($F(2,497) = 16.1756$, $p = <.01$, $R^2 = 0.06$; $\beta = 2.2612$, $t(497) = 3.6692$, $p = <.01$) but, did not predict the overall model when the mediator was included ($F(1,498) = 14.2601$, $p = .38$, $R^2 = 0.03$; $\beta = 2.3638$, $t(498) = 3.7763$, $p = <.01$). The model with sexual abuse has the main predictor revealed direct (Effect = 2.2612, SE =.6163, LLCI = 1.0504, ULCI = 3.4721) effects, but could not reveal indirect effects (Effect = .1026, Boot SE =.1055, Boot LLCI = −.0871, Boot ULCI =.3342), as the 95% confidence intervals included zero.

It is important to notice that although child abuse variables were significant predictors in every model, with the exception of sexual abuse, for the distinct outcome variables, there were very different mediations and effects. These important differences had additional evidence that these two constructs should be examined separately.

Discussion

The results emphasize the importance of investigating SOR and attachment-related anxiety and avoidance when examining the impact of different types of child maltreatment. Furthermore, these findings are consistent with previous literature linking SOR and attachment-related anxiety and avoidance (Jerome & Liss, 2005), as well as child abuse to SOR (Koomar, 2009). It is important to

note that the proposed model expresses higher mediation for attachment-related anxiety rather than avoidance. Generally, there is supporting evidence for a relationship between SOR and anxiety (Kinnealey & Fuiek, 1999).

SOR is considered a condition that predisposes the individual to be hyper-vigilant for stimuli, even those that are mostly neutral, which can increase the sensation of threat. Individuals that are systematically confronted with unpleasant environmental stimuli, anxiety can become generalized and assumed as acceptable (Van Hulle et al., 2018). Research suggests that people who exhibit high sensory reactivity are more likely to experience anxiety in relationships than those with low to normal reactivity. It is plausible that those who are sensitive to sensory stimuli may be oversensitive to environmental factors in general and may naturally be more likely to worry about details in relationships that would not concern the average individual (Jerome & Liss, 2005).

These findings also emphasize the need to examine attachment-related anxiety and avoidance as separate constructs (Espeleta et al., 2017). We found that physical abuse and physical neglect are the most significant and with the highest percentage of mediation, both in attachment-related anxiety and avoidance. Another study reported that physical abuse was significantly related to the avoidant attachment style (McCarthy & Taylor, 1999). Physically abused children are described as less compliant and more impulsive than neglected children, with acting-out behavior and lack of concern or empathy toward the distress of peers and appears to become more problematic with age (Wodarski et al., 1990).

Studies have shown that preschoolers who experience neglect tend to exhibit characteristics such as social withdrawal, increased vulnerability to victimization, heightened anxiety, and decreased popularity, while also demonstrating lower levels of social competence and greater dependence on others. However, as these children grow up and enter school, some of these negative effects may become less pronounced (Schilling & Christian, 2014). Another study found that 50% of the neglected infants belong to the anxious/ambivalent group (Finzi et al., 2000).

Of the five types of child abuse severity, sexual abuse was the only maltreatment variable in the model that is not correlated to SOR. These results are consistent with a study that also found no relationship between the prevalence of atypical sensory processing behaviors and postnatal risks such as sexual abuse (Jirikowic et al., 2020). This result can be explained by the fact that in this sample only 19 individuals were separated from the average score of 5 in sexual abuse. As this is a community sample, it is expected that most people do not suffer from sexual abuse. These results could be different if this relationship were studied in people who have been sexually abused (Jeon & Bae, 2022). Much of adult attachment and intimacy is highly dependent on how we manage sensory stimuli, for which SOR may be challenging. Individuals with sensory modulation dysfunction can be over-responsive to the sensations

of touch, movement, sight, sound, and smell, thus negatively impacting their attachment to romantic partners.

Considerations for intervention

The current results have implications for individual treatment approaches for child abuse victims. Trauma often first manifests on a somatosensory level (Gupta, 2013), causing feelings of numbness, detachment, or dissociation from the body, which can lead to difficulties processing and integrating sensory information. Incorporating sensory modulation-based interventions into established verbal-based therapies such as trauma-focused CBT or DBT may be a suitable treatment approach for adult trauma survivors. This may be particularly useful in cases where overwhelming stress impedes verbal expression of emotions.

Therapy approaches that utilize bottom-up and body-centered techniques have the potential to be an effective treatment option for trauma survivors (Van der Kolk, 2014). These approaches focus on body responses to sensory input rather than thought processes when addressing emotional disorders. There is evidence from case studies that utilizing sensory inputs (e.g., vestibular, proprioceptive, and tactile) can effectively reduce behavior problems and symptoms of post-traumatic stress in children and adolescents (Warner et al., 2014).

Limitations

While these novel findings contribute to our understanding of the relationship between child abuse severity, SOR, and attachment-related anxiety and avoidance within intimate relationships, we must temper our interpretation of findings by considering the limitations of the study. First, data collection was conducted using an online survey which ultimately does not allow to represent the whole population. Given the online limitation, we had a gender class imbalance, being that male participants were only 29.4% of our sample, skewing the results regarding gender.

Some potential participants do not have access to the Internet or were not exposed to our online recruitment/advertising endeavors, not allowing them to be recruited for this study. The questionnaire was fairly extensive which might have made the answers less credible due to the participants being bored. Finally, this study utilized retrospective, self-report data thereby limiting the ability to infer temporal or causal relations. Additional longitudinal studies would be valuable to understand how SOR, child maltreatment, and attachment develop over time.

Although other studies have examined relationships among two of the three variables studied here (SOR, child abuse, and attachment-related

anxiety and avoidance), this is the first study the authors are aware of that examines all variables in one model. The inclusion of SOR within this model provides a clear point of intervention for child abuse survivors experiencing attachment difficulties within romantic relationships. Therefore, it should be considered to address sensory issues and SOR in counseling and occupational therapy interventions to approach problems in romantic relationships that are related to attachment-related anxiety or avoidance. Researchers have long sought to understand how experiences in childhood are interpreted and translated into behaviors and interpersonal styles in adulthood.

Conclusion

This study is one piece of the puzzle that attempts to unravel the relation between child abuse experiences and attachment-related anxiety and avoidance in adult intimate relationships. The current study suggests that SOR expresses higher mediation for attachment-related anxiety rather than avoidance. By delving deeper into the underlines of the specific mechanisms connecting these variables, we can better target our interventions to address the specific needs of individuals with SOR and help them learn and implement strategies to manage their social interactions. Additionally, it is important to note that physical abuse and neglect presented the highest mediation in both attachment-related anxiety and avoidance.

Understanding the impact of child abuse and neglect on attachment and interpersonal functioning is essential to providing effective interventions to survivors. Tailoring interventions to the specific needs of each individual can help them overcome the effects of past trauma and develop resilience for the future. Our research opens up the possibility that incorporating sensory modulation-based interventions into trauma-focused therapies may contribute to improving attachment and adult intimate relationships among survivors. Future research is required to determine the effectiveness of this approach for individuals with different types of trauma experiences.

Through this enlightened knowledge regarding SOR, attachment-related anxiety and avoidance, we can improve our ability to assist survivors in growing and remaining resilient throughout adulthood, and ultimately help them strive in their lives, including relationships goals and professional achievements.

Disclosure statement

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