

RELATIONSHIP BETWEEN SENSORY PROCESSING SENSITIVITY AND ANXIETY TRAIT/STATE WITH SELF-INJURIOUS BEHAVIORS IN ADOLESCENTS WITH AUTISM SPECTRUM DISORDER

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ABSTRACT

Objectives: This research was aimed to examine the link between sensory processing sensitivity and self-harming behaviors, specifically by mediating this link through state anxiety and moderation by trait anxiety.

Design of the study: This is a cross-sectional study

Place and duration of the study: Shifa Tameer-e-Millat University, September 2023 to July 2024.

Sample and Method: 100 adolescents, aged between 11 to 18 years ($M = 14.14$, $SD = 2.85$). They were recruited from Autism centers in Islamabad and Clinical Psychology Department, Shifa Tameer-e-Millat University. The participants were selected using a purposive sampling method, and the information that was obtained about them includes demographic details such as age and educational level of the parents. The Highly Sensitive Person Scale (HSPS) was used to assess the degree of sensory processing sensitivity, the level of anxiety by state trait anxiety inventory (STAI), and self-injurious behavior through Inventory of Statements About Self-Injury (ISAS). A strong positive correlation was observed between the level of anxiety and the level of sensory processing sensitivity in this study. Hierarchical regression depicted state anxiety not mediate between the sensory processing sensitivity and self-injurious behavior but trait anxiety moderates the relationship between sensory processing sensitivity and self-harming behaviors.

Results and conclusion: These results indicate that adolescents with high sensory processing sensitivity struggle with emotional regulation, which can intensify the risk of self-harm. The study emphasizes the significance of incorporating sensory processing sensitivity into intervention strategies planned to cope anxiety and alleviate the risk of self-injury.

Keywords: Sensory processing sensitivity; Self-injurious behavior; Anxiety; Autism

INTRODUCTION

The neurological disorder known as Autism spectrum disorder (ASD) is characterized by repetitiveness, few behaviors, and challenges in social communication (American Psychiatric Association, 2013). Individuals with Autism also commonly experience hypersensitivity to sensory inputs owing to SPS, which may make them more emotionally reactive, deeply invested in cognitive processing, and sensitive to sensory inputs (Aron & Aron, 1997). According to Green et al. (2016), the heightened sensitivity would make one even more stressed and anxious and therefore unable to regulate their emotions leading to the onset of self-injurious behaviour. Self-injurious behaviors are defined as self-harming actions that do not include a suicide attempt. Studies show that children with ASD usually engage in these behaviors daily (Richards et al., 2019). Further studies on the relationships between sensitivity to sensory processing, differences in levels of trait and state anxiety, and subsequent self-harm.

One of the most defining features of ASD is sensory processing problems, in which people are either hypersensitive or hyposensitive to sensory stimuli (Robertson & Baron-Cohen, 2017). Increased sensitivity to environmental stimuli and sensory sensitivity, known as sensory processing sensitivity (SPS), can lead to distress and sensory overload in some situations (Aron & Aron, 1997). Thus, studies have linked emotional regulation issues in ASD, which frequently lead to increased anxiety and depression symptoms, to sensory hyper-reactivity (Ben-Sasson et al., 2009). Teens that experience sensory overload may find it very challenging to cope with the overwhelming stimuli coming their way and seek out self-harm as a coping mechanism (Dellapiazza et al., 2018). The study of how SPS contributes to self-harm may help develop intervention strategies that aim to reduce sensory-related discomfort and promote adaptive coping.

Between 40% and 50% of adolescents with ASD experience anxiety disorders (Kerns et al., 2015). Anxiety is commonly dichotomized into two forms: trait anxiety, a chronic tendency to feel anxious in a variety of contexts, and state anxiety, a transitory feeling of tension caused by specific stressors (Spielberger, 1983). Both types of anxiety are typically worse in adolescents with ASD due to difficulties in social communication, emotional regulation, and sensory processing (White et al., 2009). Anxiety has been demonstrated to be the

primary trigger for self-harming behaviors; individuals harm themselves as a coping mechanism for unmanageable emotions or to reclaim control (Mazurek et al., 2013). State anxiety may lead to impulsive self-harm because of the acute distress; however, it is the case that trait anxiety is associated with chronic self-harming behaviors (Maddox & White, 2015). Investigating the interaction between anxiety, sensory sensitivity, and self-harm could be helpful because it could be related to mechanisms that would explain why adolescents with ASD are engaging in self-harming behavior.

Previous works have looked into the relationships between sensory sensitivity, anxiety, and self-harm; however, the existing literature remains insufficient regarding the actual interaction between ASD, anxiety, and self-harm. However, due to the resultant act of trying to cope with it, the increased likelihood of producing self-harm behavior correlates positively with elevated levels of anxiety arising from sensory hypersensitivity (Green et al., 2016). It can be anxiety, which might act as the mediating variable between SPS and self-harm because higher SPS scores make people feel emotional discomfort (Fletcher et al., 2020).

According to several studies, excessive sensory stimulation may impair emotional control, which may encourage self-harm as a maladaptive coping mechanism for stress (Bishop-Fitzpatrick et al., 2015). As a result, the purpose of this research is to expand on these intricate relationships in order to fully comprehend the mechanism between anxiety, sensitivity and self-harming behavior among adolescents. This study fills a gap in the literature by establishing a connection between anxiety, self-harming behaviors, and sensory processing sensitivity. In contrast to other pieces of writing, very little has been written about how these factors work together to affect this particular group of people. This study provides an integrated view of self-harming behaviors in ASD by using frameworks for emotional regulation and sensory integration theory. By reducing anxiety, managing sensory overload, and preventing self-harm, the findings may assist in the development of specific interventions to enhance the well-being of adolescents with ASD.

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1. There will be a significant relationship between sensory processing sensitivity, anxiety (state, trait), and self-injurious behavior among adolescents with ASD.
2. State anxiety will be a mediator, whereas trait anxiety will moderate between sensory processing sensitivity and self-injurious behaviors among adolescents with ASD.
3. Sociodemographic variables, such as age and education of parents, will predict sensory processing sensitivity (SPS) and self-injurious behavior among adolescents with ASD.

METHOD

The study used across sectional correlational research design to study the relation between sensory processing sensitivity, anxiety and self-injurious behavior.

Participants

The study sample comprised adolescents aged 11 to 18 years who had been diagnosed with Autism Spectrum Disorder (ASD), including both male and female participants. Participants from recently diagnosed adolescents with ASD who met the study's criteria were selected through purposeful sampling. The sample size, determined to be 100 using G Power software (Kang, 2021), consisted of adolescents aged 11-18 with a confirmed diagnosis of ASD through standardized clinical assessments. The age range of 11 to 18 was chosen to focus on adolescents of both genders. This ensured that the connection between sensory processing sensitivity, self-injurious behavior, and state/trait anxiety was thoroughly understood. Additionally, educated parents were included as informants to provide valuable insights into the participants' behaviors and experiences from an external perspective. Individuals without ASD and those with any mental or physical conditions were excluded from the study to maintain its specificity. Any other medical conditions that could contribute to sensory processing sensitivity, anxiety, and self-injurious behaviors were not considered.

Measures

Demographic Sheet

Background information of participant data, such as age, degree of severity of autism spectrum disorder of adolescents, family structure and parental education, were gathered on the demographic sheet. Family history about physical disorders and mental diseases acquired from parents for hereditary implications.

Highly Sensitive Person Scale (HSPS) (Aron & Aron, 1997)

Highly Sensitive Person Scale (HSPS) is a self-report measures, used to assess level of sensitivity. It is 7-point Likert scale, with 1 indicating “not at all” and 7 indicating “extremely”. It comprises of 27 items because it evaluates sensitivity in multiple domains, including sensory, emotional, social, cognitive, and imaginative response. Prior research has also confirmed the HSPS's reliability in assessing sensitivity-related traits in adolescents (Pluess et al., 2018). Scores 0 to 14 indicate minimal responses across domains, scores 15 to 21 indicate equal responsiveness, and scores 22 to 27 indicate a high level of reactivity to sensory, emotional, social, cognitive, and imaginative activities. The scale divides people into three sensitivity levels based on their responses. Modifications of the HSPS were made to enhance the validity of measuring self-injurious behaviors among adolescents with ASD. The modified version did not ask adolescents about self-harming behaviors but obtained information from the observations of mothers. For example, the question, "Have you ever engaged in self-injury?" would be presented to mothers in the phrased question, "Have you ever observed your child to be hitting, biting, or scratching himself?" Such an assessment procedure is less susceptible to self-injurious trends. The scale had a satisfactory internal consistency and reliability as ascertained from a reliability coefficient of 0.87, thus upholding its applicability in assessing SPS.

State-Trait Anxiety Inventory (STAI) (Spielberger et al.,1983)

Spielberger et al. (1983) developed the State-Trait Anxiety Inventory that measures both types of anxieties, state and trait anxieties. STAI has 40 items that are further divided into two sections, namely, 20 for state anxiety and 20 for trait anxiety. That measure different aspects of anxiety. In this study, the anxiety

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levels in adolescents having Autism Spectrum Disorder were assessed based on maternal report. Since most adolescents with ASD have difficulties identifying and expressing their emotions, maternal observations provide a more reliable and objective view of their anxiety symptoms. Some items were modified in order to better align with parental observations. For example, the original item "I feel tense or nervous" was changed to "My child seems tense or nervous in social or unfamiliar situations." The item "I worry excessively about different things" actually speaks to "My child often seems worried or troubled, even for no apparent reason." An original item was "I find it difficult to relax." It has been revised to "My child seems unable to calm down, even in a situation that is familiar or comfortable. Anxiety levels were classified using the STAI scores. Low anxiety is a classic personality characteristic, characterized by trait anxiety scores between 20 and 39. Moderate levels of chronic anxiety are characterized by scores between 40 and 59.

Inventory of statements about self-injury (ISAS) (Klonsky, & Glenn, 2009).

The ISAS inventory assesses non-suicidal self-injury (NSSI) in two parts. The first part measures 12 different self-injurious acts, such as biting, scratching, burning, preventing wounds from healing, or ingesting harmful substances. Since adolescents with ASD may have difficulty recognizing or reporting these behaviors, maternal reports were used. Mothers were asked about observed behaviors (e.g., "Have you ever seen your child hitting, biting, or scratching themselves?").

The second part evaluates the functions of self-injury, including five intrapersonal (e.g., emotional regulation, preventing dissociation, autonomy, sensation-seeking) and eight interpersonal functions (e.g., expressing distress, establishing boundaries, peer bonding, avoidance). Items were adapted for maternal reporting (e.g., "My child engages in self-injurious behaviors when emotionally overwhelmed or distressed"). Mothers rated each function on a 3-point Likert **scale**: 0 = not observed, 1 = occasionally observed, 2 = strongly observed. Higher scores indicate more reasons for self-injury. The ISAS showed good reliability in this sample ($\alpha = 0.87$), supporting its consistency in assessing self-harming behaviors among adolescents with ASD.

Procedure

The ethical approval to conduct study, was provided by Preliminary Ethical Research Committee (PERC) and ensured adherence to ethical guidelines. For data collection department issues No Objection Certificate (NOC). The Autism Centers in Rawalpindi and Islamabad (Ask Occupational Therapist, Bases, Zam Zam, Creative Kinder, Transition Center Wellbeing Center) was authorized permission to researcher for have access to participants. Participants was debriefed and mothers of participants guarantee a consent after a thorough comprehension of study. The questionnaire was completed by participants approximately in fifteen to twenty minutes. They were acknowledged for their participation in study.

RESULTS**Table 1***Socio-Demographic Characteristics of the Participants (N=100)*

Variable	<i>M</i>	<i>SD</i>	<i>f</i>	%
Age	14.14	2.85		
Gender				
Male			53	53.0
Female			47	47.0
Family System				
Nuclear			58	58.0
Joint			42	42.0
Birth Order				
First Born			48	48.0
Middle Child			33	33.0
Last-born			19	19.0
Education of Mothers				

Inter	5	5.0
Bachelor's	41	41.0
Masters	52	52.0

Note, N = 100

Table 1 illustrates the descriptive statistics of the socio-demographic characteristics of the participants. The mean age of the participants, ranging from 11 to 18 years, was 14.14 (SD=2.850). In terms of gender distribution, male predominated the study, constituting 53.0% of the participants, while girls accounted for 47.0%. Family system composition revealed that 58.0% of the sample lives in the nuclear family system and 41.0% of the sample lives in the joint families. Further examination based on birth order indicated that 33.0% were middle-born, 48.0% were first-born and 19.0% were last-born in their families. Regarding education, 5% has done inter, 41.0% have done bachelors, and 52.0% have done masters.

Table 2

Reliability of the Annex-STAI Questionnaire, The Highly Sensitive Person Questionnaire (HSP), And Inventory of Statements About Self-Injury (ISAS)

Scale	<i>M</i>	<i>SD</i>	<i>Range</i>	<i>A</i>
STAI (Total Anxiety)	63.15	10.84	38–86	0.88
STAI-S (State Anxiety)	31.22	6.88	18–52	0.68
STAI-T (Trait Anxiety)	32.09	7.65	20–61	0.71
HSP (Highly Sensitive Person Scale)	92.49	28.42	40–13	0.72
ISAS (Self-Injury Questionnaire)	92.68	7.65	68–10	0.68

Note, M=mean, SD=Standard Deviation, α =Cronbach alpha, STAI= State Trait Anxiety Inventory. STAI-S= State Trait Anxiety Inventory-State, STAI-T= State Trait Anxiety Inventory-trait, HSP= The Highly Sensitive Person Questionnaire, ISAS= Inventory of statements about self-injury

In order to evaluate the reliability of the measurement scales employed in this study, a reliability analysis was conducted, Annex-STAI questionnaire, the

highly sensitive person questionnaire (HSP), and Inventory of statements about self-injury (ISAS) were used as instruments to examine anxiety (state, trait), sensory processing sensitivity and self-injurious behaviors among autistic adolescents. The reliability analysis of the STAI questionnaire resulted in a Cronbach's alpha coefficient of .88, which indicated good internal consistency. The reliability statistics of the highly sensitive person questionnaire (HSP) indicated Cronbach's alpha coefficient of 0.723, suggesting good reliability. Similarly, the reliability statistics of the Inventory of the statements about self-injury (ISAS) revealed a Cronbach's alpha coefficient of 0.688, indicating good internal consistency. This high value suggested that the items within the scale are highly correlated with each other, demonstrating strong reliability in measuring the construct of interest.

Table 3

Pearson correlation between Annex-STAI questionnaire, the highly sensitive person questionnaire (HSP), and Inventory of statements about self-injury (ISAS)

Variable	<i>M</i>	<i>SD</i>	<i>1</i>	<i>2</i>	<i>3</i>
Anxiety (Total)	63.15	10.84	—	—	—
State Anxiety	31.22	6.88	.91**	—	—
Trait Anxiety	32.09	7.66	.84**	.91**	—
SPS (Sensory Processing Sensitivity)	92.49	28.42	.21*	.21*	—
SIB (Self-Injurious Behaviors)	92.68	7.65	.31**	-.09	.12*

Note: SPS=Sensory Processing Sensitivity, SIB=Self-injurious behavior, N=Number of population, M=Mean, S.D=Standard deviation

Table 3 demonstrated total and trait anxiety were positively associated with self-injurious behaviors, which aligns with theoretical expectations that chronic anxiety can increase engagement in self-injury. In contrast, state anxiety showed a very weak negative correlation with self-injurious behaviors ($r = -.094$), suggesting that temporary fluctuations in anxiety or other influencing factors may account for this pattern. Additionally, sensory processing sensitivity was modestly associated with higher levels of anxiety, consistent with the notion that more sensitive individuals tend to experience greater emotional reactivity.

Table 4

Simple Linear Regression for Sensory Processing Sensitivity Self-Injurious Behavior Among Adolescents with ASD (N=100)

Variables	<i>B</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	<i>R</i> ²
Constant	86.06	5.55	15.49	.00	-
Sensory Processing Sensitivity (SPS)	0.05	0.02	1.79	.07	0.02

A linear regression analysis revealed that sensory processing sensitivity did not significantly predict self-injurious behaviors among adolescents, $B = 0.05$, $SE = 0.02$, $t(98) = 1.79$, $p = .07$, $R^2 = .02$.

Table 5

Moderation of Trait Anxiety between Sensory Sensitivity and Self-injury behavior among Adolescents with ASD (N=100)

Model 1	β	<i>T</i>	<i>P</i>	<i>R</i> ²	<i>F</i>
Constant		18.82	.00	.05	2.83
Sensory Sensitivity	-.04	-.43	.66		
Trait Anxiety	.22	2.18	.03		
Model 2					
Sensory sensitivity*Trait Anxiety	.18	1.80	.07	.0	3.02

* $p < .05$. ** $p < .01$. $R^2 = R$ Square, $\Delta R^2 =$ Change in R Square

Model 1 showed that trait anxiety significantly predicted self-injurious behaviors ($\beta = .22$, $t = 2.18$, $p = .03$), while sensory sensitivity was not significant ($\beta = -.04$, $t = -.43$, $p = .66$), explaining 5.5% of the variance ($R^2 = .05$, $F = 2.84$).

Model 2, including the interaction between sensory sensitivity and trait anxiety, was marginally non-significant ($\beta = .18$, $t = 1.81$, $p = .07$), with 8.6% of variance explained ($R^2 = .08$, $F = 3.02$).

Table 6

Hierarchical Multiple Regression Analysis for Mediating Role of State Anxiety Between Sensory Processing Sensitivity and Self- Injurious Behavior (N=100)

Model	<i>B</i>	<i>S.E</i>	<i>B</i>	<i>R2</i>	<i>t</i>	<i>P</i>
Constant	90.04	5.19		.02	17.32	.00
Step 1						
SPS	-.01	.02	-.05		-.54	.58
Step 2						
Constant	87.98	3.55		0.01	24.74	0.00
SPS	-.02	.02	-.09		-.93	.35
State anxiety	.15	.11	.13		1.35	.17

Note= β : standardized beta, B: unstandardized beta, SE: standardized error, p: significance SPS: sensory processing sensitivity.

A hierarchical regression was conducted to assess the mediating role of state anxiety between sensory processing sensitivity and self- injurious behavior. In Step 1, SPS was not a significant predictor, $\beta = -.05$, $t = -.54$, $p = .58$, explaining only 2% of the variance ($R^2 = .02$). In Step 2, State Anxiety was added and model did not significantly improve. Neither SPS ($\beta = -.09$, $p = .35$) nor State Anxiety ($\beta = .13$, $p = .17$) significantly predicted the outcome. The final model explained only 1% of the variance ($R^2 = .01$).

DISCUSSION

This study investigated the relationships among self-harming behavior (SIB), state and trait anxiety, and sensory processing sensitivity (SPS) in adolescents with autism spectrum disorder (ASD). The findings provide new insights into how sensory sensitivity and anxiety relate to self-harming behaviors in this population. As expected, adolescents with higher sensory sensitivity tend to experience greater anxiety that showed trait anxiety and SPS were positively correlated. These findings are consistent with previous literature depicting that adolescents with high sensitivity issues are more inclined to manifest emotional reactivity and trait anxiety (Ben-Sasson et al., 2010). Though, differing the theoretical explanations, sensitivity processing sensitivity was not a significant predictor of self-injurious behaviors, other factors such as coping mechanisms or difficulties with emotional regulation may play a more central role in driving self-harming behaviors and sensory sensitivity may contribute to distress (Mazefsky et al., 2013; Green et al., 2015).

Anxiety is considered a risk factor for self-injurious behaviour but findings of study revealed surprisingly negative inverse relation between state anxiety and self-injurious behaviour (Lugo-Marín et al., 2019), these outcomes reflected that adolescents might use alternative coping strategies may reflect that highly anxious adolescents engage in alternative coping strategies like self-soothing behaviour or avoidance to aversive momentary stimulus lower the probability of self-injurious behaviour. It showed that trait anxiety may be a chronic anxiety has strong correlation with self-injury. Moderation analysis signifies that trait anxiety may not be a strong moderator that influence the relationship between SPS and SIB, contrary to some previous findings (Duerden et al., 2012). Mediation analysis indicated that state anxiety did not mediate the relationship between SPS and SIB ($\beta = 0.135$, $p = 0.179$), implying that adolescents with high sensory sensitivity may exhibit increased worry without necessarily engaging in self-injurious behavior.

In general, the results show that a number of factors affect self-harming behaviour in teens with ASD, and treatments shouldn't just focus on anxiety or sensory sensitivity. In practice, these results support the use of multimodal interventions, such as cognitive-behavioral strategies to enhance coping skills and distress tolerance (Wood et al., 2009), combined with sensory integration therapies to help manage sensory overload and associated anxiety.

Conclusion

It investigated the complex relationship among sensory processing sensitivity, anxiety, and self-injurious behaviors in adolescents with ASD. While increased sensory sensitivity is associated with elevated anxiety levels, its underlying causes in the context of self-injury remain largely unidentified. Research is needed to figure out how this works and to find ways to help people with ASD feel better.

Limitations and Recommendations

The study has few limitations; First, the sample size (N = 100) limit the generalizability of results. Secondly, the target population was adolescents with autism spectrum disorder but we used maternal reports instead of self-reports to collect information about the behaviors and feeling of them which may introduce bias, particularly because adolescents with ASD can have difficulty accurately reporting their own behaviors and feelings. In future, to gain a more accurate understanding of these relationships, multimodal method can be applied like physiological measures and observational methods. Moreover, how anxiety, sensory sensitivity and self-harming behavior are developed over time and either interventions can reduce the effect of anxiety on SIB, can be studied in longitudinal studies. Additionally, executive functioning and emotion regulation, can be studied as potential mediator that may explain the mechanisms between sensory sensitivity and self-injury in adolescents with ASD.

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