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RESEARCH ARTICLE

The Role of Anxiety Sensitivity and Emotion Regulation Difficulties in the Relationship Between Sensory Processing Sensitivity and Anxiety

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Introduction: Sensory-processing sensitivity (SPS) describes how deeply and intensely individuals process various environmental stimuli. SPS, as an adult temperament trait, may influence different aspects of an individual's life.
Aim: This study explored potential mediating roles of anxiety sensitivity (AS) and emotion regulation difficulties (ERD) in the relationship between SPS and trait anxiety (TA).
Methods: Participants (N = 420; 60.5% female; age range: 18–61 years) were administered the Highly Sensitive Person Scale, Trait Anxiety Inventory, Anxiety Sensitivity Index-3, and Difficulties in Emotion Regulation Scale.
Results: Results of the stepwise nested regression models indicated that SPS, AS, and ERD significantly predicted trait anxiety, with the final model explaining 54% of the variance. SPS was a significant predictor initially, but its effect became nonsignificant after AS and ERD were included, indicating a full mediation pattern. Serial multiple mediation analysis indicated that the association between SPS and trait anxiety was fully mediated by AS and ERD, with AS demonstrating a significant independent indirect effect, whereas the indirect effect of ERD alone was not statistically significant. The sequential pathway from SPS to AS to ERD to trait anxiety was statistically supported, and gender remained a significant covariate throughout.
Conclusions: The findings indicate that the association between SPS and trait anxiety is fully accounted for by AS and ERD rather than by a direct relationship. These results underscore the importance of considering sequential psychological mechanisms and covariate-adjusted models when examining vulnerability to trait anxiety.

Keywords: anxiety sensitivity, emotion regulation, sensory processing sensitivity, trait anxiety, serial mediation

Introduction

In recent years, there has been growing interest in understanding why some individuals are more vulnerable to anxiety than others. Rather than being attributed solely to external stressors, anxiety is increasingly conceptualized as emerging from the interaction between dispositional characteristics and emotion-related processes (García-Fernández et al., 2025; Shackman et al., 2016). Within this perspective, individual differences in how internal bodily sensations are perceived and interpreted have been shown to play an important role in anxiety-related vulnerability (Paulus & Stein, 2010). In addition, difficulties in regulating emotional experiences are considered

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a factor functioning in the etiology of anxiety disorders (Cisler et al., 2010). Taken together, these perspectives underline the multifaceted nature of vulnerability to anxiety.

Sensory processing sensitivity (SPS) has been increasingly examined in relation to anxiety and related traits. Given the complex nature of this association, particular attention is directed toward the potential roles of anxiety sensitivity (AS) and emotion regulation difficulties (ERD). SPS, initially proposed by Aron and Aron in 1997, has gained prominence as an adult temperament trait, and it correlates with some personality dimensions such as negative affect, introversion, and susceptibility to stress, anxiety, and depression.

SPS refers to an individual's heightened sensitivity in perceiving, interpreting, and responding to physical discomforts from within the body (e.g., hunger, pain) and sensory input from the outside world (e.g., bright light, loud sound, pungent odor) stimuli across physical and social contexts (Aron & Aron, 1997). Thus, it is associated with AS (Reiss, 1991), characterized by a heightened sensitivity to sensations and symptoms associated with anxiety. However, it is essential to recognize that AS arises from a complex interplay of biological factors and personality traits related to illness avoidance (Reiss, 1991). Moreover, the biological underpinnings of SPS and its association with the harm avoidance dimension of personality (Hofmann & Bitran, 2007; Litch et al., 2011; Şengül-İnal & Sümer, 2020) contribute to bridging these phenomena.

Examining the connection between AS and emotion regulation, it has been observed that the sensitivity to bodily sensations and the importance of emotion regulation processes in panic disorder are frequently highlighted. It is demonstrated that AS plays a pivotal role in panic disorder (Olatunji & Wolitzky-Taylor, 2009). Individuals who have experienced panic attacks tend to show increased avoidance behaviors alongside reduced emotional openness and acceptance when compared to individuals without such history. Furthermore, these individuals tend to rely more on avoidance strategies for emotion regulation. This maladaptive coping mechanism stems from a general fear of heightened arousal during intense emotional experiences, whether positive or negative. Consequently, concerns about physical sensations are linked to increased experiential avoidance, emotional rejection (Tull & Roemer, 2007), and reduced clarity of emotions (Tull et al., 2008). Additionally, failure to define emotions accurately may lead to confusion with bodily sensations, exacerbating AS. Moreover, this mischaracterization hinders effective reduction of stressor-induced arousal and impedes the ability to make sense of and overcome stressors (Baker et al., 2004).

Building on this, it is important to note that individuals with high sensory processing sensitivity (SPS) exhibit pronounced awareness of subtle environmental cues, including others' emotional expressions, and enhanced empathy (Acevedo et al., 2014). The level of sensitivity is associated with both positive and negative interpersonal sensitivity and social cognitive abilities (Tabak et al., 2022). Consequently, these individuals tend to show heightened emotional responses to both negative and positive experiences, which may render them more vulnerable to developing mental health problems when exposed to adverse events (Liss et al., 2005). Moreover, the intense emotions frequently experienced by highly sensitive individuals can hinder their ability to regulate emotions effectively and even to comprehend their own emotional experiences (Lionetti & Pluess, 2024). Furthermore, limited access to adaptive emotion regulation strategies, coupled with reduced acceptance and increased awareness of distress, has been found to partially mediate the relationship between SPS and symptoms of anxiety and stress. It has been suggested that repeated exposure to adverse sensory experiences among highly sensitive individuals may affect their general awareness of internal states, their acceptance of these states, and their confidence in regulating them, which in turn contributes to the experience of negative affective states (Brindle et al., 2015). Supporting this, other findings indicate that emotion dysregulation mediates the relationship between sensory sensitivity and depression, anxiety, and stress (Eşkisu et al., 2022).

In summary, the intricate interplay between an organism's sensitive physiological response to external stimuli and its ability to swiftly detect environmental details and changes contributes to the emergence of various forms of anxiety (Ahadi & Basharpoor, 2010; Neal et al., 2002). Individuals with heightened SPS exhibit greater susceptibility to strong stimuli and emotionally intense events, which correlates with elevated anxiety levels (Bakker & Moulding, 2012; Liss et al., 2008). While the relationship between SPS and various anxiety types has been suggested, other probable mediating factors remain insufficiently explored. Notably, AS is proposed to be associated with sensory sensitivity which is characterized by an excessive fear of anxiety-related feelings and symptoms and believed to stem from the biological structure of an individual, driven by the need to avoid illness (Reiss, 1991). Furthermore, difficulties in emotion regulation play a pivotal role in anxiety and anxiety disorders (e.g., Cisler & Olatunji, 2012; Markarian et al., 2013; Mennin et al., 2007). Traits such as increased sensitivity to danger, heightened emotional reactivity, and a propensity to experience negative emotions significantly impact the emotion regulation processes of anxious individuals (Campbell-Sills et al., 2014; Gross, 2014).

Although SPS is recognized as an adult temperament trait and shares conceptual overlaps with existing personality frameworks, its theoretical foundations remain underdeveloped. While high sensory sensitivity offers advantages, it appears to be predominantly associated with negative outcomes such as anxiety, stress, or symptoms of psychological disorders (Şengül-İnal & Sümer, 2018). In our current study, we specifically explore some negative facets and assess SPS as a potentially dysfunctional trait. Our findings may guide therapeutic interventions in clinical settings by considering AS and ERD among individuals exhibiting high SPS and elevated anxiety levels.

Purpose of the Current Study

Researchers have extensively explored the idea that temperament is not fixed and inflexible; rather, it can be determined by various individual and environmental factors. Additionally, factors related to temperament also have the potential to change. Recognizing this, it becomes essential to examine the fundamental factors and concepts associated with it. Gaining such insight is critical for effective clinical interventions with individuals. Moreover, recent studies have emphasized the link between SPS and anxiety. Investigating the roles of AS and ERD in this relationship serves as a key focus in our current study.

Taking into account the potential for SPS to give rise to AS, the tendency for AS to lead to avoidance behaviors in conjunction with heightened arousal, and the subsequent disruption of effective emotion regulation processes, and given that difficulties in emotion regulation processes render individuals more susceptible to anxiety, has contributed to developing this model.

In conclusion, understanding the intricate connections among SPS, AS, and difficulties in emotion regulation sheds light on vulnerability to anxiety. These insights inform both preventive strategies and targeted clinical interventions for anxiety-prone individuals. In this context, our study sought to address several key questions: Is there a significant connection between SPS, AS, ERD, and anxiety? Do SPS, AS, and ERD together predict trait anxiety? And finally, do AS and ERD serve as serial mediator roles in the relationship between SPS and anxiety?

Methods

Participants

The study sample comprised a total of 420 adult participants, with 254 females (60.5%) and 166 males (39.5%). The age range spanned from 18 to 61, with a mean age of 30.55 (*SD* = 8.90). Regarding marital status, 147 participants had no relationship (35.0%), 62 were in a relationship (14.8%), 192 were married and in a relationship (45.7%), 5 were married but living separately (1.2%), and 14 were widowed or divorced (3.3%). In terms of educational background, 24 participants had completed primary school (5.7%), 45 were high school graduates (10.7%), 11 were currently enrolled in an associate degree program (2.6%), 36 had completed an associate degree (8.6%), 65 were undergraduate students (15.5%), 133 were university graduates (31.7%), 57 were enrolled in a postgraduate program (13.6%), and 49 had completed postgraduate studies (11.7%). Overall, the majority of participants were married or in a relationship (259; 61.7%) and held at least an undergraduate degree (239; 56.9%). The study was conducted in Türkiye and employed a cross-sectional, correlational design. Participants were recruited through snowball sampling, initially via social media channels and the researchers' personal networks, and subsequently through referrals from participants' acquaintances. Inclusion criteria included being 18 years or older and fluent in Turkish. Participation was voluntary and anonymous, and no financial or academic incentives were provided.

Measures

The data collection instruments comprise a demographic information form developed by the researcher, as well as the following validated scales: the Highly Sensitive Person Scale, the Trait Anxiety Inventory, the Anxiety Sensitivity Index-3, and the Difficulties in Emotion Regulation Scale.

Demographic Information Forms

The researcher designed a survey form that captures essential demographic information from each participant, including details related to age and gender.

Table 1. Descriptive Statistics

	Range	*M*	*SD*	Skewness	Kurtosis	α
Sensory Processing Sensitivity	1.15–7	4.26	1.21	–0.44	–0.36	.94
Trait Anxiety	23–71	44.67	9.48	0.16	–0.34	.87
Anxiety Sensitivity	0–72	22.13	15.08	0.81	0.45	.93
Difficulties in Emotion Regulation	40–172	86.64	23.77	0.38	–0.04	.93

Note. M and *SD* indicate mean and standard deviation, respectively.

Highly Sensitive Person Scale

The original version of the Highly Sensitive Person Scale (HSPS) is employed to assess individuals' SPS (Aron & Aron, 1997). The scale adapted into Turkish (Şengül-İnal, 2014) is constituted by 27 items and has a seven-point Likert-type scoring. Increase in the total score means a rise in the individual's stimulus sensitivity level.

The Cronbach's alpha coefficient for internal consistency in the Turkish version of the scale was robust, with a value of .90 for the total score. In the current sample, the scale showed strong internal consistency, as reflected in the Cronbach's alpha reported in Table 1. Furthermore, the test-retest reliability demonstrated consistency, ranging from .75 to .88, while the split-half reliability coefficient stood at .82 (Şengül-İnal, 2014). Notably, the construct validity of the scale was supported by significant correlations between the scores of sensory sensitivity and behavioral activation systems, behavioral inhibition systems, and Big Five personality traits (Şengül-İnal & Sümer, 2020).

State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983) serves as a valuable tool for assessing anxiety levels in individuals. This inventory comprises two distinct components: State Anxiety and Trait Anxiety. In the context of the present study, we focused exclusively on participants' trait anxiety levels, utilizing the 20-item Trait Anxiety Scale from the STAI.

The Trait Anxiety Scale consists of 20 items and employs a four-point Likert-type response format. For the Turkish adaptation of the scale, Öner and Le Compte (1985) reported reliability coefficients. Specifically, the Kuder-Richardson reliability coefficient ranged between .83 and .87, while test-retest reliability fell within the range of .71 to .86. Additionally, item reliability coefficients varied from .34 to .72. These values underscore the scale's consistency and stability. Reliability analyses in this study confirmed the instrument's consistency for our sample, with Cronbach's alpha values provided in Table 1.

Furthermore, it is demonstrated that the scale is able to discriminate between individuals with and without psychiatric disorders, supporting the criterion validity of the STAI (Öner & Le Compte, 1985).

Anxiety Sensitivity Index-3

The Anxiety Sensitivity Index-3 (ASI-3) serves as an instrument for assessing AS (Taylor et al., 2007). Comprising 18 items, the ASI-3 employs a five-point Likert-type scale. Higher total scores on this scale correspond to heightened AS levels in individuals.

The Cronbach's alpha value for the internal consistency of the Turkish version (Mantar, 2008) was .93. Internal consistency for the ASI-3 in the present sample was satisfactory, as documented in Table 1. Notably, the ASI-3 demonstrates discriminant validity. Clinically diagnosed patients consistently exhibit distinct scores compared to healthy individuals, reinforcing the scale's ability to differentiate between these groups. Additionally, the ASI-3 correlates significantly with scores from the Anxiety Sensitivity Index (Ayvaşık, 2000), a related measure adapted to Turkish.

Difficulties in Emotion Regulation Scale

The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) serves as an instrument for assessing individuals' levels of ERD. It comprises 36 items, each rated on a five-point Likert scale. Notably, an increase in the total score on this scale corresponds to heightened emotion regulation difficulty.

The Cronbach's alpha value for the internal consistency of the Turkish adaptation of the scale was found to be .94 (Rugancı & Gençöz, 2010). Furthermore, the Guttman halving reliability coefficient stood at .95, while the test-retest reliability coefficient was .83. For our sample, Cronbach's alpha indicated good reliability, as can be seen in Table 1. To assess concurrent validity, the Turkish adaptation of the DERS was compared with the Brief Symptom Inventory. The results revealed positive relations between the scores of the Brief Symptom Inventory and DERS (r = .58).

Procedure

Ethical approval for this research was granted by the Istanbul Sabahattin Zaim University Ethics Review Committee (approval: 2021/07). Data collection was carried out through an online platform. The survey comprised an informed consent document prepared by the researcher, followed by a demographic questionnaire and relevant measurement scales. Participants reviewed the consent form, which detailed the study's purpose, the expected time required, the voluntary nature of participation, the option to withdraw at any point, and assurances that all data would be utilized exclusively for scientific research. After providing their consent by selecting the agreement option, participants proceeded to complete the demographic questionnaire and the other scales. To mitigate order effects, the sequence of the subsequent scales was given in different orders. Respondents were required to answer all questions in the survey, and they took approximately 10 to 15 minutes to complete the task.

Data Analysis

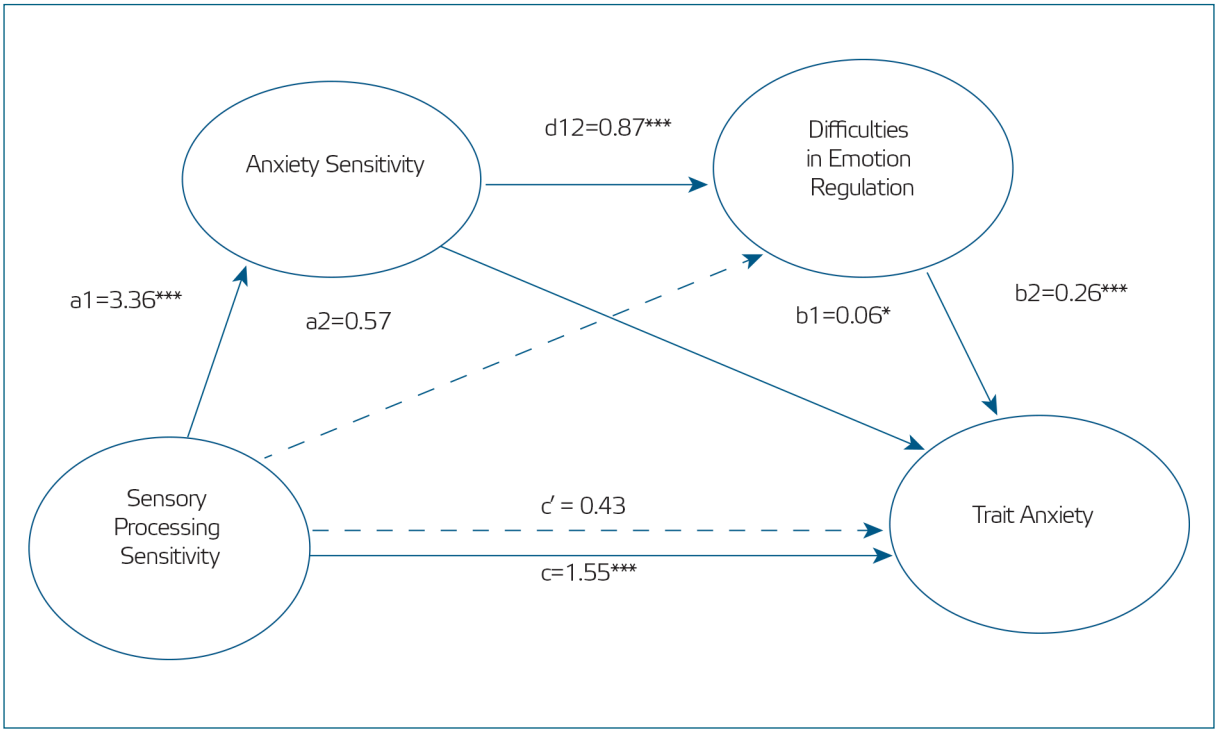
This study involved a sample of 420 participants. All analyses in the study were conducted using R version 4.4.0 (R Core Team, 2024) and RStudio (RStudio Team, 2020). Mediation analyses were performed using PROCESS version 4.3 for R (Hayes, 2022). For reporting results, the "apaTables" (Stanley, 2021) and "rempsyc" (Thériault, 2023) packages were utilized. The HSPS total score was derived by computing the average of its item scores, while the total scores for the remaining three scales were determined by summing their respective item scores. Descriptive statistics, Pearson correlation, stepwise estimation of nested linear regression models (conducted using the R base lm() function with predictors entered sequentially), and serial mediation analyses were conducted.

Stepwise nested regression models were used to examine the direct effects of the independent variable while accounting for control variables. Age and gender were included as covariates to control for potential confounding influences, given prior evidence indicating their associations with anxiety-related outcomes and sensitivity-related traits (Aron & Aron, 1997; Kessler et al., 2005; McLean et al., 2011). In line with recommendations for covariate selection in mediation models, covariates were included only when theoretically and empirically justified as potential confounders (Hayes, 2022). Specifically, following the Backdoor Criterion proposed by Hünermund et al. (2025), only variables that plausibly block non-causal pathways between the independent and dependent variables were retained in the models.

Serial mediation analysis was employed to examine the mechanisms underlying indirect effects. By integrating stepwise nested regression and mediation analyses, direct and indirect effects were examined separately, thereby avoiding analytical redundancy. PROCESS Model 6 was used for serial mediation analysis, which estimates one direct and three indirect effects. As shown in Figure 1, the first indirect effect reflects the influence of SPS on trait anxiety through AS (path a1b1). The second indirect effect represents the effect of SPS on trait anxiety via ERD (path a2b2). The third represents the serial indirect effect of SPS on trait anxiety through AS and ERD (path a1d12b2). The direct effect of SPS on trait anxiety is represented by c′. Accordingly, the total effect of SPS on trait anxiety is the sum of the direct and indirect effects (c = a1b1 + a1d12b2 + a2b2 + c′).

Gender was statistically controlled by including it as a covariate in all regression models. Although age was initially considered as a covariate, it was excluded from the mediation model due to its non-significant contribution in the preliminary stepwise nested regression analyses. PROCESS estimates a saturated model, and standard errors and 95% confidence intervals for indirect effects were computed using 5000 bootstrap samples with the bias-corrected percentile method. All variables were standardized prior to analyses. Prior to statistical analyses, all variables were examined for normality, and skewness and kurtosis values indicated acceptable distributions (Table 1), supporting the use of parametric tests.

Figure 1. Serial-Multiple Mediation Analysis



Note. Values represent unstandardized path coefficients estimated using 5000 bootstrap samples. Gender was included as a covariate in all analyses. Solid lines indicate statistically significant paths, whereas dashed lines indicate nonsignificant paths. *indicates $p < .05$; ***indicates $p < .001$.

Results

Descriptive Statistics

The range, mean, standard deviation, skewness, kurtosis and internal consistency values of the primary variables examined in the current study are presented in Table 1. Participants displayed variability in trait anxiety ($M = 44.67$, $SD = 9.48$), SPS ($M = 4.26$, $SD = 1.21$), AS ($M = 22.13$, $SD = 15.08$), and ERD ($M = 86.64$, $SD = 23.77$).

Correlation Analysis

Pearson Product Moment Correlation Analysis was conducted to determine the relationships between the main variables considered in the study. The analysis reveals a positive association between SPS and trait anxiety, AS, and ERD. Trait anxiety is also found to be positively associated with AS and with ERD. Additionally, AS is positively related to ERD. The results are presented in Table 2.

Results of Stepwise Nested Linear Regression Models

Stepwise estimation of nested linear regression models was conducted to examine the incremental contributions of SPS, AS, and ERD in predicting trait anxiety. Age and gender were entered as control variables in the first step. The results of the analysis are presented in Table 3.

In Model 1, the demographic variables explained a very small proportion of variance in trait anxiety. While gender emerged as a significant predictor, age was not significant, and the overall model provided only a limited explanatory contribution. In Model 2, the inclusion of SPS led to a significant improvement in model fit. SPS emerged as a significant positive predictor of trait anxiety, indicating that higher sensitivity was associated with greater levels of trait anxiety. The contribution of SPS substantially increased the explained variance beyond the demographic variables.

Table 2. Correlation Analysis Results for Examining the Relations Between the Main Variables

		1	2	3	4
1.	Sensory Processing Sensitivity	–			
2.	Trait Anxiety	.21* [.12, .30]	–		
3.	Anxiety Sensitivity	.25* [.16, .34]	.47* [.39, .54]	–	
4.	Difficulties in Emotion Regulation	.17* [.12, .30]	.72* [.67, .76]	.56* [.49, .62]	–

Note 1. Values in brackets represent 95% confidence intervals for the Pearson correlation coefficients.
* indicates $p < .001$.

Table 3. Stepwise Nested Linear Regression Models Predicting Trait Anxiety

	Model 1			Model 2			Model 3			Model 4		
	B	*SE*	β	B	*SE*	β	B	*SE*	β	B	*SE*	β
Age	0.02	0.05	.01	0.02	0.05	.02	0.02	0.05	.02	0.03	0.04	.03
Gender	−2.06	0.94	−.11*	−1.37	0.94	−.07	−2.44	0.85	−.13**	−2.12	0.66	−.11**
SPS				1.56	0.38	.20***	0.58	0.35	.07	0.44	0.27	.06
AS							0.29	0.03	.46***	0.06	0.03	.10*
ERD										0.26	0.02	.66***
Adj.R^2	.01			.04			.24			.54		
ΔR^2	–			.04			.20			.30		
F	2.44			7.25***			34.04***			98.96***		

Note. SPS: Sensory Processing Sensitivity, AS: Anxiety Sensitivity, ERD: Emotion Regulation Difficulties.
* indicates $p < .05$; ** indicates $p < .01$; *** indicates $p <. 001$.

In Model 3, AS was entered into the model and produced a marked increase in explained variance. AS emerged as a strong positive predictor of trait anxiety, while the effect of SPS was notably reduced, suggesting a potential mediating or overlapping role of AS in the association between SPS and trait anxiety. Gender remained a significant predictor at this step. In Model 4, ERD were added to the model, resulting in a substantial further increase in explained variance. ERD emerged as the strongest predictor of trait anxiety in the final model. With this inclusion, the contribution of AS was attenuated but remained significant, whereas the effect of SPS was no longer significant. Gender continued to be a significant predictor in the final step, while age remained non-significant throughout all models.

Overall, the adjusted R^2 increased from .04 in Model 2 to .54 in Model 4, demonstrating a substantial improvement in explained variance following the inclusion of anxiety sensitivity and emotion regulation difficulties. Accordingly, the final model accounted for a large proportion of variance in trait anxiety, indicating that emotion regulation difficulties and anxiety sensitivity play central roles, while the predictive contribution of sensory processing sensitivity appears to operate largely through these mechanisms.

Serial-Multiple Mediation Analysis Findings

The total effect of SPS on trait anxiety was statistically significant. However, when AS and ERD were included as mediators, the direct effect of SPS was no longer significant, indicating full mediation, as shown in Figure 1. The total indirect effect was significant, suggesting that the mediators collectively account for the association between SPS and trait anxiety.

When examining the individual indirect pathways, the indirect effect via AS was statistically significant, whereas the indirect effect via ERD alone was not. These findings indicate that AS independently mediates the relationship between SPS and trait anxiety, while ERD do not account for the indirect effect on their own. Importantly, the serial mediation pathway—where SPS predicted AS, which in turn contributed to ERD, and subsequently was linked to trait anxiety—was statistically supported. Moreover, the contrast analysis demonstrated that the serial indirect effect was significantly stronger than the indirect effect via AS alone. These findings suggest that SPS is associated with trait anxiety primarily through a sequential mechanism in which heightened AS contributes to

increased ERD, ultimately elevating anxiety levels. The overall model accounted for a substantial proportion of variance in trait anxiety, supporting the theoretical relevance of the proposed mediators. Full results are presented in Table 4.

Table 4. Results Regarding the Serial Multiple Mediating Role of AS and ERD in the Relationship Between SPS and Trait Anxiety

Effect	Effect	*SE*	*t*	*p*	BootSE	95% Boot CI [LL, UL]
Total effect (c)	1.55	0.38	4.07	< .001	–	[0.80, 2.30]
Direct effect (c′)	0.43	0.27	1.55	.121	–	[−0.11, 0.97]
Total indirect effect	1.12	–	–	–	0.30	[0.55, 1.73]
Indirect via AS	0.21	–	–	–	0.11	[0.02, 0.46]
Indirect via ERD	0.15	–	–	–	0.24	[-0.29, 0.63]
Serial indirect effect (AS → ERD)	0.76	–	–	–	0.17	[0.46, 1.11]
Contrast (AS − Serial)	−0.55	–	–	–	0.17	[−0.93, −0.24]

Note. Effects are calculated from the unstandardized regression coefficients. Bootstrap confidence intervals are based on 5000 resamples. Gender was included as a covariate in all models. An indirect effect is considered statistically significant when the 95% bootstrap confidence interval does not include zero.
SPS: Sensory Processing Sensitivity, AS: Anxiety Sensitivity, ERD: Emotion Regulation Difficulties, CI: Confidence Interval, LL: Lower Limit, UL: Upper Limit.

Discussion

The empirical findings corroborate a body of prior research that underscores a consistent association between SPS and anxiety (e.g., Ahadi & Basharpoor, 2010; Bakker & Moulding, 2012; Liss et al., 2008). According to the current study, a high level of SPS indicates heightened anxiety levels in individuals. Their perceptual acuity allows for deeper and more sensitive processing of anxiety-related cues—both external environmental stimuli and internal sensations. Especially highly sensitive individuals demonstrate an amplified vigilance toward anxiety-provoking situations, perhaps as a protective mechanism. Consequently, their heightened sensitivity extends to the sensations and symptoms associated with anxiety.

In addition, the findings demonstrate that AS serves as a predictor of trait anxiety. In essence, an increase in an individual's AS is likely to correspond with a rise in their anxiety levels. As an individual's belief that anxiety-related sensations and symptoms will have negative physical, cognitive, and social consequences strengthens, that person may become more susceptible to experiencing heightened anxiety. Moreover, as the individual's anxiety levels rise and they encounter these symptoms and sensations more frequently, that person's AS may increase, thereby creating a vicious cycle. Furthermore, Reiss (1987) posited that elevated AS heightens the risk of panic attacks, which in turn exacerbates AS.

The results of the current study indicate a positive relationship between AS and ERD. Accordingly, individuals with high AS experience greater ERD. It seems that AS has been shown to lead to various avoidance strategies, which in turn disrupt emotion regulation processes and create additional challenges for individuals. Tull and Roemer (2007) reported that individuals with a history of panic attacks tend to display elevated avoidance behaviors along with reduced emotional clarity and acceptance in comparison to healthy controls. Additionally, these individuals are more likely to employ avoidance strategies in the emotion regulation process. This reliance on avoidance, a maladaptive strategy, when experiencing intense emotions—whether positive or negative—may stem from their fear of arousal. Consequently, fear of bodily sensations, coupled with experiential avoidance and emotional unacceptance (Tull & Roemer, 2007), predicts inadequate emotional clarity (Tull et al., 2008). Furthermore, emotions that are not appropriately defined may be misinterpreted as somatic sensations, thereby increasing AS. Mischaracterization of these emotions impedes the effective understanding of the stressor causing sensory arousal, making it challenging to reduce, eliminate, or overcome the level of arousal (Baker et al., 2004).

The present study identifies a significant association between ERD and anxiety. This indicates that as an individual's ERD increases, the level of anxiety also significantly rises. Importantly, after including gender as a covariate (age was not included in the mediation models because it was nonsignificant in the stepwise nested regression models), ERD remained a significant predictor, whereas the direct effect of SPS became nonsignificant, indicating a shift from partial to full mediation. Thus, the inability to regulate emotions adequately and effectively

can facilitate the onset of anxiety disorders. In anxiety disorders, an increased tendency towards cognitive and behavioral avoidance significantly impairs effective emotion regulation (Campbell-Sills et al., 2014). Additionally, individuals with anxiety disorders experience their emotions more intensely and perceive themselves as less capable of managing their emotional experiences (Suveg et al., 2010). Consequently, anxiety is often associated with inadequate emotion regulation, and there is an intrinsic connection between the two due to common vulnerability factors (Amstadter, 2008). After controlling for gender, the nonsignificant effect of SPS suggests that the association between emotion regulation difficulties and anxiety may be more pronounced in women, whereas different regulatory mechanisms may operate in men (García-Fernández et al., 2025; Nolen-Hoeksema, 2012).

Notably, ERD, included in the model last, significantly predicted trait anxiety. While the contributions of SPS and AS persisted, the contribution level of AS decreased after controlling for gender. Although the importance of SPS and AS is acknowledged, it appears that difficulties in emotion regulation play a much more significant and determinant role in the development of anxiety. Research suggests that people with generalized anxiety disorder often experience marked impairments in identifying their emotions and in applying appropriate emotion regulation strategies (Mennin, 2004; Mennin et al., 2002). This indicates an inherent link between anxiety disorders and the emotion regulation process (Amstadter, 2008). Thus, these findings suggest that an individual with high sensory sensitivity, high AS, and ERD may be a key factor contributing to trait anxiety.

The relationship between SPS and anxiety has been demonstrated in numerous studies (e.g., Ahadi & Basharpoor, 2010; Bakker & Moulding, 2012; Liss et al., 2008). When AS is included in the model, it is shown to predict trait anxiety alongside sensory sensitivity. The fact that the contribution of sensory sensitivity remains significant in the model underscores its meaningful role in the development of anxiety. However, after controlling for gender as a covariate, the direct effect of SPS on anxiety became nonsignificant, highlighting the importance of the mediating variables AS and ERD in explaining the relationship in a genderadjusted model.

Evidence from the analysis supports a serial multiple mediation model, with AS and ERD mediating the association between SPS and trait anxiety. Consequently, it is anticipated that highly sensitive individuals will develop heightened sensitivity to anxiety-related symptoms, which may be linked to increased anxiety levels through ERD. The deep processing of internal and external stimuli, which leads to increased attention, may also facilitate the emergence of sensitivity to anxiety-related symptoms. According to the "hyperarousal-avoidance" model, the cognitive bias towards threat, characteristic of anxiety disorders, results in reduced processing of the threat stimulus and an increased avoidance response through cognitive avoidance (Campbell-Sills et al., 2014). Thus, individuals employing strategies of experiential and cognitive avoidance are likely to experience ERD. Indeed, it is emphasized that engaging with emotionally salient stimuli generally provides more effective emotion regulation than avoiding and not addressing them (Campbell-Sills et al., 2014). Consequently, it can be expected that individuals who cannot effectively and adequately cope with feelings of anxiety will develop heightened anxiety.

Finally, the findings reveal that while the total effect of SPS on trait anxiety is significant, the direct effect of SPS on trait anxiety becomes non-significant after including AS and ERD as mediators and controlling for gender as a covariate, indicating a full mediation effect. The most notable result of the current study is that the association between SPS and trait anxiety operates primarily through indirect mechanisms, particularly through AS and the serial pathway involving AS and ERD. These findings underscore the central role of AS as a primary mediator and highlight the importance of its sequential influence on emotion regulation difficulties in explaining anxiety.

Strengths and Limitations

This study contributes to the literature by examining factors that are associated with trait anxiety and anxiety-related psychological difficulties, with a particular focus on SPS as a biologically grounded temperament trait. The findings provide clinically relevant insights into the mediating role of anxiety sensitivity and emotion regulation difficulties in the relationship between sensory sensitivity and anxiety.

Nonetheless, it is important to acknowledge several limitations inherent in the current study. Data were collected exclusively through self-report measures, rendering the results dependent on participants' honesty and self-awareness. Such reliance may have led to under- or over-reporting of sensitivity, anxiety, or emotion regulation difficulties. Furthermore, no information was collected regarding participants' clinical diagnoses, which prevents comparisons between individuals with and without anxiety disorders and precludes including diagnostic status as a covariate in the analyses. This limitation is particularly important because diagnostic status could act as a confounding variable, potentially influencing the observed relationships among sensory processing sensitivity, anxi-

ety sensitivity, emotion regulation difficulties, and trait anxiety. Consequently, it remains uncertain whether the patterns observed are consistent across clinical and non-clinical populations. Additionally, the sample consisted of relatively well-educated individuals, and participants were recruited via convenience sampling. These factors constrain the generalizability of the findings, indicating that the results are most applicable to individuals with a relatively high level of education.

Finally, as this study employed a cross-sectional design, causal interpretations of the mediation model are inherently limited. Mediation analyses assume a temporal sequence, yet the absence of longitudinal data precludes definitive conclusions regarding directional effects (Baron & Kenny, 1986; Cole & Maxwell, 2003; Maxwell et al., 2011). Future studies employing time-lagged or experimental designs are necessary to better establish causality in the relationships among sensory processing sensitivity, anxiety sensitivity, emotion regulation difficulties, and trait anxiety.

Conclusion, Implications, and Future Directions

In conclusion, this study is significant in evaluating the factors that may be associated with trait anxiety and various anxiety-related psychological problems. SPS, regarded as a biologically based temperament trait, remains a vulnerability factor in individuals, although its expression may be modulated by environmental factors. Given that temperament traits are relatively resistant to change, the results highlighting the mediating functions of AS and ERD in the association between SPS and anxiety carry important clinical implications. The most significant contribution of the study is demonstrating that the relationship between SPS and anxiety operates primarily through indirect pathways. Instead of exerting a strong direct effect, SPS appears to influence trait anxiety through intermediary mechanisms. AS appears to play a central mediating role in the relationship between SPS and trait anxiety, while ERD contributes to this association particularly within the serial mediation pathway rather than as an independent mediator. Thus, incorporating considerations of AS and ERD, alongside anxiety-focused interventions, may positively impact the treatment process.

Furthermore, the results of this research are anticipated to offer valuable contributions to the literature by clarifying the role of sensory processing sensitivity in psychological functioning. In turn, this will increase knowledge of the nature of this relationship and, most importantly, provide insights into the development of anxiety while informing its treatment.

Building on these findings, subsequent investigations would benefit from extending these findings to longitudinal and clinically diagnosed cohorts, thereby clarifying the temporal and etiological significance of SPS, AS, and ERD in anxiety. Moreover, situating these mechanisms within more socio-demographically heterogeneous samples may improve the ecological validity of the conclusions. Additionally, employing complementary methodologies, including behavioral indices or psychophysiological markers, could also offset the inherent constraints of self-report measures and allow a more nuanced characterization of these constructs. Finally, translational work that integrates the modulation of anxiety sensitivity and emotion regulation capacities into therapeutic protocols holds promise for alleviating the heightened susceptibility associated with sensory processing sensitivity, thereby informing both preventive and clinical practice.

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Author contribution

Pelin SEÇGİN: conceptualization, design, methodology, funding acquisition, investigation, project administration, data management, formal analysis, interpretation, supervision, writing original draft, writing review and editing.

Volkan KOÇ: conceptualization, design, methodology, investigation, project administration, data management, interpretation, supervision, writing review and editing.

Declaration of interest statement

The authors have no conflicts of interest to disclose.

Ethical statement

This manuscript is the authors' original work.
All participants engaged in the research voluntarily and anonymously.
Their data are stored in coded materials and databases without personal data.
The studies involving human participants were reviewed and approved by the Istanbul Sabahattin Zaim University Ethics Review Committee (approval number: 2021/07).

Data availability statement

Datasets presented in this article are available in a publicly accessible repository: Open Science Framework (OSF): https://osf.io/a85qe/?view_only=bc804612a0c14b19ac81324c91e20d23
All datasets produced or examined in this study can be accessed through the following link: https://osf.io/a85qe/?view_only=bc804612a0c14b19ac81324c91e20d23

Declaration on using artificial intelligence in research and manuscript preparation

The authors have used AI technologies in the preparation of the manuscript, but not in their research. The authors utilized AI-based language assistance tools (ChatGPT: OpenAI, GPT-4) solely for language editing. All conceptual, methodological, and analytical aspects of the study were independently conducted and controlled by the authors.

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