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Theoretical background of *high sensitivity* – systematic review*

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ABSTRACT

Aim

The aim of the article is to systematize the knowledge regarding the theoretical background of the notion referred to in numerous studies as *high sensitivity*. The basis for the undertaken analyses is the concept of sensory processing sensitivity, which is important for the theoretical development of the issue of environmental sensitivity. Due to its application value, the concept is used in applied studies of individual differences in sensitivity to environmental stimuli. Based thereon, psychometric tools are developed to measure sensitivity, understood as a phenotypic trait in adults and children.

Method

The article presents qualitative research that was carried out using a systematic literature review (PRISMA) as part of the project "High sensitivity – innovative module in human sciences" (HSP) No. 2020–1-PL01-KA203–082261. The study was conducted using the following databases: PubMed, ScienceDirect and Scopus.

Results

As part of the systematic review, 821 articles were identified containing the keywords "sensory processing sensitivity" OR "highly sensitive person" AND "theory" OR "theoretical background". After eliminating duplicating articles (n = 33), titles and abstracts were analysed. In the next step, 705 articles were removed in line with the adopted exclusion criteria, and after analysing the full text, another 74 articles were excluded. Eventually, 12 articles were included in the review.

Conclusions

The obtained results indicate that in the context of the research conducted in this field, three main concepts are mentioned: Differential Sensitivity, Sensory Processing Sensitivity and Biological Sensitivity to Context. Research proves the independence of the sensory processing sensitivity trait from other traits, such as neuroticism or introversion. The concept of environmental sensitivity demonstrates its application value, and psychometric tools are developed within its framework.

Keywords: high sensitivity, highly sensitive person, sensory processing sensitivity, environmental sensitivity, systematic review, theoretical background

Introduction

The ongoing discussions concerning the importance of diverse human sensitivity for the tasks undertaken by a human and the quality of their functioning touch many stereotypical beliefs and unclear foundations. The aim of the review described below was to systematize knowledge about the so-called high sensitivity and present the theoretical background of the topic. In the last dozen or so years, the concept of Sensory Processing Sensitivity (SPS) has attracted the attention of many researchers. The growing number of scientific articles concerning both the issue itself (Acevedo et al., 2017; Aron et al., 2012; Hellwig & Roth, 2021; Jagiellowicz et al., 2011; Lionetti et al., 2018; Pluess et al., 2018) and the psychometric tools (Aron & Aron, 1997; Baryła-Matejczuk et al., 2021; Chacón et al., 2021; Ershova et al., 2018; Khosravani et al., 2019;

Konrad & Herzberg, 2017; Smolewska et al., 2006; Tillmann et al., 2018; Þórarinsdóttir, 2018) developed to measure it, indicates its theoretical and application value. Sensory processing sensitivity has also become a popular concept in the so-called popular culture under the name of "high sensitivity" (Aron, 2002, 2013; Falkenstein, 2019). Thus, there are many different publications on the sensitivity of children and adults, including guides for highly sensitive people, workbooks and compilations supporting parents of highly sensitive children. The theoretical background of these compilations is not always clear, explicit and is often based on intuitive knowledge or personal experiences of the authors. Therefore, an attempt was made to prepare a systematic review concerning the theoretical background of *high sensitivity*.

Sensory Processing Sensitivity

According to the conducted research, (e.g. Lionetti et al., 2019a) diverse sensitivity to environmental stimuli depends, among others, on the temperamental trait known as sensory processing sensitivity. Individuals with a high intensity of this trait are commonly referred to as highly sensitive people. Thus, sensory processing sensitivity is defined as a trait describing interpersonal differences in sensitivity to stimuli coming from the environment, both positive and negative ones (Aron et al., 2012; Greven et al., 2019). The analyses carried out so far show (e.g. Acevedo et al., 2018; Lionetti et al., 2018) that SPS is a hereditary temperamental trait that is associated with the risk of psychopathology when a person grows up, is raised and lives in negative conditions/inappropriate environment (Brindle et al., 2015; Homberg et al., 2016; Liss et al., 2008). In addition, this trait is associated with specific benefits (including greater awareness, responses to interventions) when a person grows up, is raised and lives in positive conditions/environment (Acevedo et al., 2014; Nocentini et al., 2018; Pluess et al., 2017). The first publications concerning sensory processing sensitivity appeared slightly over 20 years ago (Aron & Aron, 1997). SPS-related issues have been noticed and popularised by an American psychologist, Elain N. Aron. Among others, she supported the assumption that SPS coexists with emotional reactivity (Aron et al., 2012) and assumptions about the independence of the trait from other traits, such as neuroticism or introversion (Aron & Aron, 1997; Aron et al., 2005; Jagiellowicz et al., 2011). An important problem connected with a clear definition of the theoretical background of the issue is the low accuracy of the definitions presented in the literature. SPS has been conceptualized in terms of heterogeneity, such as reaction to the environment (Lionetti et al., 2018), making it difficult to distinguish individual differences delineated by SPS from other temperamental and personality traits. In addition, the terminology used in works devoted to environmental sensitivity is not uniform and sometimes mutually contradictory. With regard to behavioural styles, there is a conflict as to whether SPS falls under the category of ability constructs (Hellwig & Roth, 2021) or personality constructs (Aron & Aron, 1997; Greven et al., 2019). The selected

problems related to the conceptualization of the issue described above indicate the need to systematize the knowledge about it.

It should also be added that the concept of diverse sensitivity to environmental stimuli is not a new one. The authors of publications on individual differences have already attempted to explain this phenomenon.

Materials and Methods

This article attempts to integrate the scientific evidence on environmental sensitivity, and in particular sensory processing sensitivity. The next stages of the work were aimed at the identification, selection, critical assessment and analysis of data from significant studies qualified for the review. The method used enables presentation of reliable and credible scientific evidence (cf. Orłowska et al., 2017). For the purposes of the study, the systematic review methodology based on the PRISMA (Preferred reporting items for systematic reviews and meta-analyses) was used (Moher et al., 2010). The quality of the initial study was assessed using different types of tools, depending on the design of the study itself. The analysis used the Newcastle–Ottawa (NOS) scale for cohort studies, the assessment tool for cross-sectional studies (AXIS) and the Cochrane Collaboration Risk of Bias (ROB) tool for randomized studies (Downes et al., 2016; Higgins et al., 2016).

Data Sources

As part of the systematic review, articles were searched for in databases such as PubMed, ScienceDirect and Scopus. The databases were selected by their size, frequency of citations and substantive area concerning the topic, taking into account its interdisciplinarity. Additional articles were identified by searching for references to other articles.

Searching Strategy

A bulk searching strategy was used, using both descriptors, keywords and terms used in the titles or abstracts. The adopted strategy was aimed at identifying published articles available as full text. In order to carry out the search, the following terms (keywords) were used: “sensory processing sensitivity”, “highly sensitive person”, “theory” and “theoretical background”. These terms were accompanied by logical operators (AND, OR) such as: “sensory processing sensitivity” OR “highly sensitive person” AND “theory” OR “theoretical background”.

Table 1 presents the search strategy used in the databases mentioned above.

Date of last study was 7th November 2021. There are no time limits regarding the year of publication of studies.

Table 1

Searching strategy in databases

Database	Searching strategy
PubMed	((sensory processing sensitivity) [Title/Abstract] OR (highly sensitive person)) AND ((theory) OR (theoretical background))
ScienceDirect	("sensory processing sensitivity" OR "highly sensitive person") AND ("theory" OR "theoretical background")
Scopus	("TITLE-ABS-KEY (sensory processing sensitivity)" OR "highly sensitive person") AND ("theory" OR "theoretical background")

Inclusion and Exclusion Criteria

In the development of a systematic review of the literature, the following criteria for the selection of articles for further analysis were adopted: (I) articles available as full text; (II) articles published in Polish, English or Spanish; (III) articles directly referring to the theoretical background concerning the topic of sensory processing sensitivity. In addition, as an exclusion criterion, (I) articles not related to the topic and not referring to its theoretical background were taken into account; (II) articles being literature reviews or meta-analyses; (III) compilations summarising conferences, were taken into account.

Results

As a result of the conducted analyses, a total of 821 articles were identified. There were 549 articles in PubMed, 94 in ScienceDirect, and 178 in SCOPUS. After eliminating duplicating articles (n = 33), their titles and abstracts were read. In the next stage, following the adopted exclusion criteria, 705 articles were removed (e.g. reviews and meta-analyses, articles not related to sensory processing sensitivity). Afterwards, the full text of the remaining 84 articles was read and another 74 articles were excluded following the analysis. Eventually, 12 articles were included in the review (figure 1, p. 84).

The analysed articles adopt various theoretical approaches as the theoretical basis of diverse sensitivity (Table 2). Five analysed articles explained individual differences in environmental sensitivity from the perspective of the Diathesis-Stress model (Chavez et al., 2021; Iimura, 2021; Lionetti et al., 2018; Slagt et al., 2017). The three studies described in these articles have shown that there is a group of people who are more vulnerable to experience the negative consequences of life adversities or more sensitive to difficult events (Iimura, 2021; Lionetti et al., 2019b; Slagt et al., 2017). Attention was drawn to the tendency of some people to react intensively to stimuli that evoke emotions, demonstrated by high sensitivity and low resilience. Also in the three studies mentioned above,

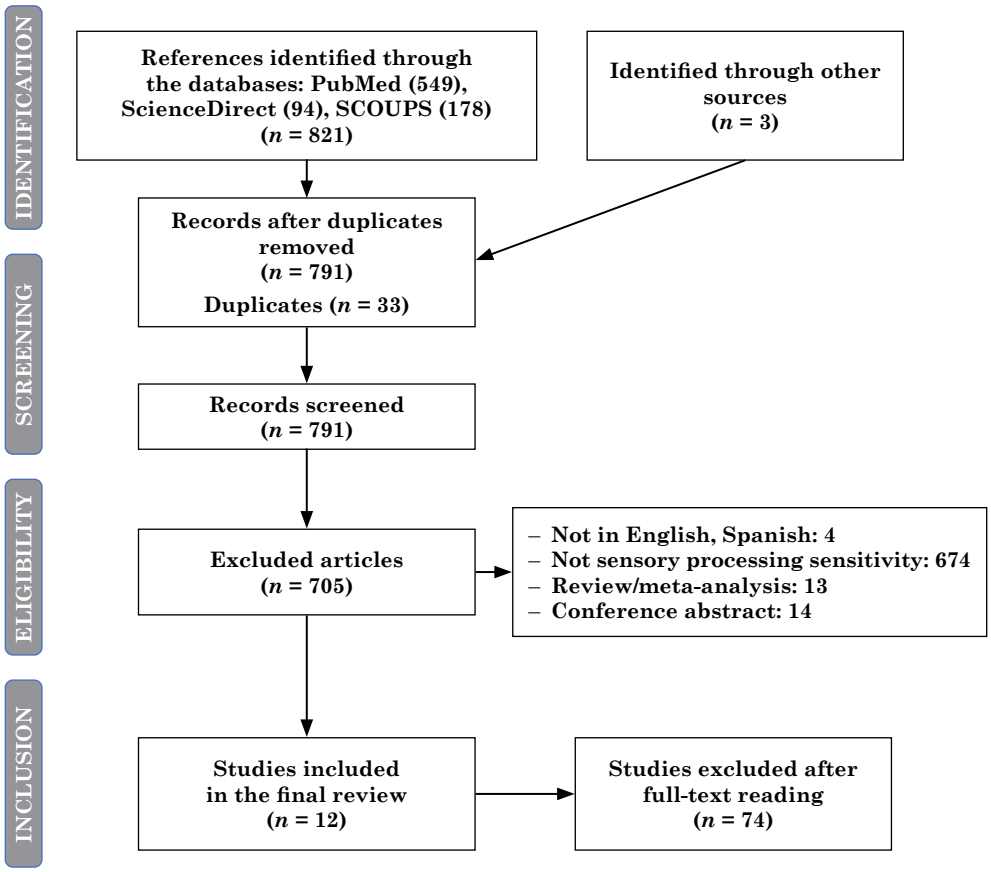

Figure 1. Flow diagram of study selection process.

the authors argue that this sensitivity can be explained by certain individual risk factors that may be genetic in nature (short allele of the serotonin transporter gene) (Chavez et al., 2021; Iimura, 2021; Lionetti et al., 2018).

Four studies suggest that there are individual differences in reactivity to a positive or supportive environment (Iimura, 2021; Lionetti et al., 2019a; Lionetti et al., 2018). These articles focus on the specific sensitivity of some people to positive stimuli from the environment (Vantage Sensitivity) and the resulting benefits (Iimura, 2021; Lionetti et al., 2018). One of the studies proved (Lionetti et al., 2019b) that some people may make disproportionately more use of the resources available in the environment, but may not necessarily be more affected by difficulties or life adversities. The results of the studies show that children's sensitivity interacted with both low and high parental quality in the development of behavioural problems and in the development of social competences in children (3 and 6 years old) (Lionetti et al., 2019b).

Table 2

Description of the theories mentioned in the articles

Authors, year	Diathesis-Stress model	Vantage Sensitivity theory	Differential Susceptibility theory	Biological Sensitivity to Context	Sensory Processing Sensitivity framework	Environmental Sensitivity meta-framework
Aron et al., 2005	–	–	–	–	+	–
Black & Kern, 2020	–	–	–	–	+	–
Bröhl et al., 2020	–	–	–	–	+	–
Chavez et al., 2021	+	–	+	–	+	–
Iimura, 2021	+	+	–	–	–	–
Iimura & Kibe, 2020	–	–	+	+	+	–
Jagiellowicz et al., 2016	–	–	–	–	+	–
Lionetti et al., 2018	+	+	–	–	–	+
Lionetti et al., 2019a	+	+	+	+	+	+
May et al., 2020	–	–	–	–	+	–
Pluess, 2015	–	+	+	+	+	+
Slagt et al., 2017	+	–	+	–	–	–
Tillmann et al., 2021	–	–	–	–	+	+

The authors of five analysed articles pay special attention to the combination of the foundations of the Diathesis-Stress model with the concept of the so-called Vantage Sensitivity, collectively referred to as Differential Susceptibility (Chavez et al., 2021; Iimura & Kibe, 2020; Lionetti et al., 2019b; Slagt et al., 2017; Tillmann et al., 2021). In one of the cited texts, the authors suggest that the concept of differential susceptibility indicates that due to certain characteristics some people are more susceptible to negative conditions and more susceptible to positive conditions (Slagt et al., 2017). One study concluded that this susceptibility could be explained by developmental plasticity (Tillmann et al., 2021). In two studies, the authors believe that individual differences in sensitivity are related to plasticity and adaptability, and both of these developmental strategies have been preserved due to natural selection (Iimura & Kibe, 2020; Lionetti et al., 2019b). These two articles mention that this evolutionary strategy includes a fixed strategy characterised by low susceptibility and a plastic strategy with high susceptibility.

Two articles discussed the framework of the Biological Sensitivity to Context concept (Iimura & Kibe, 2020; Lionetti et al., 2019b). This assumption is based on physiological and biobehavioural differences resulting from exposure to environmental stimuli (Lionetti et al., 2019b). Moreover, one text indicates that the likelihood of developing higher physiological reactivity and environmental sensitivity may increase due to early life exposure to a negative environment or experiencing a positive environment (Iimura & Kibe, 2020).

In addition, nine articles focus on sensory processing sensitivity, which assumes that there are individual differences in sensitivity to both internal (e.g. pain or hunger) and external (e.g. noise or intense light) stimuli (Aron et al., 2005; Black & Kern, 2020; Branjerdporn et al., 2019; Bröhl et al., 2020; Chavez et al., 2021; Iimura & Kibe, 2020; Jagiellowicz et al., 2016; Lionetti et al., 2019b; May & Pitman, 2021; Tillmann et al., 2021). The authors of all the mentioned articles agree on classifying sensory processing sensitivity as an innate temperamental trait connected with higher sensitivity to social and environmental stimuli.

Six of the described studies suggest that sensory processing sensitivity is related to the tendency to process complex sensory information in depth, strong emotional or biological reactivity, increased awareness of subtleties, overstimulation due to sensory stimuli (Aron et al., 2005; Black & Kern, 2020; Iimura & Kibe, 2020). Two studies have also pointed to the fact that SPS intensity is connected with increased inhibiting, withholding of actions that may result in negative or painful consequences (Behavioural Inhibition System – BIS) (Aron et al., 2005; May et al., 2020). Table 3 (pp. 87–90) presents the basic characteristics of the studies included in this review.

In three analysed articles, an attempt was made to integrate various approaches explaining diverse sensitivity to stimuli into one meta-concept of Environmental Sensitivity (Lionetti et al., 2018; Lionetti et al., 2019b; Tillmann et al., 2021). All of these studies have shown that people differ in their environmental sensitivity, whether exposed to negative and unfavourable or positive and supportive conditions. In addition, the authors of three articles also agree with the assumption that a minority of the population demonstrates high environmental sensitivity (Lionetti et al., 2018; Lionetti et al., 2019b; Tillmann et al., 2021).

Table 3

Main characteristics of the studies included in the review

Authors	Country	Year	Age (years)		Sample size	Objective(s)	Design
			Mean age	Range			
Aron et al., 2005	The United States of America	2005	Study 1 18.7 Study 2 19.1 Study 3 19 Study 4 20,03	–	Study 1 $N = 96$ women: $n = 47$ men: $n = 46$ no data: $n = 3$ Study 2 $N = 213$ women: $n = 126$ men: $n = 87$ Study 3 $N = 396$ women: $n = 196$ men: $n = 200$ Study 4 $N = 160$ women: $n = 119$ men: $n = 41$	1. To examine the relation between SPS and adult shyness. 2. To examine the relation between SPS and negative affectivity. 3. To examine the mediation of negative affectivity between SPS and shyness.	Correlational and causal-comparative study
Black & Kern, 2020	Australia	2020	–	19–69	$N = 12$ women: $n = 11$ men: $n = 1$	To investigate how highly sensitive individuals surrounded by an extravert-dominant social context experience and conceive well-being.	Qualitative exploration
Bröhl et al., 2020	Belgium	2020	19.70 (±2.84)	16.17–26.08	$N = 397$ women: $n = 256$ men: $n = 141$	To examine the associations between SPS and personality facets of Five-Factor Model.	Correlational study

Continuation of Table 3

Authors	Country	Year	Age (years)		Sample size	Objective(s)	Design
			Mean age	Range			
Chavez et al., 2021	Belgium	2021	Sample 1 11.54 (±.49) Sample 2 10.85 (±.57)	Study 1 10.5–13 Study 2 10–12	Study 1 N = 222 women: n = 101 men: n = 121 Study 2 N = 252 women: n = 127 men: n = 125	To investigate the effects of parenting and the personality traits of young adolescents on behavior problems during adolescence.	Causal-comparative study
Iimura, 2021	Japan	2021	Sample 1 18.7 (±.8)	–	Study 1 N = 114 women: n = 71 men: n = 43 Study 2 N = 100 women: n = 62 men: n = 38 Study 3 N = 105 women: n = 67 men: n = 38 Study 4 N = 106 women: n = 67 men: n = 39	To determine which models of differential susceptibility, diathesis-stress, and vantage sensitivity show an adequate framework to describe current socioemotional well-being.	Correlational and causal-comparative study

Continuation of Table 3

Authors	Country	Year	Age (years)		Sample size	Objective(s)	Design
			Mean age	Range			
Iimura & Kibe, 2020	Japan	2020	–	Study 1 14–15 Study 2 15–16	Study 1 $N = 412$ women: $n = 206$ men: $n = 206$ Study 2 $N = 344$ women: $n = 170$ men: $n = 174$	Study 1 1. To test the validity of the Japanese version of the HSCS. 2. To examine the psychometric properties of the HSCS. Study 2 To investigate which model of diathesis-stress or differential susceptibility would best reflect the development of socioemotional well-being among school transition	Study 1 Two-wave longitudinal research Study 2 Two-wave longitudinal study
Jagiellowicz et al., 2016	The United States of America	2016	High SPS 19.21 Low SPS 19.94	–	$N = 96$ women: $n = 65$ men: $n = 31$	To examine the extent to which SPS predicts negative and positive experiences in response to emotional stimuli	Correlational and causal-comparative study
Lionetti et al., 2018	The United States of America	2018	Sample 1 19.2 (±2.52) Sample 2 22.29 (±5.47)	–	Study1 $N = 906$ women: $n = 564$ men: $n = 342$ Study 2 $N = 230$ women: $n = 159$ men: $n = 71$	1. To investigate whether ES is a unitary concept. 2. To investigate whether HSP data support the existence of different sensitivity categories in the general population. 3. To investigate whether the sensitivity groups differ significantly in terms of personality traits and emotional reactivity.	Descriptive and correlational study

Continuation of Table 3

Authors	Country	Year	Age (years)		Sample size	Objective(s)	Design
			Mean age	Range			
Lionetti et al., 2019b	The United States of America	2019	3.7 (±.26)	–	N = 292 women: n = 134 men: n = 158	To create an observational measure to assess the different levels of ES.	Instrumental study
May et al., 2020	South Africa	2020	Study 1 22.36 (±6.36) Study 2 19.83 (±1,3)	Study 2 18–25	Study 1 N = 94 women: n = 79 men: n = 15 Study 2 N = 750 women: n = 615 men: n = 135	1 Assess the factor structure of the HSPS 2 Confirm the three-class distribution of sensitivity phenotypes	Instrumental study
Pluess, 2015	The United Kingdom	2015	–	–	–	To integrate the different perspectives concerning environmental sensitivity into a broad meta-framework.	–
Slagt et al., 2017	The Netherlands	2017	4,76 (±.57)	3.77–6.14	N = 190 girls: n = 86 boys: n = 104	To test the differential susceptibility theory.	–
Tillmann et al., 2021	Germany	2021	15 (±.45)	–	N = 757 women: n = 345 men: n = 412	Replicate existing studies examining sensitivity groups in a sample of adolescents in Germany	Descriptive study

SPS: Sensory Processing Sensitivity; DCD: Developmental Coordination Disorder; ADHD: Attention Deficit and Hyperactivity Disorder; HSCS: Highly Sensitive Child Scale; SP: sensory processing; ES: Environmental Sensitivity; HSP: Highly Sensitive Person; ASD: Autism Spectrum Disorder; TD: typical development

One of the articles also presents how the sensitivity of the central nervous system is shaped by genetic markers, the environment and their interaction in the early stages of life.

Discussion

In the field of studies on high sensitivity, three explanatory approaches prevail: (1) the concept of Biological Sensitivity to Context (Ellis et al., 2011; Shakiba et al., 2019), (2) the Vantage Sensitivity approach and the Diathesis-Stress model (Belsky & Pluess, 2009) approach, collectively referred to as Differential Susceptibility, and (3) the concept of Sensory Processing Sensitivity.

Each of the above-mentioned integrated systems of hypotheses and assumptions that enables predicting and explaining facts, contributes in a unique way to developing our knowledge about sensitivity. What they have in common is the conclusion that there are individual differences in sensitivity to the environment, these are largely inherited, are the result of the structure of the nervous system and depend on sensitivity to both positive and negative stimuli, experiences and the environment (cf. Greven et al., 2019; Pluess, 2015). In addition, high intensity of sensory processing sensitivity is characteristic of the minority of society (about 30%) (Baryła-Matejczuk et al., 2022; Lionetti et al., 2018; Pluess et al., 2018; Tillmann et al., 2021), and such people are referred to as highly sensitive. Each of the approaches described above also assumes that adaptability and susceptibility to environmental influences on the organism is varied. In the above-mentioned approaches, attention is also drawn to the differences in perceiving and processing of the stimuli resulting from SPS intensity (cf. Craik & Lockhart, 1972) and manifestation of the trait through being overloaded, emotionally reactive, and aesthetically sensitive. The overriding meta-concept that combines the assumptions of the discussed theories is the concept of Environmental Sensitivity.

To sum up, the concept of sensory processing sensitivity, which is part of the assumptions of environmental sensitivity, is developed in the socio-cognitive approach, as part of the theory of personality, and the remaining ones following biological and evolutionary foundations.

As part of the summary of the conducted review, it is also worth paying attention to the way in which the trait, that is sensory processing sensitivity, manifests itself. It shows both the importance of the intensification of the trait itself in humans and the need for further analysis in this area. As already mentioned, the so-called highly sensitive people process information and environmental stimuli more deeply than others (as defined by Craik & Lockhart, 1972). The depth of processing understood in this way refers to the amount of detailed information analysed in relation to some object, information or stimulus. It is a process that begins with focusing attention on the features of a given object, starting with its perception, interpreting, and ending with giving it meaning, referring to previous experiences and memory. Due to e.g. emotional reactivity and intensity of the experienced stimuli, the behaviours of highly sensitive people can be classified as

dysfunctional (neurotic, anxiety-based or depressive) (cf. Degnan & Fox, 2007). It should be emphasized, however, that the latest research does not include the high sensitivity to disorders (including sensory processing disorders) or risk factors for disorders. However, they point to the key importance of the quality of the development environment. SPS intensity leads neither to communication or socialization difficulties, nor to poorer coordination or disintegration in response to sensory signals (cf. Acevedo, 2020).

Among the possible limitations of the analyses carried out, it should be mentioned that despite the review of three key databases, other databases were not taken into account. This means that there are probably articles that could broaden the knowledge on the theoretical background of the topic of high sensitivity, and also confront it with the existing knowledge on individual differences in this field. Therefore, in future analyses, it is also worth considering articles from databases other than these analysed. In addition, although a wide variety of descriptors and keywords have been used, it is possible that there are words that have not been included and which may contribute to the effective search for such articles.

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