



# Sensory processing dysfunctions as expressed among children with different severities of intellectual developmental disabilities

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## ABSTRACT

High frequency of sensory processing dysfunctions (SPD) is prevalent among children with intellectual developmental disabilities and contributes to their maladaptive behaviors. However, the knowledge about the expressions of SPD in different levels of IDD severity is limited. As SPD may reduce adaptive responses and limit participation, this knowledge should be elaborated. The purpose of the present study was to examine the specific expressions of sensory processing among children with different severity levels of IDD. Participants were 91 children aged 4–9 years with mild, moderate severe-profound and IDD. Their parents completed the short sensory profile (SSP). According to the results, SPD were manifested across all levels of IDD. Groups differed in specific behaviors related to sensory stimuli. The highest percentage of children with severe sensory processing difficulties was found among children with mild and severe IDD level. SPD may characterize children with all severity levels of IDD. Nevertheless, the probability that children with a specific IDD level will be more vulnerable to specific aspects of SPD emphasizes the need for early evaluation and intervention to address the specific sensory needs of children with different IDD levels. This may enhance their development, performance and participation in daily living.

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## 1. Introduction

Intellectual developmental disabilities, also known as intellectual developmental deficits (IDD), is a generalized disorder, characterized by subaverage cognitive abilities and deficits in two or more adaptive behaviors, impacting the individuals' functioning in their environment (Chakrabarti & Fombonne, 2001). Maladaptive behaviors of children with IDD are not only related to their cognitive status, but may also be a result of difficulties in performing other functions. Indeed, in the case of general brain damage that affects the intellectual level, it is possible that other functions, such as motor and sensory functions, which are derived from brain processing, will be affected. Studies show that IDD severity impairs motor abilities accordingly. For example, children with severe-profound IDD are reported to show severe difficulties in their motor skills that are affected by their severe brain damage in general, their lack of motivation to develop motor learning, and by other health conditions, for example, decreased heart activity (Kosma, Wood, Rintala, & Acock, 2004; Ulla, Pauli, & Antero, 2007).

High frequency of *sensory processing dysfunctions* (SPD) is prevalent among children with IDD and contributes to their maladaptive behaviors (Gorman, 1997; Wuang, Wang, Huang, & Su, 2008). *Sensory processing* refers to registration and modulation of sensory information and to the organization of sensory input to execute successful adaptive responses to situational demands (Humphry, 2002; Miller, Anzalone, Lane, Cermak, & Osten, 2007). One of the major models for sensory processing, which refers to the interaction between neural sensitivity and behavioral response/self-regulation, is Dunn's model

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(Dunn, 1997). According to this model, sensory processing patterns are a result of the interaction between the person's neurological threshold and behavioral response/self-regulation strategies. Low neurological threshold indicates that very low stimulation activates the system. High neurological threshold indicates that the person requires a high level of stimulation to activate the sensory system. In the *passive behavior* strategy, individuals allow stimuli to occur and then respond to them, whereas those individuals who use an *active behavior* strategy act to control the amount and type of sensory input they receive (Dunn, 2007). Based on these relationships, the model yielded four patterns: (1) *low registration* – individuals with *high* neurological threshold who fail to detect sensation and use *passive* behavior – they do not actively seek rich sensations (low self-regulators); (2) *sensation seekers* – individuals with *high* neurological threshold who *actively* seek a rich sensory environment; (3) *sensory sensitivity pattern* – individuals with a *low* neurological threshold who are distracted and feel discomfort with sensation, but do not actively limit their exposure to the uncomfortable sensation (low self-regulators); (4) *sensation avoiders* – individuals with a *low* neurological threshold who *actively* limit exposure to sensations (Dunn, 1997).

When these patterns are found at the extremes of the continua, sensory processing dysfunctions (SPD) may occur. SPD encompass difficulties in registering and modulating sensory information and organizing sensory input to execute successful adaptive responses to situational demands (Humphry, 2002; Miller et al., 2007). They lead to maladaptive behaviors and to difficulties in meaningful engagement in daily occupations and in disruption of daily routines (Parham & Mailloux, 2001).

SPD among individuals with IDD were explained by structural abnormalities of the central nervous system (Van Essen et al., 2006). However, although motor dysfunctions were investigated and found to differ among children with different levels of IDD, researchers have not yet sought to establish such differences in relation to SPD.

The literature has mentioned that children with IDD often show defensive reactions to sensory stimuli or low muscle tone (Murray & Anzalone, 1991). Yet, most studies about the sensory processing abilities of children with IDD referred to children with specific syndromes, such as Fragile X (Kogan et al., 2004; Scharfenaker et al., 1996) and Williams syndrome (John & Mervis, 2010). Rogers, Hepburn, and Wehner (2003) examined sensory processing abilities of young children with developmental disabilities, and specifically, children with Fragile X syndrome and Autism spectrum disorders (ASD). They found that both children with Fragile X syndrome and children with ASD had significantly more sensory processing dysfunctions overall than children with other developmental disabilities and typical peers, as expressed in tactile sensitivity and atypical auditory filtering. Children with Fragile X syndrome were more abnormal than all other groups in low energy/weak muscles. These results were also strengthened by animal models. For example, Chen and Toth (2001) found abnormal processing in the auditory system expressed in sensory hyper-reactivity to auditory stimuli in mice with Fragile X.

Researchers noted that SPD among individuals with IDD may be related to specific needs and expressed in behaviors that characterize them. For example, Gal, Dyck, and Passmore (2002, 2010) suggest that stereotyped movements are functionally related to sensory stimulation and that individuals who frequently engage in stereotyped movements may do so to cope with under-stimulation and/or aversive over-stimulation. Indeed, various studies suggest that these movements are generated to provide self-sensory stimuli (Kennedy, Meyer, Knowles, & Shulka, 2000; Sprague & Newell, 1996), or, alternatively, used for reducing overloaded sensory stimuli in the environment, or eliminating unpleasant sensory stimuli (Urwin & Ballinger, 2005). Baranek et al. (2002) supported these points and claimed that these children's use of avoidant versus independent behaviors may reflect different self-regulatory or coping strategies that potentially mediate the relationship between SPD and occupational behaviors. In addition to stereotyped movements, SPD among individuals with IDD were related to various adaptive functions and change across the life span.

Children with Williams syndrome, who present severe SPD, demonstrated poorer adaptive functioning, low executive functioning, more behavioral problems, and more negative temperament than children with less severe levels of SPD (John & Mervis, 2010). Another important point stressed by Baranek et al. (2008) was that SPD among boys with Fragile X syndrome increased with age and specifically grew increasingly problematic from infancy through the preschool ages.

As sensory processing abilities are crucial for effective responses to situations, and facilitate learning, social behavior, and day-to-day functioning and participation, it is necessary to examine further the unique expressions of SPD among individuals with IDD. Not only that knowledge is needed regarding the sensory processing abilities of children with IDD as a whole, but research should also examine specifically the relationship between SPD and IDD severity.

The present study aimed to address this need by comparing the sensory processing abilities of children with mild, moderate and severe IDD with no other known syndromes. This knowledge may contribute to intervention programs for children with IDD. Addressing their specific sensory processing deficits may enhance the application of intervention that is focused on these specific needs and thus may improve their performance in daily living.

It was hypothesized that: (1) children in all IDD severity levels will show sensory processing difficulties. (2) Significant differences will be found between the groups in their sensory processing abilities: the more severe the IDD, the more severe the sensory processing dysfunction that will be presented.

## 2. Method

### 2.1. Participants

Participants were 91 children, aged 4–9 years, 53 boys and 38 girls with IDD, who all studied in special education segregated kindergartens and schools specifically for children with IDD. All children were diagnosed with IDD by

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