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A comparative study of sensory processing in children with and without Autism Spectrum Disorder in the home and classroom environments

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ABSTRACT

Sensory processing and higher integrative functions impairments are highly prevalent in children with ASD. Context should be considered in analyzing the sensory profile and higher integrative functions. The main objective of this study is to compare sensory processing, social participation and praxis in a group of 79 children (65 males and 14 females) from 5 to 8 years of age ($M = 6.09$) divided into two groups: ASD Group ($n = 41$) and Comparison Group ($n = 38$). The *Sensory Processing Measure (SPM)* was used to evaluate the sensory profile of the children: parents reported information about their children's characteristics in the home environment, and teachers reported information about the same characteristics in the classroom environment. The ASD Group obtained scores that indicate higher levels of dysfunction on all the assessed measures in both environments, with the greatest differences obtained on the social participation and praxis variables. The most affected sensory modalities in the ASD Group were hearing and touch. Only in the ASD Group were significant differences found between the information reported by parents and what was reported by teachers: specifically, the teachers reported greater dysfunction than the parents in social participation ($p = .000$), touch ($p = .003$) and praxis ($p = .010$). These results suggest that the context-specific qualities found in children with ASD point out the need to receive information from both parents and teachers during the sensory profile assessment process, and use context-specific assessments.

1. Introduction

In the recently published DSM-5 (APA, 2013), Autism Spectrum Disorder (ASD) is considered as a neurodevelopmental disorder characterized by: (1) "persistent deficits in social communication and social interaction across multiple contexts", and (2) "the presence of restricted, repetitive patterns of behavior, interests or activities". The possible inclusion of sensory

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criteria – "hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment" (APA, 2013) – has been considered under diagnostic criterion 2.

Sensory processing refers to the way the central and peripheral nervous systems manage incoming sensory information from the sensory organs, namely visual, auditory, tactile, taste, smell, proprioception and vestibular. Sensory Integration Theory (Ayres, Robbins, & McAtee, 1979) proposes that the processing and integration of sensory inputs is a critical neurobehavioral process that strongly affects development. Sensory functioning characteristics include registration (or detection) of stimuli, modulation (regulation of level or intensity), discrimination and praxis (planning of new motor acts). Sensory processing impairment is a neurological dysfunction affecting the adequate reception, modulation, integration, discrimination or organization of sensory stimuli, and the behavioral responses to sensory input (Tomchek, 2001). In children, behavioral problems, learning difficulties, motor coordination difficulties, attentional problems and even maladaptive social functioning may, in many cases, be attributable to dysfunctions in any of these sensorial processes, since difficulties at the level of sensory processing often contribute to impairments in higher level integrative functions, such as social participation and praxis (or the ability to plan and organize movement). On the basis of Ayres' theory, Dunn (1997) proposed a model for classifying patterns of sensory processing dysfunction according to individuals' behavioral response to stimuli and neurological thresholds. This model described four patterns: *sensory sensitivity* (distress and distraction from sensations), *sensation avoiding* (controlling or limiting the amount and type of sensations), *low registration* (lack or low awareness of sensations), and *sensation seeking* (enjoyment and interest in increasing sensations). Both sensory sensitivity and sensation avoiding represent hypersensitivity, whereas low registration and sensation seeking represent hyposensitivity.

In the case of children with ASD, sensory processing impairments have been reported to be highly prevalent (Baranek, David, Poe, Stone, & Watson, 2006; Costa & Lampreia, 2012; Kientz & Dunn, 1997; Liss, Saulnier, Fein, & Kinsbourne, 2006; Watling, Deitz, & White, 2001). Sensory dysfunctions are not always present in or exclusive to ASD, as they are also present in other disorders and disabilities (Cheung & Siu, 2009; Ermer & Dunn, 1998; Leekam, Nieto, Libby, Wing, & Gould, 2007; O'Brien et al., 2009; Rogers, Hepburn, & Wehner, 2003; Wiggins, Robins, Bakeman, & Adamson, 2009). Several studies have compared sensory processing characteristics of children with ASD with those of children with typical development, finding significantly higher dysfunctions in the case of children with ASD (Ashburner, Ziviani, & Rodger, 2008; Ben-Sasson et al., 2007, 2009; Dickie, Baranek, Schultz, Watson, & McComish, 2009; Dunn, Myles, & Orr, 2002; Kern et al., 2006; Kientz & Dunn, 1997; Lai, Chung, Chan, & Li-Tsang, 2011; Tomchek & Dunn, 2007; Watling et al., 2001). The sensory modalities that have shown more differences are hearing and touch (Ashburner et al., 2008; Kientz & Dunn, 1997; Rogers et al., 2003; Tomchek & Dunn, 2007; Wiggins et al., 2009) with hypersensitivity being the most common in people with ASD-, although differences have been also found in the other sensory modalities (both external and internal).

The most common way to assess sensory processing characteristics in children with ASD has involved parent or teacher reports on standardized questionnaires. Standardized questionnaires such as the Sensory Profile, SP (Dunn, 1999), and the Sensory Processing Measure, SPM (Parham, Ecker, Kuhaneck, Henry, & Glennon, 2007), allow a detailed assessment of the child's sensory profile based on estimates by adult references of observed behavior. Moreover, since behavior is influenced by the context, this variable should also be considered in analyzing the sensory profile. Thus, each setting contains unique characteristics that can support children and/or create challenges for their performance. Each setting also contains inherent sensory features (Dunn, Saiter, & Rinner, 2002). Hence, the aforementioned assessment instruments contain different versions that are applicable in different contexts. For example, in the case of SPM, psychometric validation studies conducted with Chinese (Lai et al., 2011) and US populations (Parham et al., 2007) obtained low correlations across settings (home and classroom). In general, the literature on multiple informants indicates that when parents and teachers are asked the same question, the correlations of the answers are low (De los Reyes & Kazdin, 2005). The study by Brown and Dunn (2010) also used correlation analysis to compare the sensory processing characteristics of a group of children with ASD in the two contexts (home and school), based on information provided by the children's parents and teachers in the Sensory Profile. In this study, only two sensory processing patterns were analyzed (sensation avoiding and sensation seeking), but the scores obtained in each of the different sensory modalities in the two contexts were not compared. To date, we have not found any other studies conducted in children with ASD that compared their sensory processing characteristics in different settings.

The current study had several aims: (1) to compare the characteristics of sensory processing, social participation and praxis of a group of children with ASD (ASD Group) and a group of children with typical development (Comparison Group) in the home environment (information reported by parents); (2) to compare the characteristics of sensory processing, social participation and praxis of the ASD Group and the Comparison Group in the classroom (information reported by teachers); and (3) to compare – in each group separately – the characteristics of sensory processing, social participation and praxis reported by parents with what was reported by teachers. This third objective is justified by the important effect of context on behavior and the probable existence of inherent and unique sensory features in each context. Thus, in the case of the school environment, certain environmental factors such as the demands of school assignments and stimulation overload could lead to a noteworthy sensory dysfunction in the case of the ASD Group. In sum, considering the previous studies mentioned above, we hypothesize that the ASD Group will obtain higher levels of dysfunction than the Comparison Group (in both contexts), and that the ASD Group will obtain a higher level of dysfunction in the classroom environment than in the home environment.