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Sensory Processing of Children in Early Childhood Education in the Educator's Perspective

Processamento Sensorial de Crianças na Educação Infantil na Perspectiva do Educador

El Procesamiento Sensorial de los Niños en Educación Infantil en la Perspectiva del Educador

Traitement Sensoriel des Enfants en Éducation de la Petite Enfance du Point de Vue de L'éducateur

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Abstract

Background: Children with poor sensory processing have difficulty engaging in school participation. The study aimed to identify the sensory processing patterns of preschool children from the perspective of their educators. Methods: To this end, 5 educators evaluated 70 typically developing 3-year-old children using the Sensory Processing Measure PreSchool (SPM-P). Results: The results showed that in the categories of reactivity as well as planning and ideas, most of the children evaluated were within the typical performance pattern (73% and 63%, respectively), although mild and moderate dysfunction patterns were observed (23% and 21%) and definitive dysfunction (4% and 16%). However, in the social participation category, dysfunction patterns exceeded

that of typical performance (48%), with 29% being mild or moderate and 23% definitive. Conclusion: Given that sensory processing has a strong influence on social participation, this study contributes to the knowledge base for better interventions with children with sensory processing dysfunction.

Keywords: sensory processing, occupational therapy, early childhood education.

Resumo

Contexto: Crianças com processamento sensorial deficiente têm dificuldade de se envolver na participação escolar. O estudo teve como objetivo identificar os padrões de processamento sensorial de crianças pré-escolares na perspectiva de seus educadores. Métodos: Para tanto, 5 educadores avaliaram 70 crianças de 3 anos de desenvolvimento típico usando o Sensory Processing Measure PreSchool (SPM-P). Resultados: Os resultados mostraram que nas categorias de reatividade, bem como planejamento e ideias, a maioria das crianças avaliadas estava dentro do padrão de desempenho típico (73% e 63%, respectivamente), embora tenham sido observados padrões de disfunção leve e moderada (23% e 21%) e disfunção definitiva (4% e 16%). No entanto, na categoria de participação social, os padrões de disfunção excederam o de desempenho típico (48%), com 29% sendo leves ou moderados e 23% definitivos. Conclusão: Dado que o processamento sensorial tem uma forte influência na participação social, este estudo contribui para a base de conhecimento para melhores intervenções com crianças com disfunção de processamento sensorial.

Palavras-chave: processamento sensorial, terapia ocupacional, educação infantil.

Resumen

Antecedentes: Los niños con bajo procesamiento sensorial tienen dificultades para participar en la escuela. El estudio tuvo como objetivo identificar los patrones de procesamiento sensorial de los niños en edad preescolar desde la perspectiva de sus educadores. Métodos: Para ello, 5 educadores evaluaron a 70 niños de 3 años con desarrollo típico utilizando la Medida de Procesamiento Sensorial Preescolar (SPM-P). Resultados: Los resultados mostraron que en las

categorías de reactividad, así como planificación e ideas, la mayoría de los niños evaluados se encontraban dentro del patrón de desempeño típico (73% y 63%, respectivamente), aunque se observaron patrones de disfunción leve y moderada (23% y 21%) y disfunción definitiva (4% y 16%). Sin embargo, en la categoría de participación social, los patrones de disfunción superaron al de desempeño típico (48%), siendo el 29% leve o moderado y el 23% definitivo. Conclusión: Dado que el procesamiento sensorial tiene una fuerte influencia en la participación social, este estudio contribuye a la base de conocimientos para mejores intervenciones con niños con disfunción del procesamiento sensorial.

Palabras clave: procesamiento sensorial, terapia ocupacional, educación infantil.

Résumé

Contexte : Les enfants ayant un traitement sensoriel faible ont des difficultés à s'engager dans la participation scolaire. L'étude visait à identifier les schémas de traitement sensoriel des enfants d'âge préscolaire du point de vue de leurs éducateurs. Méthodes : À cette fin, 5 éducateurs ont évalué 70 enfants de 3 ans au développement normal à l'aide de la mesure du traitement sensoriel préscolaire (SPM-P). Résultats : Les résultats ont montré que dans les catégories de réactivité ainsi que de planification et d'idées, la plupart des enfants évalués se situaient dans le schéma de performance typique (73 % et 63 %, respectivement), bien que des schémas de dysfonctionnement léger et modéré aient été observés (23 % et 21 %) et un dysfonctionnement définitif (4 % et 16 %). Cependant, dans la catégorie de la participation sociale, les schémas de dysfonctionnement dépassaient ceux de la performance typique (48 %), 29 % étant légers ou modérés et 23 % définitifs. Conclusion : Étant donné que le traitement sensoriel a une forte influence sur la participation sociale, cette étude contribue à la base de connaissances pour de meilleures interventions auprès des enfants présentant un dysfonctionnement du traitement sensoriel.

Mots clés: traitement sensoriel, ergothérapie, éducation de la petite enfance.

INTRODUCTION

Sensory Processing

From birth, children are exposed to sensory information and their behaviors are manifested by the interpretations that the Central Nervous System (CNS) makes of that information. Every human sense, such as touch, sight, hearing, taste, smell, proprioception and vestibular work together to form an integral representation of what goes on around them (Ayres, 2005).

Occupational therapist Jean Ayres in 1972 developed Ayres' Sensory Integration Theory and its dysfunctions. According to the author, sensory integration is the neurological process that organizes the sensation coming from the body and the environment, making the use of the body in space possible. To this end, the brain must have the ability to organize and process the information that arrives through the different sensory channels and to interrelate and synthesize it in order to give an adequate response (Ayres, 2005).

These sensory channels make up the sensory systems, which are classified as environmental (sight, smell, hearing and taste) and companies (touch, vestibular and proprioception). It is through these channels that systems capture the stimuli from the environment (external / internal) and transmit to the brain. These stimuli can be external when related to stimuli used by organisms, and interceptors when referring to stimuli applied within the organism (Ayres, 2005).

According to Field (1998, quoted by Inamura, 1998) the order of sensory development is the same order in which the brain areas develop, that is, sensory systems also follow a proximal-distal sequence. Thus, sensory development begins with the influence of tactile, proprioceptive and vestibular input that, throughout childhood, diminishes as the visual and auditory systems play an important role in interaction with the environment. However, it is important to note that early-developed tactile, vestibular, and proprioceptive systems continue to influence life-long transactions with the environment in the order in which the world is experienced, first in utero and then in the exterior.

According to Schaaf and Roley (2006) the processing of these sensations is the means by which the nervous system regulates sensory information, including perception, reactivity, discrimination, organization of sensory stimuli and response to sensory input.

Perception, discrimination (where and what is the function of the information / sensation received) and reactivity (regulation and organization of the degree, intensity and nature of sensory input) are essential factors of sensory processing that enable the child to act and interact with the environment. Perception and sensory reactivity have more implications on behavior, emotions, motivation and attention, and sensory discrimination has more implications on discriminative skills, postural and ocular control, praxis and the way children adapt and organize their actions in the environment (Schaaf & Roley, 2006).

Ayres (2005) hypothesized that, given the appropriate challenges, the nervous system would experience neuronal growth through the production of an adaptive response, that is, an intentional response directed at a sensory experience goal. The making of these adaptive responses helps the brain to develop and organize.

Sensory Processing Dysfunction (SPD)

The dysfunction begins when the child has difficulty having an adequate adaptive response regarding the intensity, nature or degree of sensory stimulation. Responses can lead to inappropriate behavior and inflexibility in adapting to the sensory challenges that are routinely present (Green & Ben-Sasson, 2010).

Sensory reactivity dysfunctions are divided into: hyperreactivity and hypo-reactivity. Hyper-reactive children manifest exaggerated reactions to sensory stimuli, whereas hypo-reactive children do not respond or have diminished responses to environmental stimuli and those with sensory demand require a large amount of information to activate one or more sensory systems. Such behaviors occur when the child has an excessive or insufficient reactivity to sensory stimuli, or when they have a very reduced ability to maintain the

appropriate alert level that is linked to the individual's neurological threshold to receive sensory information (Green & Ben-Sasson, 2010).

Once received, the sensorial information needs to be processed by the central nervous system, where it will be discriminated. Children with perceptual dysfunction and sensory discrimination have difficulty interpreting sensory information effectively. They receive the stimuli but cannot process it properly. There is a flaw in the ability to correctly find meaning to the specific qualities of the stimuli (Serrano, 2016).

Among the dysfunctions of perception and sensory discrimination we have: somatosensory dysfunction, vestibulo-bilateral integration dysfunction and sequencing and the dyspraxis. Somatosensory dysfunction is due to the inability to properly process the tactile and proprioceptive stimuli, that is, the difficulty signifying these sensations received. Vestibulo-bilateral integration dysfunction is characterized by signs of poor processing of the vestibular system, along with difficulty in related motor functions such as muscle tone, eye and postural control, balance, midline integration, and bilateral coordination (Schaaf & Mailloux, 2015). Dyspraxia is the difficulty in planning, sequencing and executing an unfamiliar motor action or a series of motor actions. It’s important to note that poor performance due to a cognitive difficulty or only a motor difficulty is not dyspraxia. In order to meet such diagnosis the child must have Sensory Processing Dysfunction of one or more types of sensations (Schaaf & Mailloux, 2015).

The international literature is very productive regarding the theme of sensory processing. Roberts et al. (2018) evaluated a relationship between symbolic play and sensory processing of 42 children with typical development and Engel-Yeger (2008), analyzed as differences in activities among 134 school-aged children with typical and atypical sensory processing.

The study carried out by Piwinski et al (2021) evaluated the relationship between sensory integration and occupational participation in school-age children through the SPM forma casa questionnaire and the Participation & Environment MeasureChildren and Youth (PEM-CY) questionnaire, showing that If a child has better functioning in sensory integration, they will have

greater occupational participation in their home environment. This study (Piwinski et al, 2021) provides evidence for

the relationship between sensory integration capabilities and occupational participation, and

supports the need to address sensory integration dysfunction in the pediatric population.

In the other hand, it was not possible to find studies that identified and evaluated the sensory processing of typical children in the Brazilian literature. Thus, the present study aimed to identify the sensory processing patterns of children in typical development that complete three years of early childhood education, from the perspective of their educators. To this end, the following study question was proposed: What sensory processing patterns are found in 3-year-olds?

From that question it was created the following hypotheses:

1. There will be children with typical performance standards in all categories;

2. There will be children with moderate dysfunction pattern in all categories;

3. There will be children with definitive dysfunction pattern in all categories.

METHODOLOGY

Design and participants

This is a descriptive, correlational study conducted in a medium-sized city in upstate São Paulo - Brazil, with approximately 200,000 inhabitants. The data collection locations were five public schools with geographical variations according to their location, with a full-time care, in preschool classrooms (children aged 3 to 4 years). These schools were suggested by the city department of education.

Nine educators who worked in those five schools took part in this study; they were in contact with the participant children for at least two months. Were also part of the study seventy children (22 female and 48 male) age 3 with typical development, enrolled full time in preschool.

The study was approved by the Ethics Committee and the participants (educators) and guardians of the children signed by the Informed Consent Form (ICF).

Instrument

The Sensory Processing Measure Pre-School (SPM-P; Parhan et al, 2007) is one of the assessment tools in Ayres Sensory Integration, developed in the United States based on the assumptions of the Sensory Integration Theory of Jean Ayres and The International Classification of Functioning, Disability and Health (ICF) and the Occupational Therapy Practice Framework are also referenced. This instrument is an integrated system of evaluation scales that measures sensory processing, praxis and social participation items, obtaining a unique and complete frame of the child's sensory functioning in the classroom and in school environments. It is intended to support the identification and treatment of children with Sensory Processing Dysfunction and can be used as a screening tool or as a component of diagnostic evaluation (Parham, et. al., 2007). The questionnaire has 75 questions, where each item describes the child's responses to various sensory experiences through the assessment of the tactile, visual, auditory, olfactory, taste, vestibular and proprioceptive systems, as well as motor and ideation planning and social relations.

Therefore, the educators reported the frequency with which children showed these behaviors: always (when the child responds about 90% or more as described), frequently (when the child responds about 75% of the time as described), occasionally (when the child responds about 50% of the time as described), never (when the child responds 10% or less of the time as described). The study by Gomes et al., (2016) carried out the validity and reliability of the SPM for Portuguese from Portugal. According to clinical practice in Brazil and the use of this instrument on a large scale, it was verified that its use, even in Portuguese (from Portugal), would not harm the results.

Data analysis

The data were tabulated by the researcher using the Excel electronic spreadsheet generation program. The researcher evaluated each instrument

according to the answer on all behaviors presented and the data obtained from the SPM-P were analyzed based on the criteria already established by the questionnaire and using descriptive statistics, with the assistance of a professional with expertise in the statistical field.

Procedures

For the use of the SPM-P instrument an e-mail was sent to the publisher Western Psychological Services-WPS (which owns the copyright of the instrument), with a purchase order of the Portuguese version translated and validated to Portuguese of Portugal by Gomes et. al., (2016), since the instrument is not available for online use. After negotiation of purchase, the publisher sent a license of 100 uses in the Portuguese of Portugal version to the researcher.

Of the 114 children enrolled fulltime in the 2018 preschool classes, 90 parents of children who met the inclusion criteria were contacted. These parents received an informed consent form, which contained information about the objective and stages of the study. In addition, it was highlighted that participation in the research was not mandatory and that acceptance or refusal would not harm any of the parties involved. In the document, the researcher also undertakes to present the results of the children's questionnaires to those responsible.

It should be noted that a whole class of 17 students was not included in the study due to the no-acceptance of the responsible educators to participate in the study. Of this total, 70 were allowed to participate in the study, that is, 77.77% of the enrolled children participated. From this selection, it was agreed with the educators a sufficient period to complete the questionnaires, which would be collected by the researcher in schools at free time.

After the approval and acceptance of the educators, the professionals were instructed to apply the SPM-P questionnaires. For this moment, it was necessary to provide tools that would help not only the instrumentalization process, but the whole process of applying the questionnaires, with a presentation about the main terms to be used for the observation of Sensory Processing. In addition, another presentation was prepared, covering the main

information about the instrument, including the reading and explaining of each by the researcher, thus demonstrating the practical application of the questionnaires.

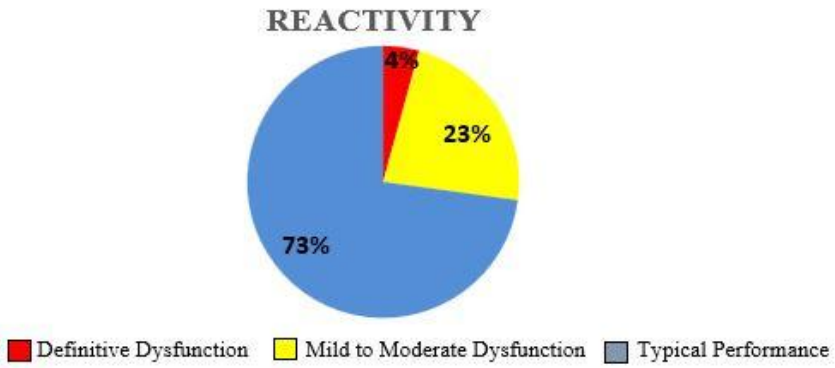
RESULTS

The results refer to the sensory processing pattern of 70 complete 3-year-olds attending 5 public preschools in a city of state of São Paulo.

It is noteworthy that the results presented were based on the perceptions from the observations made by the educators about the behavior of their students during the whole period of class. No in-person tests were performed by the researcher in this study.

The following graphs illustrate the sensory processing patterns for each category covered in the questionnaire, regardless of the gender of the child (male and female). According to the normative scores of the questionnaire we have the following standards: Typical performance, Mild to moderate dysfunction and Definitive dysfunction, as exemplified in the graphs 1, 2, 3 and 4.

Figure 1 – Patterns of sensorial reactivity:



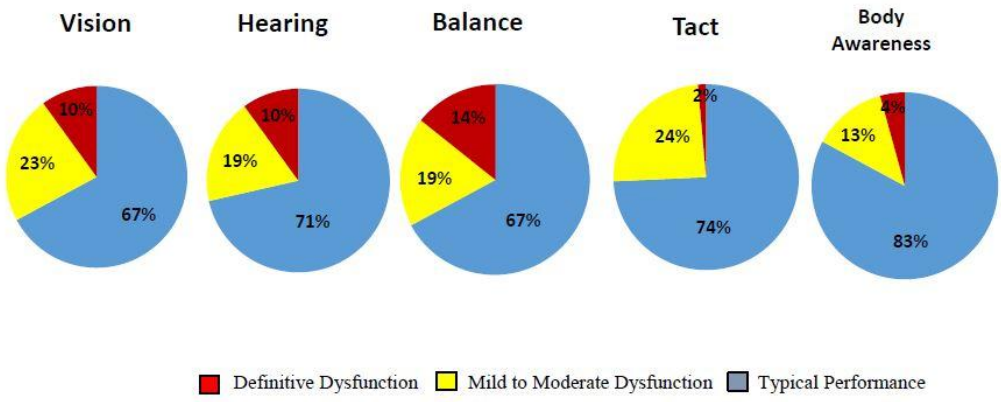
The SPM-P provides the evaluator with the total score that fits the child into or out of a sensory reactivity dysfunction pattern. This score is based on the sum of the gross scores of the categories touch, vision, hearing, taste and smell, body awareness (proprioception) and balance (vestibular).

It is noteworthy that the categories of the olfactory and taste systems do not have normative scores, the gross score of these categories is accounted for only in the total sensory reactivity pattern score.

As illustrated by Figure 1, most children have a typical performance pattern (73%), although, like all other categories, there is a percentage of children with dysfunction, 4% definitive and 23% mild to moderate. Thus, the results point to a total of 27% of the children assessed within a pattern of mild to definitive SPD dysfunction within the reactivity category.

The categories of sensory systems were also evaluated separately as shown in figure 2:

Figure 2 - Systems processing: visual, auditory, vestibular (Balance), tactile and proprioceptive (Body Awareness):

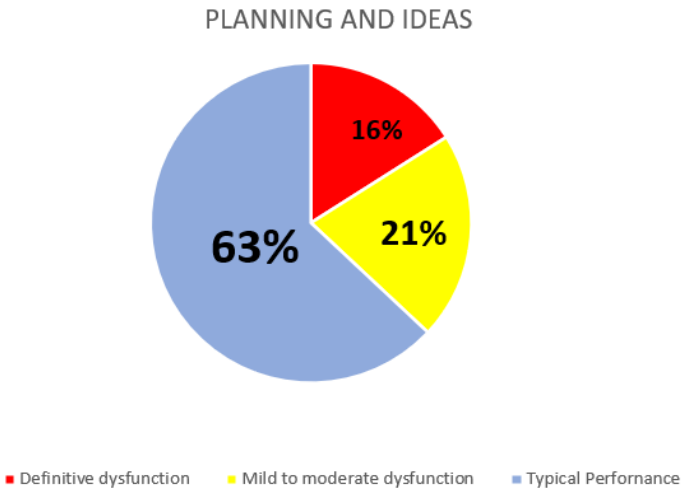


In visual and auditory processing the percentage of children with definitive dysfunction pattern is the same, with 10% of children, while the pattern of mild to moderate dysfunction presents differences, being 23% in visual processing and 19% in auditory processing.

In the processing of the vestibular system, 14% of children presented definitive dysfunction and 19% mild or moderate dysfunction, being the sensory system that presented higher predominance of definitive dysfunction compared to the others. It is noteworthy that the graph identified as “Balance” shows the pattern of the children's vestibular system processing.

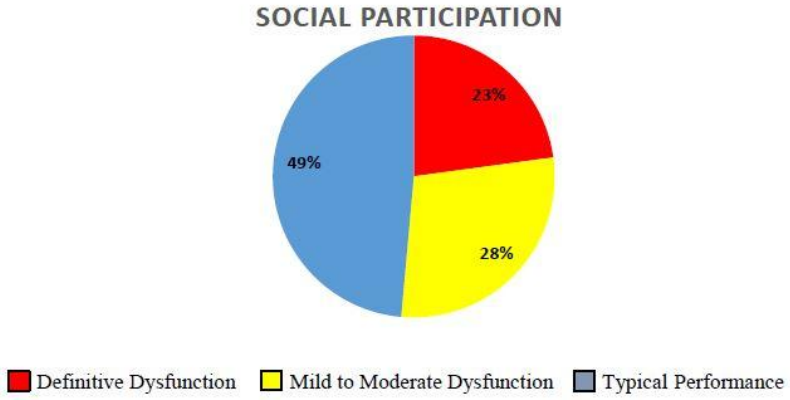
In the processing of the tactile and proprioceptive systems it is noticed a lower predominance of children with definitive dysfunction, 2% in the processing of the tactile system and 4% in the processing of the proprioceptive system. However, in tactile system processing, a higher percentage of children (24% of the total) have mild to moderate dysfunction. It is noteworthy that the graph entitled “body awareness” illustrates the pattern of proprioceptive system processing.

Figure 3 – Patterns of Planning and Ideas:



In this category “Planning and Ideas” the patterns of the child's praxic functions were evaluated and illustrated. According to Parham et al. (2007), the questionnaire is not intended to fit the child in a diagnosis of dyspraxia, considering that for this diagnosis it is necessary to evaluate the ideation, planning and execution of the child's movement in person. However, this result, despite the predominance of the typical performance pattern, 21% of children had mild to moderate dysfunction and 16% definitive dysfunction, thus suggesting a hypothesis that these children's praxis may be impaired.

Figure 4 - Patterns of Social Participation:



In this category evaluated by the instrument, unlike the results found in the others, the percentage of children with typical performance standards is composed of the smallest part of the children, being 48% of the total. Data showed that 23% of children had definitive dysfunction in this category, and 29% mild to moderate dysfunction.

It is noteworthy that the study evaluated social participation only under the bias of sensory processing, other reasons that may cause damage to the social participation of these children were not considered. However, due to the large proportion of children who fit a pattern of mild or definitive dysfunction, the study assumes that SPD may be impacting their social participation in school.

Overall, among the categories covered by the instrument, the "Body Awareness" (proprioceptive system) was the one that presented the most satisfactory results, followed by Touch, Hearing, Balance, Vision, Planning and Ideas, which maintained their percentages of children with high standards. typical performance and Social Participation which, in turn, showed more adverse results compared to the others.

DISCUSSION

International studies point the evidence of the influence of sensory processing dysfunctions in the context of daily routines. According to the authors, SPD

compromises the children's ability to maintain attention, activity, arousal and emotional responses in order to meet the demands of a particular task (Bar-Shalita et al., 2008; Nightlinger, 2007, Schaaf, et al., 2010; Williamson & Anzalone, 2001).

Considering the lack of national studies on sensory processing of children in early childhood education, the percentage of children who presented SPD in the reactivity category in this study compared to the international literature was above average. While the percentages of North American children with dysfunctions averaged 14% and 17% (Ahn, et al., 2004), in this study 27.1% of children had sensory reactivity dysfunction.

It was interesting to observe that the children evaluated in this study showed typical performance, that is, they did not offer to the educational institutions a medical diagnostic report that showed atypical development. The literature has been discussing the possibility of sensory processing dysfunction being suggested as an independent diagnosis, and the identification of a considerable percentage of children in the current sample with such dysfunction, in the absence of medical diagnosis, seems to support these discussions (Ben- Sasson, et al., 2009; Reynolds & Lane, 2011).

Among SPDs, sensory reactivity patterns are currently reported to have a higher incidence. They have received more attention in research from occupational therapists from other countries, and are believed to be more easily identifiable (Roberts, et al., 2018; Lawson , et al., 2016; Tomchek, et al., 2015; Bagatell, et al., 2010; Ben-Sasson, et al, 2009).

Regarding these SPD patterns, another relevant data for discussion pointed out by the study is the percentage of children in preschool who presented definitive dysfunction in the reactivity to the visual and auditory systems (10% of children) and vestibular (14% of children). Even though it was not the purpose of this study to frame children in the patterns of sensory reactivity (hypo reactivity or hyperreactivity), but rather to evaluate if there are impairments in the processing of their sensory systems, it is possible to assume that children's responses to sensory inputs to these systems has been received to a greater or lesser extent.

In addition, definitive dysfunction patterns could be observed in all categories related to sensory processing. This is a matter of concern considering that a 3-

year-old child is constantly exploring and discovering both his own body and the surrounding environment, being a crucial developmental phase. Particularly between 12 and 36 months, the vestibular and visual system will provide the basis for acquiring spatial orientation skills for safe walking, active balancing reactions, coordinated actions, choice and accuracy in activities, among others, skills that Ayres proposed as basis for learning (Roley et al., 2016).

In this topic, the auditory and vestibular system are strongly linked, and require body movement so that their receptors can be activated and integrated (Ayres, 2005). The study raises the hypothesis that, once ruled out biological issues such as prematurity, complications during and after delivery and associated pathologies, the new habits of children, especially with the early abusive use of technologies, can cause damage in the processing of these sensory systems (Paiva & Costa, 2015). This statement can be further reinforced by data presented by the World Health Organization, which points to increasing rates of sedentary lifestyle, with 45% of sedentary children, associated with the frequent use of electronic devices, which has replaced tradicional and lucid activities, according to Paiva and Costa (2015).

The other current analyzes did not show a significant percentage of children with definitive dysfunctions in the other sensory systems evaluated by the SPM-P. However, the category of planning and ideas, where praxis components are evaluated, pointed out that 16% of children have definite dysfunctions.

Belonging category of Sensory Processing Dysfunction, dyspraxia is a subtype of sensory discrimination dysfunction, in which the ability to determine, plan and perform a new action is compromised (Miller, et al., 2007). Although no Brazilian study were found so far pointing the number of children with such a sensory pattern, the present study indicates that these children may show significant impairments in performing their routine tasks, as studies by May-Benson and colleagues (2014) report that in performing daily occupations children with dyspraxia have difficulty with the exploration of play, clothing and writing.

LIMITATIONS AND FUTURE STUDIES

Although the sample size of 70 children is a significant portion of the number of children enrolled in the city assessed, care should be taken when generalizing these results to other populations. Thus, the possibility of the SPM-P questionnaire being self-applicable may present limitations resulting from social relations between educators and children.

It would be important to extend the study to include a population of children from other regions, such as rural and indigenous communities, as well as atypically developing children. Future research on sensory processing in typical and atypical developing Brazilian children would raise important discussion for interventions with sensory processing dysfunction.

CONCLUSION

Since sensory processing has a strong influence on occupational performance, this study contributes to the knowledge base of best practices when working with children. This study provides new evidence for occupational therapy professionals and other professionals interested in sensory processing knowledge.

In addition, it is possible to have a prior knowledge of sensory processing of 3-year-old Brazilian children from a particular region from the educator's point of view. The study also made it possible to bring the educator closer to their childrens' knowledge about sensory processing and its influence on their school performance.

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