

# Study of Sensory Processing Dysfunctions in Typically Developing Children and Children with Attention Deficit Hyperactivity Disorder

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## Abstract

**Aim:** This study aims to identify the level of sensory processing dysfunction among typically developing children and children with Attention deficit and hyperactivity Disorder.

### Objectives:

- To assess the level of sensory processing dysfunction among children with Attention Deficit and Hyperactivity Disorder.
- To assess the level of sensory processing dysfunction among typically developing children.
- To compare the level of sensory processing dysfunction between Children with Attention Deficit Hyperactivity Disorder and Typically Developing Children.

**Methodology:** Purposive sampling of 100 children were selected in mainstream schools and Occupational Therapy centers in Tamil Nadu. This study was done among the children between the age group of 4 to 9 years. Short sensory profile (SSP) was used as a measuring scale.

**Result:** This study results shows that 90% of the sample children showed some sensory processing dysfunction, comparatively Children with Attention Deficit Hyperactivity Disorder are showing higher level of sensory processing dysfunction (Mean Value is 100.46) than typically developing children (Mean is 152.56) on short sensory profile.

**Conclusion:** This study concludes that Sensory processing dysfunction is more commonly present in children with Attention Deficit and Hyperactivity Disorder whereas in typically developing children also sensory processing dysfunction was observed but most of them under probable difference. This study also suggests that the level of sensory processing impairment is high in children with ADHD than that of children who are normal and typically developing

**Key Words:** Attention Deficit and Hyperactivity Disorder, Short sensory profile, Sensory processing dysfunction

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## Introduction

Attention Deficit and Hyperactivity Disorder (ADHD) is a Neuro behavioral developmental disorder typically begins in childhood and persist in to adulthood. ADHD is characterized by developmentally inappropriate levels of inattention and impulsivity and hyper activity resulting in functional impairment

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in academic, family and social setting. Research have found that the social challenges of children with ADHD include disturbed relationship with their peers, difficulty making and keeping friendship, and deficiencies in appropriate social behavior. Long term outcome studies suggest that these problem continue in to adolescence and adulthood and impede the social adjustment of adult with ADHD.

Throughout the past decades in education there has been a severe rise in the number of children who suffer from ADHD. Handen<sup>1</sup> et al. noted, “ADHD affects 3% -5% of typically developing school age children and is characterized by over activity, impulsivity, and inattention across multiple environments”.

### **Sensory processing dysfunction**

Sensory processing disorder (SPD) is a neurological condition that exists when sensory signals don't get organised into appropriate responses. People with Sensory Processing disorder find it difficult to process sensory information (e.g. sound, touch and movement) from the world around them. This means that they may feel sensory input more or less intensely than other people. Sensory processing dysfunction can therefore impact on a person's ability to interact in different environments and perform daily activities.

The majority of evidence describing sensory processing disorder stems from parental report, retrospective video tape analysis and first hand records of living with autism. Findings are limited to study, describing observable behavior indicative of sensory processing patterns and do include behavior studies, investigating the neurophysiologic process. Sensory processing dysfunction is a neurophysiologic condition in which sensory input either from the environment or from one's body is poorly detected, modulated or interpreted to which typical response is observed. It can also be considered as a disorder when they cause significant difficulties with daily routines and task. If a person has sensory processing dysfunction often the symptoms result in emotional, behavioral, social, intentional or mitotic problems. These secondary problems can take many forms and cook different depending on child and family content.

### **Sensory processing is divided into 3 major subtypes**

- **Sensory modulation disorder-** In this group, individuals experience sensation at varying levels of intensity and have difficulty regulating responses. They may be more sensitive to one or more sensations such as noise, touch, or movement. Within this category, we often see children who either seek out extra input or who avoid input many of us would consider innocuous. it can be confusing to dissect behaviors of this children.

- **Sensory based motor disorder -** For these kids, Disorganized processing causes less than optimal motor output. We may see issues with balance, motor planning, coordination, postural control and/or endurance. These are the kids who appear clumsy, lethargic, or have difficulty keeping up with their peers.

- **Sensory discrimination disorder-** Those in this group have a more difficult time perceiving details of sensory input. It may take them longer than average to determine exactly what they're looking at, hearing or feeling. This could be the child who appears awkward with many fine and gross motor tasks or who often seems unaware of his surroundings.

It has been estimated by proponents that up to 16.5% of elementary school aged children are having problem in sensory processing mainly tactile and auditory. An estimate of 13% of the 3-9 yrs children are to be affected with sensory processing dysfunction. Hence attempt has been done to find out the results among ADHD children and typically developing.

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## Review of Literature

### Inmaculada Fernandez<sup>2</sup>

The aim of this study was to find the quality of sensory processing and higher integrative functions in children with ASD from different environments. 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 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 sensory profile assessment process needs the reports identified from two different environments which have to be concerned for the further treatment process.

### Sharon A. Cermak (2008)<sup>3</sup>

The study describes the significant sensory differences under different circumstances of autism. Sensory modulation symptoms are common in persons with autism spectrum disorders (ASD); however have a heterogeneous presentation. Results from 14 studies indicated a significant high difference between ASD and typical groups in the presence/frequency of sensory symptoms, with the greatest difference in under-responsive, followed by over-responsive and sensation seeking. Three moderators that reduced the variability in findings among studies were: chronological age, severity of autism, and type of control group. Sensory differences were highest for studies of children ages

6–9 years, samples with more than 80% with an autism diagnosis, and compared to a CA matched versus a MA or DD matched group. It is important to consider these moderators in the design of studies and interventions addressing sensory symptoms.

### Mary Alhage Kientz, Winnie Dunn(1996)<sup>4</sup>

The purpose of this study was to determine whether the Sensory Profile discriminates between children with and without autism and which items on the profile best discriminate between these groups. Parents of 32 children with autism aged 3 to 13 years and of 64 children without autism aged 3 to 10 years completed the Sensory Profile. A multivariate analysis of covariance (MANCOVA) on each category of the Sensory Profile identified possible differences among subjects without autism, with mild or moderate autism, and with severe autism. Follow-up analyses were conducted for any category that yielded a significant result on the MANCOVA. Eighty-four of 99 items (85%) on the Sensory Profile differentiated the sensory processing skills of subjects with autism from those of subjects without autism. There were no group differences between subjects with mild or moderate autism and subjects with severe autism. The study concluded that the Sensory Profile can provide information about the sensory processing skills of children with autism to assist occupational therapists in assessing and planning intervention for these children.

### Winnie Dunn, K Westman(1997)<sup>5</sup>

The purpose of this study was to obtain data about a national sample of children without disabilities on the 125-item revision of the Sensory Profile, a tool derived from sensory history items reported in the literature and designed to evaluate children's responses to commonly occurring sensory events. Parents of 1,115 children completed the Sensory Profile. The children were 3 to 10 years of age and did not have disabilities. Parents used a 5-point Likert scale to report the percentage of time their children engaged in each behaviour Researchers then analyzed the data, using multivariate methods to identify trends in performance and age and gender differences. Ninety-one (73%) of the profile's 125 items were found to be uncommon behaviours for this national sample of children without disabilities. Although age and gender differences were significant ( $p < .001$ ), effect sizes were so small (i.e., below .2) that differences

were not meaningful for clinical application (i.e., mean differences less than .5 points). Only two items in the visual category approached a 1-point difference when comparing younger and older children. The study concluded that there were no meaningful gender differences on the revised Sensory Profile, and only 2 items approached a meaningful difference related to age. Nearly three fourths of the items on the profile were uncommon for children without disabilities. This study also suggests when the children with various disabilities display these behaviours, the Sensory Profile can be useful in evaluation and program planning for children with disabilities.

### **Julie Ermer, Winne Dunn(1997) <sup>6</sup>**

The purpose of this study was to determine which factors on the Sensory Profile, a measure of children's responses to commonly occurring sensory experiences, best discriminate among children with autism or pervasive developmental disorder (PDD), children with attention deficit hyperactivity disorder (ADHD), and children without disabilities. Data for three groups of children 3 to 15 years of age were used: 38 children with autism or PDD, 61 with ADHD, and 1,075 without disabilities. The researchers conducted a discriminant analysis on the three groups, using group membership as the dependent variable and the nine factors of the Sensory Profile as independent variables. The analysis yielded two Discriminant functions: one that differentiated children with disabilities from children without disabilities and another that differentiated the two groups of children with disabilities from each other. Nearly 90% of the cases were correctly classified with these two functions. The Sensory Profile is useful for discriminating certain groups of children with disabilities. This study also suggests that patterns of behaviour associated with certain developmental disorders are reflected in populations of children without disabilities.

### **Methodology**

The purpose of the study is to identify the level of sensory processing dysfunction in children with Attention Deficit and Hyperactivity Disorder and Typically Developing children.

### **Research Design**

Descriptive study design was used in this study to investigate the level of functioning in children age matched 4-9 yrs.

### **Population**

The study involved children between age group of 4 to 9 years who are normal, typically developing and ADHD.

**Sample Size:** 100 subjects participated in this study

**Sampling Technique :** Purposive sampling technique was adopted.

### **Study Place**

The study was conducted at Mainstream schools in Erode and Namakkal Districts of Tamil Nadu and Occupational Therapy centres in Erode, Namakkal, Karur and Tirupur Districts of Tamil Nadu.

### **Inclusion Criteria**

- Age between 4 to 9 years
- Both male and female were selected
- Children Studying in Mainstream education and Diagnosed as ADHD by Developmental pediatrician.

### **Exclusion Criteria**

- Age below 4 years and above 9 years was excluded
- Children reported with developmental delay, taking medications
- children with seizure episodes are excluded

**Research Tool :** Short Sensory profile<sup>7</sup>

**Data Analysis And Result**

**Table 1: Comparison of short sensory profile Scores between Typically Developing and ADHD children in Tactile sensitivity**

SENSORY DOMAIN	GROUP	Mean	SD	't' VALUE	'p' VALUE
TACTILE	Typically Developing	24.3	3.370	10.658	0.0001
	ADHD	16.32	4.083		
TASTE AND SMELL	Typically Developing	17.16	1.973	10.791	0.0001
	ADHD	11.17	2.983		
MOVEMENT AND SENSE	Typically Developing	13.22	1.419	8.995	0.0001
	ADHD	9.68	2.394		
UNDERRESPONSIVE/ SEEKING	Typically Developing	25.38	3.999	9.812	0.0001
	ADHD	17.22	4.311		
AUDITORY SENSITIVITY	Typically Developing	25.94	2.705	14.037	0.0001
	ADHD	16.04	4.189		
ENERGY SENSITIVITY	Typically Developing	25.28	3.169	9.700	0.0001
	ADHD	17.46	4.739		
VISUAL/AUDITORY SENSITIVITY	Typically Developing	21.54	1.897	9.949	0.0001
	ADHD	14.04	4.981		

**Table 2: Comparison of total score of short sensory profile between ADHD Children and Typically developing children**

GROUP	Mean	SD	't' VALUE	'p' VALUE
Typically Developing Children	152.56	8.500	25.654	0.0001
ADHD Children	100.46	11.574		

## Discussion

Using the short sensory profile total score as an overall indicator of sensory processing response, children with ADHD were often reported to have sensory processing impairments whereas children in the typically developing group were not. According to the table the highest frequency of dysfunctional sensory processing is observed in group of children with ADHD.

Table 1 shows the sensory processing dysfunction faced by children with ADHD and typically developing children on the basis of Tactile sensitivity, Mean values of typically developing children is 24.3 and ADHD children is 16.32, “t” value is 10.658. it shows the significant difference between groups on tactile sensitivity. Similarly on taste and smell domain mean value of typically developing children is 17.16 and mean value of ADHD Children is 11.17 and “t” values is 10.79. it indicates the significant difference between the groups.

On movement and sense domain the mean value of typically developing children is 13.22 and mean value of ADHD children is 9.68 and “t” value is 8.99. In under responsive or seeking domain the mean value of typically developing children is 25.38 and mean value of ADHD children is 17.22 and “t” value is 9.81. In auditory sensitivity domain mean value of typically developing children is 25.98 and ADHD children is 16.04 and “t” value is 14.03. similarly in energy sensitivity domain the mean value of typically developing group is 25.28 and ADHD group is 17.46 and “t” value is 9.7. In visual and Auditory sensitivity domain mean value of typically developing children is 21.54 and mean value of ADHD children is 14.04 and “t” value is 10.65. higher the mean value indicates typical performance whereas lower the mean value indicates definite difference in sensory processing dysfunctions.

Table 2 shows the sensory processing dysfunction faced by children with ADHD and typically developing. Mean value of typically developing children is 152.56 and ADHD children is 100.46 and “t” value is 25.654 and p value 0.0001. These results begin to confirm the prevalence and types of sensory processing dysfunctions in ADHD Children.

## Conclusion

The majority of children with Attention deficit hyperactivity disorder in this sample were reported to have difficulties with processing and responding to sensory input on the short sensory profile. Children were reported to be inattentive, under responsive and sensitive to tactile input. They also were reported to seek sensory input and have difficulties in filtering auditory input. The Attention deficit hyperactivity disorder group performed significantly different when compared to other typically developing age matched children. Sensory processing dysfunction is more commonly present in children with ADHD whereas in typically developing children also sensory processing dysfunction was observed but most of them under probable difference.

**Ethical Clearance :** Institutional Ethical committee Approved.

**Source of Funding :** Self.

**Conflict of Interest :** NIL

## References

1. Handen et al . Occupational Therapy For Children . Second Edition. Mosby;1988.
2. Inmaculada Fernandez et al . A comparative study of sensory processing in children with and without Autism Spectrum Disorder in the home and classroom environments. Research in Developmental Disabilities.2015. 202-212.
3. Sharon A Cermak et al . “Food selectivity and sensory sensitivity in children with autism spectrum disorders”. Journal of the american dietetic association, 2010; 110, 238-246.
4. Mary Alhage Kientz, Winnie Dunn. A Comparison of the performance of children with and without autism on the Sensory profile. The American Journal of Occupational therapy. 1996; 51(7). 530-537.
5. Winnie Dunn, K westman. The sensory profile; The performance of a national sample of children without disabilities.American journal of occupational therapy. 1997; 51(1), 25-34.

6. Julie Ermer, Winnie Dunn . The Sensory profile: A Discriminant Analysis of Children with and without Disabilities. *The American Journal Of Occupational Therapy*. 1997; 52(4), 283- 290.
7. Winnie Dunn. Performance of typical children on the Sensory profile; An item analysis. *The American Journal of Occupational therapy*.1994; 48, 967-974.