# Comparison of Properties of the Persian Version of the Sensory Profile 2 in Children with Autism Spectrum Disorder and typical Individuals

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## Abstract

**Introduction:** Autism spectrum disorder (ASD) is a childhood developmental condition that affects social-emotional skills and communication. Sensory processing represents a significant factor in influencing the behavioral responses. However, it has been shown that children with ASD usually experience some sensory difficulties. The purpose of this study was to evaluate the sensory processing in children with ASD to identify which domains are mainly affected. **Methods:** The population of this study included 30 children with ASD aged between 1 to 5 years and 30 age- and gender-matched typically developing individuals. Sensory processing was assessed through a parent-reported questionnaire of the child sensory profile 2. Multivariate Analysis of Variance (MANOVA) was used to analyze the data. **Results:** The findings of this study showed that individuals with ASD had a significant difference in all sensory processing components of the sensory profile 2 compared with the age-matched peers ($P<0.05$), except for the two components named touch processing and body position ($P>0.05$). **Conclusion:** Since the present study shows that there is a difference between a number of sensory processing components in children with ASD and typically developing peers, it is suggested that therapists should perform this test in other groups of vulnerable populations such as developmental delay, attention deficit hyperactivity disorder, learning disorder, infertility, and Down syndrome.

**Keywords:** Autism Spectrum Disorder, Sensory Processing, Sensory Profile 2

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## Introduction

The central nervous system provides a network which allows us to receive, identify, interpret, and attend to environmental sensory stimuli. This system allows us to search for what is pleasant and to avoid from painful things. The way in which we interpret the senses is based on the individuals. In other words, each person reacts differently to a similar stimulus. Sensory processing is a generic term that refers to way which the central nervous system receives, detects, and integrates incoming sensory information for use in producing adaptive responses to person's environment [1]. It also refers to the reception, adjustment, coherence of sensory information sequentially, and the production of adaptive responses [2].

Based on the data extracted from more than a thousand children with and without disabilities, Dunn assumed that there is an ongoing interaction between the nervous system function and the self-management strategies, which in turns leads to developing patterns of sensory processing in individuals [3]. Sensory processing patterns were seen in all age groups from childhood to adulthood, and these patterns are more severe in people with disabilities like individuals with Autism spectrum disorder (ASD).

Dunn's model of sensory processing determines response patterns based on the neurological threshold and the self-regulatory strategies [4]. The neurological threshold continuum ranges from high threshold (when high intensity stimuli is necessary in order to respond), to low threshold (when low intense stimuli provokes a response). The continuity of self-regulation ranges between passive strategy (individuals who do not interact to unpleasant stimuli) and active strategies (individuals who act to control the amount and type of sensory input). Although individuals with passive tendencies may internally respond to stimuli, they might not take action to change

their environments; whereas at the active end of the continuum, individuals may tend to actively control the type and amount of sensory input in their environments [5, 6].

Researchers have developed numerous tests to measure the sensory processing including the child sensory profile 2. Given that individuals with ASD are usually characterized by symptoms of social skills deficiency, problems in verbal and nonverbal communication, limited interests, and repetitive behaviors and in recent years, and sensory processing problems have become one of the most common difficulties in children with ASD. Therefore, children with ASD have the distinct patterns of sensory processing in comparison of their normal counterparts. In this study, we aimed to investigate the discriminant validity of the child sensory profile 2.

# Material and methods

***Study population***

This research was a descriptive cohort study. The study population included children with ASD (based on the diagnosis of a child psychiatrist) aged between 1 to 5 years who were referred to one of the clinics for rehabilitation services in Tehran. ASD children had no other physical or neurological problems. In this study, we selected 30 children with ASD as cases (study group) and 30 age- and gender-matched typically developing children as control group through the convenience sampling.

***Data collection tool***

We employed children's sensory profile 2 to collect data. This is a standard tool for measuring children's sensory processing abilities at home and in the clinics. The questionnaire is rated on a six-point Likert scale (almost, always, often, sometimes, rarely, and almost never) investigating the levels of sensory function. The different parts of this questionnaire can be classified in five cut-off points which include much less than others, less than others, similar to others, more the others, and much more than others. These scores are calculated for each section separately, and each section has the special cut-off points.

Internal reliability of this test was assessed by two methods of internal consistency (coronaches alpha coefficient) and test-retest method on 1272 parents of children aged 0-14 years. The alpha coefficient for the different parts of this test was ranged from 0.6 to 0.9. For test-retest evaluation after the first run, the second run was performed between 7 to 12 days. The intra-class correlation was used to calculate reliability. The value of this measure fluctuated between 0.87 and 0.97 that these values indicated very good consistency in the first and second runs. We used the content validity and factor analysis methods for calculating the validity.

***Data analysis***

All statistical analyses were performed with SPSS version 22. We performed the Multivariate Analysis of Variance (MANOVA) test to compare the thirteen sensory measures (Sensory seeking, emotional reactivity, sensory sensitivity, sensory registration, visual, auditory, touch, motion, body position, oral, behavioral responses, emotional-social responses, and subjective responses) of the sensory profile in the autism and control groups. $P$-value<0.05 was considered as the significant level.

***Ethical consideration***

This study was approved by ethical committee of Shahid Beheshti University of Medical Sciences with ethical code: IR.SBMU.RETECH.REC1396.1393. Families of children participating in the study were assured of the confidentiality of their children information and parental consent was obtained for participations prior to the study.

# Results

Information about the mean and SD of age variable for both groups are presented in Table 1.

Information about mean and standard deviation of the thirteen components of sensory processing between two groups are presented in Table 2. Based on the data, the mean of all components of sensory processing was higher in the ASD group than the normal group. According to the results of Table 3, there was a significant difference between the two groups of people with ASD and normal people in terms of sensory seeking, sensory avoidance, sensory sensitivity, sensory registration, auditory, visual, motion, oral, behavioral responses, emotional-social, and subjective responses ($P$<0.05). However, touch processing and body position were not significantly different between the two groups ($P$>0.05).

# Discussion

Since the sensory profile 2 has been designed in 2014, there are limited studies using this tool to investigate the extent of sensory processing problems in children with ASD. This tool is unique since that it breaks down the components of sensory processing into the various domains. Only Lauren *et al.* examined the sensory processing status of children with attention-deficit hyperactivity disorder, ASD and their healthy control group using this tool. Their results showed that children with the attention deficit hyperactivity disorder had higher

***Table 1.***The mean and standard deviation for the age of the patient and normal individuals

| | | Mean (SD) | Minimum | Maximum |
|---|---|---|---|---|
| **Age** | Normal (control group) | 5.93 (2.57) | 3.00 | 13.00 |
| | ASD (study group) | 5.93 (2.57) | 3.00 | 13.00 |

***Table 2.*** Mean and standard deviation of sensory processing scores in normal and autistic individuals

| | | ASD (study group) | | Normal (control group) | |
|---|---|---|---|---|---|
| | Variables | Mean | SD | Mean | SD |
| **Sensory patterns** | Sensory Seeking | 41.67 | 12.34 | 22.67 | 8.20 |
| | Emotional Reactivity | 44.07 | 15.62 | 23.53 | 5.01 |
| | Sensory Sensitivity | 45.17 | 14.09 | 24.93 | 6.70 |
| | Sensory Registration | 44.00 | 13.66 | 26.20 | 5.30 |
| **Sensory sections** | Auditory | 20.60 | 6.75 | 9.40 | 2.74 |
| | visual | 10.20 | 5.03 | 7.20 | 2.05 |
| | touch | 19.70 | 8.51 | 13.77 | 3.64 |
| | Motion | 17.43 | 5.87 | 10.43 | 3.31 |
| | Body position | 14.63 | 7.82 | 14.57 | 4.96 |
| | Oral | 22.03 | 8.36 | 14.57 | 4.96 |
| **Behavioral sections** | Behavioral responses | 20.73 | 6.59 | 11.17 | 3.03 |
| | Emotional-social responses | 31.70 | 15.50 | 17.37 | 4.25 |
| | Subjective responses | 23.47 | 7.82 | 13.33 | 3.82 |

***Table 3.*** *F*-value, *P*-value, and effect size of sensory processing scores in normal and autistic individuals

| | | F | P-value | Effect Size |
|---|---|---|---|---|
| | Variables | | | |
| **Sensory patterns** | Sensory Seeking | 10.40 | 0.002* | 0.157 |
| | Emotional Reactivity | 21.40 | <0.001** | 0.277 |
| | Sensory Sensitivity | 14.25 | <0.001** | 0.203 |
| | Sensory Registration | 13.02 | <0.001** | 0.189 |
| **Sensory sections** | Auditory | 24.85 | <0.001** | 0.307 |
| | visual | 4.99 | 0.029* | 0.082 |
| | touch | 2.62 | 0.111 | 0.045 |
| | Motion | 12.97 | <0.001** | 0.188 |
| | Body position | 0.31 | 0.578 | 0.006 |
| | Oral | 6.04 | 0.017* | 0.097 |
| **Behavioral sections** | Behavioral responses | 16.25 | <0.001** | 0.225 |
| | Emotional-social responses | 13.60 | <0.001** | 0.195 |
| | Subjective responses | 12.39 | <0.001** | 0.181 |

* $P<0.05$, ** $P<0.001$

visual processing scores than children with ASD and normal children; and children with ASD had higher levels of processing of oral sense than group of children with attention deficit hyperactivity disorder and normal group [7].

The results of this study showed that children with ASD had a different sensory processing than their typically developing peers in the often items, except for body position and touch processing. This finding is consistent with previous studies conducted using sensory profile 1 by Walting *et al.* [8], Kern *et al.* [9] and Tomchek *et al.* [10].

Based on the results, among the thirteen components of sensory profile 2, sensory sensitivity had the highest mean value. The high level of this index is associated with symptoms such as sensory sensitivity, behavioral inhibition, introversion and shyness, anxiety and depression. These findings can be interpreted in this way that people's willingness to emotional arousal may be responsible for the development of emotional disorders such as depression and anxiety. These factors cause these individuals to have difficulty in self-regulation, lose control over emotional stimuli, exhibit physical symptoms, and be promptly aroused. According to Dunn's four-factor model, people with the sensory sensitivity tend to process information at a lower threshold and this makes them more vulnerable to environmental stimuli as well as more physiologically responsive and faster. Finally, sensory sensitivity structure can be a valuable tool for assessing specific psychological disorders (depression and anxiety) and helping us to understand a wide range of psychological features [11].

The findings of this study were showed the average social-emotional response of children with ASD was higher than their

typically developing peers. The possible justification for this result is that high sensory recording average is one of the components of sensory processing patterns. Sensory system recording usually fluctuates in a normal range. Children with sensory registration impairment have higher aroused arousal level than typically developing children and oscillate in the normal range at the interval of over excitation and low excitation [12] .On the other hand, anxiety, depression, and aggressive behaviors which indicate disruption of emotional behaviors are caused by an imbalance in arousal levels. Sensory registration disorder and disturbance of consciousness level is a sign of disruption of sensory processing and creates emotional instability. Thus, it is argued that this disruption of sensory processing would disrupt the outputs of sensory processing systems as a process for the emotional and emotional limbic system and attention centers in the temporal and parietal lobes. Therefore, it can be expected that sensory processing disorders can result in emotional-social deficits.

The significant limitation of this study was the large number of questionnaire items which made it difficult for parents to complete the information due to insufficient time for the test process. Therapists make it possible to justify and express children's daily behaviors based on the sensory processing using judgments from parents, teachers, and continuously connection with children, and also considering their wide age range in early detection of sensory processing disorder.

It is recommended that therapists perform this test in other groups of vulnerable populations, such as children with developmental delays, attention deficit hyperactivity disorder, learning impairment, infertility and Down syndrome to better understand the diagnostic validity of this test.

# Conclusion

The majority of children with ASD in this sample had difficulties with processing and responding to sensory input on the sensory profile 2. Children were reported to be inattentive, under responsive, and sensitive to tactile input. They also were reported to seek sensory input and to have difficulty filtering auditory input. Scores for often components of the sensory profile 2 were significantly different when children with autism were compared with age-matched peers. These present findings, considered with similar studies in the literature, confirm the presence of sensory processing disorders in children with ASD and classification of its types. Further research is needed to more clearly define patterns of sensory processing in people with ASD and to investigate the relationships of these patterns with the occupational performance of children from this population.

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Both authors made substantial contributions to the conception, design, analysis, and interpretation of data.

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