

The Relationship between Sensory Processing Patterns and Self-Care Skills in Children with Autism Spectrum Disorder

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ABSTRACT

Objectives: Children with autism spectrum disorder (ASD) frequently experience sensory processing difficulties that interfere with daily functioning, particularly self-care, yet their specific relationships remain underexplored. Therefore, this study aimed to investigate the relationship between sensory processing patterns and self-care skills in children with ASD aged 3-6 years, examining sensory quadrants, sensory sections, and behavioral domains based on the Sensory Profile-second edition (SP-2).

Materials & Methods: A cross-sectional design was employed, involving 93 children with ASD. Sensory processing patterns were assessed using the SP-2, while self-care skills were evaluated with the Pediatric Evaluation of Disability Inventory (PEDI). Researchers conducted multiple linear regression analyses to investigate how sensory processing patterns relate to self-care skills.

Results: The analysis revealed prevalent sensory processing difficulties in sensory sensitivity ($M = 42.2$, $SD = 13.1$), low registration ($M = 46.0$, $SD = 14.4$), touch ($M = 23.0$, $SD = 9.2$), movement ($M = 18.1$, $SD = 7.4$), and body position ($M = 16.0$, $SD = 8.0$). Regression analyses showed that overall sensory processing patterns significantly predicted self-care skills ($R^2 = 0.151$, $p = 0.030$). Among specific sensory patterns, the movement domain approached significance ($\beta = -0.289$, $p = 0.063$), suggesting its potential importance in predicting self-care abilities.

Conclusion: Sensory processing difficulties may predict self-care skills in young children with ASD. Motor-related sensory challenges seem particularly significant, but it is crucial to approach these findings carefully due to the study's cross-sectional design and dependence on parents' reports. Future research should include longitudinal studies with objective measurements to provide more definitive insights.

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Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition marked by persistent difficulties in social communication, interaction, and restricted, repetitive behaviors (1, 2). Between the ages of three and six years, children typically engage in various self-care activities. During this period, sensory, motor, and cognitive abilities support their independence in these tasks, thus reducing caregiver burden (3, 4). Self-care skills, including dressing, toileting, feeding, and

personal hygiene, are critical for independent living and overall well-being. However, children with ASD often struggle with these tasks due to sensory processing issues and motor coordination deficits, which can lead to substantial challenges in daily life (5).

Sensory processing deficits pop up when children really struggle to make sense of how they feel things, how they hear things, what they see, and where their body is in space. This can really start to get in the way

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of everyday life (6). Children with ASD often find themselves with sensory integration problems that affect almost every part of their day, such as touch, hearing, vision, and proprioception, and it can really get in the way of things like taking care of themselves (7-9). For instance, hypersensitivity to touch can make getting dressed a major ordeal, while being entirely insensitive to it can make them too slow to react when things in the bathroom make them uncomfortable (10). These sensory challenges highlight the complex relationship between sensory processing and self-care in children with ASD.

Sensory processing issues in individuals with ASD can show up in various forms. Some may experience hypo-responsiveness, appearing indifferent to stimuli, while others may exhibit hyper-responsiveness, overreacting to certain stimuli. Furthermore, those who display sensory-seeking behaviors, such as hand flapping or making repetitive sound (11-13). These challenges are more common in children with ASD compared to those with other developmental disorders and can have a significant impact on daily life and self-care abilities. (14, 15).

Research has identified four distinct sensory processing patterns: sensory seeking, sensory avoiding, sensory sensitivity, and low registration (16). Sensory seeking involves actively pursuing sensory experiences, while sensory avoiding entails withdrawing from overstimulating environments. Heightened sensory reactions mark sensory sensitivity, and low registration is characterized by a failure to respond to typical sensory inputs (17).

Sensory processing difficulties are closely linked to challenges in daily functioning, including self-care tasks, in children with ASD (18, 19). Sensory processing patterns significantly influence feeding, dressing, and hygiene behaviors, relying on sensory processing and motor coordination (20-24). However, the specific role of sensory patterns—Sensory Seeking, Sensory Avoiding, Sensory Sensitivity, and Low Registration—in self-care remains underexplored. Most studies have focused on broader daily functioning rather than directly examining the impact of these patterns on self-care. This study aims to address this gap by analyzing sensory processing and self-care relationships using the Quadrant Model, Sensory Sections Model, and Behavioral Sections Model, offering a detailed perspective on sensory influences (9). Understanding these challenges can improve clinical practices, as sensory interventions are common but often insufficient for addressing self-care difficulties reported by parents (25, 26). The present study aimed to examine how sensory processing patterns, including quadrants, sensory systems, and

behavioral sections, relate to self-care skills in preschool children with ASD.

Materials & Methods

Study design

This study was conducted with a descriptive-analytical, cross-sectional design.

Participants

Participants consisted of 93 children with ASD recruited by a convenience sampling method from rehabilitation centers in Tehran province, Iran. Inclusion criteria were (1) children aged three to six years, (2) ASD diagnosis based on the Gilliam Autism Rating Scale (GARS) and confirmation by a child psychiatrist, and (3) absence of co-occurring disorders such as Attention-Deficit/Hyperactivity Disorder (ADHD) or other psychiatric conditions. Exclusion criteria included parental non-cooperation in completing questionnaires and incomplete data. The sample included 65 boys (69.9%) and 28 girls (30.1%). Children presented with varying severity of ASD, and none had additional neurological diagnoses. The study was approved by the Ethics Committee of Iran University of Medical Sciences (Code of ethics: IR.IUMS.REC.1398.1340).

Sample size calculation

The sample size was calculated using G*Power software, based on a moderate effect size (Cohen's $f^2 = 0.15$), a power of 0.80, and a significance level of 0.05. The minimum required sample size was 77 participants. One hundred children were recruited, of whom 93 completed the study, accounting for dropouts and incomplete data.

Procedure

After obtaining informed consent from the parents, demographic information, the Sensory Profile-second edition (SP-2), and the Pediatric Evaluation of Disability Inventory (PEDI) were collected. Parents completed these questionnaires during their children's visits to the rehabilitation centers, with the researcher present to provide clarification as needed.

Demographic information questionnaire

The demographic questionnaire collected information on the child's age, gender, GARS score, parents' education level, and the type of rehabilitation services received.

Sensory Profile-Second Edition (SP-2)

The SP-2, developed by Dunn (2014), evaluates sensory processing characteristics in children through

four “sensory processing patterns” (sensory seeking, sensory avoiding, sensory sensitivity, and low registration), six “sensory systems” (auditory, visual, touch, movement, body position, and oral), and three “behavioral sections” (conduct, social-emotional, and attentional). This study used the children’s form, consisting of 86 items rated on a 5-point Likert scale (never to always), with a completion time of 15-20 minutes. The original SP-2 demonstrated reliability ranging from 0.60 to 0.97 (27). The Persian version, validated by Shahbazi et al. (2021), reported Cronbach’s alpha ranging from 0.61 to 0.91 and test-retest reliability ranging from 0.72 to 0.95 (28).

Pediatric Evaluation of Disability Inventory (PEDI)

The PEDI, developed by Haley et al. (2000), evaluates functional abilities in children aged 6 months to 7.5 years (29), comprising three scales: Functional skills, caregiver assistance, and modifications. This study used the self-care domain of the functional skills scale, comprising 73 items scored 0 (unable) or 1 (able), with higher scores indicating greater self-care independence. The original PEDI demonstrated high reliability, with internal consistency coefficients ranging from 0.95 to 0.99 (30). The Persian version reported similar reliability, with Cronbach’s alpha values of 0.94-0.97 (31).

Statistical analysis

Data were analyzed using SPSS version 26. Descriptive statistics (means, standard deviations, frequencies, and percentages) summarized demographic characteristics and questionnaire scores. Multiple linear regression examined the relationship between sensory processing patterns and self-care skills using three models:

1. The Quadrants model (Sensory Seeking, Sensory Avoiding, Sensory Sensitivity, and Low Registration)
2. The Sensory Sections model (Auditory, Visual, Touch, Movement, Body Position, and Oral)
3. The Behavioral Sections model (Conduct, Social Emotional, and Attentional)

Model fit and residual independence were assessed using R^2 , adjusted R^2 , and the Durbin-Watson statistic. The F-test in ANOVA determined model significance, while predictors were evaluated using Beta and B values; P-values < 0.05 indicated significance. Multicollinearity was assessed using VIF and tolerance; VIF > 10 indicated significant multicollinearity.

Results

Demographic characteristics

The study involved 93 children with ASD, predominantly boys, with a diverse range of parental

education levels. The mean age of the children was five years ($SD = 1.0$). A significant majority were receiving rehabilitation services. These demographic details provide context for interpreting the sensory processing and self-care outcomes, as summarized in Table 1.

Table 1. Demographic characteristics of participants

Child’s gender	Girl	28 (30.1)
	Boy	65 (69.9)
Receiving rehabilitation	Diploma	15 (16.1)
	Bachelor’s degree	47 (50.5)
	Above bachelor’s	19 (20.4)
Receiving rehabilitation	Yes	80 (86.0)
	No	13 (14.0)

Sensory processing and self-care skills

The SP-2 revealed that many children exhibited sensory processing challenges, particularly in Sensory Sensitivity, Low Registration, and domains such as Touch, Movement, and Body Position, with mean scores above the normal range (Table 2). The PEDI showed variability in self-care skills, reflecting differences in functional independence.

Regression analysis Quadrant Model (Table 3, Model 1): The Quadrants (Sensory Seeking, Sensory Avoiding, Sensory Sensitivity, and Low Registration) explained 12.1% of the variance in self-care skills, with the model being significant (Table 4). However, no individual quadrant was a significant predictor (Table 5).

Sensory Sections Model (Table 3, Model 2): This model, including Auditory, Visual, Touch, Movement, Body Position, and Oral domains, explained 15.1% of the variance and was significant (Table 4). The Movement domain approached significance ($P = 0.063$), indicating a potential link between motor-related sensory processing and self-care.

Behavioral Sections Model (Table 3, Model 3): The Behavioral Sections (Conduct, Social-Emotional, and Attentional) accounted for 7.2% of the variance in self-care skills. However, the model insignificant (Table 4), and no individual section was a significant predictor (Table 5).

Discussion

The present study provides a detailed examination of the relationship between sensory processing patterns and self-care skills in preschool children with ASD, using three complementary models: Sensory quadrants, sensory systems, and behavioral sections. The innovative aspect of this research lies in its multi-model approach. Unlike previous studies that have typically focused on overall daily functioning, this study explicitly examines self-care in relation to these

sensory dimensions. Sensory processing disorders, specifically in sensory sensitivity, low registration, touch, movement, and body position, were prevalent, with many scores falling outside the typical range for neurotypical children. These atypical sensory

responses significantly impact self-care tasks and align with previous research showing that sensory processing difficulties are more common and impactful in children with ASD (32).

Table 2. Descriptive information of the Sensory Profile-second edition (SP-2) and the Pediatric Evaluation of Disability Inventory (PEDI) scores in the study participants

Measure	Domain	Mean (SD)	Normal Ranges
SP-2*: Quadrants	Sensory Seeking	39.3 (14.1)	20-47
	Sensory Avoiding	44.0 (14.1)	21-46
	Sensory Sensitivity	42.2 (13.1)***	18-42
	Low Registration	46.0 (14.4)***	19-43
SP-2*: Sensory Sections	Auditory	20.0 (7.3)	10-24
	Visual	13.5 (5.4)	9-17
	Touch	23.0 (9.2)***	8-21
	Movement	18.1 (7.4)***	7-18
	Body Position	16.0 (8.0)***	5-15
	Oral	21.0 (9.0)	8-24
SP-2*: Behavioral Sections	Conduct	20.0 (8.2)	9-22
	Social Emotional	31.1 (11.4)***	13-31
	Attentional	20.1 (9.0)	9-24
PEDI**	Self-care Skills	46.0 (14.0)	-----

*SP-2: Sensory Profile-second edition; **PEDI: Pediatric Evaluation of Disability Inventory

Note: The values marked with an asterisk (***) indicate that the mean scores are above the normal range, suggesting potential sensory processing challenges in these domains. The normal ranges represent typical scores for children without sensory processing issues. The PEDI Self-care Skills domain lacks a predefined normal range, as it is used to assess individual functioning relative to developmental expectations.

Table 3. Summary of regression models predicting self-care skills based on sensory processing sections

Model	Predictors	R Square	Adjusted R Square	Durbin-Watson
1	Quadrants	0.121	0.079	1.936
2	Sensory Sections	0.151	0.090	1.975
3	Behavioral Sections	0.072	0.040	1.973

Note: R Square indicates the proportion of variance in self-care skills explained by the predictors. Adjusted R Square accounts for the number of predictors in the model, providing a more accurate measure of model fit. The Durbin-Watson statistic assesses the independence of residuals, with values closer to 2 indicating no autocorrelation.

Table 4. Analysis of Variance (ANOVA) for regression models predicting self-care skills

Model	Predictors	Mean Square	F	P-value
1	Quadrants	532.370	2.898	0.027*
2	Sensory Sections	446.524	2.465	0.030*
3	Behavioral Sections	428.743	2.247	0.089

Note: The F statistic tests the overall significance of each regression model. A significant P-value ($P < 0.05$) indicates that the model significantly predicts self-care skills.

The PEDI scores, reflecting self-care independence, showed a moderate level of independence (mean = 46.0), emphasizing the need for targeted interventions. These findings are consistent with previous studies indicating self-care challenges in children with ASD (33). Dellapiazza et al. (2018) also found a moderate correlation between sensory processing difficulties and daily life activities, supporting the link between sensory issues and self-care (34). Ahmed et al. (2021) similarly identified tactile processing as a significant barrier to daily tasks like dressing and eating, aligning with these findings (10). Additionally, Yela-González et al. (2021) highlighted the role of sensory reactivity in daily living tasks, consistent with the current results (35).

Regression analysis revealed that sensory processing patterns collectively impact self-care skills, even though the individual contributions of specific patterns—such as sensory seeking, avoiding, sensitivity, and low registration—are less distinct. This indicates a more complex relationship that is influenced by other factors. The collective effect across various sensory patterns confirms that no single pattern stands out as dominant. Therefore, therapeutic strategies should focus on interactions among multiple sensory modalities rather than on a single pattern. This integrative approach is a new contribution to the field, as it has not been highlighted in previous studies. The sensory systems model revealed that movement-related sensory processing was closely linked to self-care

abilities, highlighting the importance of vestibular-proprioceptive interventions. This is supported by Pavão et al. (2021), who found that sensory processing disorders, particularly in movement, significantly affected functional abilities (36). In contrast, the behavioral sections model did not significantly predict

self-care skills, suggesting that behavioral factors, while essential for overall functioning, do not directly influence self-care tasks (37). This may also reflect the developmental stage of the preschool-age group, in which behavioral issues may not yet significantly impact self-care.

Table 5. Coefficients of predictors in regression models for self-care skills

Model	Predictors	B	Std. Error	Beta	t	P-value	Tolerance	VIF
1	Sensory Seeking	-0.327	0.184	-0.326	-1.778	0.079	0.310	3.224
	Sensory Avoiding	-0.056	0.196	-0.056	-0.284	0.777	0.270	3.704
	Sensory Sensitivity	-0.016	0.215	-0.015	-0.075	0.941	0.259	3.856
	Low Registration	0.036	0.192	0.037	0.190	0.850	0.271	3.684
2	Auditory	-0.065	0.296	-0.034	-0.219	0.827	0.435	2.298
	Visual	0.541	0.378	0.207	1.431	0.156	0.486	2.056
	Touch	-0.286	0.219	-0.190	-1.307	0.195	0.484	2.068
	Movement	-0.559	0.297	-0.289	-1.882	0.063	0.435	2.300
	Body Position	0.204	0.307	0.114	0.666	0.507	0.351	2.850
	Oral	-0.269	0.203	-0.167	-1.327	0.188	0.646	1.549
3	Conduct	-0.170	0.220	-0.100	-0.774	0.441	0.641	1.561
	Social Emotional	-0.168	0.174	-0.136	-0.969	0.335	0.537	1.861
	Attentional	-0.138	0.213	-0.083	-0.648	0.519	0.648	1.543

Note: B represents the unstandardized regression coefficient, indicating the change in the outcome variable for each unit change in the predictor. Beta represents the standardized coefficient, showing the relative strength of each predictor. Tolerance and Variance Inflation Factor (VIF) assess multicollinearity, with VIF values above 10 indicating significant multicollinearity. P-values indicate the significance of each predictor, with values below 0.05 suggesting a significant effect on self-care skills.

Comparing with Jamshidian et al. (2016), who found a strong link between sensory sensitivity and participation in older children, this study suggests that the impact of sensory sensitivity on self-care may differ due to developmental expectations and measurement focus (38). Moreover, Lane et al. (2010) found less pronounced effects of sensory seeking and auditory filtering on daily living tasks in children aged 3-9, supporting the broader approach to sensory patterns in this study (39). Similarly, Ismael et al. (2018) found that sensory processing difficulties in adolescents were more closely related to other areas, such as play and education, rather than self-care (20). This suggests that self-care, being more structured and habitual, might be managed differently by adolescents with ASD. In contrast, self-care is not yet a habit in preschoolers; sensory and cognitive skills (particularly executive functions) have an equal impact on it (5). Moreover, this comparison indicates that the preschool period may be a critical developmental stage where sensory processing directly influences self-care skills, a novel insight that extends current knowledge of developmental trajectories in ASD.

In conclusion, the study contributes new evidence by demonstrating that self-care in preschool children with ASD is best understood through an integrated sensory framework that simultaneously considers quadrants, sensory systems, and behavioral sections. Specifically, identifying the movement domain as a

near-significant predictor highlights the clinical importance of vestibular-proprioceptive processing, which is less frequently highlighted in prior research on self-care. A deeper understanding of these relationships contributes to more tailored interventions, ultimately improving the quality of life for children with ASD. Nevertheless, this study's use of convenience sampling limits its generalizability, and its cross-sectional design precludes causal conclusions. Moreover, relying on parent-reported measures could introduce bias and fail to account for contextual factors affecting sensory processing and self-care. Future research should address these limitations through longitudinal designs, diverse samples, and objective sensory measures. Further exploration of sensory-focused interventions, environmental factors, and parent training could provide a more comprehensive approach to supporting children with ASD.

In Conclusion

This study investigated the relationship between sensory processing patterns and self-care skills in children with ASD aged 3-6 years. The obtained findings indicate that sensory difficulties, specifically in sensory sensitivity, low registration, touch, movement, and body position, significantly impact self-care abilities. Regression analysis revealed that while overall sensory processing patterns affect self-care, individual patterns had less pronounced

contributions. The movement domain emerged as particularly significant, suggesting its role in self-care skills. Additionally, these results highlight the need for targeted interventions addressing sensory processing challenges to improve self-care independence in children with ASD.

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analysis, interpretation of findings, or drawing scientific conclusions. All content, analyses, and interpretations are the authors' own, and the authors take full responsibility for the accuracy and integrity of the manuscript.

Authors' Contribution

Study conception and design: S.K.E., S.S., S.F.H.; data collection: S.S., K.T., M.B.; analysis and interpretation of results: S.K.E., S.S., S.F.H.; draft manuscript preparation: S.S., S.F.H., K.T., M.B. All authors reviewed the results and approved the final version of the manuscript. The code of ethics obtained from the Ethics Committee of Iran University of Medical Sciences (code: IR.IUMS.REC.1400.1149)

Conflict of Interest

The authors declared no conflicts of interest regarding the publication of this article.

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