

Sensory Processing Disorder in Normally Developing Egyptian Children

Original
Article

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ABSTRACT

Objective: The aim of this study was to assess the sensory processing among typically developing children between 3-8 years old to follow any negative impact on their social and behavioral development.

Patients and Methods: Sensory processing abilities were assessed for 190 typically developing children by using the Short Sensory Profile (SSP) caregiver questionnaire. A typical sensory performance was defined as an SSP total score of: 190-155 and the total scores of typical sensory performances for tactile sensitivity:35-30; taste/smell sensitivity:20-15; movement sensitivity: 15-13; under-responsive/seek sensation:35-27; auditory filtering:30-23; low energy/weak:30-26; and visual/auditory sensitivity: 25-19. Below these scores shows atypical sensory performance.

Results: The typically developed children showed some degree of sensory processing disorder on Under-responsive/seek sensitivity as well as Taste and smell sensitivity. Some children in this study (50.5 %) showed a degree of sensory processing impairment in the SSP total score. An increase in the tactile sensitivity was significantly associated with higher prevalence of the movement sensitivity ($r=0.745$, p value= <0.001). As for the Pearson correlation between the low energy/weak and the visual/auditory sensitivity is about $r=0.698$, which indicates that there is a moderate positive relationship between the 2 variables.

Conclusion: These findings showed the types of sensory processing disorder in typically developing children and the difference between female and male children. Future studies are required on larger samples to clarify more the types of sensory impairment in typically developing children and to confirm these results.

Key Words: Sensory integration, sensory processing disorder, short sensory profile (SSP).

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INTRODUCTION

Sensory processing is a general term that means how our neural systems handle any sensory information, which includes the role of the peripheral, central nervous systems and the receptor organs. According to Dunn, sensory processing is a difficult process. Sensory input from the environment and from the body provides information to the brain^[1]. The processing of an information permits the comfortable, efficient automatic response of an individual to any received sensory inputs^[2,3].

Ayres focused on the relationship between sensory input, motor responses, and normal sensorimotor development. She defined sensory processing as the ability to organize sensory information to make adaptive responses^[4]. Having a child with some sensory problems does not mean that

he or she has sensory processing disorder. Many children may suffer hypersensitivity to specific types of stimuli such as loud noise or walking on sand bare footed. Few of them may be annoyed or perturbed in their life from these sensations. These children will be considered as children who have sensory processing disorder^[5,6]. Any Behaviors related to sensory processing are not detected as abnormalities; these are differences, usually abilities, such as enhanced perception^[7].

Sensory processing or in other words Sensory integration (SI) is the behavioral & motor response resulting from a certain sense received by the nervous system^[8]. The degree of this response relies mainly on the sensory thresholds whether it is high or low which differs from one child to another^[9]. Sensory processing refers to how the brain record and processes and operate sensory input

from different sensory systems, including the five main senses as well as proprioception and vestibular senses^[10]. The behavioral and motoric response based on the sensory processing of the child affects his/her quality of life & his/her daily life activities. Sensory processing is an active process all through the child development and is influenced by the environmental interaction, receiving different stimuli from the environment or the body^[11]. Sensory registration problem which is one of the components of the sensory processing disorder is the failure in producing appropriate adaptive behavior against taste, touch, pain, sound, light, smell, and movement. As well as the hypo/hyperresponsiveness, hypersensitivity and sensory avoiding are symptoms for sensory modulation disorders which is another component of the sensory processing disorders. Sensory discrimination is one of the important components which is important for postural adjustment, tonus and motoric function development^[12].

Hypersensitive persons are characterized by having a low neurological threshold and easily notice sensory input, meaning that they are usually distracted by movement, sounds, textures, or smells not perceived by others^[13]. In contrast, hyposensitive persons present low registration; they do not notice daily sensory events. For example, they may not notice when someone comes into a room or when they have food or dirt on their face and hands^[14].

AIM OF THE STUDY

The aim of this study was to detect any sensory processing disorder in typically (normally) developing children aged 3–8-year-old in order to follow any negative impact on their social and behavioral development.

PATIENTS AND METHODS

This study included 190 normally developing children aged between 3-8 years including 86 females (45.3%) and 104 (54.7%) males who their milestones were typically developing and did not suffer from any medical disorders and are not on any long-term medications. They were selected by simple random sampling. The variable in this study was determining how child process sensory information during his daily situations by using the Short Sensory Profile (SSP) questionnaire^[15]. The Short Sensory Profile questionnaire is made up of 38 points. It is a caregiver questionnaire that measure the children's responses to daily sensory events (SP; ^[9]). Each item is scored on a 1-to 5-point scale (Likert scale). The Short Sensory Profile caregiver questionnaire consists of seven sections which are the Tactile Sensitivity, Taste/Smell Sensitivity, Movement Sensitivity, Under responsive/ Seeks Sensation, Auditory Filtering, LowEnergy/Weak, and Visual/Auditory Sensitivity. The test lasted from 10-15 minutes for each child.

Short Sensory Profile questionnaire was provided to the

mother/caregiver of each child and fulfilled by her. All the points were answered by the mother/caregiver. The idea of the questionnaire and how to choose the answers were explained to the mother then each question was asked to the mum in English orally as mentioned exactly in the SSP. Each item has from 3 to 7 assessing questions. The responses were measured by the following key; Always, Frequently, Occasionally, Seldom and Never.

'Always' was chosen when your child always responds in this manner (100% of the time). 'Frequently' was when presented with the opportunity, that 75% of the time your child frequently responds in this manner. 'Occasionally', was 50% of the time your child responds in this manner. 'Seldom' when presented with the opportunity, your child always responds in this manner, 25% of the time. Lastly, 'Never' when presented with the opportunity, your child always responds in this manner, 0% of the time.

Data Collection

The collected data was revised, coded, tabulated and introduced to a personal computer using Statistical package for Social Science (SPSS 20). Data was presented and suitable analysis was done according to the type of data obtained for each parameter. Descriptive statistics were used: Mean, Standard deviation (\pm SD) and range for numerical data. Then, Frequency and percentage of non-numerical data. Analytical statistics were used: Student T Test was used to assess the statistical significance of the difference between two study group means. While Chi-Square test was used to examine the relationship between two qualitative variables. As well as Correlation analysis (using Pearson's and Spearman's method): To assess the strength of association between two quantitative variables. The correlation coefficient denoted symbolically "r and rs" defines the strength (magnitude) and direction (positive or negative) of the linear relationship between two variables.

- $r=0-0.19$ is regarded as very weak correlation
- $r=0.2-0.39$ as weak correlation
- $r=0.40-0.59$ as moderate correlation
- $r=0.6-0.79$ as strong correlation
- $r=0.8-1$ as very strong correlation

RESULTS

Descriptive statistics:

Sensory processing abilities on the SSP

Table 1 shows the mean SD and the range among all age groups for the 7 items of the SSP including Tactile Sensitivity, Taste/Smell Sensitivity, Movement Sensitivity, Underresponsive/Seeks Sensation, Auditory Filtering, LowEnergy/Weak, and Visual/Auditory Sensitivity. There were significant results in the tactile sensitivity and low energy/weak among the other items of the SSP.

Table 2 shows the number and the percentage of each result among all age groups for the 7 items. The Underresponsive. seek sensitivity showed the highest percentage in the 'definite difference' result while visual/auditory sensitivity and low energy / weak

showed the highest percentage in the 'typical performance' result, as well as the visual/auditory sensitivity showed the highest percentage in the 'probable difference' result in comparison to the other items of the SSP.

Table 1: The performance reported on the SSP for all age groups.

	Mean \pm SD	Range
Age	5.36 \pm 1.78	3 - 8
Tactile sensitivity	27.37 \pm 5.51	14 - 35
Taste and smell sensitivity	12.78 \pm 4.75	4 - 20
Movement sensitivity	11.48 \pm 3.02	5 - 15
Underresponsive.seek sensitivity	23.38 \pm 5.81	8 - 35
Auditory filtering	22.01 \pm 5.17	6 - 30
Low energy / weak	25.09 \pm 5.37	8 - 30
visual/auditory sensitivity	18.9 \pm 4.41	5 - 25
Total	141.02 \pm 25.02	65 - 184

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Table 2: The number and the percentage of each result among all age groups for the 7 items of the SSP.

	Typical performance	Probable difference	Definite difference
Tactile sensitivity	76 (40%)	39 (20.5%)	75 (39.5%)
Taste and smell sensitivity	75 (39.47%)	39 (20.5%)	76 (40%)
Movement sensitivity	76 (40%)	44 (23.2%)	70 (36.8%)
Underresponsive.seek sensitivity	57 (30%)	38 (20%)	95 (50%)
Auditory filtering	97 (51.05%)	45 (23.7%)	48 (25.3%)
Low energy / weak	102 (53.68%)	22 (11.6%)	66 (34.7%)
visual/auditory sensitivity	107 (56.32%)	49 (25.8%)	34 (17.9%)
Total	56 (29.47%)	38 (20%)	96 (50.5%)

Descriptive and analytical statistics:

Table 3 shows the mean SD and the range among females in comparison to males' children (gender difference) for the 7 items of the SSP. The results show there was a significant difference in the Taste and smell sensitivity.

Table 4 shows the performance whether it is Typical performance, Probable difference or Definite difference in each of the 7 items of the SSP comparing females with males children.

In males the Underresponsive/ seek sensitivity showed

the highest percentage in 'definite difference' while Low energy /weak showed the highest percentage in 'typical performance'. As in females the taste/smell sensitivity showed the highest percentage in 'definite difference'. Regarding the highest percentage in 'typical performance' was seen in the visual/auditory sensitivity among other items of the questionnaire.

The results statistically showed significant difference were noticed in the following items Taste and smell sensitivity (p 0.030), Movement sensitivity (p <0.001) and Underresponsive/seek sensitivity (p 0.014) as well as the total score (p 0.017) between males and females' children.

Table 3: The mean SD and the range among females in comparison to males' children (gender difference) for the 7 items of the SSP

	Male		Female		t test	
	Mean	SD	Mean	SD	t	p value
Tactile sensitivity	27.0	5.8	27.8	5.2	-1.03	0.305
Taste and smell sensitivity	13.5	4.8	12.0	4.5	2.18	0.030
Movement sensitivity	11.5	3.1	11.4	2.9	0.18	0.860
Underresponsive/seek sensitivity	22.8	5.7	24.1	5.9	-1.62	0.107
Auditory filtering	22.2	4.8	21.8	5.5	0.58	0.565
Low energy / weak	25.0	4.8	25.3	6.0	-0.39	0.699
visual/auditory sensitivity	19.0	4.2	18.7	4.7	0.51	0.612
Total	140.9	23.5	141.1	26.8	-0.04	0.965

Table 4: The performance whether it is Typical performance, Probable difference or Definite difference in each of the 7 items of the SSP comparing females with males' children.

		Male		Female		Chi square test	
		N	%	N	%	χ^2	p value
Tactile sensitivity	Typical performance	36	34.6%	40	46.5%	4.45	0.108
	Probable difference	20	19.2%	19	22.1%		
	Definite difference	48	46.2%	27	31.4%		
Taste and smell sensitivity	Typical performance	43	41.3%	32	37.2%	3.25	0.197
	Probable difference	25	24.0%	14	16.3%		
	Definite difference	36	34.6%	40	46.5%		
Movement sensitivity	Typical performance	49	47.1%	27	31.4%	35.09	<0.001
	Probable difference	7	6.7%	37	43.0%		
	Definite difference	48	46.2%	22	25.6%		
Underresponsive/seek sensitivity	Typical performance	25	24.0%	32	37.2%	8.50	0.014
	Probable difference	17	16.3%	21	24.4%		
	Definite difference	62	59.6%	33	38.4%		
Auditory filtering	Typical performance	46	44.2%	51	59.3%	4.48	0.107
	Probable difference	27	26.0%	18	20.9%		
	Definite difference	31	29.8%	17	19.8%		
Low energy / weak	Typical performance	55	52.9%	47	54.7%	0.20	0.906
	Probable difference	13	12.5%	9	10.5%		
	Definite difference	36	34.6%	30	34.9%		
Visual/auditory sensitivity	Typical performance	54	51.9%	53	61.6%	2.27	0.322
	Probable difference	28	26.9%	21	24.4%		
	Definite difference	22	21.2%	12	14.0%		
Total	Typical performance	33	31.7%	23	26.7%	8.11	0.017
	Probable difference	13	12.5%	25	29.1%		
	Definite difference	58	55.8%	38	44.2%		

Correlation analysis (Pearson's and Spearman's correlation test): To assess the strength of association between two quantitative variables. The correlation coefficient denoted symbolically "r and rs" defines the strength (magnitude) and direction (positive or negative) of the linear relationship between two variables shown in tables 5 (different Sensory abilities). In these results, the

Pearson correlation between the tactile sensitivity and the movement sensitivity is about 0.745, which indicates that there is a large positive relationship between the 2 variables. And the Pearson correlation between the low energy/weak and the visual/auditory sensitivity is about 0.698, which indicates that there is a moderate positive relationship between the 2 variables.

Table 5: Correlation between hypersensitivity response to stimuli and the hypersensitivity response

		Tactile sensitivity	Taste and smell sensitivity	Movement sensitivity	Underresponsive/seek sensitivity	Auditory filtering	Low energy / weak
Taste and smell sensitivity	r	0.459					
	p value	<0.001					
Movement sensitivity	r	0.745	0.492				
	p value	<0.001	<0.001				
Underresponsive/seek sensitivity	r	0.4	0.243	0.436			
	p value	<0.001	0.001	<0.001			
Auditory filtering	r	0.357	0.369	0.348	0.421		
	p value	<0.001	<0.001	<0.001	<0.001		
Low energy / weak	r	0.557	0.251	0.514	0.477	0.438	
	p value	<0.001	<0.001	<0.001	<0.001	<0.001	
Visual/auditory sensitivity	r	0.669	0.448	0.612	0.469	0.49	0.698
	p value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

DISCUSSION

Sensory processing disorder have been known to physicians and parents who noticed that their children may have an unusual aversion to noise, light and or irritating touch. Some others may have fears from falling or seeks all kinds of movements. Others may suffer clumsiness and trouble in fine motor skills. These atypical behaviors like crashing into wall or people or screaming when their faces get dirty with food. Eating abnormally like eating mud or pieces of paper. All these behaviors may reflect a sensory processing disorder^[16].

Difficulty in integrating information from senses have considered from physicians as a sign of autism spectrum disorder. This is because the majority of children and adults who were diagnosed as autism may have significant sensory problems^[17].

Some other studies^[18] and The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5) found that many children with sensory problems are not on the spectrum.^[19,20,21] found that sensory problems may appear with attention deficit hyperactivity disorder and obsessive-compulsive disorder. Some other references recorded this disorder with developmental delayed children, like brain damage and learning disabilities^[6,22,23].

This study declared that abnormality in tactile sensitivity and taste and smell sensitivity as well as seeking sensation is a common and the highest among normal toddlers using the short sensory profile (Table 1). This can be explained by children who become aggressive when they experience sensory overload. They develop panic response to everyday sensations that is usually normal to others. Not all kids respond to different sensations the same way. Some normal typically developing children have difficulty in the

self-regulation mechanism responsible for the reaction or the response to tactile or movement sensitivity.

As some children experienced over or hypersensitivity and some others may experience hypo sensitivity. It was claimed that internal senses of body awareness (proprioception) and movement (vestibular) awareness when the brain showed conflicting signals as they have trouble sensing the amount of force needed to erase a paper and instead of that they rip it. This study proved that children with hyposensitivity are in constant motion, they crave fast, spinning and like jumping in the air while those with hypersensitivity feel panic from climbing stairs or playing balancing gym. Those avoiders or hypersensitive children and the seekers or hyposensitive children have poor body awareness and poor organization in the motor areas of the brain due to the distraction by the sensory problems (Table 2)^[24,25,26].

The significant findings of table 3 and 4 confirms the poor motor perception of some normal or typically developing children who showed some movement sensitivity difference as well as underresponsive seek sensitivity.

A correlative analysis (Table 5) was done to study the correlation between hypersensitivity response to stimuli and the hyposensitivity response. Positive correlation between the items of tactile sensitivity and taste and smell sensitivity may denote that the typically developing children who experienced one of the hypersensitivity disorders, may exhibit other disorders later in time. This positive correlation may help the physician or parents to look for other sensory disorders later in their child during his or her development.

The positive correlation between underresponsive seek sensitivity and low energy week sensitivity (Table 5) can

be explained by the similar rule of poor body awareness and poor organization in the motor cortical areas of the brain. These items may be present in different percentage between the study subjects and larger number of subjects may be needed to demonstrate the changes among groups.

CONCLUSION

These findings showed the types of sensory processing impairments in typically developing children and the difference between boys and girls. Future studies are required on larger samples to clarify more the types of sensory impairment in typically developing children.

CONFLICT OF INTEREST

There are no conflicts of interest.

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