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Original Research Article

Exploring prevalence of sensory patterns among children with developmental disabilities: a cross-sectional study

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ABSTRACT

Background: Developmental disabilities prevalence appears to be significant worldwide. Sensory sensitivity has also been associated with developmental disabilities. To find prevalence of sensory sensitivity and to seek an association of sensory sensitivity among developmentally disabled children with selected factors.
Methods: The study used a descriptive survey research design including 150 children aged 6-11 years diagnosed with ASD, ADHD, intellectual disability, cerebral palsy, specific language disability and down syndrome attending child developmental centre of Safdarjung hospital, selected via purposive sampling technique. Data collected through structured interviews, anthropometric measurements, and a standardized tool i.e. Parent completed Glasgow Sensory Questionnaire.
Results: Mean sensory sensitivity in terms of total, hyper and hypo sensitivity were higher in children with ASD, ADHD and Intellectual Disability. Similarly mean of vestibular, auditory, tactile and proprioception sensory sensitivity subscales were observed higher among children with ASD, ADHD and intellectual disability. The findings also showed that p values for type of family (p=0.033), socio-economic status (p=0.010), maternal occupation (p=0.022), nutritional status (p=0.004), diagnosis of child (p=0.000) were found to be statistically significant at 0.05 level of significance to seek the association between sensory sensitivity and selected variables.
Conclusions: Aberrant sensory sensitivity may play an important role among children with developmental disabilities.

Keywords: Developmental disabilities, Sensory sensitivity, Autism spectrum disorder, Attention deficit hyperactivity disorder, Cerebral palsy, Specific language disability, Intellectual disability, Down syndrome

INTRODUCTION

Human development refers to the physical, cognitive, and psychosocial changes occurring throughout the lifespan. Developmental disabilities prevalence appears to be significant worldwide. Examples of more common developmental disabilities include, attention deficit/hyperactivity disorder (ADHD), Specific language disability (SLD), autism spectrum disorder (ASD), intellectual disability (ID), and other developmental delay. Nearly 240 million children with disabilities in the world.[1] In most of the databases, Sub-Saharan Africa and South Asia accounted for more than half of children with disabilities.[2] In India, almost one in eight children of the age 2–9 years have at least one of the nine neurodevelopmental disorders this is a conservative estimate, and actual burden might be higher due to limitations of the study.[3]

Sensory sensitivity refers to the internal sensory experience of a child covering seven sensory modalities, such as vision, auditory, olfactory, gustation, tactile,

proprioception and vestibular. Hypersensitivity refers to an excessive or heightened response of a child to sensory stimuli resulting in sensory avoiding behaviour whereas hyposensitivity refers to a child's reduced responsiveness or decreased sensitivity to sensory input resulting in sensory seeking behaviour. sensory processing challenges may exist independently, comorbidly, or as part of a larger overarching diagnosis. Among children without disabilities, the prevalence of Sensory Problems ranges from 10% to 55% whereas for children with disabilities it is estimated at 40%-88%.[4]

The influence is seen in children with autism spectrum condition, where more than 70% of youngsters are said to have aberrant reactions to sensory inputs.[5,6] Sensory sensitivity and avoidance of sensory stimulation are also traits of children with ADHD.[7] Children with cerebral palsy have a high prevalence of sensory processing abnormalities.[8]

More recently, auditory tactile, auditory-visual, or motor-auditory-visual integration have been the focus on multimodal processing in children with Specific Language Disability.[9] Sensory integration may be challenging for kids with Down syndrome as they exhibit proprioceptive hyperactivity and tactile defense in response to sensory stimulation.[10] Children with intellectual developmental disabilities frequently suffer from sensory processing abnormalities, which have a detrimental effect on their everyday routines.[11]

Sensory sensitivity is linked to the children with special needs, by investigating how these factors interact and contribute to other challenges can provide valuable insights into the underlying mechanisms affecting sensory challenges in children with developmental disabilities.

Need of the study

Children who are diagnosed with developmental disabilities are often affected by underlying health conditions that impact their developing nerve system, leading to deficits in motor, intellectual, language, behaviour, and/or sensory functioning, as well as related difficulties. Sensory sensitivities in terms of hypo sensitivity and hypersensitivity are viewed as a distinct disorder or as a complex of symptoms embedded in a larger neurodevelopmental disorder, the primary responsibility of the health professionals is to minimize the impact of these differences on the social, emotional, and behavioural development of the child by early identification and treatment referral.

Therefore, there is a need for a study to assess sensory sensitivity among children with developmental disabilities to further understand the specific sensory processes that impact nutritional difficulties in this population. Ultimately, this approach aims to improve the health and well-being of disabled children.

Statement of the problem

Exploring prevalence of sensory patterns among children with developmental disabilities a cross-sectional study

METHODS

After obtaining the administrative approval and ethical clearance from Rajkumari Amrit Kaur College of nursing and Ethical Review Board of Safdarjung Hospital, this cross-sectional study conducted in Child Development Centre of Safdarjung Hospital, New Delhi, specialized facility that focuses on assessing, diagnosing, and providing intervention services for children with referred cases of developmental delays and disabilities.

Children between the age group of 6 years to 11 years diagnosed with autism spectrum disorder (ASD), cerebral palsy, specific language disability, attention deficit hyperactivity disorder (ADHD), intellectual disability and down syndrome attending child development centre selected via purposive sampling technique.

Firstly, self-introduction and establishment of rapport with the subjects was done. All samples selected using purposive sampling method. Written consent was taken from parents of each sample, who are willing to participate and confidentiality of the respondent was assured and maintained. Parents of children who do not understand Hindi and English were excluded.

We will calculate the sample size first by calculating it for infinite size and then adjusting it to the required size. Given, Z=1.960, p=0.1 (prevalence of children with developmental disabilities in India = 10% by RBSK), M=0.05

Using sample size formula, $S=Z2\times P\times (1-P)/M\times MS= (1.960)\ 2\times 0.1\times (1-0.1)\ /0.05\times 0.05= 3.8416\times 0.25/0.0025$ S=138

The sample size for the population is 138 by Cochran formula, hence 150 subjects were taken for the final study.

Tool for data collection

The tool for data collection were administered to children with developmental disabilities and their parents who accompanied them to Child development Centre, Safdarjung Hospital or were interviewed there as per their availability.

Before administration of tool, anthropometric measurements i.e., height and weight of child were taken and calculated Nutritional status of children with developmental disabilities according to BMI for age categories was assessed by IAP Growth chart application software (2014) based on WHO growth standards. The average time taken for anthropometric measurement and

Parent completed Glasgow Sensory Questionnaire for each participant was 25-30 min. For content validity, tools were given to 15 experts from the different fields of medicine and nursing (child neurology, occupational therapy, psychology, pediatric neurosurgery, nutrition, child health nursing, community health nursing, medical surgical nursing and mental health nursing). Try out of the tool was done on 10 sample subjects. As parent completed Glasgow sensory questionnaire tool is a standardized scale so the reliability coefficient found out to be 0.87 - 0.91.[12,13]

Development and description of the tool

Section I: Demographic structured interview schedule

Contains 16 items which ascertain information regarding Child code no, age of the child, sex of the child, mode of delivery at birth, birth order, birth weight, number of siblings, type of family, education of the head of the family, occupation of the head of the family, total family income, maternal education, maternal occupation, nutritional status, diagnosis of child, duration of treatment, age of diagnosis. Anthropometric measurements include height and weight of the children.

Section II: Parent completed Glasgow sensory questionnaire

The GSQ-P is our 42-item parent-report questionnaire, assessing sensory sensitivities reported scoring system that ranges from 0 to 168, where higher scores indicate greater sensory sensitivity in the children of respondents. Half of the items addressed hypersensitivity and half addressed hyposensitivity that ranges from 0-84 across seven sensory modalities. These items were equally distributed across seven sense subscales (visual, auditory, gustatory, olfactory, tactile, vestibular, proprioception) giving three questions per cell (e.g., 3 questions for visual hypersensitivity, 3 questions for visual hyposensitivity, 3 questions for auditory hypersensitivity, etc.). Each question had five possible responses, never, rarely, sometimes, often, always (coded 0 to 4).

Data entered in Microsoft excel 2016 and analysed by using SPSS 21 software for descriptive and inferential. We described continuous variables using mean and standard deviation. Categorical variables were described using frequency and percentages. We used Chi-square among categorical variables showing association between sensory sensitivity score among children with developmental disabilities and selected variables.

RESULTS

Section 1: findings related to description of socio-demographic characteristics

Majority (63.3%) of children with developmental disabilities were male and nearly half (48%) of the children were between the age group of 6-8 years. Nearly half (50.7%) of the children with developmental disabilities were from nuclear family whereas 36% children belong to family with upper lower socio-economic class and 30% of children belonged to lower middle-class family. 62% of the children with developmental disabilities had birth weight above 2.5 kg, whereas 38% children had birth weight below 2.5kg and nearly half (50%) of the children were born via vaginal institutional delivery. Over half (56%) of the mothers were home makers and 40.7% were educated as graduate or above. Nearly half (52.7%) of the children with developmental disabilities were born with a birth order of more than one whereas children were born as first child were 47.3%.

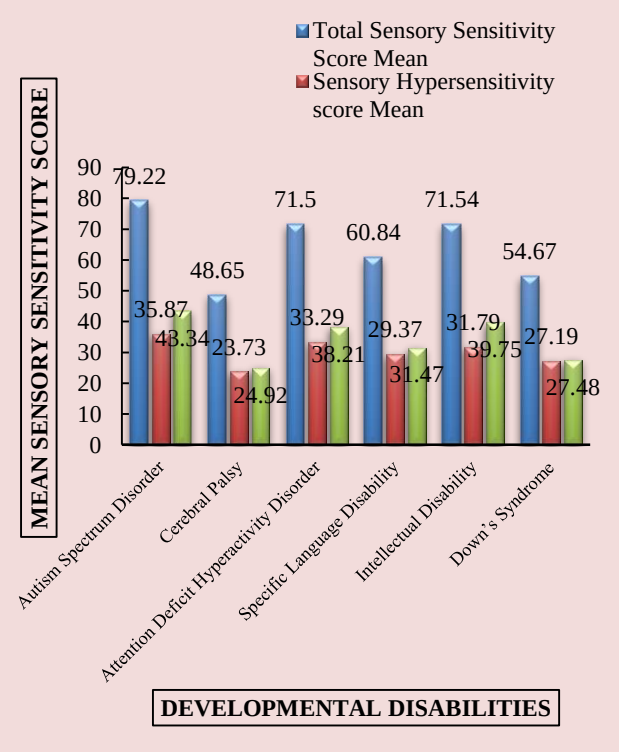

Figure 1: mean of total sensory sensitivity score, sensory hyposensitivity score and sensory hypersensitivity score of children with different developmental disabilities.

Majority (60%) of children with developmental disabilities were diagnosed before the age of 4 years and nearly half (48%) of the children were underweight.

Children diagnosed with autism spectrum disorder were 21.3%, attention deficit hyperactivity disorder (18.7%), cerebral palsy (17.3%), specific language disorder (12.7%), intellectual disability (16%) and Down syndrome (14 %). Nearly half (48%) of the children received sensory intervention less than 6 months program given by hospital/ child guidance centre. Half (50%) of the children were having no sibling whereas 21.3% children had two siblings in the family.

Section 2: findings related to total sensory sensitivity, sensory hypersensitivity and sensory hyposensitivity among children with developmental disabilities

The mean, standard deviation of total sensory sensitivity score, sensory hypersensitivity score and sensory hyposensitivity score among children with different developmental disabilities found that children with autism spectrum disorder (79.22), attention deficit hyperactivity disorder (71.5) and intellectual disability (71.54) had the higher mean total sensory sensitivity scores compared to the children with down's syndrome (54.67), specific language disability (60.84) and cerebral palsy (48.65). Sensory hyposensitivity was higher than sensory hypersensitivity whereas the highest mean of sensory sensitivity subscale was proprioception, tactile and vestibular among children with different developmental disabilities. children with autism spectrum disorder, attention deficit hyperactivity disorder and intellectual disability were observed higher proprioception, vestibular, auditory and tactile mean sensory sensitivity in terms of total sensitivity, hypersensitivity and hyposensitivity.

Section 3: findings related to association between total sensory sensitivity among children with developmental disabilities and selected variables.

Table 1: Chi square value showing association between total sensory sensitivity score among children with developmental disabilities and selected variables.

S. no.	Selected variables	Between total sensory sensitivity score		Degree of freedom (df)	Chi square value	P value	Significant/non-significant
		Below median score	Above median score				
1	**Age**						
a	6 years-8 years	36	36				
b	8 years–10 years	21	23	2	0.209	0.901	Non-significant
c	10 years–12 years	18	16				
2	**Sex**						
a	Male	45	50	1	0.718	0.397	Non-significant
b	Female	30	25				
3	**Mode of delivery**						
a	Vaginal institutional delivery	39	36				
b	Caesarean section delivery	29	31	2	0.253	0.881	Non-significant
c	Assisted delivery (forceps/ vacuum)	7	8				
4	**Birth order**						
a	One	38	33				
b	Two	16	24	3	2.197	0.533	Non-significant
c	Three	16	14				
d	More than three	5	4				
5	**Birth weight**						
a	Below 1.5kg	10	16				
b	1.5kg – 2.5 kg	18	13	3	2.29	0.515	Non-significant
c	2.5kg – 3.5 kg	29	27				
d	3.5kg above	18	19				
6	**Number of siblings**						
a	Nil	44	31	3	5.789	0.122	Non-significant
b	One	10	20				
c	Two	15	17				
d	More than two	6	7				
7	**Type of family**						
a	Nuclear Family	46	30				
b	Joint Family	27	42	2	6.829	0.033*	Significant
c	Extended Family	2	3				

Continued.

S. no.	Selected variables	Between total sensory sensitivity score		Degree of freedom (df)	Chi square value	P value	Significant/non-significant
		Below median score	Above median score				
8	**Socio-economic status**						
a	Upper	1	4	4	14.899	0.00*	Significant
b	Upper middle	30	12				
c	Lower middle	19	26				
d	Upper lower	25	29				
e	Lower	0	4				
9	**Education of mother**						
a	Professional	7	2	6	9.872	0.13	Non-significant
b	Graduate and above	33	28				
c	Senior secondary	11	8				
d	Matric	7	5				
e	Middle school	6	7				
f	Primary school	4	12				
g	Illiterate	7	13				
10	**Occupation of mother**						
a	Government	13	3	3	10.931	0.012*	Significant
b	Private	19	12				
c	Self-employed	9	10				
d	Housewife	34	50				
11	**Nutritional status of child according to BMI-for-age categories**						
a	Normal weight	20	14	3	11.819	0.008*	Significant
b	Underweight	31	41				
c	Overweight	21	9				
d	Obesity	3	11				
12	**Diagnosis of child**						
a	Autism spectrum disorder	8	24	5	30.376	0.000*	Significant
b	Cerebral palsy	21	5				
c	Attention deficit hyperactivity disorder	11	17				
d	Specific language disability	12	7				
e	Intellectual disability	7	17				
f	Down's syndrome	16	5				
13	**Duration of any sensory intervention program given by hospital/ child guidance center**						
a	Less than 6 months	32	40	3	2.846	0.416	Non-significant
b	6 months to 1 year	17	14				
c	1-2 years	10	5				
d	>2 years	16	16				
14	**Age of child at which diagnosis is made**						
a	Birth–2 years	21	17	3	1.204	0.752	Non-significant
b	2 years–4 years	23	29				
c	4 years–6 years	23	21				
d	6 years–8 years	8	8				

*Significant at 0.05 level of significance

DISCUSSION

The quality of life and emotional state of parents of children with neurodevelopmental disorders are recognized to be lower than those of parents whose children are developing normally and who require assistance to improve. Additionally, these children show disrupted sensory patterns, which may have short- or long-term effects on behavioural, feeding, psychological, and nutritional domains. The sensory experiences of daily existence are infused with the human experience. Sensory

processing problems impact everyday functioning as well as academic achievement in school-age children.[14]

The present study found that almost all children with autism spectrum disorder, ADHD, intellectual disability, specific language disability, cerebral palsy, down syndrome was having sensory sensitivity problems. This supports the study done among children diagnosed with ASD, Cerebral Palsy, ID, ADHD and SLD.[15–20] Children with ASD had patterns of both hyper- and hyposensitivity.21–23 Highest percentages were found for touch (84.9%) among children with ASD followed by the scores for body position (73.1%), movement (68.9%), auditory (67.2%), and oral (57.1%) sensory processing. The lowest percentage was found for the visual processing (32.8%), which fell within the normal range.[17]

Vestibular hyposensitivity, olfactory sensory sensitivity in terms of total sensitivity, hypersensitivity and hyposensitivity, tactile and proprioception sensory sensitivity were observed higher among children with Specific Language Disability.[9,24] Auditory sensory sensitivity problems account for most distressful problems in neurodevelopmental disorders i.e., ADHD, ASD and ID.[16] Sensory oversensitivity may be a common feature of both ASD (31.0%) and ADHD (15.5%) and 9.3% in other groups (learning disabilities, gifted, developmental delay) i.e., registration, sensitivity, avoiding.[25] Children for auditory and tactile over responsiveness or both persisted more in the neurodevelopmental population.[26]

Previous similar studies indicates that sensory profile scores were found in the order of hierarchy that highest was in the auditory, vestibular and tactile followed by the proprioception.[10]

The study concluded that there was a significant association between total sensory sensitivity and selected factors i.e. type of family, socio-economic status, maternal occupation, nutritional status and diagnosis of child. Another literature on sensory problems conducted among children with disabilities also identifies association between sensory sensitivity and same selected demographical variables.[27–31]

The study's limitations include its focus on specific developmental disabilities, such as autism spectrum disorder, cerebral palsy, specific language disability, ADHD, intellectual disability, and Down syndrome, which may not encompass all conditions, and the limited generalizability due to the sample being drawn from a single centre in New Delhi. Additionally, the focus on behavioural feeding problems may overlook other influencing factors such as environmental and psychological variables or additional health-related variables. Longitudinal studies could provide more comprehensive insights. Further researches can be carried out considering other variables that affect sensory profile like feeding behaviour issues, parenting styles, different dietary interventions, functional mobility, maternal cognition, and malnutrition.

CONCLUSION

Major findings of the present study reveal that children with ASD, ADHD and Intellectual Disability had higher mean sensory sensitivity in terms of total sensory sensitivity, sensory hypersensitivity and hyposensitivity. Mean of visual, auditory, tactile and proprioception sensory sensitivity in terms of total sensitivity, hypersensitivity and hyposensitivity were observed higher among children with ASD, ADHD and intellectual disability. Mean of gustatory sensory sensitivity in terms of total sensitivity, hypersensitivity and hyposensitivity were observed higher among children with down syndrome, autism spectrum disorder and intellectual disability.

Mean of olfactory sensory sensitivity in terms of total sensitivity, hypersensitivity and hyposensitivity were observed higher among children with ASD, Specific Language Disability and ADHD as well as children with Intellectual Disability had more mean olfactory hyposensitivity. Mean of vestibular total sensory sensitivity was observed higher among children with ASD, ADHD and Intellectual Disability. There is also an association between sensory sensitivity with type of family, socio-economic status, maternal occupation, nutritional status and diagnosis of child.

The finding of the study also has several implications so that nursing services to be based on individualised periodic assessment and dietary intervention for sensory profiles among children. Parental counselling and training for adopting better sensory based strategies to overcome related feeding and other problems among children with developmental disabilities in hospital as well as in community settings. The nurse administrator should take initiatives to make protocol and policies of regular screening for sensory profiles among children with developmental disabilities.

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