



Screening For Dyslexia And Its Relation With Attention Deficit Hyperactive Disorder In School Children Aged 6 – 12 Years

¹Dr. Deep A Shah, ²Dr. Manu Sharma, ¹Dr. Devendra Sareen
¹Department of Paediatrics, ²Department of Psychiatry,
Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India

***Corresponding Author:**

Dr. Deep A Shah

Department of Paediatrics, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Background: Dyslexia is defined as an unexpected difficulty in reading for an individual who has the intelligence to be a much better reader, most commonly caused by a difficulty in the phonological processing, which affects the ability of an individual to speak, read and spell.

Materials And Methods: The study comprised 150 children in the age group 6-12 years attending private/government school of urban and rural area in Udaipur. A cross-sectional study conducted in 4 randomly selected private schools of Udaipur for a period of one year. The children were administered intelligence assessment using Vineland Social Maturity Scale and children with low intelligence were excluded from the study. The children were screened for dyslexia with Dyslexia Assessment for language of India (DALI). Emotional and Behavioural disorder were evaluated using CBCL Parent form and DSM-5 checklist for ADHD. Children who screen positive for LD, ADHD or other behavioural disorder were advised formal paediatric/psychiatric consultation.

Results: Overall prevalence of dyslexia was found to be 12.7%. Prevalence of dyslexia was found more in males [male: female - 2.1:1]. It was found that more than half of the children with LD had ADHD and other behavioural problems. There was no significant association between parent's education, occupation and socioeconomic status and dyslexia

Conclusion: The study reiterates the importance of screening for emotional/ behaviour problems in children with LD. Timely identification of these problems is important to improve outcomes in the children. Further multicentric research on learning disability especially dyslexia are recommended.

Keywords: Dyslexia; school children; learning disability

Introduction

Specific learning disability (SLD) is a heterogeneous group of disorders of neurobiologic origin manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities ^[1]. Dyslexia, in general is a specific learning disability (SLD) that is characterised by difficulties in word recognition, spelling and decoding. Additionally, there is decreased reading experience and comprehension that

impedes the growth of vocabulary and background knowledge, and educational attainment ^[2].

Dyslexia is one of the common learning disability with a prevalence ranging from 3 to 17.5% among school age children ^[3,4]. Since, there is no national level data of the learning disabled in India, it is difficult to estimate prevalence of dyslexia. Inconsistency exists in the reported association of gender and socio-demographic factors from India. The wide variation in research findings may be due to different diagnostic criteria, assessment methods and

study design. Evidence from previous studies indicates that SLD is frequently comorbid with attention deficit and hyperactivity disorder (ADHD) other childhood emotional and behavioural disorders [5]. It may be difficult to delineate specific learning disorders clearly due to high degree of co-morbidity with other disorders,^[6,7] difficulties in making reliable and stable diagnosis in the young age groups^[8,9]. Lack of assessment may result in low self-esteem as compared to non-dyslexic students^[10, 11] and lack of appropriate help and support can have long-term effects on people with dyslexia when reaching adulthood^[12]. Therefore, screening for dyslexia as early as first grade can provide an important opportunity for diagnostic assessment and evidence based intervention^[13]. With this background, the present study was conducted with the objective of screening children aged 6-12 years for dyslexia and to study its relationship with gender, ADHD symptoms, parental education level and occupation.

Materials And Methods:

Study Type, Setting & Design:

The present cross-sectional study was conducted between January 2019 and June 2020 after obtaining approval from the institutional ethical committee. The sources of the study population were two privately-run and two government-run schools in Udaipur, Rajasthan, India.

Inclusion & Exclusion Criteria:

School children between 6-12 years of age living with their parents in Udaipur whose written informed consent produced by parents/legal guardian were included in the study. Children with a history of psychiatric illness, intellectual abnormality, seizure disorder, primary neurological disorder were excluded from the study.

Institutional ethical committee (IEC) clearance: [I.E.C/Outward no-1635; Date-31/01/2019] and written consent from parents were taken for the study.

Data Collection:

One hundred and fifty students aged 6-10 years who were living since birth with their parent(s) and whose parent/legal guardian provided written informed consent for participation in the study were included. The children with history of seizures/epilepsy, other

primary neurological or psychiatric disorder, intellectual disability disorder and sensory impairment were excluded. Students who had abnormal scores on the Vineland Social Maturity Scale (VSMS) were excluded.

The sociodemographic data was recorded on a proforma designed for the present study. The following tools were administered to parents/legal guardian:

Dyslexia Assessment for Language of India (DALI) - Junior Screening Tool (JST) and Middle Screening Tool (MST) for teachers^[14]. DALI was developed by the National Brain Research Centre and supported by Department of Science and Technology, Government of India. The DALI- JST and MST are relatively short, objectively scored, multi-faceted checklists that can be used to identify children at risk for dyslexia. A teacher who had more than three months of regular interaction with the student being assessed completed the JST and MST. The JST for classes 1 and 2 covers sound awareness and skill acquisition (reading, writing and number concepts). The MST for classes 3 to 5 covers memory and skill acquisition (reading, writing and mathematics). Both the JST and MST cover communication, motor coordination, behaviour. Those students who were detected to be 'at risk for dyslexia' were advised further evaluation by ophthalmologist, otologist and clinical psychologist.

DSM-5 checklist for ADHD^[15] - Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition developed by American Psychiatric Association Washington DC in the year 2000. A persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development, as characterized by 1-Inattention and/or 2-Hyperactivity and impulsivity. The cut off score for diagnostic criteria includes Six (or more) of the symptoms from both Inattention, Hyperactivity and impulsivity have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities.

Child Behaviour Checklist (CBCL) Parent form^[16] - The 113-item behaviour problems section of the CBCL was used as a screening tool for 4-16yr olds. Each item was rated by the parent as 0 = not true, 1 = sometimes or somewhat true and 2 = very true or

often true. The original cut off scores were found to be too high for the Indian cultural settings and were modified based on unpublished data collected at Ranchi and discussions with experts at the Indian Council of Medical Research (Male: 6 to 11 years ≥ 21 , 12 to 16 years ≥ 18 ; female: 6 to 11 years ≥ 16 , 12 to 16 years ≥ 13)^[17].

Data Analysis:

Statistical analyses were done using the Statistical Package for Social Sciences for Windows, version 16 (SPSS Inc., Chicago, Ill., USA). Continuous variables were expressed as mean with standard deviation. All statistical analyses were done at a 95% confidence interval, and $p < 0.05$ was considered statistically significant.

Results:

Sociodemographic characteristics:

Out of 150 students in our study, 119 (79.33%) students were distributed in 6-8 years, 30 (20%) students were distributed in 9-11 years and 1 student (0.67%) in ≥ 12 -year age group. Mean age of study population was 7.4 ± 1.2 years. In study population, number of males were 1.4 times more as compared to females. (Table 1)

Prevalence of dyslexia:

The prevalence of dyslexia was found to be 12.7% in our study. When compared with gender, prevalence of dyslexia was found more in males [male: female - 2.1:1]. (Table 2)

Association of ADHD with Learning disability in children:

Out of 19 students screened positive for LD, 12 students had associated symptoms of ADHD (p value < 0.05) (Table -3). Out of 150 students in 1) 6-11 years age group 4.6% were male (cut off score ≥ 21) and 3.3% were female (cut off score ≥ 16) 2) ≥ 12 years age group 0.7% were male (cut off score ≥ 18) indicating behavioural disorder. (Table 3)

Association of Parent's education and occupation with LD:

In our study no statistically significant association was found between parent's education and occupation with dyslexia.

Discussion:

In the present study total 150 school going children from Udaipur between the age group of 6 years to 12 years were studied for the screening of dyslexia and assessment of behavioural problems.

In our study, majority number of children with learning disability (dyslexia) were in the age group between 8-10 years age group-14 cases (73.6%), followed by 5-7 years age group-5 cases (26.4%). The mean age of children was 7.4 ± 1.2 years. This finding was in accordance with a study from South India^[18, 19] which concluded that majority number of children were found in age group of 8-10 years age group and mean age for children was 9.4 year. In our study, majority of cases were male in the ratio ratio 2.1:1. Difference in distribution among sexes was statistically not significant (p -value > 0.05). This finding was in accordance with a previous Indian study^[20]. On the aspect of domicile, we found that $> 50\%$ children belonged to rural area. This may be due to the environmental influences on children and urban children are usually provided with many facilities that may help them to achieve their goals. The life style of urban children, the teaching method, and teachers' education level may all influence upon these children and they may perform better^[21]. Our finding was in accordance with study done by Koradia et al^[22].

We examined the association of parent's education (head of the family) with dyslexia. There was no significant association between parent's education and dyslexia. This observation is consistent with the findings of previous studies^[23]. However, study done in China^[24] concluded that mother's education level was associated with child's dyslexia. This may be because of the reason that an educated mother may harbour higher expectations from the child and this may pressurize the child. This makes child emotionally weak and this may become the cause for the risk of dyslexia for the child. There is a scarcity of reports evaluating the relationship between parent's occupation in dyslexia. In the present study, we found no significant relationship between parent's occupation or socio-economic status and dyslexia. In our study we also studied association of parent's SES with dyslexia. Our finding was in accordance with study done by researchers from UK^[25].

In the present study, we found the prevalence of dyslexia to be 12.7%. This finding was in accordance

with study done in South India ^[26]. Our finding was in accordance with study by researchers in Africa ^[27], researchers in Asia ^[28, 29]. Our findings contradicted by the study done by researcher in North India ^[30] and researchers from Rajasthan ^[31]. The reason for the variation in prevalence rates could be due to: different cut-off points to identify 'cases' on the continuum between mild and severe dyslexia, geographic location, nature of population studied, study instruments and methodological variations.

We examined the association of other psychiatric disorder with dyslexia. This is important to because an additional disorder may affect the clinical presentation and severity of dyslexia ^[32]. Learning-disabled children with comorbidity exhibit more severe neurocognitive impairment, negative academic experience, social outcomes and lower treatment response as compared with children without other comorbid condition ^[33]. In the present study, more than half of the children with LD had ADHD and other behavioural problems. ADHD and LD are neurodevelopmental disorders and our findings are in accordance with previous studies ^[32, 34] This finding represents the frequent association of ADHD, behavioural/emotional disorders and LD. It was found that relation between dyslexia and inattention symptoms was stronger than the association with hyperactive and impulsive symptoms of ADHD ^[32].

Limitation:

Study includes the inherent limitations of a postgraduate dissertation, the present study is encumbered by certain limitations such as: small sample size, predominated by males from rural area which limits the generalization of the study findings. The study includes a screening tool for dyslexia and not a detailed diagnostic evaluation of learning disabilities. However, the assessment of emotional/behavioural problems with validated tools is a relative merit for study. Despite the limitations, the present study adds to the Indian database on learning disability, especially dyslexia.

Conclusion:

This study suggests that the prevalence of dyslexia is higher among children especially among male children belonged to rural area. More than half of the children with LD had ADHD and other behavioural problems. It is an invisible handicap. Early diagnosis of dyslexia with appropriate intervention or learning

strategies can be started to prevent further handicap in their learning. Timely identification of these problems is important to improve outcomes in the children. Further multicentric research on learning disability especially dyslexia are recommended.

References:

1. Hammill DD. On defining learning disabilities: an emerging consensus. *J Learn Disabil.* 1990;23:74–84
2. Lyon, G. R., Shaywitz, S. E., & Shaywitz, B. A. (2003). Defining dyslexia, comorbidity, teachers' knowledge of language and reading: A definition of dyslexia. *Annals of Dyslexia*, 53, 1- 14
3. Lerner JW. Educational interventions in learning disabilities. *J Am Acad Child Adolescent Psychiat.* 1989;28:326–31
4. Shaywitz SE, Shaywitz BA, Pugh KR, Fulbright RK, Constable RT, Mencl WE, et al. Functional disruption in the organization of the brain for reading in dyslexia. *Proc Natl Acad Sci USA* 1998;95:2636–41
5. Sahoo MK, Biswas H, Padhy SK. Psychological co-morbidity in children with specific learning disorders. *J Fam Med Primary Care.*2015;4:21–5
6. Landerl K, Moll K. Comorbidity of learning disorders: prevalence and familial transmission. *J Child Psychol Psychiatry.* 2010;51: 287–94. 5
7. Kohli A, Sharma A, Padhy SK, Grover S, Subodh BN. Pattern of deficits in specific learning disorders. *J Indian Assoc Clin Psychol.* 2014
8. Lavigne JV, Arend R, Rosenbaum D, Binns HJ, Christoffel KK, Gibbons RD. Psychiatric disorders with onset in the preschool years: I. Stability of diagnoses. *J Am Acad Child Adolesc Psychiatry.* 1998;37:1246–54. 9
9. Cantwell DP, Baker L. Stability and natural history of DSM-III childhood diagnoses. *J Am Acad Child Adolesc Psychiatry.* 1989;28:691–700
10. Miles, T.R. The Inner Life of the Dyslexic Child, in: V. Varma(Ed) *The inner Life of Children with Special Need:Whurr.* 1996
11. Humphrey, N. Teacher and pupils ratings of self-esteem in developmental dyslexic. *British*

- Journal of Special Education. 2002;29(1):29-36
12. Morgan, E., & Klein, C. The dyslexic Adults in a non- dyslexic world. London: Whurr. 2000
 13. haywitz SE, Shaywitz JE, Shaywitz BA. Dyslexia in the 21st century. *Curr Opin Psychiatry*. 2021 Mar 1; 34(2):80-86
 14. Rao C, T A S, Midha R, Oberoi G, Kar B, Khan M, Vaidya K, Midya V, Raman N, Gajre M, Singh NC. Development and standardization of the DALI-DAB (dyslexia assessment for languages of India - dyslexia assessment battery). *Ann Dyslexia*. 2021 Oct; 71(3):439-457.
 15. American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition.2000; Washington DC, American Psychiatric Association
 16. Achenbach, T. M. and Rescorla, L. A., 2001, Manual for the ASEBA School Age Forms and Profiles. Burlington, VT: University of Vermont, Res. Center for Children, Youth, and Families.ISBN 0-938565-73-7
 17. Srinath S, Girimaji SC, Gururaj G, Seshadri S, Subbakrishna DK, Bhola P, Kumar N. Epidemiological study of child & adolescent psychiatric disorders in urban & rural areas of Bangalore, India. *Indian J Med Res*. 2005 Jul;122(1):67-79. PMID: 16106093
 18. Rao S, Raj SA, Ramanathan V, Sharma A, Dhar M, Thatkar PV, et al. Prevalence of dyslexia among school children in Mysore. *Int J Med Sci Public Health* 2017;6:159-164
 19. Mogasale VV, Patil VD, Mogasale V. Prevalence of specific learning disabilities among primary school children in a South Indian city, *Indian J Pediatr* 2012 Mar;79(3):3427
 20. Priti A, Bir S.C, Rachna B, Archana S and Jaspreet K, 2013, Prevalence of specific developmental disorder of scholastic skills in school students in Chandigarh, India. *Indian J. Med. Res*, 138:89-98
 21. Heerashree P, Manjula P. Prevalence of dyslexia in higher primary school children and its effect on behavioural problems. *Karnataka J Agric Sci* 2015;28(4): 592–5
 22. Koradia K Devi, S and Narang D. 2012, Environmental factors influencing specific learning disabilities among children. *International J. Multidisciplinary Res*, 2(9):29-33
 23. Saleem SM. Modified Kuppuswamy socioeconomic scale updated for the year 2020. *Indian J Forensic Community Med*. 2020;7(1):1-3
 24. Zhao Sun, Li Zou, Jiajia Zhang, Shengnan Mo, Shanshan Shao, Rong Zhong, Juntao Ke, Xuzai Lu, Xiaoping Miao, and Ranran Song, 2013, Prevalence and associated risk factors of dyslexic children in a middle-sized city of china: a cross-sectional study
 25. Friend, Angela et al. “Parental education moderates genetic influences on reading disability.” *Psychological science* vol. 19,11 (2008): 1124-30. doi:10.1111/j.1467-9280.2008.02213
 26. G. Sridevi, A. G. George, D. Sriveni, K. Rangaswamy. Learning disability and behavior problems among school going children. *J. Disability Stud.*, 2015, 1(1), 4-9
 27. Irene JC. Prevalence of dyslexia among children aged 7 to 9 in a Nairobi school. Thesis Dissertation, University of Nairobi, 2015
 28. Chan W, Ho CSH, Tsang SM, Lee SH, Chung KHK. Prevalence, gender ratio and gender differences in reading-related cognitive abilities among Chinese children with dyslexia in Hong Kong. *Educ Stud* 2007;33:249–65.
 29. Roongpraiwan R, Ruangdaraganon N, Visudhiphan P, Santikul K. Prevalence and clinical characteristics of dyslexia in primary school students. *J Med Assoc Thai* 2002 Nov;85(4):S1097– 103
 30. Priti A, Bir S.C, Rachna B, Archana S and Jaspreet K, 2013, Prevalence of specific developmental disorder of scholastic skills in school students in Chandigarh, India. *Indian J. Med. Res*, 138:89-98
 31. Dhanda A. and Jagawat T. 2013, Prevalence and Pattern of Learning Disabilities in School Children Delhi *Psychiatry J*. 16(2):386-390
 32. Willcutt E G, Pennington B F. Psychiatric comorbidity in children and adolescents with

reading disability. *J Child Psychol Psychiatry*. 2000;41(08):1039–1048

33. Aro, T., Poikkeus, A. M., Eklund, K., Tolvanen, A., Laakso, M. L., Viholainen, H., et al. (2009). Effects of multidomain risk accumulation on cognitive, academic, and behavioural outcomes. *Journal of Clinical Child and Adolescent Psychology*, 38, 883–898

34. Anamika Sahu, Vaibhav Patil, Rajesh Sagar, Rachna Bhargava *J Neurosci Rural Pract*. 2019 Oct; 10(4): 617–622. Published online 2019 Nov 11. doi: 10.1055/s-0039-1697879

TABLES:

Table 1: Sociodemographic characteristics of study population

Demographic Variables		N (%)
Age group	6-8 years	119 (79.33)
	9-11 years	30 (20)
	≥12 years	1 (0.67%)
	Mean ± SD	7.4 ± 1.2 year
Gender	Male	88 (58.7)
	Female	62 (41.3)
Domicile	Urban	74 (49.3)
	Rural	76 (50.7)
Parent's Education		N (%)
Illiterate		14 (9.3)
Primary school certificate		20 (13.3)
Middle school certificate		9 (6)
High School Certificate		26 (17.3)
Graduate		32 (21.3)
Post-graduate		33 (22)
Professional course		16 (10.7)
Parent's Occupation		N (%)
Business		1 (0.7)
Clerical		22 (14.7)
Professional		47 (31.3)
Semi-professional		28 (18.7)
Semiskilled worker		23 (15.3)
Shop keeper		3 (2)
Skilled worker		13 (8.7)
Unemployed		13 (8.7)

Total	150 (100)
-------	-----------

[SD – Standard Deviation]

Table 2: Prevalence of learning disability (dyslexia) as per Dyslexia Assessment for Language of India (DALI) - Junior Screening Tool (JST) and Middle Screening Tool (MST) checklist

JST score		≥ 12	< 12
		N (%)	N (%)
Age-group	5-7 years	5 (5.9)	79 (94.1)
Gender	Male	5 (100)	50 (63.3)
	Female	0 (0)	29 (36.7)
	Total	5 (100)	79 (100)
MST score		≥ 23	< 23
		N (%)	N (%)
Age-group	8-10 years	14 (21.9)	50 (78.1)
Gender	Male	8 (57.1)	24 (48)
	Female	6 (42.9)	26 (52)
	Total	14 (100)	50 (100)

Table 3: Association of ADHD with learning disability in children

LD Screening tool			DSM-5 for ADHD		p-value
			Score ≥ 6	Score < 6	
JST (N=83)	≥12 (N=4)	N (%)	1 (25)	3 (75)	0.1859
	<12 (N=79)		0 (0)	79 (100)	-
MST (N=64)	≥23 (N=14)	N (%)	11 (78.6)	3 (21.4)	0.0030
	<23 (N=50)		0 (0)	50 (100)	-