Assessment of Refractive Status of 5-15 Years Old Children Attending Government Schools of Rural Agra

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Abstract:

Introduction: In children uncorrected refractive errors have a profound effect on educational and psychosocial development hence it is necessary to estimate the prevalence both at the community and at the school level to aid planning and implementation of refractive error services in children. **Objective:** To determine the refractive status of 5 to 15 years old children attending government schools of rural areas of district Agra, Uttar Pradesh (UP), India. **Method:** Study conducted on 902 students of age group 5-15 years of randomly selected government schools of Bichpuri Block of district Agra. Children underwent visual acuity assessment and torch light examination, height and weight measurement. Children with VA ≤6/9 were further examined and cycloplegic retinoscopy, fundus examination, slit lamp examination and post mydriatic refraction was done. On the basis of values of cycloplegic refraction and post mydriatic refraction, refractive error was classified as myopia, hypermetropia and astigmatism. Statistical Analysis was done by applying Chi square test. **Results :** Out of 902 children, 125 children (13.86 %) were having refractive error of which 76 were myopic (8.43%), 39 were astigmatic (4.32%) and 10 were hypermetropic (1.11%). There was an increase in the overall prevalence of refractive error with advancing age. There was no significant association of refractive error with gender and nutritional status. **Conclusion:** Vision screening of school children is very useful for early detection and correction of refractive errors. Screening of the refractive errors in school should be carried out periodically and regularly.

Keywords: Astigmatism, Hypermetropia, Myopia, Refractive Error

Introduction:

Vision is a facility or a state of being able to see. As vision is the major sensory modality in humans, normal vision is important for the general development of a child. Visual impairment has significant implications on the affected child and family in terms of education, future employment and personal and social welfare throughout life, so early detection and treatment of refractive errors in children is very important.

Uncorrected refractive errors are the most common cause of visual impairment around the world[1] and in children uncorrected refractive errors and their consequences have a profound effect on their overall development, most importantly on educational and psychosocial development.[2,3]

The prevalence of childhood blindness in India is 0.17%. Treatable refractive error causes 33.3% of the

blindness followed by 16.6% due to preventable causes.[4] The control of blindness in children is considered a high priority within the World Health Organization's (WHO's) VISION 2020 — The Right to Sight programme.[5]

Refractive error has not gained much attention among the causes of blindness. It is because blindness is mostly defined on the basis of best corrected visual acuity (BCVA). However, if blindness was defined on the basis of presenting distant visual acuity, uncorrected refractive errors are the second most common cause of blindness after cataract.[6] Although refractive errors cannot be prevented, they can be treated. Diagnosis and treatment of refractive error is relatively simple and is one of the easiest ways to reduce impaired vision.

In India, as per census 2011 there are nearly 253 million children aged 5-14 years of age (24.60% of the population),[7] therefore, providing vision screening for all children is a daunting task. The availability of eye care services in the country varies between and within regions. Given these disparities, school based vision screening services are considered cost effective in detecting correctable causes of decreased vision.[8] As part of the National Program for Control of Blindness, school vision screening is widely practiced at present in the country.[9] Hence it is necessary to estimate the prevalence both at the community and at the school level to aid planning and implementation of refractive error services in children.

Refractive errors may appear throughout childhood and adolescence. If refractive errors are left untreated they can result in amblyopia and/or strabismus hence vision screening should be done to identify children with uncorrected refractive error, so that treatment can be offered before educational and social progress is affected.

Method:

This study was a cross sectional observational study conducted among 902 students of age group 5 to 15 years of randomly selected government primary and junior high schools of Bichpuri block of district Agra. Permission was taken from the Institutional Ethical Committee and Basic Shiksha Adhikari of Basic Education Department of district Agra. The sample size was calculated by taking prevalence of refractive errors in school going children 10.8% at 95% confidence interval and 20% allowable error and was 818 which had been rounded off to 900. The study was carried out from September 2018 to September 2020.

Exclusion Criteria of this study were children with congenital glaucoma, congenital cataract, corneal diseases, history of ocular trauma, children with diseases of posterior segment, children with neurological disorder, children with infective ocular diseases.

A standard examination procedure was used for every children. Height, weight were recorded and torch light ocular examination and assessment of VA by Snellen's E chart was done. Height was measured using a portable stadiometer. Weight was measured using an electronic weighing balance. Body mass index for age (5-19years) based on Z Score [10,11] was used to determine the nutritional status.

Cycloplegic retinoscopy, dilated fundus examination, slit lamp examination and post mydriatic refraction was performed on children having VA≤6/9 after taking informed consent from parents of children. On the basis of values of cycloplegic refraction and post mydriatic refraction, refractive error was classified as myopia, hypermetropia and astigmatism.

Myopia was considered when the measured refractive error was more than or equal to −0.5 spherical equivalent diopters in one or both eyes. Hypermetropia was considered when the measured objective refraction was greater than or equal to +2.00 spherical equivalent diopters in one or both eyes, so long as neither eye had myopia. Astigmatism was considered to be visually significant if ≥ 0.75 D.[12]

Results:

Table 1: Prevalence of refractive error (Myopia, Hypermetropia and Astigmatism) as per age group

Age group (yrs)	Number of children (N)	Myopia		Hypermetropia		Astigmatism		Total Refractive Error	
		(n)	%	(n)	%	(n)	%	(n)	%
5-7	173	8	4.62	5	2.89	2	1.16	15	8.67
8-10	329	26	7.90	2	0.61	14	4.25	42	12.67
11-13	313	29	9.26	2	0.64	20	6.39	51	16.29
14-15	87	13	14.94	1	1.15	3	3.45	17	19.54
Total students	902	76	8.43	10	1.11	39	4.32	125	13.86
p-value		0.038		0.055		0.055		0.043	
Chi- square value		8.43		6.39		7.59		8.43	

Table 2: Gender wise prevalence of refractive error (Myopia, Hypermetropia and Astigmatism)

Gender	Myopia		Hypermetropia		Astigmatism		Total Refractive Error	
	(n)	%	(n)	%	(n)	%	(n)	%
Boys (n=466)	34	7.30	4	0.86	22	4.72	60	12.88
Girls (n=436)	42	9.63	6	1.38	17	3.90	65	14.91
Total students (n=902)	76	8.43	10	1.11	39	4.32	125	13.86
p-value	0.207		0.458		0.544		0.207	
Chi-square value	1.59		0.551		1.69		1.59	

Table 3: Nutritional Status wise distribution of refractive error (Myopia, Hypermetropia and Astigmatism)

Nutritional Status	Myopia		Hypermetropia		Astigmatism		Total Refractive Error	
	(n)	%	(n)	%	(n)	%	(n)	%
Thin (n=219)	23	10.50	1	0.46	9	4.11	33	15.07
Normal (n=667)	50	7.50	8	1.20	30	4.50	88	13.19
Overweight (n=12)	2	16.67	1	8.33	0	0	3	25.00
Obese (n=4)	1	25.00	0	0.00	0	0	1	25.00
Total students (n=902)	76	8.43	10	1.11	39	4.32	125	13.86
p-value	0.217		0.084		0.850		0.536	
Chi-square value	4.55		6.66		0.796		2.18	

All data was collected on a preformed data collection form. After collection, whole data was compiled on Microsoft Office Excel spreadsheet and Chi-square test was used to analyze differences in the refractive errors between boys and girls and among different age groups. p value <0.05 was considered significant.

This study was conducted among 902 children of age group 5-15 years. The mean age of overall study population was 10.02±2.63 years. 466 children (51.66%) were boys and 436 children (48.34%) were girls. Boy to girl ratio was 1:0.94.

Out of these 902 children, 125 children were having refractive error of which 76 were myopic, 10

were hypermetropic and 39 were astigmatic. The prevalence of refractive error in our study was found to be 13.86%.

Table 1 shows that myopia was found to be the most common type of refractive error and was observed in 76 children (8.43% of study population) which contributed 60.80% of all the refractive error. Hypermetropia was observed in 10 children (1.11% of study population) who contributed 8.00% of all the refractive error. Astigmatism was observed in 39 children (4.32% of study population) who contributed 31.2% of all the refractive error.

There was an increase in the overall prevalence of refractive error with advancing age which was statistically significant (p<0.05) as shown in Table 1.

There was an increase in prevalence of myopia with increase in age which was statistically significant (p<0.05) while there was no statistically significant association (p>0.05) found between hypermetropia and astigmatism with increase in age as shown in Table 1.

Prevalence of refractive error in girls (14.91%) was observed to be more than boys (12.88%) but this was statistically not significant (p>0.05) as shown in Table 2.

There was no significant association of gender with myopia, hypermetropia and astigmatism as shown in Table 2.

There was no statistically significant association found between nutritional status and refractive error (p> 0.05). Refractive error was found highest (25%) among overweight and obese children, while it was present in 15% of thin or underweight children and13% in children with normal range of BMI for Age with z score as shown in Table 3.

Discussion:

In the present study VA ≤6/9 was taken as a defective vision. Among 902 children, 125 children had refractive error so the prevalence of refractive error in our study was found to be 13.86 % (Table 1).

This finding was similar to those of Gupta et al[13] where prevalence of refractive error (VA ≤6/9) was found to be 13.2 % in school children (4-12years) of Aligarh. Batra et al[14] also observed that the prevalence of refractive error (VA ≤6/9) was 12.7% in school children (5-15 years) from both rural and urban areas of Ludhiana city. S Seema et al[15] also observed that the prevalence of refractive error (VA ≤6/9) was 13.6 % in school children (6- 15 years) in a rural block of Haryana. A similar study was also conducted by Kumar MN et al[16] in school children of 5-15 years age group of urban and rural areas of Ludhiana city and prevalence of refractive error (VA ≤6/9) was found to be 13.9%.

However, this prevalence was higher when compared to that observed by GVS Murthy et al[17] in New Delhi (6.4%) and Kumar et al[18] in Lucknow (7.4%), Pavithra MB et al[19] in Bangalore (7.03%), Deshpande Jayant D et al[20] in rural North Maharashtra (10.12%). As compared to our study, much higher prevalence of refractive error was observed by Das A et al[21] (25.11%) and Sonam sethi et al[22] (25.32%).

In our study the most common refractive error was myopia (60.80%) followed by astigmatism (31.20%) followed by hypermetropia (8.00%). This result was similar to the study conducted by S Seema et al,[15] Pavithra MB et al,[19] Rahman M[23] and Sethu S et al[24] who observed that commonest refractive error among school children was myopia followed by astigmatism and hypermetropia, whereas Tarannum Shakeel et al[25] found that most common refractive error was astigmatism followed by myopia and hypermetropia.

There is an increase in the prevalence of refractive error with advancing age which was statistically significant (p<0.05) as shown in Table 1 which was comparable with the study conducted by Pavithra et al,[19] Tarannum Shakeel et al[25]

It was observed that there was a significant association of increase in myopia (p<0.05) with older age groups however statistically significant

association (p>0.05) was not found between astigmatism, hypermetropia with an increase in the age. Murthy et al[17], Batra et al[14], S Seema et al[15], Pavithra MB et al[19], all reported that there was an increase in cases of myopia with increasing age.

In our study, there was no statistically significant difference in the prevalence of refractive error between boys and girls (p> 0.05). This was similar to the results observed by Tarannum Shakeel et al[25], Ande V R et al[26] and Krishnan V M et al.[27] However, studies conducted by S Seema et al[15], Pavithra MB et al[19] showed evidence of increased refractive errors in girls, whereas Rahman M et al[23], Bhattacharya RN et al[28], Sriram C et al[29] found refractive error to be more prevalent in male students than female students.

There was no statistically significant difference in the prevalence of myopia, hypermetropia and astigmatism between boys and girls in our study (p>0.05). Similar results were observed by Krishnan VM et al[27] in a study conducted in Villupuram and Puducherry. Whereas Batra et al[14], Pavithra MB et al[19] observed a significant association of hypermetropia with females and Saxena R et al[30] observed that myopia was higher among girls than boys.

In our study, refractive error was found lesser in children with normal BMI for age as compared to thin, overweight and obese children but this was not statistically significant (p>0.05).

There is no statistically significant association found between myopia, hypermetropia and astigmatism with nutritional status (p>0.05). Similar result was also found by Nanda Wahyu Anandita et al[31] who concluded that there was no significant association between anthropometric parameters and dietary factors with refractive error whereas Fen Yang et al[32] observed that high BMI (>19.81 kg/m2) was associated with a higher visual impairment.

Conclusion:

Refractive error is a common cause of visual impairment among school children. Myopia was found to be the most common refractive error. Children often do not complain of defective vision and may not even be aware of their problem. There is also lack of awareness about refractive error in children at the family and the community level. Our study supports that vision screening of school children is very useful for early detection and correction of refractive errors. Screening of the refractive errors in school should be carried out periodically and regularly. In India, as part of the National Program for Control of Blindness, a School Eye Screening Program has been in place for more than two decades. Overall, outcome of our study is in the favour of vision screening and spectacle correction in the school children through School Eye Screening Programme.

Declaration:

Conflict of Interest: Nil

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References:

1. Dandona L, Dandona R. Estimation of global visual impairment due to uncorrected refractive error. Bull World Health Organ 2008; 86:B–C.

2. Pratt C, Bryant P. Young children understanding that looking leads to knowing (so long as they are looking into a single barrel). Child Dev 1990; 61:973–982.

3. Packwood EA, Cruz OA, Rychwalski PJ et al. The psychosocial effects of amblyopia study. J AAPOS 1999; 3:15–17.

4. R Dandona, L Dandona. Childhood blindness in India: a population based Perspective. Br J Ophthalmol. 2003 Mar; 87(3): 263–265

5. World Health Organization. Programme for the Prevention of Blindness and Deafness. (2000). Global initiative for the elimination of avoidable blindness. World Health Organization:17-18 https://apps.who.int/iris/handle/10665/63748 [Last accessed on 2020 oct 01]

6. Dandona R, Dandona L. Refractive error blindness. Bull World Health Organ 2001; 79:237-43.

7. Office of Registrar General & Census Commissioner, India, Ministry of Home Affairs, Government of India: 2011 Census Data: Population in different age groups and their proportions

to total population. https://censusindia.gov.in/census_and_you/age_structure_and_marital_status.aspx [Last assessed on 2020 oct 01]

8. Limburg H, Vaidyanathan K, Dalal HP. Cost effective screening of schoolchildren for refractive errors. World Health Forum 1995; 16:173-178.

9. Jose R, Sachdeva S. School eye screening and the National Program for Control of Blindness. Indian Pediatr 2009; 46: 205–208.

10. World Health Organization. Growth reference data for 5-19 Years: indicators: BMI-for-Age (5-19 years) for Boys. https://www.who.int/tools/growth-reference-data-for-5to19-years/indicators/bmi-for-age [Last accessed on 2020 oct 01].

11. World Health Organization. Growth reference data for 5-19 Years: indicators: BMI-for-Age (5-19 years) for Girls. https://www.who.int/tools/growth-reference-data-for-5to19-years/indicators/bmi-for-age [Last accessed on 2020 oct 01].

12. Negrel AD, Maul E, Pokharel GP. Refractive error study in children: sampling and measurement methods for a multi-country survey. Am J Ophthalmol 2000; 129: 421– 426

13. Gupta M, Gupta Y. A Survey on refractive error and strabismus among school children in a school at Aligarh. Ind J Public Health 2000; 44: 90-3

14. Batra N, Kaushal D, Gill AS. Refractive errors in school children- Data from a school. Tropical Ophthalmology 2007; 7(3): 43-7

15. S Seema, B Vashisht, K Meenakshi, G Manish. Magnitude of Refractive Errors among school children in a rural block of Haryana. The Internet Journal of Epidemiology. 2009;Volume 6 Number 2:1-5

16. Kumar MN, Chopra S, Bhatti A. Refractive errors in school children in urban and rural areas of Ludhiana, Punjab. J. Evid. Based Med. Healthc. 2017; 4(63), 3779-3781

17. Murthy GVS, Gupta SK, Ellwein LB et al. Refractive error in children in an urban population in New Delhi. Invest Ophthalmol Vis Sci 2002; 43: 623– 631.

18. Kumar JV, Singh PC, Ahuja J, Mohan U. Ocular morbidity among school children in Sarojini Nagar Lucknow. Indian J Community Med 1992; 17:109-13

19. Pavithra MB, Maheshwaran R, Rani Sujatha MA. A study on the prevalence of refractive errors among school childern of 7-15 years age group in the field practice areas of a medical college in Bangalore. Int J Med Sci Public Health 2013; 2(3): 641-645.

20. Deshpande JD, Malathi K, Prevalence of ocular morbidities among school children in rural area of north Maharashtra in India, National Journal of Community Medicine 2011; 2 (2):249-254.

21. Das A, DuttaH, Bhaduri G, De Sarkar A, Sarkar K,Bannerjee M. A study on refractive errors among school children in Kolkata; J Indian Med Assoc.2007;105(4):169-72.

22. GP Kantha, SonamSethi: Prevalence of refractive errors in school children (12–17 years) of Ahmedabad city. Indian Journal of Community Medicine 2000; 25(4):181-183

23. Rahman M, Devi B, Kuli JJ, Gogoi G. A study on the refractive status of school going children aged between 10 to 15 years in Dibrugarh Town, Assam, India. IOSR J Dent Med Sci. 2015;14:27–33

24. Sheeladevi S, Seelam B, Nukella PB, Modi A, Ali R, Keay L. Prevalence of refractive errors in children in India: a systematic review. Clin Exp Optom. 2018 Jul;101(4):495-503

25. Shakeel T, Mittal SK. Pattern of Refractive Errors in Primary School Children in Dehradun City of Uttrakhand State. Delhi J Ophthalmol 2016; 27:106-10.

26. V R Ande, R K Peeta, M R Chella, C Gujjarlapudi. Prevalence of refractive errors among school children in a rural setting. Med Pulse. International Medical Journal 2015; 2:98-101

27. Krishnan V M, Baba D, Poovitha R, Kumar PS. Study of Prevalence of Refractive Errors in School Children of Villupuram & Puducherry. Sch. J. App. Med. Sci 2015; 3(7B):2568-73.

28. Bhattacharya RN, Shrivastava P, Sadhukhan SK. A study on visual acquity and vitamin A deficiency among primary school students in Naxalbari village, Darjeeling District of West Bengal.Indian Journal of Public health 2004;48(4):171-180

29. Sriram C, Jain Raj.R; A Cross-Sectional Study on Prevalence of Refractive Errors among School Children in Thiruvallur District, Tamilnadu. Indian Journal of Applied Research 2014; 4:2249-55

30. Saxena R, Vashist P, Tandon R. Prevalence of myopia and its risk factors in urban school children in Delhi: the North India Myopia Study (NIM Study). PLoS One 2015; 10: e0117349

31. Anandita NW, Aini N. Relationship between anthropometric parameters and dietary factors in refractive error in Indonesia. Eurasia J Biosci 2019 13: 871-875.

32. Fen Yang, Chongming Yang, Yuzhong Liu, Shuzhen Peng, Bei Liu, Xudong Gao, Xiaodong Tan. Associations between Body Mass Index and Visual Impairment of School Students in Central China. Int. J. Environ. Res. Public Health 2016; 13,1024:1-10.