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Original Research Article

Prevalence of visual impairment among school children in Burla, Odisha: a cross-sectional study

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ABSTRACT

Background: According to WHO, approximately 19 million children and adolescents 5-15 years of age suffer from visual impairment. Priority should be given to effective methods of vision screening in children and correction as early as possible.
Methods: The study was conducted as a cross-sectional study among 340 school students in Burla, in the age group of 10–15 years. A child with a presenting maximum vision ≤6/12 Snellen equivalent in the better eye is considered visually impaired. Details of near work and outdoor activities were collected from their parents by administering a pretested questionnaire. Data was analyzed using EPI Info software version 7.
Results: The overall prevalence of visual impairment (vision ≤6/12) among the study participants was 11.8% (95% confidence interval = 8.8% to 15.6%). Participants who spend more hours reading/writing and on a digital screen have a higher prevalence.
Conclusions: The study highlights the high prevalence of undetected visual impairment in school children and the importance of early detection, treatment, and compliance with using corrective spectacles, which halts the further progression of low vision.

Keywords: Vision impairment, School health, Refractive error, Visual acuity

INTRODUCTION

Vision is the most dominant of the five senses and plays a crucial role in every stage of our lives. The school-going years are the formative years for determining one's physical, intellectual, and behavioral development. Any problem in their vision during these years can affect their performance in school and also hamper their intellectual development and maturity in their future life. International Classification of Diseases (ICD-11) defines visual impairment as a presenting visual acuity of less than 6/12, but equal to or better than 3/60 in the better eye.[1] Recently, a world report on vision showed that at least 2.2 billion people have a vision impairment or blindness globally.[2] According to WHO, approximately 19 million children and adolescents 5-15 years of age suffer from visual impairment, among which, approximately 12.8 million cases are due to uncorrected refractive error.[3] Globally, the leading causes of vision impairment are uncorrected refractive errors, cataracts, age-related macular degeneration, glaucoma, diabetic retinopathy, corneal opacity, and trachoma.[2] The school eye screening (SES) program became an essential part of the NPCBVI in 1994.[4] The planning of SES is carried out by the respective District Health Societies (DHS). From

each school, one teacher is selected for a one-day training course. At the end of the training, teachers are provided with a kit for screening the children in their schools. Despite the contentious effort for so long, there are many challenges and areas of concern with the potential for improvement in this program.

We focus on children aged 10-15 years, this is because of the reason that children in this age group are in a position to understand the purpose and need for vision screening. Administratively, it is easy to implement, and the students can carry the message home, thereby creating awareness. There is limited data available about the magnitude of visual impairment in school children in India and also in Odisha. Therefore, this study aims to generate evidence by estimating the prevalence of visual impairment in school-going children.

METHODS

This study was conducted as a school-based cross-sectional study among school children belonging to the age group of 10–15 years in selected schools of Burla, Odisha, between September 2022 to July 2024. The sample size was 330 based on the estimated prevalence of visual impairment, 11%.5 Considering a confidence interval of 95%, design effect=2, absolute precision of 5% with 10 % excess sampling to account for non-response.

Out of fourteen schools in Burla, four schools (28%) were randomly selected using the lottery method in the first stage of sampling. In the next stage, from the selected schools, seventeen students from each class (5th- 9th) whose age falls in the range of 10 to 15 years were randomly selected using a random number table. A total of 340 school children were included to estimate the prevalence of visual impairment in school children.

Data collection was done in the selected schools after obtaining approval from the institute's ethics committee and the principals of the schools. A participant information sheet explaining the study aim and objectives, the detailed procedure that was carried along with a form to sign for providing informed consent for the procedure sent to all the parents.

The sociodemographic details, family history of wearing spectacles, time spent on near work activities like reading, watching TV, digital screen (laptop/tablet/videogame/smartphone) were collected from parents by administering a pretested questionnaire. The telephone number of the investigator was provided in the participant information sheet so that parents can ask if there are any doubts regarding the procedure or the questionnaire. If the parents do not return the signed informed consent form, the child will not enroll in this study. The principals of the schools were consulted, and convenient days in a week were fixed for the examination of the eye. Children who wear spectacles were instructed to bring their spectacles on the day of examination without fail.

The vision of the child was recorded as the smallest line read with one or no errors using Snellen's chart, keeping it at a six-meter distance from the subjects in a properly illuminated space, unaided (uncorrected visual impairment) as well as with spectacles (presenting visual acuity). The right eye was tested first, then the left eye, each time occluding the fellow eye. The pretested structure questionnaire was filled up by all the participants.

A short talk regarding eye health education was given to children after the vision screening. At the end of the screening, school heads and their parents were informed about the vision status of the children, and the subjects, whose visual acuity was equal to or less than 6/12, were referred for further examination and treatment.

RESULTS

A total of 340 children were screened. Out of them, 173 (50.9%) were boys, and the rest, 167(49.1%) were girls. The mean age of children was 12.3 ± 1.6 years. Most of the participants, 203 (59.7%), were from a nuclear family, and their parents had studied up to secondary level.

The majority of the participants were from the lower middle class (33.5%) and middle-class families (27.4%) middle-class families. The overall prevalence of visual impairment among the study participants was 11.8% (40) with a 95% C.I. of (8.8% to 15.6%), and the remaining 88.2% (300) children had normal vision. Among the participants with visual impairment, 23(57.5%) had mild visual impairment and 17(42.5%) had moderate visual impairment.

The proportion of visual impairment was high among lower age groups and low among the higher age groups. The prevalence of visual impairment was comparatively higher among male participants (15.6%) than female participants (8.4%), nuclear family (13.3%) compared to joint (9.5%) families, and children belonging to middle-class families (15.1%). It has been observed that as the level of literacy of parents increases, the prevalence of visual impairment is also increasing in their children.

Among the study participants, government school students had a slightly higher prevalence of visual impairment as compared to students who had studied at private schools (Table 1). It shows that in (Table 2) the prevalence of visual impairment was higher among participants spending six hours or more on reading and those spending more than two hours on a digital screen. The prevalence of visual impairment was higher among underweight children compared to normal and overweight children. Children who play outdoors for two hours or more have a higher prevalence of visual impairment.

Table 1: Sociodemographic determinants and visual impairment (n=340).

Sociodemographic determinants	Visual impairment Frequency (%)		Total
	Present	Absent	
Age (in years)			
10	9 (18)	41 (82)	50
11	14 (19.2)	59 (80.8)	73
12	6 (9.5)	57 (90.5)	63
13	3 (5.7)	50 (94.3)	53
14	5 (7)	67 (93)	72
15	3 (10.3)	26 (89.7)	29
Sex			
Male	26 (15)	147 (85)	173
Female	14 (8.3)	153 (91.7)	167
Type of family			
Nuclear	27 (13.3)	176 (86.7)	203
Joint	13 (9.5)	124 (90.5)	137
Education of father			
Illiterate-primary	9 (9.5)	86 (90.5)	95
Secondary/high-higher secondary	27 (13)	180 (87)	207
Graduate/above	4 (10.5)	34 (89.5)	38
Education of mother			
Illiterate-primary	10 (7.5)	123 (92.5)	133
Secondary/high-higher secondary	24 (13.3)	157 (86.7)	181
Graduate/above	6 (22.2)	21 (77.8)	27
Socioeconomic classification (modified BG prasad)			
Upper class	1 (7.7)	12 (92.3)	13
Upper middle	8 (13)	53 (87)	61
Middle class	14 (15)	79 (85)	93
Lower middle	12 (10.5)	102 (89.5)	114
Lower class	5 (8.5)	54 (91.5)	59
Type of school			
Government	21 (12.4)	149 (87.6)	170
Private	19 (11.2)	151 (88.8)	170

Table 2: Visual impairment and selected determinants (n=340).

Selected determinants	Visual impairment Frequency (%)		Total
	Present	Absent	
Time spent in reading (h/day)			
< 6	9 (10.3)	78 (89.7)	87
≥ 6	31 (12.3)	222 (87.7)	253
Tv watching duration (h/day)			
≤2	27 (12.5)	189 (87.5)	216
>2	13 (10.5)	111 (89.5)	124
Time spent on digital screen (h/day)			
≤2	23 (11.3)	180 (88.7)	203
>2	17 (12.4)	120 (87.6)	137
Time spent playing outdoors(h/day)			
<2	23 (10.7)	192 (89.3)	215
≥2	17 (13.6)	108 (86.4)	125
Parental history of refractive errors			
Present	6 (8.2)	67 (91.8)	73
Absent	34 (12.7)	233 (87.3)	267
BMI			
Underweight	28 (14.5)	165 (85.5)	193
Normal	11 (8.2)	123 (91.8)	134
Overweight	1 (7.7)	12 (92.3)	13
Obese	0	0	0

DISCUSSION

The current study is a school-based cross-sectional study conducted to estimate the prevalence of visual impairment and the distribution of its various associated factors among school children. This study carries significance as there is a large iceberg of visual impairment in school children, which can be easily detected and treated at the primary health care level itself.

In our study, the prevalence of visual impairment was found to be 11.8% (95% CI = 8.8–15.6). This was similar to a school-based cross-sectional study in Delhi by Saxena et al, which reported a prevalence of presenting vision ≤6/12 in the better eye was 10.8 percent.[6] Bezabih et al reported that 7.24% of school-age children were visually impaired, of whom 3.9% had low vision and 3.34% had severe visual impairment.[7] Wadhwani et al reported visual impairment according to ICD-10 criteria was 5.92 per thousand.[8] The prevalence of visual impairment was 1.72% in a study in Andhra Pradesh where children aged 4–15 years were screened.[9] A school-based study in Kolkata found that visual acuity of less than 6/12 in the better eye was 4.2 percent.[10] Vishnuprasad et al reported prevalence of visual impairment (vision ≤6/12) among school children was 6.37 percent.[11] A cross-sectional study across eleven schools from both urban and rural parts of Udupi taluk was conducted by Prabhu et al, who reported prevalence of visual impairment was found to be 4.32% (3.38%, 5.26%:95%) confidence interval.[12] The prevalence varies due to different visual acuity cut-offs, different sample populations, and different methodologies. Therefore, this should be kept in mind while comparing these estimates.

In the current study, we found that the proportion of mild visual impairment (6.8%) was higher than the moderate category (5%). A similar finding was observed by Woldeamanuel et al in a school-based study where the prevalence of mild visual impairment, 41 (3.9%), was found to be relatively higher than moderate, 12 (1.1%), and 2 (0.2%) severe category.[13] A cross-sectional study at Delhi by Saxena et al among 9884 children found that mild visual impairment was 249 (19.2%), which was comparable higher than moderate 204 (15.7%) and 2 (0.2%) severe.[6] Vision impairment is a chronic condition that occurs gradually over a period. Delay in diagnosis and treatment, and insufficient eye care can substantially increase the severity of vision impairment and the degree of disability.

Children in the age group of 10 and 11 years had a higher prevalence than others; this could be possible due to the earlier age of starting study or early exposure to digital screens. In contrast to this, many studies reported that the prevalence of visual impairment increased with age. In South Ethiopia, a study done by Woldeamanuel et al observed that as age increases prevalence of visual impairment increases.[13] A study among school children in Uttarakhand observed a higher prevalence in older age groups.[14] In the present study, the prevalence of visual impairment was higher in boys (15%) than in girls (8.3%). In surveys done by Vishnuprasad et al, Saxena et al, Woldeamanuel et al, and Kavitha et al, boys had a high prevalence compared with girls.[6,11,13,15] In the present study, the prevalence of visual impairment was higher in children belonging to lower and middle-class families. A similar finding was reported by Woldeamanuel et al, Saxena et al reported that as the socio-economic class improves, the prevalence of visual impairment also increases.[6,13] In the current study, it has been observed that as the level of literacy of parent increases, the prevalence of visual impairment is also increasing in their children. This could probably be due to increased pressure from parents to spend more time on academic activities. We found that government school children had a comparatively higher prevalence of visual impairment than private school children. Contrary to this study done by Kamath et al, Vishnuprasad et al, and Ekpenyong et al found that children who attended private schools were more likely to have visual impairment than those in government schools.[11,16,17]

In the present study, it has been observed that the prevalence of visual impairment was low among the children with a positive parental history of visual impairment (8.2%) compared to those who had no parental history of visual impairment (12.7%). Wu et al and Vishnuprasad et al reported that a higher prevalence of visual impairment was associated with a positive parental history of vision defect.[11-18] Families share the same environment, nutrition, culture, and education besides their genetic makeup. Therefore, more than the genetic factors, the shared social and environmental influences are more likely to promote the development of low vision.

In the current study, we found that the prevalence of visual impairment was higher among students spending ≥6 hr. per day in reading and writing (12.3%) compared to those who spent less than six hours (10.3%). A similar finding was also reported by Saxena et al, where they found a positive association of the presence of myopia with children studying/reading > 5 hours a day.[6] In the current study, we found that those who were using digital screens like computers/laptops/tablets/smartphones for more than 2 hours per day have a higher prevalence of visual impairment compared to the children who spent ≤ 2 hours per day. Similarly, a study done by Bezabih et al, Pradhan et al, Mohan et al, and Saxena et al reported that students who were exposed to digital screens for a prolonged time were more likely to develop visual impairment compared to those who were exposed less.[6,7,19,20] This might be related to the fact that eye focusing and coordination requirements can make the eyes work too hard. High visual demands of computer and digital screen viewing make many individuals susceptible to the development of vision-related symptoms. We found that children who play outdoors for more than or equal to two hours have a higher prevalence

of visual impairment (13.6%) compared to those who play outdoors for less than two hours (10.7%). Contrary to this study, Saxena et al, and Vishnuprasad et al observed an inverse association of visual impairment with time spent in outdoor activities.[6,11]

In the current study, we found that as the BMI increases, the proportion of visual impairment decreases. In a cross-sectional study done by Vishnuprasad et al, where BMI was taken as the nutritional status of children, no significant association of visual impairment with underweight children was found.[11]

Our study limitations are a relatively small sample size, as it was done among school-going children only, hence limiting the generalizability of findings. A large section of children in rural India are dropouts and do not attend school. The present investigation does not allow for making assumptions about causal relationships due to the cross-sectional study design. Further large-scale analytical studies may be required to establish strong evidence regarding the determinants of visual impairment.

CONCLUSION

The prevalence of visual impairment in our study population was found to be 11.8 percent. Children who spend more hours reading /writing and on a digital screen (computer, smartphone, laptop, tablet) have a higher prevalence of visual impairment. The study, therefore, highlights the high prevalence of undetected visual impairment in school children and the importance of early detection and treatment to halt the further progression of low vision.

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