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Prevalence Of Refractive Errors In School Going Children In Rural And Urban Areas -A Cross-Sectional Study

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Introduction: Visual impairment affects students' routine schoolwork and day-to-day activities. Hence, the aim is to study the prevalence of various refractive errors and their comparison among school children of 5-15 years in rural and urban areas. **Methods:** This cross-sectional study examined 998 students from both rural and urban schools. After obtaining ethical clearance and informed consent, students were examined for refractive errors. The students with the refractive error were given a socio-demographic questionnaire and questionnaire regarding their usage of television, computer, and family history of refractive errors. A Chi-square test was used to test the statistical significance of proportions. P-value < 0.05 was considered statistically significant, and data were analyzed by using coGuide software, V.1.03 **Results:** The prevalence of refractive error was found to be 6.41 %, with a prevalence of 7.61% in urban and 5.21% in rural areas. The difference in the type of refractive error between the study groups was found to be insignificant, with P= 0.897. **Conclusion:** Prevalence of refractive errors was more in urban school children than rural. Refractive error was more prevalent in 13-15 years age group in both rural and urban school children. The most common refractive error was myopia, followed by astigmatism and hypermetropia.

Keywords: Astigmatism, Blindness, Hypermetropia, Myopia, Refractive errors

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Introduction

Ametropia or refractive error is the term for any refractive condition other than emmetropia or condition in which parallel rays of light fail to converge to a sharp focus on the retina with accommodation at rest. Refractive error includes myopia, hyperopia, and astigmatism.[1] A refractive error is determined by a mismatch between the two factors: refractive power of the cornea and the lens, and axial length of the eye, which usually occurs during childhood when the eyes are growing.[2] It is known that both hereditary and environmental influences cause the development of refractive error, although the exact causes are still being studied.[3]

Visual impairment due to uncorrected refractive errors can lead to short-term and long-term consequences in adults and children, like loss of educational and career opportunities for individuals, families, and societies, and thus result in a poor quality of life. It may also affect a child's interaction and learning in the classroom and harm his or her learning process.[4,5] 25% of the population in developing countries include children of the school-going age group, which fall under the preventable age group for correction of refractive errors.[6] It has been estimated that 19 million children are visually impaired; of these, visual impairment due to refractive errors accounts for 12 million.[7] Blindness and visual impairment in childhood are more important and perhaps more disabling than adult-onset blindness because of the long span of life and their permanent effects on the developing eyes.[6] Children are not aware of the problem and usually do not complain of defective vision. This necessitates early detection and treatment of ocular morbidity and visual impairment to prevent permanent visual defects.[8]

In 1994, the National program for control of blindness initiated a school eye screening program. In 1999, WHO launched a global initiative, Vision 2020-the right to sight to eliminate avoidable blindness like cataracts, xerophthalmia, refractive errors, trachoma, and other causes of childhood blindness by 2020.[9] India accounts for 20% (7.8 million) of the 39 million blind population across the globe, of which 62% are of cataract, 19.7% refractive error, 5.8% glaucoma, and 1% corneal blindness. Population-based studies from India report that refractive errors were the major cause of visual impairment in 61% of eyes in the rural population and 81.7% in the urban population.[10]

Differences in the availability of access to eye care services and even the magnitudes of refractive error between rural and urban students in the Guntur district were not considered much in studies. Hence, the present study aims to study the prevalence of various refractive errors and their comparison among school children of 5-15 years in rural and urban areas.

Objective

The objective of this study is to determine the association between demographic character and refractive errors with rural and urban school children of 5-15 years of age.

Materials and Methods

Study population and Study site: The study population included all the children of the age group 5-15 years, studying in rural and urban schools. The children were examined in the classrooms of the schools.

Inclusion Criteria:

01. All children between 5-15 years of age were included.
02. Patients who gave consent for this study

Exclusion criteria:

01. Children with congenital eye disease/systemic disease.
02. Patients below 5 years and above 15 years of age.
03. Patients with corneal opacities/scars.
04. Any previous history of ocular trauma.
05. Patient who didn't give written consent.

Study design: Cross-sectional study

Sample size: Sample size was calculated assuming the prevalence of uncorrected refractive error in urban as 5.46% and in rural as 2.6%, as per a study by Khandekar et al. [11]. The other parameters considered for sample size calculation include 80% power of the study and 5% alpha error. The following formula was used to calculate the sample size.

$$N=\frac{(\{u\sqrt{[\pi_1(1-\pi_1)+\pi_0(1-\pi_0)]} + v\sqrt{[2\bar{\pi}(1-\bar{\pi})]}\}^2}{(\bar{\Pi}_0-\bar{\pi}_1)^2}$$

$\bar{\Pi}= \pi_0+\pi_1/2$

N	Sample Size per group
п1, п0	Proportion (5.46% and 2.63%)
u	one-sided percentage point of the normal distribution corresponding to 100 % – the power (for 80% power)
v	Percentage point of the normal distribution corresponding to the (one-sided) significance level (For a significance level of 5%, v = 1.96)

As per the above-mentioned calculation, the required sample size was 462 subjects in each group. To account for a loss to follow up of about 8%, another 37 subjects were included in each group. Hence, the final sample size was 499 subjects in each group.

Sampling method: Fifty-seven mandals in a district was divided into 4 divisions. From these eight schools from 4 divisions, one village and one municipality were selected randomly. Lists of Standard 1 to Standard 10 students from each selected school were obtained two weeks before the examination day. Four hundred ninety-nine students from rural and urban schools each were recruited from the list by random selection using a simple table of randomization. Both processes of random selection were performed by an independent observer. Questionnaires were distributed to parents or guardians to obtain information.

Study duration: Six months from July 2019 to December 2019

Ethical considerations: The study was approved by the institutional review board and the ethics committee of the hospital

Data collection tools and clinical examination

Demographic and Risk Factors: A questionnaire was given to the parents of the students who were having a refractive error. The questionnaire sought information on details such as the child's demographic data, duration of watching TV in a day, duration of using a computer, playing video games, and family history of refractive error.

A pilot study was performed to assess the inter-examiner reliability of two optometrists, which was found to be high (0.923). These two optometrists conducted all the examinations in schools and referred students to the hospital.

Refractive Error Examinations: The examination conducted involved three main steps:

The first step was examination of visual acuity using the Snellen chart.

All the children with vision less than 6/6 were subjected to autorefractrometry using a portable autorefractometer, and all of them were given a full correction.

Those children whose vision was not improving with refraction were referred to the ophthalmology outpatient department at NRI Medical College and General Hospital, Chinakakani. For those who were referred to OPD, the complete ophthalmic examination was done with a slit lamp to rule out any anterior segment abnormalities.

After slit-lamp examination, children were subjected to cycloplegic refraction using 0.5% cyclopentolate eyedrops, and streak retinoscopy was done. Fundus examination was done with slit-lamp biomicroscopy. Children were asked to come after two days for a post mydriatic test, and spectacles were prescribed. Types of refractive errors were identified and recorded for analysis.

Statistical methods: Type of refractive error, amblyopia, and best-corrected visual activity was considered as primary outcome variables. Study groups (urban v/s rural) were considered as primary explanatory variables.

The association between explanatory variables and categorical outcomes was assessed by cross tabulation and comparison of percentages. Chi square test was used to test statistical significance. Data was also represented using appropriate diagrams like staked bar diagrams.

P value < 0.05 was considered statistically significant. Data was analyzed by using coGuide software, V.1.03. [12]

Results

The prevalence of refractive error was found to be 6.41 %, with a prevalence of 7.61% in urban and 5.21% in rural areas.

The difference in the proportion of different age groups between the study groups was found to be insignificant, with a p value of 0.519. In urban areas, most of the participants, 18(47.37%), were aged between 13 to 15years, whereas in rural areas, it was 16 (61.54%). The difference in the proportion of males and females between the study groups was found to be insignificant with p value of 0.100, with the majority of the male participants, 20(52.63%) from the urban area and 19(73.08%) from the rural area. (Table 1)

Table :1 comparison of demographic parameter between urban and rural people (N=64)

Parameter	Study group		P value
	Urban(N=38)	Rural(N=26)	
Age group (in years)			
5 to 8	7(18.42%)	4(15.38%)	0.519
9 to 12	13(34.21%)	6(23.08%)	
13 to 15	18(47.37%)	16(61.54%)	
Gender			
Male	20(52.63%)	19(73.08%)	0.100
Female	18(47.37%)	7(26.92%)	

The difference in the type of refractive error between the study groups was found to be insignificant, with p value of 0.897. In the urban area, the majority of the participants, 28 (73.68%), reported myopia, followed by astigmatism 8(21.05%), whereas in rural areas, the proportion of myopia and astigmatism was 18(69.23%) and 6(23.07%) respectively. The difference in amblyopia between the study groups was found to be insignificant with p value of 0.225; 6 (15.79%) participants with amblyopia were from the urban area. The difference in best-corrected visual activity (<6/6) between the study groups was found to be insignificant with p value of 0.945, with the majority of the participants, 12(31.57%), from urban areas. (Table 2)

Table 2: Comparison of outcome parameters between urban and rural people (N=64)

Parameter	Study group		P value
	Urban(N=38)	Rural(N=26)	
Type of refractive error			
Myopia	28(73.68%)	18(69.23%)	0.897
Hypermetropia	2(5.26%)	2(7.69%)	
Astigmatism	8(21.05%)	6(23.07%)	
Amblyopia	6(15.79%)	1(3.84%)	0.225
Best corrected visual activity (<6/6)	12(31.57%)	8(30.76%)	0.945

The difference in the proportion of urban and rural areas between various factors like watching TV, duration of watching TV, a distance of watching TV, duration of using computer and playing video games was not statistically significant (p value > 0.05). The difference in the proportion of urban and rural areas between various factors like duration of using computer and family history of refractive error was statistically significant (p value <0.05). (Table 3)

Table 3: Comparison of various factors between urban and rural people (N=64)

Parameter	Study group		P value
	Urban(N=38)	Rural(N=26)	
Watching television	27 (71.05%)	13 (50%)	0.088
Duration of tv watching in a day			
Upto 2hrs	10 (37.04%)	4 (30.77%)	1.000
>2hrs	17 (62.96%)	9 (69.23%)	
Distance of watching tv			
Near(≤1meter)	8 (29.63%)	2 (15.38%)	0.451
Far(>1meter)	19 (70.37%)	11 (84.62%)	
Using computer	32 (84.21%)	22 (84.62%)	1.000
Duration of using computer			
Upto 2hrs	24 (75%)	9 (40.91%)	0.012
>2hrs	8 (25%)	13 (59.09%)	
Playing video games	27 (71.05%)	15 (57.69%)	0.269
Family history of refractive error	25 (65.79%)	9 (34.62%)	0.014

Discussion

Out of 998 subjects, 64 participants had refractive errors (38 urban and 26 rural). The prevalence of refractive error was found to be 6.41 % (7.61% in urban and 5.21% in rural). The majority of the participants had myopia (73.68% urban and 69.23% rural) followed by astigmatism. Most of them were under the age group 13 to 15 years followed by 9 to 12 years, and were mainly males. The difference in the proportion of urban and rural areas between various factors like duration of using computer and family history of refractive errors were statistically significant.

Khandekar et al. reported a prevalence of refractory error of 5.46% in the urban area and 2.63% in a rural area, Pune.[11] Our present study also showed a similar pattern, but a slightly higher prevalence was noted. The majority of the participants were in the age group 13 to 15 years, 47.37% in the urban area and 61.54% in the rural area, followed by the age group 9-12 years, in this study. Similarly, many studies reported an increase in the prevalence of refractive error with increasing age.[13,14,15] In contrast, Khandekar et al. reported that refractory error was more in the age group 9-12 years, followed by 6-8 years.[11] In the present study, refractive errors were seen more in males, 52.63% from the urban area and 73.08% from the rural area. In a study by Khandekar et al., boys had the higher uncorrected refractive error, although gender was not significantly associated with uncorrected refractive error in urban and rural children.[11] In contrast, studies by Vidusha KSS et al. [15] Prema N et al. [16], and Yadav et al. [17] reported female preponderance for refractive errors in their study.

The main type of uncorrected refractive error was myopia in this study, which was significantly higher in urban children compared to rural children (73.68% in the urban area and 69.23% in the rural area). Studies by Dandona et al. [18] and Khandekar et al. [11] found the prevalence of myopia to be 5%, 2.5%, 3.16%, 1.45% in urban and rural regions, respectively. Many studies reported myopia as the most common pathology among refractive errors. [15],[19] Dandona et al. [18] in Andhra Pradesh eye diseases study also noted that urban location was a predictor of myopia, and children of the urban area had 2.5 times higher risk compared to rural children. Increased prevalence of myopia in an urban population may be due to increased literacy rate, educational demands, and differences in lifestyle, for example, reading, watching TV, and computer visual display units.[20]

The prevalence of refractive error was significantly associated with the duration of using the computer in this study. Kumar P et al. and Sharma S et al. reported that refractive error was more common in the students who have a history of watching TV/or computer for more than 3 hours.[21.22] Rathod HK et al. [13] also reported that defective eye problem was more in that students who had a history of watching TV. The presence of refractive error was significantly associated with a positive family history, as seen in other studies.[23,24,25]

Periodic eye check-ups are essential for school children and should be included in the school health screening programs, as early detection helps in the prevention of complete blindness and ocular infections. Parents and teachers should be educated about the importance of eye care and taught not to ignore any complaint of the child.[20]

Limitation

The data was collected through a self-reported questionnaire to the parents; hence, there is a potential of recall bias. The questionnaire on risk factors was given only to the students who were having refractive errors. The sample was restricted to a narrow age group, even though refractive errors are common in 5 to 15 years of age.

Conclusion

The prevalence of refractive errors was more in urban school children than in rural. Refractive error was more prevalent in the 13-15 years age group, in both rural and urban school children. The common refractive error was found to be myopia, followed by astigmatism and hyperopia. Periodic screening in school and pre-school should be carried out to identify the refractive errors at an earlier stage. Besides, school-going children and their parents should be educated about signs and symptoms of refractive errors.

Contribution by authors

Author Chimata Triveni, Tirumuru Divya had conceptualized the study, prepared the study protocol, conducted the data collection, analysis and manuscript writing. Chimata Triveni has verified all the drafts and approved the final draft., Ponna Rama Devi, N. Lakshmi Chowdary, Gantela Sirisha had provided key inputs on methodology during protocol preparation, supported data compilation and analysis and also edited all the drafts and approved the final draft of the manuscript.

What does the study add to existing knowledge

There is a dearth of data on refractive errors between rural and urban students in the Guntur district of Andhra Pradesh.

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