Spectrum of visual impairment among urban female school students of Surat

Mausumi Basu, Palash Das[1], Ranabir Pal[2], Sumit Kar[2], Vikas K Desai[3], Abhay Kavishwar[3]

Aim: Eye morbidities with or without symptoms delineate a significant morbidity among adolescent schoolgirls in India. The study was undertaken to assess the extent of visual impairment and ocular morbidity to identify influencing factors and the impact on scholastic performance. **Materials and Methods**: A population-based cross-sectional study was undertaken among 3002 urban girl students of Surat in Gujarat, India. Overall prevalence of refractive error was found to be 15.22%; myopia affected 91.47%, hyperopia 4.60%, and astigmatism 0.04%. The prevalence of myopia and astigmatism was more in higher age groups, while hyperopia was more in lower age groups; even students with good vision reported ophthalmic symptoms. Of all spectacle users, in 29.73% cases the eyesight was not found to be with the best possible corrections. Refractive error was observed to be higher among the general caste (50.98%) and among Muslims (54.05%). Still, among those with problems of eyesight, 75.93% students had good academic performance. Associated ocular morbidity was noted in 20.35% participants along with the refractive error. **Conclusion**: This study highlighted the load of eye morbidities of adolescent Indian urban girls.

Key words: Refractive errors, Schoolgirls, visual impairments

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The World Health Organization (WHO 2002) estimated that globally 161 million people were visually impaired from eye diseases such as cataract, glaucoma and macular degeneration; an additional 153 million people were visually impaired because of uncorrected refractive errors.[1] Refractive errors are common in children and are the commonest cause of visual impairment around the world and the second leading cause of treatable blindness.[2,3] Poor vision in childhood affects performance in school or at work and has a negative influence on the future life of the child. Integration of vision screening and refractive services for school students within screening for other health issues is recommended by the WHO.[4-6] The control of blindness in children is one of the priority areas of the WHO's "Vision 2020— the right to sight" program.[7] The magnitude and causes of uncorrected refractive error seem to differ in the urban and rural areas of India. Hence refractive services should be adapted to the situation in the various areas of developing countries.[8] In India, several quantitative studies carried out on the health status of school-age children indicated that emphasis was needed on diseases of eye, the prevalence of which was around (4.0-8.0%).[9,10] The school-age children and adolescents have to be considered a priority area as severe visual loss in children can affect their development, mobility, education, and employment opportunities that have far-reaching implications on their quality of life and their affected families.[11] In a nationwide survey, nearly half of the ocular morbidities (49.9%) were due to refractive error. Among different problems of adolescent schoolgirls, eye problem forms a significant burden.[12]

The aim of the study, conducted among the schoolgirls of Surat city, was to assess the magnitude of ocular morbidity, influencing factors and the impact on scholastic performance of schoolgirls.

Materials and Methods

We conducted a population-based cross-sectional study from August 2006 to July 2007 in four urban schools of Surat, Gujarat. From the WHO publication, we calculated the cumulative prevalence of refractive error in Indian school children between 7 to 15 years of age to be 5.84%.[1] Moreover, according to Padhye *et al.*, the prevalence of uncorrected refractive error in urban school children was 5%.[8] Using these two data, the sample size was calculated as 3103. The participants were adolescent school-going girl students in the age group of 7 to 15 years selected by multistage random sampling from four urban schools; those schools were selected randomly from among all schools in urban Surat. The students present on the day of the visit were included in the study. The non-response rate (including absent, or refused to be examined) was found to be 3.25% resulting in analysis of 3002. The main outcome measures were the eye morbidities prevalent among the adolescent school-going girl students. The data collection tool used for the study was an interview schedule that was developed at the Institute with assistance from the faculty members and other experts. This pretested questionnaire contained questions relating to the socio-demographic information on family characteristics like religion, caste, and personal characteristics like age at onset and self-reported academic performance. The pilot study was carried out at the outpatients' department of

Department of Community Medicine, Institute of Post Graduate Medical Education and Research, W.B., [1]Department of Community Medicine, Midnapore Medical College, W.B., [2]Department of Community Medicine, Sikkim Manipal Institute of Medical Sciences and Central Referral Hospital, 5th Mile, Tadong, Gangtok, Sikkim-737 102, [3]Department of Community Medicine, Government Medical College, Surat, Gujarat, India

Correspondence to: Prof. (Dr.) Ranabir Pal, Department of Community Medicine, Sikkim Manipal Institute of Medical Sciences and Central Referral Hospital, 5th Mile, Tadong, Gangtok, Sikkim-737 102, India. E-mail: ranabirmon@yahoo.co.in

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the institute among comparable subjects following which some of the questions from the interview schedule were modified. The study conformed to the Helsinki declaration. The study was approved by the Institutional Ethics Committee (IEC/IRB). All concerned Principals, teachers, members of parents' associations and students were briefed about the study. Official permission to conduct the study in these four schools was taken from the heads of these schools well ahead of data collection. They were ensured strict confidentiality, and then informed consent was taken from each of the participants before the total procedure. The participants were given the option to not participate in the study. Data regarding family and personal characteristics were recorded by personal interview by the principal investigator. It was followed by a battery of ophthalmic check-up using standard techniques that comprised retinoscopy, slit-lamp examination and ophthalmoscopy to detect ophthalmic conditions including myopia/hyperopia using spherical equivalents. Children with uncorrected visual acuity of 20/40 or worse in either eye underwent refraction under cycloplegia. One competent specialist from the ophthalmology department of the New Civil Hospital, Surat diagnosed ophthalmic morbidity. The information on ophthalmic morbidities was disseminated through health education sessions. Students found with eye morbidities were referred to the hospital and followed up for further interventions.

We followed standard case definitions as per the WHO:[1]

- Myopia (nearsightedness): difficulty in seeing distant objects clearly;
- Hyperopia (farsightedness): difficulty in seeing close objects clearly;
- Astigmatism: distorted vision resulting from an irregularly curved cornea, the clear covering of the eyeball;
- Good eyesight=20/70 or better;
- General caste= did not declare themselves as Scheduled Caste, Scheduled tribe or Other backward community;
- Good academic performance= as reported by their class teachers;
- Refractive error=myopia, hyperopia or astigmatism.

The collected data was thoroughly cleaned and entered into Excel spreadsheets and analysis was carried out. SPSS 11.0 for Windows was used to calculate proportions, and the Chi-square test was used in this study.

Results

Out of 3002 children, 457 (15.22 %) had defective vision. Myopia affected 418 (91.47%) students while hyperopia was observed in 21 (4.60%) students; astigmatism was present in 18 (0.04%). The prevalence of myopia in the total number of participants was 13.93%. The prevalence of myopia and astigmatism was more in higher age groups, while hyperopia was more in lower age groups; even students with good vision reported ophthalmic symptoms. There was significant statistical association between type of refractive error and age of the participants [Table 1].

"Good" eyesight was noted in 2545 (79.9%), though students even with good vision had reported ophthalmic symptoms. Difficulty in seeing blackboard was the commonest visual complaint by 8.53% with poor vision as compared to 1.10% with good vision. Difficulty in reading books was complained by 58.42% with poor vision as compared to 0.31% with "good" eyesight. Watering of eyes was more common in students with poor vision (17.29%) than in those having good vision (6.83%) [Table 2].

Among 433 spectacles users, 407 girls could correctly report age at onset of refractive error. Of all spectacle users, in 29.73%, the correction was not adequately done and the resultant eyesight was not found to be with the best possible corrections. The commonest age of onset of refractive error was 10-14 years (79.61%) [Table 3].

Refractive error was observed to be higher among Muslims (54.05%) compared to other religions. The prevalence of refractive error was more among participants from the general caste (50.98%) followed by scheduled caste (26.48%). Among those with eyesight problems, 75.93% students were having good academic performance. Significant statistical differences existed between those with problems of eyesight and those without eyesight problems, in terms of religion (Chi square =49.98, d.f. =3 P <0.001), caste (Chi square =89.36, d.f. =3, P <0.001) and self-reported academic performance (Chi square =114.27, d.f. =1, P <0.001) [Table 4].

Associated ocular morbidity was noted in 93 (20.35%) cases with refractive error. Conjunctivitis was noted in 31.18% of cases followed by blepharitis which was seen in 20.43% of cases. Around 11.83% cases had conjunctival xerosis while the presence of other co-morbid eye conditions was minimal [Table 5].

Discussion

Our study showed the prevalence of refractive error as 15.22%. Myopia was noted in 91.47% and hyperopia in 4.60%; 0.04 percent had astigmatism. Even students with good vision reported ophthalmic symptoms. Significant statistical differences exist between those with eyesight problems and those without eyesight problems, in terms of religion, caste

Table 1: Distribution of refractive error with age

Refractive error	Age group (years)			Total n (%)	Statistical analysis	
	7 – 10 n= 339 No (%)	10-13 n= 335 No (%)	13 – 15 n= 2328 No (%)		λ^2	P value
Myopia	24(5.74)	43(10.29%)	351(83.97)	418(91.47)	16.165	<0.001
Hyperopia	10(47.62)	7(33.33)	4(19.05)	21(4.60)	43.36	<0. 001
Astigmatism	2(11.11)	6(37.50)	10(55.56)	18(0.04)	9.10	0.0105
Total	36	56	365	457		

Of 3002, 457(15.22%) had refractive error

and self-reported academic performance. Associated ocular morbidity was noted in 20.35% cases with refractive error.

A south Indian study among children aged 15 years or younger for visual acuity measurements using Cambridge crowded cards noted that 6.2 of 10000 children were blind. The majority (42.9%) of this blindness was potentially avoidable. Refractive errors and strabismus were the major ocular morbidity in this population.[13] The Tirupati study reported defective vision to be 4.7% in school-going girls.[14] In a study from schools in Ladakh among children aged 15 years or younger, the reported prevalence of refractive error was 5.69% and myopia 4.1% in at least one eye, considering the baseline presenting visual acuity of 20/40 or worse.[15] A study on urban school children 5 to 15 years of age revealed that the prevalence of uncorrected, baseline (presenting), and best-corrected visual acuity of 20/40 or worse in the better eye was 6.4%, 4.9%, and 0.81%, respectively. Refractive error was the cause in 81.7% of eyes with vision impairment, amblyopia in 4.4%, retinal disorders in 4.7%, other causes in 3.3%, and unexplained causes in the remaining 5.9%. There was an age-related shift in refractive error from hyperopia in young children (15.6% in five-year-olds) toward myopia in older children (10.8% in 15-year-olds). Overall, hyperopia was present in 7.7% of children and myopia in 7.4%. Hyperopia was associated with female gender. Myopia was more common in children of fathers with higher levels of education.[16]

Table 2: Ophthalmic symptoms reported by students

Eye symptoms* as perceived by students	Vision not good (n=457) No. (%)	Vision good (n=2545) No. (%)	Total (n=3002) No. (%)
Difficulty in seeing blackboard	39(8.53)	28(1.10)	67(2.23)
Difficulty in reading books	267(58.42)	08(0.31)	275(9.16)
Discharge from eyes	10(2.19)	31(1.22)	41(1.37)
Eye pain	12(2.63)	54(2.12)	66(2.20)
Itching of eyes	11(2.41)	40(1.57)	51(1.70)
Redness of eyes	07(1.53)	39(1.53)	46(1.53)
Stickiness of eyes	06(1.31)	24(0.94)	30(1.0)
Watering from eyes	79(17.29)	126(4.95)	205(6.83)

*Multiple responses noted

Table 3: Self-reported age of onset of defective eyesight among spectacle users

Age at onset (years)	Eyesight not good (n=121)		Eyesight good* (n=286)		Total (n=407)	
	No	%	No	%	No	%
0-4	01	0.83	01	0.35	02	0.49
5-9	24	19.83	57	19.93	81	19.90
10-14	96	79.34	228	79.72	324	79.61

Out of 407, 121 (29.73%) spectacle users were not adequately corrected

In another study the baseline visual acuity of 20/40 or worse in the better eye in rural school children of Andhra Pradesh in India was 2.6%.[17] Kathmandu valley researchers reported that among the students aged 5 to 16 years, 34.2% had some form of ocular disorders.[18] A study to assess the prevalence of refractive error and common ocular diseases in urban school-aged children in Hyderabad observed that the prevalence of uncorrected and best-corrected visual impairment (< or = 20/40 in the better eye) was 9.8%, which dropped to 7.1% with presenting vision and further reduced to 1.1% with best-corrected visual acuity [19] A study from Pokhara, Nepal reported that 6.43% of school children aged 10 to 19 years had refractive errors. Myopia was found to be most common (4.05%). More boys (7.59%) were found to have suffered from refractive errors than girls (5.31%).[20] A study from Cleveland Clinic Cole Eye Institute reported that 7% of children had errors of refraction that necessitated optical correction, about 2.1% had strabismus, and 1.7% had amblyopia. About 10% of five- and six-year-old schoolchildren have eye problems that require either glasses or treatment for strabismus or amblyopia.[21]

A study of primary school children between 6 and 14

Table 4: Distribution of refractive error with socio-demographic variables

Socio-demographic variables	Refractive error			
	Present (n=457) No. (%)	Absent (n=2545) No. (%)	Total (n=3002) No. (%)	Statistical analysis
Religion				
Hindu	193(42.23)	1311(51.51)	1504(50.10)	λ^2 =49.98 d.f.=3 *P* <0.001
Muslim	247(54.05)	1220(47.94)	1467(48.87)	
Christian	15(3.28)	10(0.39)	25(0.83)	
Parsi	02(0.44)	04(0.16)	06(0.20)	
Caste				
General	233(50.98)	1713(67.31)	1946(64.82)	λ^2=89.36 d.f.=3 *P* <0.001
Scheduled Caste	121(26.48)	617(24.24)	738(24.58)	
Scheduled Tribe	72(15.75)	152(5.97)	224(7.46)	
Other Backward Caste	31(6.78)	63(2.48)	94(3.13)	
Self-reported academic performance				
Passed	347(75.93)	2350(92.34)	2697(89.84)	λ^2 =114.27 d.f.=1, *P* <0.001
Failed	110(24.07)	195(7.66)	305(10.16)	

Table 5: Associated Ocular morbidity among students (n=93)

Ocular morbidity*	Only right eye	Only left eye	Both eyes	Total N	%
Inflammatory diseases					
Conjunctivitis	05	07	17	29	31.18
Blepharitis	02	04	13	19	20.43
Chalazion	02	01	02	05	5.38
Stye	02	05	01	08	8.60
Trachoma	00	00	06	06	6.45
Nutritional disorders					
Bitot's spot	01	01	05	07	7.53
Dry conjunctiva	02	00	09	11	11.83
Miscellaneous					
Ocular trauma	05	01	00	06	6.45
One eye blindness	04	01	00	05	5.38
Squint	00	01	03	04	4.30

*Multiple responses noted, Associated ocular morbidity was noted in 20.35% (93 out of 457) cases with refractive error.

years of age in the rural Tibetan area of Maqin County, China, reports that 18.36% had ocular morbidity. Refractive errors were found in 11.07%, strabismus in 2.49%, corneal leukoma in 1.20%, amblyopia in 1.02%, and vernal conjunctivitis in 0.65%. Monocular blindness was seen in 1.48%.[22] Among the school children aged 5 to 10 years in Kolkata a study showed that 25.11% had refractive errors, myopia being the commonest (14.02%); astigmatism affected 3.93%. The prevalence of refractive errors increased with age with no difference of refractive errors between boys and girls.[23] A study of school children 7 to 15 years of age showed that the prevalence of uncorrected (unaided), presenting, and best-corrected visual impairment (visual acuity < or =20/40 in the better eye) was 17.1%, 10.1%, and 1.4%, respectively. In eyes with reduced vision, refractive error was the cause in 87.0%, amblyopia in 2.0%, other causes in 0.6%, and unexplained causes in 10.4%. Myopia was present in 9.8% of children seven years of age, increasing to 34.4% in 15-year-olds; and hyperopia in 10.0% and 32.5%, respectively". Myopia was associated with older age, female gender.[24] A study from the Darjeeling district of West Bengal noted a prevalence of abnormal Visual Acuity (VA) (< 20/30 in any eye) of 3.65% and it was highest in the seven to eight years age group in both the sexes contributing to 75% of the total students having abnormal VA. Prevalence of Vitamin A deficiency was 8.16%. Prevalence of Bitot's spot was 3.63%; females outnumbered the males.[25] School children 5-15 years of age, screened for eye morbidity, revealed that trachoma (18%) was the most common ocular morbidity followed by vitamin A deficiency (10.6%), refractive error (7.4%) and apparent / latent squint (7.4%).[26]

The study of Refractive error in Children revealed that" the children in urban areas of Delhi (5-15 years) and rural site of Andhra Pradesh (7-15 years) had an overall prevalence of functional low vision of 2.35 and 2.75 in 1000 respectively.[27]

This study explored a morbidity where most of the children with uncorrected refractive error are asymptomatic and hence we suggest that screening helps in early detection and timely interventions. The present study had several limitations. First, the data was based on findings from urban high schools of one city and drawn from one limited geographic area within Surat due to economic and other constraints (manpower, time); the results may not be generalized. Second, because of the cross-sectional design, this study had limited external validity. The study may not be generalized to judge the variation among urban and rural schools in India; still it shows some trends and patterns of refractive error and ocular morbidity among female adolescent high school students in this part of the world. Lastly, in the absence of a uniform format in the country for assessing ocular morbidity in school-age children, comparable data were limited. This study highlighted the load of eye morbidities of adolescent Indian urban girls.

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