

Prevalence and pattern of refractive errors among school-going children in district Baramulla, Kashmir: A cross sectional study

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Purpose: Uncorrected refractive error is one of the most important causes of visual impairment worldwide. Addressing childhood vision impairment (VI) is one of the main goals of the World Health Organization (WHO) to combat blindness strategies. **Objective:** To ascertain the prevalence and pattern of refractive errors among children aged 10 to 16 years in Baramulla district, Kashmir. **Methods:** A cross-sectional study was carried out among 680 school children during an eye camp under the school health program of the national program for control of blindness. The screening was conducted in four schools in Baramulla district, Kashmir. The schools were selected using the non-probability convenient sampling technique. **Results:** A total of 680 school children from classes sixth to tenth aged 10–16 years participated in the study. Out of 680 students, 545 (80%) had normal vision, 97 (14%) had impaired visual acuity ranging between 6/9 and 6/24, and 38 (6%) had severe VI ranging from 6/36 to 6/60. Among the various types of refractive errors, myopia was the most prevalent affecting 54 children. Age distribution of refractive errors showed myopia to be more prevalent in the age group 13–14 years (16, 14 cases), hypermetropia was more prevalent in the age group 14–15 years (10, 8 cases), and astigmatism 5 cases in the age group 14–15 years. **Conclusion:** The study provides useful and baseline data about the refractive error amongst the school children of the Baramulla district. A larger study needs to be conducted in all schools of the state to get a clear picture of RE and other eye-related problems to detect vision problems earlier.

Key words: Astigmatism, hypermetropia, myopia, refractive error

Refractive error is a problem with focusing light accurately on the retina due to the shape of the eye. An impairment of vision is defined as a patient having the best-corrected visual acuity of less than 6/18 in the better eye. Blindness is defined by the World Health Organization (WHO) as visual acuity less than 3/60 with the best possible correction in the better eye on Snellen visual acuity chart.^[1] Defective vision and childhood blindness may affect undesirably the lifestyle of a particular child for the rest of his social and educational life. Uncorrected refractive errors are the leading causes of moderate to severe visual impairment (VI) worldwide and the second most common cause of avoidable blindness.^[2,3] Childhood blindness is one of the priorities in Vision 2020: the right to sight.^[4] It is estimated that there are 1.4 million blind children in the world, two-thirds of whom live in developing countries, and of all the blind children, it is estimated that 2,70,000 live in India.^[5] Childhood myopia takes the lead in some countries of Southeast Asia with the prevalence reaching 80% among adolescents, whereas hyperopia in children may be most prevalent in the Americas.^[6,7] At present, myopia, in particular childhood myopia, is a major public health issue, which in recent years has grown into an epidemic.^[8-10] Refractive errors are considered an important public health problem affecting people all over the world. These errors are classified into three types: myopia, hypermetropia, and astigmatism.^[11] In myopia (short-sightedness) parallel rays of light coming from

infinity are focused in front of the retina when accommodation is at rest, in hypermetropia (long-sightedness) in which parallel rays of light coming from infinity are focused behind the retina with the accommodation being at rest and astigmatism, wherein the refraction varies in different meridians. Consequently, the rays of light entering the eye cannot converge to a point focus but form focal lines.^[12]

About 13% of the Indian population is in the age group of 7–15 years, and about 20% of children develop refractive errors by the age of 16 years.^[13]

According to the WHO regions, the estimated pool prevalence (EPP) of hyperopia is 4.6% (95% confidence interval [CI]: 3.9e5.2) in children. The lowest and highest EPP was observed in South-East Asia (2.2%, 95% CI: 1.2e3.3) and the Americas (14.3%, 95% CI: 13.4e15.2). The EPP of hyperopia was 30.6% (95% CI: 26.1e35.2) in adults. Based on the results of the meta-analysis, Africa had the highest EPP of hyperopia (38.6%, 95% CI: 22.4 e54.8), followed by the Americas (37.2%, 95% CI: 25.3e49), whereas Europe had the lowest EPP (23.1%, 95% CI: 6.1e40.2).^[14]

Modern technology is changing the lifestyle; hence, children are spending a lot of time in front of television (TV)

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or computers. This leads to problems in their vision. If the problems are unnoticed, they will suffer in the future from VI and they may even lose their vision completely.^[15] Visual impairment due to uncorrected refractive errors can lead to short-term and long-term consequences in adults and children such as loss of educational and career opportunities for individuals, families, and societies, and therefore, 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.^[16,17] 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 VI to prevent permanent visual defects.^[18]

Methods

Study design

Cross-sectional study.

Study population and study site

A total of 680 children were screened for refractive errors. The study population included children in the age group 10–16 years, studying in two rural and two urban schools of the Baramulla district, which were chosen using the convenience sampling technique during an eye camp organized by the Department of Ophthalmology, Government Medical College (GMC) Baramulla. Permission was sought from the principals of the respective schools. All children between 10 and 16 years of age were included.

Inclusion criteria

- Participants who gave assent for this study.

Exclusion criteria

- Participants below 5 years and above 16 years of age.
- Participants with corneal opacities, congenital eye disease/systemic disease.

Table 1: Distribution of study subjects based on the percentage of school children with refractive errors

	Frequency	Percentage (%)
Normal vision	545	80
Reduced vision with visual impairment	135	20
Total	680	100

Procedure

An eye team including ophthalmologists, optometrists, and community medicine doctors, visited the respective schools. The visual acuity was tested using Snellen's chart, which was placed at 6 m. All children with vision less than 6/6 were referred to the outpatient department of ophthalmology, Baramulla, where they were subjected to autorefractometry, and all of them were given spectacle correction. For those children whose vision was not improving, a complete ophthalmic examination was performed 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 eye drops, and dilated retinoscopy was performed. Fundus examination was conducted with slit-lamp biomicroscopy using a 90 D lens. Children were asked to come after 2 days for a post-mydratic test, and spectacles were prescribed. Types of refractive errors were identified and recorded for analysis.

Statistical analysis

The data were entered in an Excel sheet and analyzed using the Statistical Package for the Social Sciences version 23. The data are expressed as proportions (*n*, %).

Results

A total of 680 school children from the grades sixth to tenth of two rural and two urban schools of Baramulla district participated in the study. The majority of the study subjects were boys (56%) with 79% in the age group of 12–15 years. About 20% of students had reduced vision due to VI and the rest had normal vision [Table 1]. The sex distribution of study participants showed that females were equally affected as males [Table 2]. Visual acuity when repeated using a pinhole correction depicted 41 students had normal visual acuity, 70 students had visual acuity in the range of 6/9–6/24, and the remaining 24 students had visual acuity of 6/36–6/60 [Table 3]. Myopia was most prevalent, affecting 57.4% (*n* = 54), followed by 36.1% of hypermetropia (*n* = 35) and the remaining 5.3% of astigmatism (*n* = 5) [Table 4]. Age distribution of refractive errors showed myopia to be more prevalent in the age group 13–14 years, hypermetropia in the age group 14–15 years, and astigmatism in the age group 14–15 years [Table 5].

Discussion

In India and other developing countries, the school health services provided are hardly effective because of a shortage of resources and insufficient facilities. Prevalence of myopia

Table 2: Sex-wise distribution of study subjects according to visual acuity in both eyes

Visual acuity	Males (381)				Females (299)			
	Right eye		Left eye		Right eye		Left eye	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
6/6	306	80	306	80	239	80	239	80
6/9	15	4	15	4	15	4	15	4
6/12	11	3	15	4	9	3	10	4
6/18	15	4	11	3	12	4	9	3
6/24	11	3	13	3	9	3	9	3
6/36	15	4	15	4	10	4	10	4
6/60	8	2	8	2	5	2	5	2

was highest among all refractive errors being (57.4%) with comparison of refractive errors in different parts of the country [Table 6]. The refractive services provided as a part of the school health program in the schools included in this study were poor. In present study, the highest prevalence was for myopia (57.4%), which in comparison to other studies conducted in different parts of the world showed prevalence of myopia as (31.9 %) in East Sikkim 24, 61 % in Bengaluru 25, 35.7% in Bihar 26 where as Jammu showed the highest prevalence for astigmatism (64.8%) 27.

The study was carried out to find the pattern of refractive errors among school children. In this study, 680 schoolchildren were included and the majority of the study subjects were boys (56%) followed by girls (44%). Among both genders, the majority of the students (79%) belonged to the

Table 3: Visual acuity of right and left eyes with pinhole correction

Visual acuity	Right eye	Left eye
6/6	41	41
6/9	20	20
6/12	23	23
6/18	15	14
6/24	12	13
6/36	15	15
6/60	9	9

Table 4: Type of refractive error in relation to the sex among school children

Sex	Myopia	Hypermetropia	Astigmatism
Male	34	22	3
Female	20	13	2
Total	54	35	5

Table 5: Type of refractive error in relation to the age among school children

Age	Myopia	Hypermetropia	Astigmatism
10	1	2	0
11	2	1	0
12	6	5	0
13	14	5	0
14	16	10	3
15	9	8	2
16	6	4	0
Total	54	35	5

Table 6: Comparison of prevalence of refractive errors of current study with others studies of country

Type of refractive error	Kashmir (district Baramulla) n=680	North India (East Sikkim) ^[24] n=1077	South India (Bengaluru) ^[25] n=97	Northeastern India (Bihar) ^[26] n=980	North India (Jammu) ^[27] n=75
Myopia	57.4%	31.9%	61%	35.7%	36.9%
Hypermetropia	36.1%	2.6%	14%	3.15%	3%
Astigmatism	5.3%	29.4%	22%	30.6%	54.8%

age group 12 to 15 years. In a study conducted by Shrestha *et al.*,^[19] 52.8% were males and 47.2% were females. In our study, because many children were from rural areas, these children might not get a balanced diet and this may contribute to poor vision. A study done in South Africa showed that poor protein, fruit, and vegetable intake led to poor visual acuity in the subjects.^[20]

In the present study, out of 680 students examined, uncorrected refractive errors were found in 135 (20%) students. The reasons for this might be genetic inheritance, unhygienic living conditions, malnourishment, and the alluring media influence such as television and computer games, which is in favor with other studies performed by Mutti,^[21] stating that the risk of inheriting impaired visual acuity increases if parents had similar problems.

In the present study, 80% of the school-age children had normal visual acuity (6/6), 14% of them had impaired visual acuity ranging between (6/9–6/24), and 6% of them had severe visual impairment (6/24–3/60). Similarly, in a study conducted by Darge *et al.*,^[22] the findings showed that 22 (5.8%) participants were visually impaired (VA $\leq$ 6/12 in either eye) and 356 (94.2%) of them were normal (VA and gt; 6/12 in the worse eye).

We observed 545 children had normal vision, 41 students went through pinhole correction, 54 children had myopia (34 males and 20 females), 35 had hypermetropia (22 males and 13 females), 5 had astigmatism (3 males and 2 females) which was in favor with the study conducted in Manipal that showed that myopia was the most common refractive error, with 27.1% and 1.3% of them having myopia and hypermetropia, respectively.^[23] The prevalence of myopia was high among all refractive errors and the reason for this might be an increase in screen time among students, the use of which has increased more during COVID-19 due to online classes.

Conclusion

This study concludes that refractive error was a major cause of VI among school children. So, screening of school children for visual acuity and ocular problems should be performed at regular intervals, and it should be one of the main components of school health programs. For this, school teachers should be trained in identifying common eye problems so that these children can be referred for prompt treatment. They should also impart awareness of ocular hygiene among school children. Referral services have to be strengthened after a preliminary examination of visual acuity.

Limitation

This was a school-based study, non-school-going children were left out of the sampling frame.

Ethical approval

Consent was obtained from the study participants before including them in the study. The confidentiality and anonymity of the participant's information were also ensured.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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