

## Refractive error in school children in armed forces community in Goa

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### Abstract

Refractive errors are common among school children and are the second leading cause of treatable blindness. Uncorrected refractive errors are responsible for visual impairment, and remain prevalent even in high income countries.

**Aim:** To estimate the refractive errors in school age children attending the ophthalmology outpatient department of a secondary care hospital in Goa.

**Settings and Design:** Cross sectional study.

**Materials and Methods:** All school children 5 to 16 years of age attending the eye OPD of a Secondary Care Hospital at Goa were examined for refractive errors. Children with defective vision were further examined using auto-refractometer followed by streak retinoscopy after instilling 1% cyclopentolate eye drops. Children were further categorized according to the type of refractive error on post mydriatic examination. Statistical analysis was done by using SPSS version 17. Chi square test was done and p value <0.005 was considered as significant.

**Results:** A total of 1472 children were screened out of which 107 children (7.2%) had refractive errors. Of the total males and females examined 51.2% and 48.7% respectively had refractive errors. Most of the children presented with myopia 70 (65.4%) followed by hypermetropia 20(18.7%) & astigmatism 17(15.8%). There was no significant difference in the prevalence of refractive error between males and females. The prevalence increased with age. The single most common refractive error was myopia, followed by hypermetropia and then astigmatism.

**Conclusions:** Refractive error is one of the leading causes of treatable blindness in school age children. There is a need to have regular vision testing in school children.

**Keywords:** Astigmatism, Hypermetropia, Myopia, Refractive error

### Introduction

Child's vision is essential for successful learning in school. When the vision suffers, child's routine school work and day to day activities also get affected. Refractive errors are common among school children and are the second leading cause of treatable blindness.<sup>(1)</sup> Uncorrected refractive errors are responsible for up to 42% of the cases of visual impairment worldwide,<sup>(2)</sup> and remain prevalent even in high income countries.<sup>(3-6)</sup> Approximately 12.8 million children in the age group 5-15 years are visually impaired from uncorrected or inadequately corrected refractive errors, estimating a global prevalence of 0.96%.<sup>(7)</sup> Because of the increasing realization of the enormous need for correction of refractive errors worldwide, this condition has been considered one of the priorities of Vision 20-20, 'The right to sight', a global initiative launched by a coalition of non government organizations and the World Health Organization.<sup>(8-9)</sup> The students are not mature enough to point out the deficiency at this early stage and the parents are not so aware of the gradually developing vision problem. This results in tiredness, distraction, headache and a few other disorders. Poor vision in childhood affects performance in school and they adjust to the poor eyesight by sitting near the blackboard, holding the books closer to the eyes, squeezing the eyes and even avoiding work requiring visual concentration. Moreover, planning of a youth's career is very much

dependent on the visual acuity, especially jobs in armed forces, railways, aviation etc. This warrants early detection and treatment to prevent permanent disability.<sup>(10)</sup>

Our study aims to estimate the refractive errors in school age children attending the ophthalmology outpatient department (OPD) of a secondary care hospital in Goa. The objectives of this study were to estimate the prevalence and pattern of refractive errors in the study population so that an effective approach can be planned to tackle the burden of correctable refraction problems in school children. The results were compared with similar studies in other parts of India and worldwide for inferences.

### Subjects and Method

The present study was a cross sectional study. All the children between 5 to 16 years of age attending the ophthalmology OPD of a secondary care hospital at Goa, from Oct 2013 to Jan 2017 were included in the study. The children visiting the eye OPD were the ones screened at the school health programme, or referred by teachers or brought by parents who felt that the child is experiencing diminution of vision.

A detailed history was taken regarding current and past problems, treatment and family history. Students then underwent a preliminary ocular examination. A cyber chart was used at a distance of 3 meter for assessment of uncorrected and best corrected visual

acuity. Hirschberg's test was used to determine the presence or absence of strabismus. A cover-uncover test was performed to confirm the diagnosis. All children with defective vision with visual acuity  $\leq 6/9$  were selected for detailed ocular examination including visual acuity, both for distance and near, refraction with auto-refractometer followed by retinoscopy under cyclopentolate 1% eye drops, anterior segment and fundus examination. Examination was performed by a single ophthalmologist and optometrist. Children with history of prior ocular surgery or any other ocular pathology contributing to diminished visual acuity, manifest strabismus and pathological myopia were excluded from the study.

The children with any type of refractive error on post mydriatic examination were further evaluated according to the type of refractive error.

A spherical equivalent of - 0.5 diopter (D) or more was defined as Myopia, +2D or more was defined as Hypermetropia and a cylinder refraction greater than 0.75D was considered as Astigmatism.<sup>(11)</sup>

**Statistical Analysis:** Chi-square test was used to analyze differences in the refractive errors between males and females and among different age groups. P value < 0.05 was considered significant.

## Results

A total of 1472 children between 5 and 16 years of age were included in the study. Out of these, 754 (51.2%) were males and 718 (48.7%) were females and they were divided into four groups according to their age (Table 1). Unaided VA was normal (6/6) in 1365 (92.7%) children. A total of 107 children (7.2%) had

refractive error. 45 children (3%) had presenting VA 6/9-6/12 and 58 children (4%) had VA 6/18-6/60 and 4 children (0.27%) had VA <6/60 (Table 3). After refractive correction, visual acuity improved to 6/6 in 103 children (96.2%) out of 107 children detected to have refractive error. 4 (3.7%) children were amblyopic with VA < 6/12 after refractive correction.

Refractive error was prevalent in 55 males (7.3%) and 52 females (7.2%). There was no significant difference between the prevalence of refractive error between males and females ( $p>0.05$ ) (Table 4). Prevalence of refractive error in 5-7 years age group was 4.1% which increased to 8.3% in 14-16 years age group. This increase was statistically significant. ( $p<0.01$ ) (Table 4). Of the total 107 children with refractive error, myopia was present in 70 children (65.4%), hypermetropia in 20 (18.7%) and astigmatism in 17 (15.8%) children (Table 2).

The prevalence of Myopia increased from 5.7% in the 5-7 years age group to 44.28% in the 14-16 years age group which was statistically significant ( $p=0.010$ ). The prevalence of Hypermetropia decreased from 35% in the 5-7 years age group to 10% in the 14-16 years age group which was statistically significant ( $p<0.00$ ). The prevalence of Astigmatism was not statistically significant with age ( $p=0.613$ ).

The prevalence of myopia was 60% in males and 40% in females which was significant ( $p=0.014$ ). The prevalence of hypermetropia was 45% in males and 55% in females which was not significant ( $p=0.258$ ). The prevalence of astigmatism was 29.4% in males and 70.5% in females which was significant ( $p=0.048$ ) (Table 6).

**Table 1: Distribution of Students as per Age and Sex**

Age Sex	5 to 7 years	8 to 10 years	11 to 13 years	14 to 16 years	Total
Male	112 (7.61%)	141 (9.58%)	238 (16.17%)	263 (17.87%)	754 (51.2%)
Female	128 (8.70%)	149 (10.12%)	203 (13.79%)	238 (16.67%)	718 (48.7%)
Total	240 (16.3%)	290 (19.7%)	441 (30%)	501 (34%)	1472 (100 %)

**Table 2: Prevalence of Refractive Errors**

Type of Refractive Error	Number of students	Percentage among Refractive Errors detected	Percentage among children visiting eye OPD
Myopia	70	65.4%	4.75%
Hypermetropia	20	18.7%	1.35%
Astigmatism	17	15.8%	1.15%
Total	107	100 %	7.2%

**Table 3: Distribution of Uncorrected and Best Corrected Visual Acuity**

Visual Acuity	Unaided n (%)			Best Corrected Visual Acuity in those with Refractive Errors n (%)
	Total n (%)	New Detected Refractive Errors n (%)	Previous Refractive Errors n (%)	
6/6	1365 (92.7%)	-	-	103 (6.9%)
6/9-6/12	45 (3%)	38 (2.58%)	7 (0.48%)	-
6/18-6/60	58 (4%)	42 (2.85%)	16 (1.09%)	04 (0.27%)
<6/60	4 (0.27%)	3 (0.20%)	1 (0.07%)	-
Total	1472 (100%)	83 (5.64%)	24 (1.63%)	107 (7.27%)

**Table 4: Distribution of Refractive Error as per Age and Sex**

Age Sex	5 to 7 years	8 to 10 years	11 to 13 years	14 to 16 years	Total
Male	4 (3.57%)	9 (6.38%)	19 (7.98%)	23 (8.75%)	55 (7.29%)
Female	6 (4.69%)	11 (7.38%)	16 (7.88%)	19 (7.98%)	52 (7.24%)
Total	10 (4.17%)	20 (6.90%)	35 (7.94%)	42 (8.38%)	107 (7.3%)

**Table 5: Association of Age with type of Refractive Error**

Age (years)	Type of refractive error		
	Myopia n=70	Hypermetropia n=20	Astigmatism n= 17
5-7	2	7	1
8-10	12	6	2
11-13	25	5	5
14-16	31	2	9
P value	P=0.010	P<0.00	P=0.613

**Table 6: Association of Sex with type of Refractive Error**

Sex	Type of Refractive Error		
	Myopia n=70	Hypermetropia n=20	Astigmatism n=17
Male	42(60%)	9(45%)	5(29.4%)
Female	28(40%)	11(55%)	12(70.5%)
P value	p=0.014	p=0.258	p=0.048

## Discussion

In India as in other developing countries, the school health services provided are hardly more than a token service because of the shortage of resources and insufficient facilities.<sup>(11)</sup> Childhood blindness is a priority area because of the number of years of blindness that ensues. Data on the prevalence and causes of blindness in children is needed for planning and evaluating preventive and curative services for children. The prevalence of refractive error in this study was 7.2% which was similar to the prevalence observed by GVS Murthy et al. in New Delhi (6.4%)<sup>(12)</sup> and Kumar et al. in Lucknow (7.4%).<sup>(13)</sup> Similar studies from different parts of the world showed a prevalence of (8.2%) in Baltimore (USA),<sup>(14)</sup> (12.8%) in Shunyi district in China,<sup>(15)</sup> (2.9%) in Nepal<sup>(16)</sup> and (15.8%) in Chile.<sup>(17)</sup> These variations in the prevalence data from studies carried out in different parts of the world are due to different operational definitions considered by

investigators and also due to differences in demographic factors such as different geographical location, different socioeconomic class, different race etc.

There was an increase in the overall prevalence of refractive errors with advancing age as shown in Table-4. Our results were comparable with the study conducted by Pavithra et al<sup>(18)</sup> in Bangalore which showed the prevalence of refractive error more (7.5%) in the 13 -15 years age group compared to 6.6% in the 7-9 years age group. A study conducted in Ahmedabad city showed that the prevalence of refractive errors was highest (40%) in 17 years old students compared to only 6.7% in 11 year old children.<sup>(19)</sup> Matta S et al. also found that refractive error increased with increasing age especially in the age group of 10- 14 years.<sup>(20)</sup>

In our study Myopia was more common in males (p=0.014). Astigmatism more common in females (p=0.048) and no significance of hypermetropia

between males and females ( $p= 0.258$ ) as shown in Table 6. This was similar to the results shown by Sriram C et al. in Tamil Nadu which showed refractive errors to be more prevalent in male children (21.5%) than female children (17%).<sup>(21)</sup> Ande V R et al. in Andhra Pradesh<sup>(22)</sup> and Krishnan V M et al. in Villupuram and Puducherry,<sup>(23)</sup> where no sex predilection of refractive error was noted. However some studies showed evidence of increased prevalence in female students.<sup>(24)</sup>

In our study the single most common refractive error was Myopia followed by Hypermetropia. Astigmatism was least common of all as shown in Table 2. Our results were comparable with the study conducted by Pavithra et al. in Bangalore,<sup>(18)</sup> Sethi S et al. among school children of Ahmedabad<sup>(19)</sup> and S Matta et al. among the adolescents attending outpatient department of ophthalmology in New Delhi<sup>(20)</sup> which concluded that myopia was the most common refractive error among school children. In a study of Prevalence of refractive errors in school children of Tafila city conducted by Hussein A et al., it was found that myopia (63.5%) was the most common type of refractive error followed by hypermetropia 20.4% and astigmatism 11.2%.<sup>(25)</sup>

In the present study, myopia showed an increasing trend with advancing age whereas hypermetropia showed a decreasing trend with advancing age which was statistically significant as shown in Table 5. Similar pattern was shown in many previous studies conducted in New Delhi<sup>(12)</sup> Bangalore,<sup>(18)</sup> Andhra Pradesh<sup>(21)</sup> and Kolkata.<sup>(26)</sup>

The presenting VA was 6/6 in 92.7% students, while after refractive correction 96.2% students could attain a VA of 6/6. 4(0.27%) children in our study had amblyopia. Treatment of amblyopia is most effective when done early in the child's life, usually before the age of seven.<sup>(27)</sup> School screening is the most effective method to detect amblyopia. An annual school screening programme in all the schools should be done without fail. The screening for refractive errors should be done in a well planned and effective manner, in order not to miss even a single child with refractive error. The teachers of the school should also be educated about various refractive errors and should be vigilant to detect refractive errors in the students and refer them at the earliest to the nearest eye center.

In our study Myopia was the main type of refractive error and it increased with age. Myopia can be linked to more near work and excessive use of devices like mobiles, I- pads, computers, television etc. Element of chance in this study could not be ruled out. A more detailed study with a larger sample size is required to validate these findings. Our study had some limitations. Detailed evaluation was done only in children with vision less than 6/9. Thus some refractive errors like latent hypermetropia might have been missed.

Studies from all over the continents and from India suggest early screening, spectacle compliance and spreading awareness among parents to motivate students to use spectacles. Improved utilization of existing eye care services is required.

### Conclusion

The prevalence of uncorrected refractive error, especially myopia, was higher in school children. Causes of higher prevalence and barriers to refractive error correction services should be identified and addressed. An annual eye screening for school children is recommended with proper follow up.

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