

An Observational Study on Refractory Error in Primary School Aged Children

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Conflict of interest: Nil

Abstract:**Objectives:** The present study was to evaluate the prevalence and type of refractory error in primary school aged children.**Methods:** A standard ophthalmic examination procedure was used for each study subject. Ophthalmic examination included assessment of visual acuity for distance with Snellen's illiterate E chart at 6 meters in a well-illuminated room. Children detected with defective vision were referred for further examination. They were further evaluated employing subjective refraction with auto refractometer by Ophthalmologist. Prevalence of visual impairment (visual acuity less than 6/18) was calculated for uncorrected visual acuity, and best measured visual acuity.**Results:** A total of 222 children were enrolled. Among them, 94(42.34%) children were males and 128(57.66%) children were females. Prevalence of RE was 25.22%. Astigmatism was the commonest refractive errors in both right 27(12.16%) and left 25(19.38%) eye. While, myopia 14(10.85%) was the least frequent in both right eye 14(6.31%) and left eye 11(4.95%). All types of the refractive errors were relatively more common in females than males. It was statistically significant relation between the gender and refractive errors ($p=0.008$).**Conclusions:** Refractory error is preponderance in female children as compared to male children. RE is more common in children with age group 9-11 years. Astigmatism is the most common RE, while myopia is least frequent RE present in children.**Keywords:** Children, Refractory error, Astigmatism, Myopia.**DOI:** 10.25258/ijcpr.18.5.227

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Introduction

Uncorrected refractive error (URE) is the leading cause of vision impairment and the second leading cause of blindness globally, [1] affecting 1 in 90 people of all ages [2]. Available evidence indicates that URE in school- aged children continues to be a major public health problem in India [3].

Vision screening for schoolchildren can identify children who have a vision problem that might affect physiological or perceptual processes of vision. Reduced vision may affect academic performance, choice of occupation and socio-economic status in adult life. Vision screenings are not diagnostic, but screening results may indicate a potential need for further assessment. The availability of optical correction with spectacles after school vision screening is relatively little cost. The outcome of this intervention will generally improve the children's academic and the quality of life. Visual screening in children provides early diagnosis, therapy, prevention, and health promotion for many eye

diseases, such as cataract, glaucoma, and retinal detachment [4].

RE is an eye condition in which light from a distant object is not focused on the retina; it might be focused in front of or behind the retina. There are 3 types of RE: myopia, hypermetropia and astigmatism. The exact cause of ametropia remains unknown with common risk factors being hereditary, nutritional and environmental [5].

At birth, the eye is normally mildly hyperopic, and this error reduces over the next several years. The risk of myopia in childhood is associated with a range of socioenvironmental factors, with indoor lifestyle and with more time on schooling and other near- work tasks [6,7]. Myopia is associated with urban locations, but near tasks related to mobile phones, tablets and other technologies are common and influence refractive error in both rural and urban locations [6]. Objectives of the present study was to evaluate the refractory error in primary school aged children.

Material & Methods

The present study was conducted in the Department of Ophthalmology, SKMCH, Muzaffarpur, Bihar during a period from July 2025 to November 2025.

Five school were chosen using cluster random sampling technique. A special predesigned form was used to collect personal and socio-demographic data including name, sex, age, history of present and past ocular problems and using of spectacles; and family history of ocular problems and use of spectacles. A total of 222 children were selected for the study.

In the present study the protocol supported by WHO named (The Refractive Error Study in Children, RESC) was followed using consistent definitions and methods; refractive error was defined as an error of $\pm 0.50D$ or more for myopia and hyperopia and a cylindrical error of $\geq 0.50 D$ [29,30]. School children were screened for refractive error.

Methods

A standard ophthalmic examination procedure was used for each study subject. Ophthalmic examination included assessment of visual acuity for

distance with Snellen's illiterate E chart at 6 meters in a well-illuminated room. Children detected with defective vision were referred for further examination. They were further evaluated employing subjective refraction with auto refractometer by Ophthalmologist. Prevalence of visual impairment (visual acuity less than 6/18) was calculated for uncorrected visual acuity, and best measured visual acuity.^{21,22}

Statistical Analysis: Data was analysed by using SPSS version 26 software. All data was tabulated and percentages were calculated. Chi-squared test was applied. P-value was taken less than or equal to 0.05 ($p \leq 0.05$) for significant differences.

Results

A total of 222 children were enrolled in the present study. Among them, 94(42.34%) children were males and 128(57.66%) children were females. Out of 222 children, 56(25.22%) cases had refractive error. Out of 56 refractive error children, 12(5.41%) RE children had positive history of wearing glasses, whereas 50(22.52%) had positive family history of wearing glasses.

Table 1: Distribution of children with refractive errors according to gender (Rt eye).

Refractive error Rt eye		Gender		Total
		Male	Female	
Myopia	No.	6	8	14(6.31%)
	% within RE	42.86%	57.14%	
	% within gender	6.38%	6.25%	
Hyperopic	No.	6	9	15(6.75%)
	% within RE	40%	60%	
	% within gender	6.38%	7.03%	
Astigmatism	No.	9	18	27(12.16%)
	% within RE	33.33%	66.67%	
	% within gender	9.57%	14.06%	
Normal	No.	73	93	166(74.77%)
	% within RE	43.98%	54.79%	
	% within gender	77.66%	72.66%	
Total	No.	94	128	222(100%)
	% within RE	42.34%	57.66%	
	% within gender	100%	100%	

Astigmatism was the commonest refractive errors in both right 27(12.16%) and left 25(19.38%) eye. While, myopia 14(10.85%) was the least frequent in both rt eye 14(6.31%) and left eye 11(4.95%).

Visual acuity was better in the left eye 171(77.03%) had normal visual acuity of 6/6 compared with right eye 166(74.77%).

Out of the 56(25.22%) of the participants with refractive errors in right eye, 21 of them were males, representing 37.5% of male participants; while 35 of them were females, representing 62.5% of female participants. All types of the refractive errors were

relatively more common in females than males. Our study showed statistically significant relation between the gender and refractive errors ($p = 0.008$). Majority of the participants with refractive errors were in the age group 9-11 years, 37.5%, and 49.01% in both right and left eyes respectively. Different types of refractive errors were relatively higher in this age group.

We found that 56 (25.22%) RE was found in right eye and 51(22.97%) RE was found in left eye.

Table 2: Distribution of children with refractive errors according to age (Rt eye).

Refractive Error Rt eye		Age groups				Total
		6-8	9-11	12-14	>14	
Myopia	No.	5	6	3	0	14(6.31%)
	% within RE	35.71%	42.86%	21.43%	0	
	% within age groups	6.09%	6.45%	9.38%	0	
Hyperopic	No.	4	5	5	1	15(6.76%)
	% within RE	26.67%	33.33%	33.33%	6.67%	
	% within age groups	4.88%	5.38%	15.62%	6.67%	
Astigmatism	No.	9	10	8	0	27(12.16%)
	% within RE	33.33%	37.04%	29.63%		
	% within age groups	10.97%	10.75%	25%	0	
Normal	No.	64	72	16	14	166(74.77%)
	% within RE	46.57%	49.31%	4.11%	0	
	% within age groups	78.05%	77.42%	50%	93.33%	
Total	No.	82	93	32	15	222(100%)
	% within RE	36.94%	41.89%	14.41%	6.76%	
	% within age groups	100%	100%	100%	100%	

Table 3: Distribution of children with refractive errors according to gender (Lt eye).

Refractive error Lt eye		Gender		Total
		Male	Female	
Myopia	No.	4	7	11(4.95%)
	% within RE	36.36%	63.64%	
	% within gender	4.25%	5.47%	
Hyperopic	No.	7	8	15(6.76%)
	% within RE	46.67%	53.33%	
	% within gender	7.45%	6.25%	
Astigmatism	No.	6	19	25(11.26%)
	% within RE	24%	76%	
	% within gender	6.38%	14.84%	
Normal	No.	76	95	171(77.03%)
	% within RE	44.44%	55.56%	
	% within gender	80.85%	74.22%	
Total	No.	94	128	222(100%)
	% within RE	42.34%	57.66%	
	% within gender	100%	100%	

Table 4: Distribution of children with refractive errors according to age (Lt eye).

Refractive Error Lt Eye		Age groups				Total
		6-8	9-11	12-14	>14	
Myopia	No.	4	6	1	0	11(4.95%)
	% within RE	36.36%	54.54%	9.09%	0	
	% within age groups	4.88%	6.45%	3.12%	0	
Hyperopic	No.	5	6	3	1	15(6.76%)
	% within RE	33.33%	40%	20%	6.67%	
	% within age groups	6.09%	6.45%	9.38%	6.67%	
Astigmatism	No.	8	13	4	0	25(11.26%)
	% within RE	32%	52%	16%		
	% within age groups	9.76%	13.98%	12.5%		
Normal	No.	65	68	24	14	78(35.13%)
	% within RE	83.33%	87.17%	3.85%	7.69%	
	% within age groups	79.27%	73.12%	75%	93.33%	
Total	No.	82	93	32	15	222(100%)
	% within RE	36.94%	41.89%	14.41%	6.76%	
	% within age groups	100%	100%	100%	100%	

Discussions

Refractive error is one of the most common causes of visual impairment [8,9]. Refractive error as a cause of blindness has been recognized recently. Large numbers of people are blind in different parts of the world due to high refractive errors because they are not using appropriate refractive correction [9].

School-age children constitute a particularly vulnerable group, because uncorrected refractive error may have a dramatic impact on learning capability and educational potential [10].

The prevalence of refractive errors is changing over time depending on sex, age, and different geographic areas [11]. Refractive error is the most common cause of ocular morbidity among school going children [12,13]. Regarding prevalence of refractive errors among pupils, our results showed that 25.22% of the participants had refractive errors. This finding was higher than prevalences reported by Alhadhari, and Abukheir, among primary school children in Tuti Island-Sudan, 12.9%, [14] These variations in the prevalence of refractive errors among different studies may be due to differences in sample sizes, definitions of refractive errors, methodology, ethnic, environmental, lifestyle and genetic factors in the study populations.

In general, our findings confirm that the refractive errors are one of the most common prevalent ocular conditions occurring in the age group 9-11 years. Astigmatism was the commonest refractive errors encountered, 12.16% of the participants in the present study. Myopia was the least frequent in our study. A finding that was in agreement with other local and regional studies from Sudan [15,14] and Saudi Arabia, [16] but in contrast to several regional and international studies; [20,21,17] myopia was the commonest refractive errors in their studies.

Our study showed that Visual acuity was much better in the left eye 171(77.03%) had normal visual acuity of 6/6 compared with right eye 166(74.77%).

A study from Cairo-Egypt found that 12.5% of the screened primary school children were visually impaired.9 Similar finding, visual impairment in 11.6% of primary school children, was also reported from Ethiopia [18]. A global study estimated that 20% of the study populations were visually impaired due to refractive errors; they reported that the uncorrected refractive errors represent the second cause of blindness after the cataract and the main cause of low vision [19]. This reflects that refractive errors are one of the important public health concerns that might be responsible of preventable blindness.

Our study showed that all types of the refractive errors were relatively more common among females

than males, with statistically significant relation between the male gender and refractive errors, ($p = 0.008$). This finding was contrast to other studies from Sudan, [14] and several other regional and international studies from Saudi Arabia, [16,17] Egypt, [20] Ethiopia, [21] and Thailand [11]. They reported preponderance of refractive errors among females more than males.

Majority of the participants with refractive errors were in the age group 9-11year old, 37.5%, and 49.02% in the right and left eyes respectively.

Different types of refractive errors were relatively higher in this age group. This is approximately similar to that found by other studies [21,16,22]. This may be explained by the complex pattern of human refractive development suggesting that the emmetropia is not the preferred endpoint for refractive development [23].

Variations in data results could be due to variations in populations studied in different settings such as urban, semi-urban and core rural settings.

Other studies suggest that known genetic factors explain 35% of myopia, [24] and that education can potentiate these effects. Lack of time spent outdoors, parental education and myopia are other important risk factors, with a systematic review suggesting that there is a 2% reduction in the progression of myopia with every hour spent outdoor [25].

Goh et al [26] also reported that amblyopia is second only to refractive error as a cause of visual impairment. Though the aetio-pathogenesis of amblyopia is known to be multifactorial, uncorrected high refractive error has been noted to be a dominant cause of amblyopia in children [27]. Baseline preventive measure implementation by eye-care stakeholders at all strategic levels will include; early case detection, eye examination, refraction, dispensing of glasses and follow-up to ensure compliance with prescription [28].

Conclusions

The present study concluded that the refractory error is preponderance in female children as compared to male children. RE is more common in children with age group 9-11 years. Astigmatism is the most common RE, while myopia is least frequent RE found in children.

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