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### RESEARCH ARTICLE

## PREVALENCE OF REFRACTIVE ERRORS IN 10 – 16 YEARS OF STUDENTS IN EASTERN BANGALORE, INDIA.

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#### Manuscript Info

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##### Key words:-

Refractive error, Visual impairment, Myopia, Hypermetropia, Astigmatism.

#### Abstract

**Background:-** In eye care refractive error is common cause of avoidable visual impairment though diagnosis and treatment is simple and successful.

**Aim and Objective:** To determine the prevalence of refractive errors amongst students of 10-16 years after one year of vision screening.

**Methodology:** A prospective study of 2113 school children of 10–16 years age group in eastern Bangalore. Vision of the students were checked using Log MAR chart and Optometrist confirmed the findings. Students with refractive error were referred to eye hospital for spectacle.

**Results:** 2450 government and 1776 private school children eyes were examined. Myopia was found to be more prevalent, 9.5% myopia, 2.60% hypermetropia, 0.47% astigmatism. Myopia was also more in female similarly greater proportion was noted in private schools.

**Conclusion:** Prevalence rates of myopia increases with intensive near work<sup>1</sup>. Uncorrected refractive errors were prevalent in this age group. This can be due to lack of awareness on what quality of vision one should have.

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#### Introduction:-

Refractive error is a wide range of problem which affects the vision of individuals globally. There is possibility of three major types of refractive error in the population of an area viz. Myopia, Hypermetropia and Astigmatism.

It is estimated that 2.3 billion people worldwide have a refractive error<sup>2</sup>. World Health Organization estimates that 153 million people worldwide live with visual impairment due to uncorrected refractive errors<sup>3</sup>. India has largest population of blind people in the world. That's over 12 million people, 80 percent of them (9.6 million) could have been prevented from going blind if they had received timely treatment. Refractive error is known as second leading cause of blindness in India (after cataract)<sup>4</sup>.

The proportion of visual impairment due to uncorrected refractive errors in children aged 3-15 years varies from 72.6% in Australia<sup>5</sup>, 82% in India<sup>6</sup> and 97.1% in China<sup>7</sup>. Uncorrected refractive errors are the commonest cause of visual impairment in children in all regions, affecting an estimated 12.4 million children<sup>8</sup>. Incidence of myopia in children is multiplying globally is what is now an 'epidemic' in East Asia, Europe and United States<sup>9</sup>. In Singapore, China, Taiwan, Hong Kong, Japan and Korea, 80-90% of children completing high school are now myopic<sup>9-10</sup>.

Variation in prevalence of uncorrected refractive error in children by age and urban/rural location is evident in India as well<sup>(6, 11, 12)</sup>.

About 20 percent of children develop refractive error by the age of 16 years<sup>13</sup>. 6-7 percent of children in age group of 10-15 in India have refractive error affecting their learning at school<sup>14</sup>.

Vision 2020 a program by WHO with slogan "Right to Sight" as global initiative gives its first preference in the correction of refractive error in children then looks successively towards other diseases like cataract and other corneal diseases<sup>(8, 15)</sup>.

### Materials and Methods:-

A prospective study was conducted in eastern part of Bangalore, Karnataka, India. Altogether 12 (8 government and 4 private) schools were included in the study wherein no eye screening was done within one year. A total of 2113 (2024 male and 2202 female eyes) students of age group 10-16 years participated in the study. All the students were provided with informed consent form in English and/or regional language before the evaluation started. Students who have signed the consent, a brief ocular history was taken by an optometrist. If they presented complaints like blurred vision, eye strain, watering, itching and headache, torch light examination was done to rule out any corneal or lenticular opacities; ocular malformation i.e. microphthalmos, anophthalmos, coloboma; whoever detected were excluded from the study and new student was recruited. Vision was checked monocularly using Log MAR Alphabet chart both for distance and near with their own spectacle if they had. Power of spectacle was noted by hand neutralization by the same optometrist who did retinoscopy. Dry retinoscopy (Welch Allyn 11772-VC) was performed at arm length (67cm) of the examiner with Log MAR chart, illuminated by additional CFL lamp. The chart was kept 4 meters away from the patient as a target in semi dark room at all the schools. Net value of the retinoscopy was determined by subtracting the dioptric value (1.50 Diopters) of arm length of the examiner. Amount as well as type of refractive error was confirmed finally after subjective refraction.

Refractive error definition was taken as Myopia (M) when the measured objective refraction was more than or equal to  $-0.50$  spherical equivalent diopters in one or both eyes. Hyperopia (H) was considered when the measured objective refraction was greater than  $+1.00$  spherical equivalent diopters in one or both eyes. Astigmatism (A) was considered to be visually significant if  $>1.00$  Diopter Cylinder. Since cycloplegic refraction was not carried out the hypermetropia consideration was taken slightly higher to minimize the accommodative effort of the subject.

Students needing glass and/or having other anomaly which needed further examination was referred to the nearest eye hospital.

### Statistical Analysis

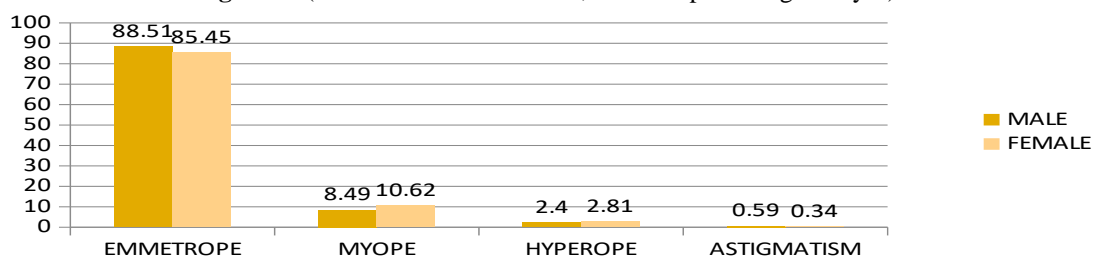
The data was entered in Microsoft Excel spread sheet and statistical analysis was done using z test for proportion.

### Results:-

Out of 4226 eyes, 279 female eyes and 253 male eyes were found to have Ametropia (refractive error) and rest was Emmetrope (E). Myopia (9.5%) was found to be more prevalent followed by hypermetropia (2.6%) and astigmatism (0.47%). The prevalence rates were calculated based on z - cal and p value. If  $p > 0.05$  then hyperopia in male is equal to that in female and vice versa and the data were tested at 95% confidence levels.

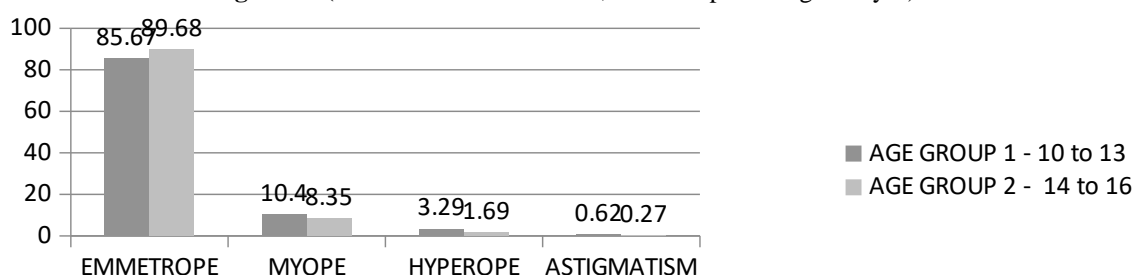
**Table. I:-**Prevalence of refractive error in association with gender, age group and type of school. A. Gender

Null Hypothesis	Alternative Hypothesis	Z – cal	p-value	Conclusion
E in M = E in F	E in M > E in F	2.9667	0.0030	E in M > E in F
M in M = M in F	M in M < M in F	-2.3579	0.0184	M in M < M in F
H in M = H in F	H in M < H in F	-0.8366	0.4028	H in M = H in F
A in M = A in F	A in M > A in F	1.213	0.2251	A in M = A in F

**Figure I:-**(X – axis refractive errors, Y – axis percentage of eyes)

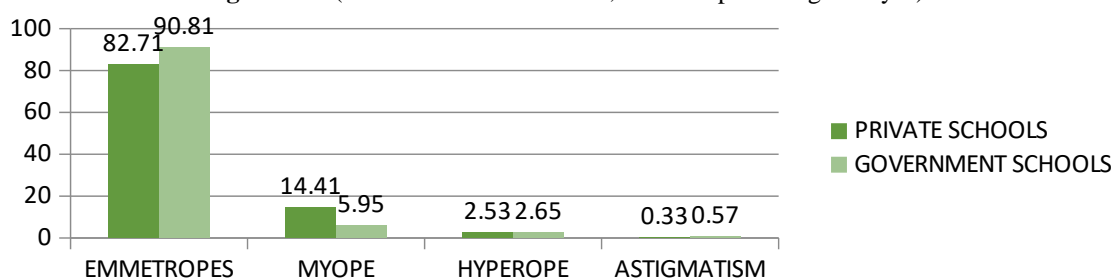
B. Age group (AG1 - 10 to 13; AG2 - 14 to 16)

Null Hypothesis	Alternative Hypothesis	Z - cal	p-value	Conclusion
E in AG1 = E in AG2	E in AG1 < E in AG2	-3.8941	<0.0001	E in AG1 < E in AG2
M in AG1 = M in AG2	M in AG1 > M in AG2	2.2512	0.0244	M in AG1 > M in AG2
H in AG1 = H in AG2	H in AG1 > H in AG2	2.239	0.0012	H in AG1 > H in AG2
A in AG1 = A in AG2	A in AG1 > A in AG2	1.6485	0.0993	A in AG1 = A in AG2

**Figure II:-**(X – axis refractive errors, Y – axis percentage of eyes)

C. Type of school (PRI – Private; GOV – Government)

Null Hypothesis	Alternative Hypothesis	Z-cal	p-value	Conclusion
E in PRI = E in GOV	E in PRI < E in GOV	-7.8348	<0.0001	E in PRI < E in GOV
M in PRI = M in GOV	M in PRI > M in GOV	9.2537	<0.0001	M in PRI > M in GOV
H in PRI = H in GOV	H in PRI < H in GOV	-0.2419	0.8089	H in PRI = H in GOV
A in PRI = A in GOV	A in PRI < A in GOV	-1.1259	0.2602	A in PRI = A in GOV

**Figure III:-**(X – axis refractive errors, Y – axis percentage of eyes)

Out of 2113 students tested 82 were wearing spectacle and 2031 were not in which 1747 were emmetropes and 284 (13.44%) had uncorrected refractive errors. Although they had refractive error but only 37 (1.17%) reported complaints, rest 247 (11.68%) were asymptomatic.

## Discussion:-

Even though the treatment of refractive error is simple and successful, the condition is still responsible for a significant amount of visual impairment in both developing and developed countries <sup>(16-22)</sup>. Refractive error is also one of the leading causes of visual impairment in different parts of the world <sup>(18-24)</sup>.

Prevalence of refractive error in this study was 12.6% which is similar to the study done by S Matta et al in Bangalore (12.5%) <sup>25</sup> And Batra et al done in Ludhiana city for 5 – 15 age group (12.7%) <sup>26</sup>. It was observed to be slightly less as compared with Medi Kawuma et al in Kampala district, Uganda for 6 – 9 age group (11.6%) <sup>27</sup> and slightly higher in Chile (15.8%) <sup>28</sup> as compared to that of Batra et al on school children <sup>26</sup>.

Myopia (75.5%) was the most common refractive error found in students followed by hyperopia (20.67%) and astigmatism (3.75%). It is similar to the study done by Sonam Sethi and GP Kartha in Ahmedabad city 63.3% had myopia, 11.2% had Hypermetropia and 2.4% of the cases had astigmatism <sup>13</sup>.

This study reported that myopia prevalence is more in females than in males. The results are supported by other studies done by National Eye Institute and Health Services USA <sup>29</sup>. It can be doubted that is the hormonal levels in the females after puberty starts, triggers myopia but there is no clear evidence for it. A study done by Chen ZT et al and Manning JT says that there is no sex difference in prevalence of myopia <sup>(30-31)</sup>.

Myopia prevalence varies strongly with the education stream. Private schools are scheduled in such a way that the amount of near tasks goes up and play time drops down which may be one of the factor aiding myopia <sup>1</sup>. Association between Refractive Error and Near Work may be there. This result supports the study done by Lejila Muhamedagic et al in Zenica in 2014 saying that myopic proportion increases with increased near work <sup>32</sup>.

Hyperopia in our study was second most prevalent refractive error which was similar to that of Padhye AS et al done in urban school children (1.06%) <sup>33</sup>. A low rate of hyperopia was observed as compared to myopia which could be because hyperopia declines due to increasing years of education <sup>34</sup>.

Astigmatism was found to be significantly less in overall figure which gives similar result as AS Padhye et al done in urban children (0.16%) <sup>(33-34)</sup>. Astigmatic population of both private and government schools were found to be same statistically.

## Limitation of the study

Due to paucity of time cycloplegic refraction was not performed, a further session of detailed examination is required to show yet more effective analysis.

## Conclusion:-

Vision screening of school children in developing countries would be useful in detecting correctable cause of decreased vision especially refractive errors and in minimizing long term visual disability. It also indicates that school age represents high risk for refractive errors.

Proper gap and study oriented outdoor activities between the study hours would decrease the intensive near work and might reduce in myopia prevalence which in turn will reduce prevalence of uncorrected refractive error percentage.

Visual impairment can have a significant impact on child's life in terms of education and development. It is important that effective strategy to be developed to eliminate this easily treated cause of visual impairment <sup>35</sup>.

Hence screening for refractive errors should be carried out on periodic basis. Children in school going age and their parents should be educated about symptoms of refractive errors. School teachers should be trained in screening the children and identifying children with poor performance due to defective vision <sup>35</sup>.

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