# **Original Research Article**

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# The prevalence of myopia among school-going children (6-14 years) in Chidambaram, Tamil Nadu: a cross-sectional study

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#### **ABSTRACT**

**Background:** Refractive errors are one of the most common causes of visual impairment worldwide. Uncorrected, under corrected and undetected refractive errors among school-going children are the most significant problem in developing countries like India. Schools are the best place for early detection of ocular morbidity. Myopia, hypermetropia and astigmatism are the three main types of refractive errors, of which myopia is the most common type in school-going children.

**Methods:** This descriptive cross-sectional study was carried out for the period of 6 months from October 2019 to March 2020 among school-going children in the field practice area of Chidambaram. 575 students from two government and 2 private schools were selected conveniently. Data were collected using a pre-tested, semi-structured questionnaire and analysed using Statistical Package for social sciences (SPSS) software version 23. Descriptive statistics were used and a Chi-square test of significance was applied.

**Results:** The prevalence of myopia was found to be 12.9%. There is a significant association between the frequency of reading hours, time spent on outdoor activities and mobile usage and the presence of myopia (p<0.05).

**Conclusions:** The risk factors like hours of reading books, time spent on outdoor activities and mobile usage are the contributing factors for the development of refractive error like myopia. They are easily detectable through the program on eye screening of school children.

Keywords: Prevalence, Refractive error, Myopia, Risk factors

#### INTRODUCTION

The eye is one of the most remarkable sensory systems in the human body.<sup>1</sup> Refractive error is one of the primary causes of visual impairment in children worldwide.<sup>2</sup> To focus the issue of blindness in children, the WHO recently launched a global initiative, VISION 2020- the right to sight, to eliminate avoidable blindness among children.

Myopia is the most common refractive error. A recent study in Southeast Asia estimated a global potential productivity loss of US\$244 billion from uncorrected myopia, bearing the greatest potential burden.<sup>3</sup> The prevalence of myopia is more than 2 times higher among

East Asians in different countries and it seems to be increasing among younger people in East Asia. Severe cases of myopia are associated with the risk of visual impairment and blindness due to pathological changes in the retina like a retinal tear, retinal detachment, macular degeneration, cataract and glaucoma which are irreversible. Most cases of myopia are corrected with spectacles, contact lenses or refractive surgery hence it is considered to be a benign condition. Globally 285 million people are with visual impairment. The main causes of visual impairment are uncorrected refractive errors (myopia, hypermetropia, astigmatism) 43%, cataract 33%, glaucoma 2% of population in developing countries. It is estimated that 19 million children are visually impaired of which 12 million visual impairment is due to refractive

errors. Among the refractive error myopia is one of the most common vision conditions affecting nearly 30% of the population. Mostly it affects the school children between 8 and 12 years. The objective of learning begins in childhood hence the accuracy of a child's vision can affect his/her learning capacity to a great extent. Vision helps in determining the future of an individual. Moreover, the planning of a youth's career is mostly dependent on visual acuity, especially in jobs for navy, military, railways and aviation. Childhood blindness proves to be a particular challenge that is different from controlling adult blindness. Hence, there is urgency in treating ocular morbidities in children.

The overall incidence of refractive error in India has been reported to vary between 21% and 25% of the patients attending eye OPD.<sup>8</sup> Children in the school-going age group (6-14 years) represent 25% of the population in developing countries.<sup>9</sup> In India 20% of children develop refractive error by the age of 16 years and 6-7% of children in the age group of 10-15 years have refractive errors affecting their learning. 30% of India's blind lose their eyesight before the age of 20 years.<sup>10</sup> Special attention has to be given to school age because it is the age at which refractive error begins. Hence early detection and treatment of visual impairment among young children are very important.<sup>11</sup>

Myopia is the leading cause of the refractive error. The risk of becoming myopic increases with the near work for long hours affects the eye and is suspected to be a risk factor for myopia. Spending more time outdoors has been shown to decrease the likelihood of becoming myopic and also slow down the progression of myopia. 12 About 80% of children spend a majority of days in a year in school and are easy to contact. Schools are the best centres for effectively implementing the comprehensive eye health care programme and school children are the ideal candidates for health education and can protect a child from health complications at a later stage.<sup>15</sup> Thus, the study was conducted among school-going children in the age group of 6-14 years to find out the prevalence of myopia and its association with selected known background variables among school-going children in selected schools of Chidambaram.

#### **METHODS**

This descriptive cross-sectional study was conducted among 6-14 years of school children in 2 government and 2 private schools in the field practice area of Chidambaram, Cuddalore. This study was carried out for the period of 6 months from October 2019 to March 2020. There are 33 schools in the practice area of Chidambaram, out of which two government schools and 2 private schools were selected conveniently. 575 students in the age group of 6 to 14 years in the class 1<sup>st</sup> to 9<sup>th</sup> standard students were selected for the study. Permission was obtained from the school authorities and written consent was obtained from

the parents of each student before the commencement of this study.

#### Study tool and data collection

A pre-tested semi-structured questionnaire was used to collect the data. Information on socio-demographic details and risk factors associated with a refractive error such as hours of reading a book per day, hours on the usage of mobile per day and hours spent on outdoor activities were collected individually and the examination of the eye was carried out by the investigator. Based on WHO guidelines refractive error was tested by the investigator. Each student was examined and data were collected simultaneously in their respective schools. Students aged between 6-14 years who were permitted by their parents and those present on the survey days were included in the study population.

A class with good illumination or a class with good natural light was chosen. The general eye examination like the appearance of the eye, conjunctivitis, bitot's spots, stye, amblyopia, blepharitis, congenital cataract for both the eye was examined with the help of Torchlight for the students individually. Snellen's chart in English and Tamil and E chart was used based on the student's preference for few children to test visual acuity for Distant vision who doesn't read the English or Tamil letters.

The distance of 6 m was measured using a measuring tape, the Snellen's chart was hung on the wall and the procedure was explained to the students and they were made to sit/stand at a distance of 6m from the chart and were asked to read the letters from the top line with the one eye and the other being covered at a time with the palm of the student's hand. The smallest line he/she can read will be expressed as a fraction, e.g., 6/18 or 6/24 is the visual acuity. The upper number refers to the distance between the chart and the patient (6 metres) and the lower number is the distance in metres at which a student with no impairment should be able to see the chart. If the student cannot read the largest letter (first letter) at 6 metres, move him/her closer, one metre at a time until the top letter can be seen by the student. The Visual acuity will then be recorded as 5/60 or 4/60, etc accordingly. If the top letter cannot be read at 1 metre (1/60), hold up your fingers at varying distances of less than 1 m and check whether the student can count them or not. This is recorded as counting fingers (CF). Record as visual acuity is equal to counting fingers. The whole procedure is repeated for the next eye. If the student already wearing spectacles, the procedure was done without spectacles first and with spectacles after for each eye. 'Tumbling E' chart, was used for few children who do not know the alphabet. The 'Tumbling E' eye chart uses a capital letter E that faces in different directions instead of using alphabets and the student being tested to use their fingers to show the direction in which the "fingers" of the E are pointing/facing. Then the same procedure and recording methods were followed as mentioned above.

At the end of the procedure, the study findings were recorded and reported to the parents of the children who needed vision care. At the end of the study, a general session on visual health education was conducted.

#### Statistical analysis

Collected data were entered in Microsoft excel and analysed by using SPSS software version 23. The Chi-square test was used to find out the association between myopia and selected background variables ( $p \le 0.05$ ).

#### Ethical approval and informed consent

Ethical approval was obtained from the Institutional Ethics Committee of Raja Muthiah Medical College and Hospital. After explaining the study and its objectives, written and oral consent was obtained from the parents and the study participants respectively.

#### **RESULTS**

575 school children in the age group of 6-14 years from 2 government schools and 2 private schools in areas of Chidambaram were the study participants.

Out of 575 students, 186 (32.3%) students belong to 6 to 8 years, 160 (27.8%) students belong to more than 8 years to 11 years and 229 (39.8%) students belong to >11 to 14 years. 369 (64.2%) were male and 206 (35.8%) were females. Students who belong to government schools were 290 (50.4%) and private schools were 285 (49.6%). Nearly 289 (50.3%) students were from rural area and 286 (49.7%) students were from urban area. According to the modified BG Prasad socioeconomic scale classification, 61

(10.6%) students belong to the upper class, 226 (39.3%) students belong to the upper-middle class and 288 (50.1%) students belong to the lower middle class. The sociodemographic details of the study subjects given in Table 1.

The prevalence of myopia among school-going children 6-14 years was found to be 12.9%. Figure 1 shows that the prevalence of myopia among school-going children. There was a significant association between reading hours (p value=0.032), outdoor activities (p value=0.001), mobile usage (p value=0.001) and myopia among school children (p value<0.05). The association between myopia and selected background variables among school children are given in Table 2-4. The association between gender and type of school with myopia among school children were not significantly associated, given in Table 5.

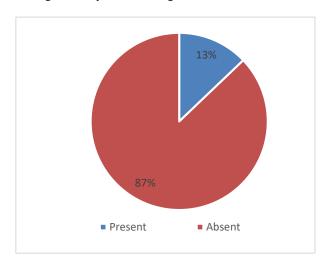


Figure 1: Prevalence of myopia among school study subjects (N=575).

Table 1: Basic characteristics of school students (N=575).

Basic characteristics	Frequency	Percentage (%)
Age (years)		
6 to 8	186	32.3
>8 to 11	160	27.8
>11 to 14	229	39.8
Sex		
Male	369	64.2
Female	206	35.8
Type of school		
Government	290	50.4
Private	285	49.6
Area of the residence		
Rural	289	50.3
Urban	286	49.7
SES		
Upper class	61	10.6
Upper middle	226	39.3
Lower middle	288	50.1

Table 2: Association between reading hours with myopia among school children.

Reading hours	Myopia	Myopia		Chi-square value,
	Absent (%)	Present (%)	Total	df, p value
<1	62 (92.5)	5 (7.5)	67	
1-2	362 (85.0)	64 (15.0)	42	6.86,
>2	77 (93.9)	5 (6.1)	82	0.032
Total	501 (87.1)	74 (12.9)	575	0.032

Table 3: Association between outdoor activities with myopia among school children.

Outdoor activities	Myopia		Total	Chi-square value,
(hours)	Absent (%)	Present (%)	Total	df, p value
Nil	5 (8.1)	57 (91.9)	62	
<1	52 (75.4)	17 (24.6)	69	419.7,
1-2	401 (100.0)	0	401	3,
>2	43 (100.0)	0	43	0.001
Total	501 (87.1)	74 (12.9)	575	

Table 4: Association between mobile usage with myopia among school children.

_	Myopia	Myopia		Chi-square value,
	Absent (%)	Present (%)	Total	df, p value
Nil	88 (93.6)	6 (6.4)	94	
<1	213 (97.3)	6 (2.7)	219	120.2
1-2	155 (83.3)	31 (16.7)	186	130.2,
2-3	41 (77.4)	12 (22.6)	53	4, 0.001
>3	4 (17.4)	19 (82.6)	23	0.001
Total	501 (87.1)	74 (12.9)	575	

Table 5: Association between gender and type of school with myopia among school children.

Variables	Myopia Absent (%)	Present (%)	Total	Chi-square value, df, p value
Gender				0.150,
Male	323 (87.5)	46 (12.5)	369	1,
Female	178 (86.4)	28 (13.6)	206	0.699
Type of school				2.226
Government	260 (89.7)	30 (10.3)	290	3.326,
Private	241 (84.6)	44 (15.4)	285	0.068
Total	501 (87.1)	74 (12.9)	575	0.000

## DISCUSSION

In the present study, the overall prevalence of myopia is 12.9%. In a study by Saxena et al on prevalence of myopia and its risk factors in urban school children in Delhi, was found to be 13.1%. <sup>14</sup> In another similar study in rural Vietnam by Hung et al showed that the prevalence of myopia among secondary school children was 14.2%. <sup>15</sup> Meta-analysis of the last four decades by Agarwal et al showed 10% prevalence of myopia among Indian school children. <sup>16</sup> Higher prevalence was found by Holden et al and Fan et al as 22.9% and 36.71% respectively which is a contrast to a recent study by Grzybowski et al, where the prevalence of myopia was found to be low under 10% in African and South American children. <sup>17-19</sup> In this study,

there is a statistically significant association between reading hours (1-2 hours) and myopia among school children. Similarly in a study done by Huang et al indicated that individuals who perform more near work activities (reading books) had an 80% higher risk of having myopia. In another study by Saxena et al showed that the development of myopia increases with hours of reading more than 2 hours in Delhi. 21

A study on parental myopia, near work, school achievement and children with the refractive error by Mutti et al showed an association between myopia and hours of reading books (p=0.024).<sup>22</sup> In the present study, there is an association between myopia and children using mobile phones for more than 2 hours. A study by Saxena et al

found that there was a positive association between the presence of myopia and children playing computer/video/mobile games for >2 hours. 14 Similarly, studies by Binu et al in Kerala, Kumar et al and Mccrann et al found that there is a significant association between increased daily usage of the smartphone and myopia more than 2 hours. 23-25

In the present study, there is a significant inverse association between the increase in outdoor activities and myopia. Similarly in a study by Jin et al on the effect of outdoor activity and myopia, he found an association between the increase in outdoor activities prevented the onset and development of myopia.<sup>26</sup> In a study of metaanalysis and systematic review, Xiong et al found to have a significant protective effect of outdoor time for incident myopia.27 In another study by Saxena et al, there is an inverse association with outdoor activities more than 2 hours and myopia.<sup>21</sup> There was no significant association between gender and myopia in the present study. Similarly in a study by Chinawa et al, found the there was no statistical difference in neither male (p=0.411) nor female (p=0.416) gender with myopia.<sup>28</sup> But in a recent study on the prevalence of myopia and associated risk factors among primary students by Xie et al, found that Girls were at a higher risk of myopia than boys.<sup>29</sup> In a study by Czepita et al, myopia occurs earlier and more often in girls than in boys which is in contrast to the study by Fan et al, where boys on average had more myopic refractive error than girls. 18,30 In the present study, there is no significant association between type of schools and myopia. That is in contrast to a study by Saxena et al Delhi in 2015 and Kumari et al at Hyderabad in 2016 found that the prevalence of myopia was higher in private schools compared to government schools. 14,31

#### Limitations

The information regarding the background variables like duration of hours of reading books, using mobile phones and time spent for outdoor activities were collected from the study subjects cannot be cross-checked.

## CONCLUSION

The prevalence of myopia among school children 6-14 years was found to be 12.9%. Myopia is the most common refractive errors among school-going children that can be treated with early intervention to prevent irreversible complications. For early intervention and treatment for refractive errors like myopia, schools are the best centre for effective implementation of comprehensive eye health care program.

Active involvement of field level medical officers, optometrists, school teachers and parents are mandatory for promoting ocular health and preventing ocular morbidities among school children. We can also motivate the school authorities, teachers to train the students to read at the proper distance (i.e.; the distance between the eye

and the book approximate distance of 33 cm) and in good illumination. Students can also be trained for outdoor activities like exercises, yoga activities and outdoor games etc., which will delay the onset of myopia and also reduce the progression of myopia. It is also mandatory to motivate the parents and give education about the harmfulness of mobile usage to the eye, which is a major factor in the development of myopia in the current scenario.

Hence early detection of refractive errors like myopia through school health programs and offering corrective glasses would improve the school performance of the children.

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