

A Study on Socioeconomic, Nutritional, and Individual Factors on Prevalence of Myopia in School-Age Children

Hemalatha Krishnamurthy¹, Terese Jose², Sunil Shivanna³, Gajaraj T Naik⁴, Archana Shivamurthy⁵

¹Associate Professor, Department of Ophthalmology, Mysore Medical College and Research Institute, Mysuru, Karnataka, India, ²Undergraduate Student, Department of Medicine, Mysore Medical College and Research Institute, Mysuru, Karnataka, India, ³Assistant Professor, Department of Orthopaedics, Chikkaballapur Institute of Medical Sciences, Chikkaballapur, Karnataka, India, ⁴Senior Resident, Department of Ophthalmology, Karwar Institute of Medical Sciences, Karwar, Karnataka, India, ⁵Senior Resident, Department of Pathology, JSS Medical College, JSSAHER, Mysuru, Karnataka, India

Abstract

Introduction: Myopia is a common refractive error of the eye, especially seen in children. The prevalence of myopia is high in India (6–22%) as well as in the whole world (4–12%). This study aimed at finding the prevalence of myopia as well as determining the factors relating to it.

Materials and Methods: The study commenced after obtaining ethical clearance. Sample size selected was 500. Three schools in Mysore, Karnataka, were chosen for the study. The participants were school-going children of 8–12 years of age (classes 5–7). Consent was taken from the headmasters/principals of the respective schools. The study model consisted of a survey and ophthalmologic examinations using Snellen chart and streak retinoscopy. The data collected were analyzed and presented in table forms.

Results: Many studies have been done on myopia and its prevalence and factors associated with it have been determined. This study supported many of the findings while contradicted some of them. The higher prevalence of myopia (30%) was found in this study compared to the previous studies. Myopia was found to be the most common cause for visual problems in children. The mean age of students with myopia was found to be 10.81. A statistically significant correlation was found between the symptoms of myopia and the presence of myopia.

Conclusion: This study indicated that symptoms could be used for early detection of the disease. No statistical socioeconomic and nutritional factors were linked with myopia. This information could help in better planning of eye care programs in schools.

Key words: Myopia, Prevalence, Refractive error

INTRODUCTION

Myopia is the most common refractive error seen in children.^[1-3] Although it is one of the easily correctable disorders of the eye, studies show that it is also one of the leading eye problems in India, where its prevalence 6–22%.^[3-8] The prevalence of myopia in the world population is 4–12%.^[2-5]

Myopia is mostly seen in the children. A possible reason behind this could be that children have to strain their eyes more than adults, especially for studying. Closely watching TV and playing computer games adds to the strain. Being in the actively growing age, they are more prone to nutritional deficiencies which could also have contributed to these defects of the eye. There are many factors which lead to myopia in school-going children and the determination of the most important among them could help in prevention or control of the condition. Early detection of myopia is important for its correction.

Children from specific schools in Mysore, Karnataka, were selected for this study, as schools are the most efficient means to approach children. The study model consisted of a survey and ophthalmologic examination using Snellen

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Corresponding Author: Dr. Gajaraj T Naik, Department of Ophthalmology, Karwar Institute of Medical Sciences, Karwar, Karnataka, India.

charts and streak retinoscopy. The intention of the survey was to collect data about the sociodemographic details, the lifestyle with respect to watching TV and reading habits, symptoms relating to myopia, and nutritional intake of the students. A questionnaire was prepared to interview the students based on it. Later, the ophthalmologic examinations were done.

Thus, this study presents the prevalence of refractive errors in relation to age, gender, economic status (type of school), TV viewing habits, reading habits, symptoms of myopia, and the nutritional status of the student. This information could help to plan for eye care programs for the students in school, which could help in early detection and correction and thus reduce the burden of visual impairment in the population, hence prevent the chances of amblyopia.

MATERIALS AND METHODS

The aim of the project is to determine the prevalence of myopia in school-going children of 8–12 years of age (in classes 5th to 7th) in selected schools of Mysore district in Karnataka and to determine the major factors (socioeconomic, nutritional, or individual) contributing to it.

The study also aimed at determining the prevalence of myopia in pupils presenting with symptoms of myopia, so as to see how much well the symptoms can help in the early detection of the disease.

This was a cross-sectional type of study conducted in the schools of Mysore district, Karnataka, for 2 years. It started off after getting the ethical clearance certificate from K.R. Hospital, Mysore.

The sample size was calculated using the formula,

$$n = 4PQL^2$$

Where, n = Sample size,

P = Prevalence

Q = 100-P

L = Allowable error

From the previous Indian studies,^[2,3,5,6,8] a good estimate of the prevalence of myopia among schoolchildren of India was taken as 16.6%. The calculated sample size was 483. The sample size was selected to be 500, considering 20% precision and 5% absolute error.

Three schools were selected randomly, two of which were government schools and one, a private school. Consent was taken from the headmasters/principals of the schools to carry out the study during class hours. The participants were students of classes 5–7, that is, of ages 8–12 years.

The schools chosen were Medar Public School, Medar Block, Mysore (101 students), St. Thomas High School-Government section (237 students), and St. Thomas High School-Private section (162 students), Vishweshwara Nagar, Mysore.

The students were interviewed with a questionnaire for the following:

- The sociodemographic details; age, sex, occupation of the parent, number of members in the household, the school – government school or private school, and if already diagnosed to be a myopic, the place of diagnosis.
- Habit of watching TV; the duration (<1/2 h or do not watch at all, around 2 h, 3–4 h, and more than 4 h), the distance they keep from the screen (<1 m, 1–2 m, 2–3 m, and >3 m), and the posture they have while watching TV (good and bad).
- Reading habits; the posture they have while reading (good and bad), the distance at which they keep the book (<10 cm, 10–20 cm, and more than 20 cm), and the lighting in the room where they read (tube light, CFL, and yellow light).
- Any eye straining work they do (yes/no)
- Whether their parents have myopia (yes/no)
- Whether they spend time on outdoors (yes/no)
- The symptoms related to myopia; frequent headaches, pain in the eyes, blurring of vision, watering of eyes, squinting while trying to see something that is not clear, discomfort in bright light (yes/no)
- Nutritional factors; food frequency of milk, starch, egg, fruits, and green leafy vegetables (taken every day of the week, more than 4 days, 2–4 days, and <2 days).

Then, ophthalmologic examination was done using Snellen chart, in which each student was asked to read the letters on the chart (which was kept at a distance of 6 m from the student) line by line, with one eye closed at a time. If they could read at least till the line corresponding to 20/20 vision (the metric equivalent of which is 6/6 vision), they were considered to have a normal vision. For the others with any other difficulty in vision, refraction test was done with streak retinoscopy for confirmation of myopia.

The data collected were entered into Microsoft Excel sheet. It was analyzed using SPSS version 13 software and tables were made. The Chi-square value and precision were checked in each table to see if the correlation was significant.

Observations

Of the 500 students, 150, that is, 30% had myopia. The mean age of the children with myopia was found to be 10.81 with a standard deviation of 1.017. Male students showed a higher prevalence of myopia (30.6%) over female students (29%) but the correlation was found to

Table 1: Sociodemographic distribution of the students

Characteristics	Myopia		Total	Chi-square	P value
	Yes	No			
Age (in years)				6.080	0.193
8	2 (25.0%)	6 (75.0%)	8 (100%)		
9	14 (34.1%)	27 (65.9%)	41 (100%)		
10	52 (36.6%)	90 (63.4%)	142 (100%)		
11	37 (24.0%)	117 (76.0%)	154 (100%)		
12	45 (29.0%)	110 (71.0%)	155 (100%)		
Sex				0.132	0.716
Female	54 (29.0%)	132 (71.0%)	186 (100%)		
Male	96 (30.6%)	218 (69.4%)	314 (100%)		
Type of school				0.111	0.739
Government school	103 (30.5%)	235 (69.5%)	338 (100%)		
Private school	47 (29.0%)	115 (71.0%)	162 (100%)		

Table 2: Association of TV viewing with the presence of myopia among the children

Characteristics	Myopia		Total	Chi-square	P value
	Yes	No			
Difficulty in vision				61.484	>0.001
Yes	31 (88.6%)	4 (11.4%)	35 (100%)		
No	14 (34.1%)	27 (65.9%)	465 (100%)		
No. of TV viewing hours				1.565	0.667
Less than half an hour or do not watch at all	46 (29.9%)	108 (70.10%)	154 (100%)		
Around 2 h	70 (28.9%)	172 (71.1%)	242 (100%)		
3–4 h	22 (29.7%)	52 (70.3%)	74 (100%)		
More than 4 h	12 (40%)	18 (60%)	30 (100%)		
TV distance practiced				5.359	0.147
Less than 1 m	26 (32.5%)	54 (67.5%)	80 (100%)		
1–2 m	49 (26.8%)	134 (73.2%)	183 (100%)		
2–3 m	51 (28.3%)	129 (71.1%)	180 (100%)		
More than 3 m	24 (42.1%)	33 (57.9%)	57 (100%)		
Posture maintained while watching TV				0.475	0.290
Bad	24 (27.0%)	65 (73.0%)	89 (100%)		
Good	126 (30.7%)	285 (69.3%)	411 (100%)		

be statistically insignificant. A higher prevalence of myopia was seen among students of government school (30.5%) than private school (29%) [Table 1].

Among the students with difficulty in vision, a statistically significant number (88.6%) were myopic, indicating that myopia is the leading cause of defective eye in the children. In TV viewing habits, a higher prevalence of myopia was found among the students who watch TV for more than 4 h (40%). No relevant observation could be made out from the TV distance practiced by the students relating to the presence or absence of myopia. Moreover, the students who keep a good posture while watching TV were found to have a slightly higher prevalence of myopia among them. This could be because of interference of TV duration factor with the posture factor [Table 2].

In reading habits, myopia was more prevalent in students who keep a bad posture while reading (41.7%) over the students who keep a good posture while reading (29.4%) but this was not significant. A lower prevalence of myopia was found in students who read in tube light (28.1%) than

in CFL (32.8%) or yellow light (30.4%), but this also did not show any statistical significance. Reading distance practiced showed no correlation with the presence of myopia which could be due to the involvement of other factors such as posture and the lighting used while reading [Table 3].

About 42.9% of the students doing any eye straining work were found myopic, but it was not significant [Table 4].

If parents were myopic, 81% of their kids were also myopic. This was found to be statistically significant [Table 4].

Likewise, the finding that there is a lower prevalence of myopia among the children who play outdoor games (27.8%) over the ones who does not play (41.8%) was also statistically significant [Table 4].

The following symptoms could be correlated to the presence of myopia in children. About 56.3% with frequent headaches, 65.2% with pain in their eye, 75% with blurring of vision, 65.5% with watering of eye, and the only two

Table 3: Association of reading habits with the presence of myopia among students

Characteristics	Myopia		Total	Chi-square	P value
	Yes	No			
Posture while reading				1.634	0.201
Bad	10 (41.7%)	14 (58.3%)	24 (100%)		
Good	140 (29.4%)	336 (70.6%)	476 (100%)		
Reading distance practiced				4.985	0.083
Less than 10 cm	25 (32.5%)	52 (67.5%)	77 (100%)		
10–20 cm	77 (34.1%)	149 (65.9%)	226 (100%)		
More than 20 cm	48 (24.4%)	149 (75.6%)	197 (100%)		
Light used while reading				1.113	0.573
Tube light	75 (28.1%)	192 (71.9%)	267 (100%)		
CFL	58 (32.8%)	119 (67.2%)	177 (100%)		
Yellow light	17 (30.4%)	39 (69.6%)	56 (100%)		

Table 4: Association of other risk factors, heredity, and physical activity with the presence of myopia among children

Characteristics	Myopia		Total	Chi-square	P value
	Yes	No			
Eye straining work				0.559	0.4555
Yes	3 (42.9%)	4 (57.1%)	7 (100%)		
No	147 (29.8%)	346 (70.2%)	493 (100%)		
Parents myopic				27.100	<0.001
Yes	17 (81.0%)	4 (19.0%)	21 (100%)		
No	133 (27.8%)	346 (72.2%)	479 (100%)		
Outdoor games				6.192	<0.05
Yes	117 (27.8%)	304 (72.2%)	421 (100%)		
No	33 (41.8%)	46 (58.2%)	79 (100%)		

Table 5: Association of various symptoms of myopia with the presence of myopia among children

Characteristics	Myopia		Total	Chi-square	P value
	Yes	No			
Frequent headaches				11.218	>0.05
Yes	18 (56.3%)	14 (43.8%)	32 (100%)		
No	132 (28.2%)	336 (71.8%)	468 (100%)		
Pain in the eyes				14.239	<0.01
Yes	15 (65.2%)	8 (34.8%)	23 (100%)		
No	135 (28.3%)	342 (71.7%)	477 (100%)		
Blurring of vision				18.439	<0.001
Yes	19 (65.5%)	10 (34.5%)	29 (100%)		
No	131 (27.8%)	340 (72.2%)	471 (100%)		
Squinting while trying to see something that is not clear				4.685	<0.05
Yes	2 (100%)	0	2 (100%)		
No	148 (29.7%)	350 (70.3%)	498 (100%)		
Discomfort in bright light				0.016	0.899
Yes	1 (33.3%)	2 (66.7%)	3 (100%)		
No	149 (30.0%)	348 (70.0%)	497 (100%)		

who presented with squinting (i.e., 100%) had myopia. These were found to be statistically significant. Although, a slightly higher prevalence of myopia was seen among the students with discomfort in bright light (33.3%), it was not found to be significant [Table 5].

Considering the nutritional status, the students who used to take egg and green leafy vegetables for lesser number

of days of the week showed higher prevalence of myopia but this was not statistically significant. No such pattern could be made out from the food frequency of milk, starch, and fruits. This could be because food frequency tables are a very vague method of the assessment of nutritional status. Furthermore, other factors mentioned in the above tables could have interfered with these nutritional factors [Table 6].

Table 6: Association of nutritional status through food frequency tables with the presence of myopia among schoolchildren

Characteristics	Myopia		Total	Chi-square	P value
	Yes	No			
Food frequency of milk				0.637	0.959
Every day of the week	132 (30.3%)	304 (69.7%)	436 (100%)		
More than 4 days	4 (30.8%)	9 (69.2%)	13 (100%)		
2–4 days	7 (24.1%)	22 (75.9%)	29 (100%)		
Less than 2 days	6 (33.3%)	12 (66.7%)	18 (100%)		
0 days	1 (25.0%)	3 (75.0%)	4 (100%)		
Food frequency of starch				2.653	0.617
Every day of week	142 (30.3%)	327 (69.7%)	469 (100%)		
More than 4 days	3 (21.4%)	11 (78.6%)	14 (100%)		
2–4 days	4 (44.4%)	5 (55.6%)	9 (100%)		
Less than 2 days	1 (14.3%)	6 (85.7%)	7 (100%)		
0 days	0 (0.0%)	1 (100%)	1 (100%)		
Food frequency of egg				2.975	0.562
Every day of week	6 (23.1%)	20 (76.9%)	26 (100%)		
More than 4 days	9 (24.3%)	28 (75.7%)	37 (100%)		
2–4 days	25 (27.5%)	66 (72.5%)	91 (100%)		
Less than 2 days	60 (29.7%)	142 (70.3%)	202 (100%)		
0 days	50 (34.7%)	94 (65.3%)	144 (100%)		
Food frequency of fruits				7.984	0.092
Every day of week	61 (30.3%)	142 (70.0%)	203 (100%)		
More than 4 days	28 (44.4%)	35 (55.6%)	63 (100%)		
2–4 days	31 (26.1%)	88 (73.9%)	119 (100%)		
Less than 2 days	29 (26.1%)	82 (73.9%)	111 (100%)		
0 days	1 (25%)	3 (75%)	4 (100%)		
Food frequency of green leafy vegetables				2.154	0.707
Every day of week	58 (27.0%)	157 (73.0%)	215 (100%)		
More than 4 days	21 (32.8%)	43 (67.2%)	64 (100%)		
2–4 days	35 (30.2%)	81 (69.8%)	116 (100%)		
Less than 2 days	28 (33.7%)	55 (66.3%)	83 (100%)		
0 days	149 (30.0%)	348 (70.0%)	22 (100%)		

DISCUSSION

The prevalence of refractive errors, obtained from done around the world, ranges from 4% to 12%.^[4] From the studies conducted in various parts of India, the prevalence was found to be 6–22%.^[2-6,8]

In this study, 150 subjects were found to be myopic out of 500, that is, 30%, which is slightly higher in comparison to the other studies. This variation could be because of the difference in lifestyles or living conditions (for example, time spent watching TV, reading habits, and nutrition) or the different diagnostic criteria used.

In a study done in Surat,^[5] Gujarat, the mean age of the onset of refractive error was found to be 10.9 years. A study done in Ahmadabad found the mean age of myopia onset to be 11.22. The mean age of the students with in this study is 10.81, with a standard deviation of 0.017. These statistics indicate that myopia starts at a younger age, and therefore, screening should be done at an early age for proper detection and correction.

It was seen in this study that the male students had a higher prevalence of myopia (30.6%) than female students

(29%), but the small difference seems to be insignificant in statistical analysis. In the study done in Kathmandu too, similar observations were made but the study in Chandigarh showed a higher prevalence of myopia among female students.^[9]

Proportion of cases with refractive error was found to be more in government schools compared to private schools in this study which was in contrast to a study done in Shimla^[6] but it was found to be statistically insignificant in both the cases. In some other studies too, the same observations as the study in Shimla were made.^[4-7] This could be because the students of good socioeconomic classes are the ones who spend more time with TV and computers. Furthermore, the burden of studies is more for them. The reason why this project gave a higher prevalence of myopia in government schools could be that the students of private schools are better off than the students of government school and so they get better nutritional and health facilities.

It was seen that among the students with difficulty in vision, 88.6% were myopic, indicating that myopia is the most common visual problem among these students and this was found statistically significant too. Other studies also

give a higher prevalence of myopia among the refractive errors in children.^[5-8]

Other studies have shown significant association between watching computer or TV closely with the presence of refractive errors among schoolchildren.^[6] In this study, a higher prevalence of myopia was found among students who watch TV more than 4 h/day (40%), and those who have a bad posture while doing it (41.7%) but both the correlations were found to be statistically insignificant. It was found that in students who keep an optimum distance from the screen while watching TV, the myopia prevalence is high, but this too was insignificant. Nevertheless, this could be because of the other factors involved while watching TV like the duration and posture.

This study showed a higher prevalence of myopia among the students who keep a bad posture (41.7%) while reading over the others (29.4%). It was found that the students who use tube light while reading showed a lower prevalence of myopia (28.1%) than the students who use CFL (32.8%) or yellow light (30.8%). However, these were not statistically significant. This study could not find any significant association between close study habits with the presence of refractive errors. The findings of the study done in Lahore showed a correlation between close study habits and studying in dim light with myopia and it was statistically significant.^[2]

In a study done under Australian National University, it was found that hereditary myopia is influenced by environmental factors. Low hereditary values were seen when there is rapid environmental change between generations.^[10] In this study, if the parent/s was myopic, the child was also myopic in 81% of the cases. This finding was statistically significant.

According to a study done by Rose *et al.*^[11] in Sydney, the prevalence of myopia was seen to be lower among the students more involved in outdoor activities. In this study, a lower prevalence of myopia was seen in students who play outdoor games every day (27.8%) than the students who do not play outdoor games regularly (41.8%). This could be because outdoor gaming plays an important role in the physical development of children. Compulsory physical training in schools every day could help in the physical development of the kids as well as keep them healthier.

The prevalence of myopia was higher among the students who complained of frequent headaches (56.3%), pain in the eyes (65.2%), blurring of vision (75%), watering of eyes (65.5%), squinting while trying to see something that is not clear (100%), and discomfort in bright light (33.3%). In the study done in Surat,^[5] blurring of vision and

watering of eyes (17.3%) was found to be present during the disease onset. These symptoms of myopia could help in its early detection. Being a correctable error of the eye, early detection is important in case of myopia. Therefore, health education activities regarding the symptoms of myopia should be carried out in schools.

The analysis of nutrition of the students, done by checking the food frequency of taking milk, starch, egg, fruits, and green leafy vegetables, did not show any correlation with the presence or absence of myopia except that the students who used to take egg and green leafy vegetables for lesser number of days of the week showed higher prevalence of myopia, which was not statistically significant. This could be because the food frequency is a vague estimation of the nutritional status. In a study done in Singapore and Chinese schoolchildren, higher saturated fat and cholesterol intake was found to be associated with longer axial length of the eye ball in otherwise healthy children.^[12]

CONCLUSION

The prevalence of myopia in this study was found to be 30% which confirms the high prevalence of myopia among the school-going children.

The mean age of onset of myopia observed is 10.81, which emphasizes the need for screening activities at a younger age.

Myopia was found to be the most prevalent among the visual disorders in the children.

A high prevalence of myopia was found in the students whose parents had myopia which confirms the role of hereditary factor in the disease.

The prevalence of symptoms of myopia such as frequent headaches, pain in the eyes, blurring of vision, watering of eyes, and squinting was high in the students with myopia. Timely detection of myopia is very important as it could progress if unnoticed. Hence, health awareness in schools with regard to symptoms of myopia could help in the early detection and correction of the condition. Even at the school level, the teacher can be trained to check for subnormal vision and refer the students for further refraction tests.

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