Original Article

Determinants of Myopia among School-Going Children: A Questionnaire-Based Assessment of Risk Factors in North India

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Abstract

Purpose: To assess risk factors associated with high myopia among school-going children in Moradabad, Uttar Pradesh, attending a tertiary eye care hospital.
Patients and Methods: A cross-sectional questionnaire-based study was conducted among 386 patients younger than 18 years diagnosed with myopia. A pre-validated questionnaire was administered through interviews; for children under 6 years, responses were obtained from parents. Information was collected on demographics, duration of spectacle use, study hours at school and home, near-work activities, and daily outdoor activity. Logistic regression was used to analyze potential risk factors, and results were reported as odds ratios with 95% confidence intervals. A p-value ≤ 0.05 was considered statistically significant.
Results: High myopia was present in 10.9% (n = 42) of participants. Most children with high myopia (69.04%) attended private schools. A positive parental history of spectacle use was significantly associated with high myopia ($p = 0.03$). Studying or reading for more than 4 hours per day ($p = 0.01$) and playing video or mobile games for more than 2 hours daily ($p = 0.001$) were positively associated with high myopia. Outdoor activity for more than 2 hours per day showed an inverse association, with fewer children with high myopia engaging in extended outdoor play.
Conclusion: Our results indicate statistical associations between behavioral patterns, environmental exposures, and high myopia in school-going children. These associations should be interpreted with caution given the hospital-based, cross-sectional design. Identifying potentially modifiable behaviors may inform preventive strategies, though longitudinal studies are required to establish temporal or causal relationships.
Keywords: Myopia, Risk Factors, Child, Adolescent, Schools, Northern India

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Introduction

Myopia, or nearsightedness, has become a significant global public health concern, particularly among children and adolescents. Its prevalence has been rising steadily, and projections suggest that by 2050 nearly half of the world's population will be affected [1]. This trend is especially prominent in Asia's urbanized regions, including India, where rapid socioeconomic development and evolving lifestyles contribute to the increasing burden of myopia [2].

Beyond reduced visual acuity, myopia is associated with a higher risk of serious ocular complications such as retinal detachment, myopic maculopathy, and glaucoma, all of which may lead to irreversible vision loss if untreated [3]. The condition also carries a substantial economic burden due to expenditures on corrective lenses, medical care, and losses in productivity linked to visual impairment [4].

In North India, myopia is becoming more prevalent among school-aged children. Studies indicate a higher prevalence in urban areas compared with rural regions, highlighting the influence of urbanization-related lifestyle factors[2]. Children are particularly vulnerable due to a combination of genetic susceptibility, environmental exposures, and behavioral patterns that shape visual development. A family history of myopia is a well-established risk factor [5-6], while environmental contributors include prolonged near-work activities such as reading and studying, as well as increasing screen time associated with digital device use [2,5,6].

Limited outdoor exposure has emerged as one of the most important modifiable risk factors. Time spent outdoors appears to be protective, potentially due to greater exposure to natural light and distance viewing, which may help regulate ocular growth [7-9]. However, outdoor activity is often restricted in urban environments, further increasing risk [7-9].

The burden of myopia among Indian children is expected to rise as academic demands intensify and reliance on private tuition increases[2]. Students in private schools also tend to have greater access to digital devices, leading to more screen exposure compared with those in government schools [2].

Because this study is hospital-based, the findings may not fully represent the broader school-going population. Nevertheless, given the multifactorial influences on myopia development, understanding its determinants among North Indian children is essential. The present study aimed to evaluate risk factors associated with high myopia in school-going children in Moradabad, Uttar Pradesh, attending a tertiary eye care hospital.

Patients and Methods

A cross-sectional study was conducted among 386 children visiting the tertiary eye institute of the Moradabad District who were younger than 18 years of age. The study was approved by the Institutional Review Board and adhered to the tenets of the Declaration of Helsinki. Informed consent was obtained from each participant's caregiver prior to inclusion in the survey. Patients with myopic refraction with or without cylindrical refraction were included in the study, whereas patients with myopic pathologic lesions, retinal pathologies, prior refractive surgeries, and corneal ectatic disorders were excluded. Children were recruited using a consecutive sampling approach, representing a clinical convenience sample rather than a population-based cohort.

Ophthalmic Examination

A detailed ophthalmic examination was

performed on all children before participation to ensure eligibility. All children underwent visual acuity assessment, dry and cycloplegic refraction, slit-lamp examination, and dilated fundus evaluation. Visual acuity assessment was performed using a LogMAR chart. Cycloplegic refraction was performed using 1 % cyclopentolate hydrochloride, instilled twice at an interval of 10 minutes. After 60 minutes from the first cycloplegic drop, a minimum pupil dilation of 6 mm or more with no pupillary reaction was considered appropriate for cycloplegic refraction. Retinoscopy was performed using a streak retinoscope (Beta 200; Heine, Herrsching, Germany). Spherical equivalent refraction for each eye was recorded as the numerical sum of the sphere and half of the cylinder. Myopia was defined as spherical equivalent refraction of −0.50 D or greater in either or both eyes. Spherical equivalent and spherical refraction were further classified into three categories: low, moderate, and high. Low myopia was considered when refraction was between ≤ −0.50 D and ≥ −1.50 D. Moderate myopia was defined when the refraction of an eye was between < −1.50 D and > −6.00 D. High myopia was defined when refraction was ≤ −6.00 D [10].

Study Questionnaire

A pre-validated questionnaire was obtained from a previous study[6] and was imported into Google Forms. The responses were collected by interviewing children who presented to the hospital and were diagnosed with myopia. For children younger than 6 years of age, the responses were collected from parents, with preference given to mothers. The questionnaire was originally in English and was translated into Hindi. The Hindi version underwent review for conceptual equivalence to ensure accuracy of translation. In addition to demographic information, details were obtained on the duration of spectacle use, study duration at school and at home, near-work activities such as playing mobile or video games, and outdoor activity time in school and at home.

Statistical Analysis

Statistical analysis was performed using SPSS software (Statistical Package for the Social Sciences, IBM SPSS Statistics for Windows, Version 25.0; Armonk, NY: IBM Corp). Demographic characteristics were summarized using descriptive statistics (frequencies, percentages, mean, and standard deviation). The chi-square test was used to estimate the relationship between categorical variables. Logistic regression was performed to analyze risk factors and results were reported as odds ratios with 95 % confidence intervals. A p-value of 0.05 or less was considered statistically significant.

Results

Of the 386 children, 195 (50.5 %) were boys and 191 (49.5 %) were girls. The mean age of the children was 10.36 ± 6.78 years. A total of 72.5 % of the children were diagnosed with low myopia, followed by moderate (16.6 %) and high myopia (10.9%). The prevalence of low myopia (≤ −0.50 D and ≥ −1.50 D) was higher in boys than in girls. However, an inverse pattern was observed for high myopia, with 62 % of girls having high myopia (Table 1). Similarly, the majority of the children (90 %) were using spectacles regularly. More than one-third of the participants (41.23 %) wore glasses for more than 15 hours per day, followed by 11–15 hours in nearly one-third (26.7 %) of the children. There was a significant association between gender and

Table 1: Demographic characteristics of the participants entering the study

Parameters	Male	Female	p-value
Age Group			0.001
0–5 years	23	6	
6–10 years	66	49	
10–15 years	65	73	
>15 years	41	63	
Class			0.02
Below 1st standard	20	8	
1st–3rd standard	29	22	
4th–6th standard	45	37	
>6th standard	101	124	
Wearing glasses permanently			0.01
Yes	169	180	
No	26	11	
Hours of wearing glasses			0.12
0–5 hours	42	22	
6–10 hours	51	35	
11–15 hours	76	27	
>15 hours	41	92	
Myopia Classification			0.06
Low	167	113	
Moderate	30	34	
High	16	26	

demographic characteristics, except for hours of spectacle use (Table 1).

The distribution of spherical equivalent refraction by age and gender are represented in figure 1 and figure 2 respectively.

The risk factors for high myopia were analyzed, and odds ratios for all variables were estimated (Table 2). There was a significant association between developing high myopia and not wearing spectacles permanently (OR 2.36, 95 % CI 1.17–5.22, p = 0.01). The results also showed a positive association between developing high myopia and having a positive parental history of spectacle use (OR 1.66, 95 % CI 0.83–2.99, p = 0.03). With respect to behavioral risk factors, a significant positive association with high myopia was observed in children studying or reading for more than 4 hours per day at school and at home (OR 2.67, 95 % CI 1.62–4.82, p = 0.01), as well as in children playing video or mobile games for more than 2 hours per day (OR 2.14, 95 % CI 1.29–5.76, p = 0.001). Additionally, an inverse association with outdoor activities was observed, as only 23.8 % of children with high myopia engaged in more than 2 hours of outdoor play compared with 68.3 % of children without high myopia (p = 0.001; Table 2).

Discussion

The purpose of the present study was to evaluate the risk factors for myopia among North Indian children visiting tertiary eye care hospitals. More than 10% (n = 42) of the children had high myopia. The results showed a statistical association between increased near-work activities (reading/writing for more than 4 hours per day) and higher odds of high myopia. Similarly, we found a negative association between high myopia and outdoor

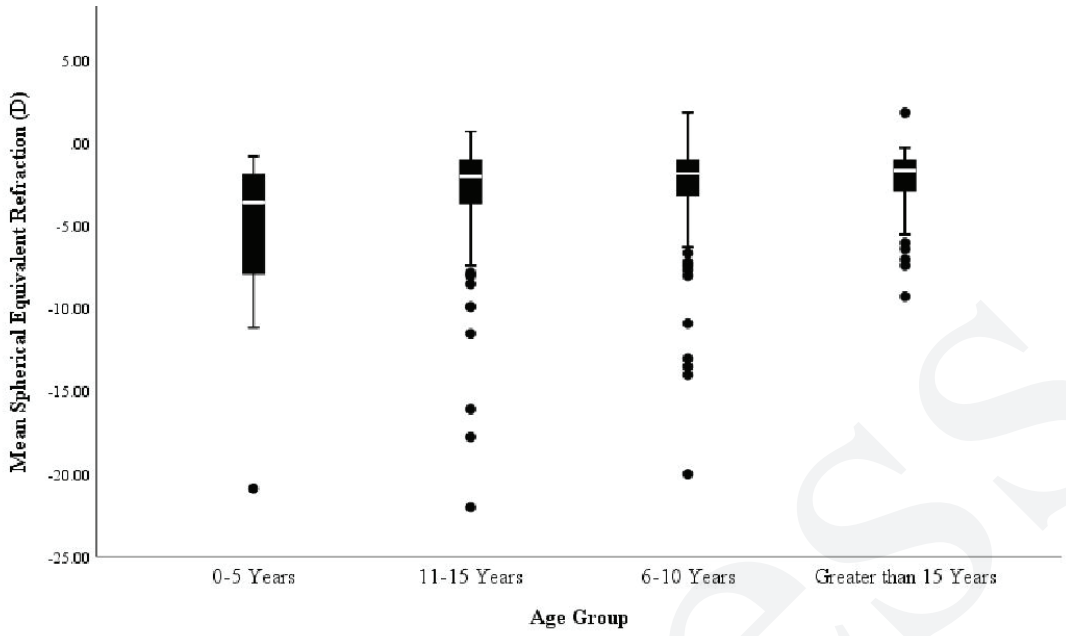

Figure 1: Box-and-whisker plot showing the magnitude of myopia with age group.

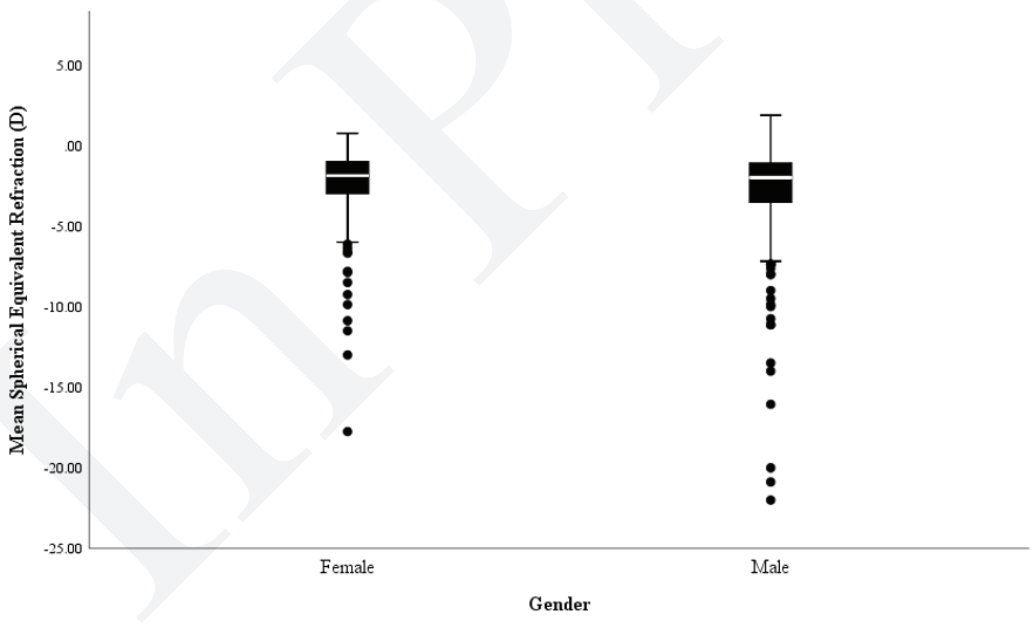

Figure 2: Box-and-whisker plot showing the magnitude of myopia with gender.

activities. The findings further suggested that children who spent more than 2 hours playing outdoors were less likely to develop high myopia. These associations must be interpreted cautiously because the hospital-based sample may not reflect the wider school-going population.

The cross-sectional design prevents establishing temporal or causal relationships. Self-reported behavioral data may introduce

Table 2: Associated risk factors of high myopia among patients entering the study.

Risk Factors	High MyopiaYes (n = 42)	No High MyopiaNo (n = 344)	OR (95% CI)	*P-value
Using glasses permanently				
Yes	10	301	1 (Reference)	
No	32	43	2.36 (1.17–5.22)	**0.01**
Family history of wearing spectacles				
No	14	286	1 (Reference)	
Yes	28	58	1.66 (0.83–2.99)	**0.03**
Study hours (reading/writing) at school and home				
0–4 hours	08	158	1 (Reference)	
>4–8 hours	29	186	2.67 (1.62–4.82)	**0.01**
>8 hours	05	0	—	—
Hours per day playing mobile/ video games				
0–1 hour	11	164	1 (Reference)	
>1–2 hours	10	83	0.54 (0.07–1.86)	**0.02**
>2–3 hours	14	89	2.14 (1.29–5.76)	**0.001**
>3 hours	07	08	3.48 (1.69–5.76)	**0.001**
Hours per day playing outdoor games				
0–2 hours	32	109	1 (Reference)	
>2–3 hours	06	192	0.22 (0.06–0.36)	**0.001**
>3 hours	04	43	0.11 (0.03–0.52)	**0.001**

*Based on chi-square test

recall or reporting bias. Important confounders such as socioeconomic status, parental education, and school type were not included in the regression model and may influence the associations.

The findings of the present study are similar to previous literature [2-6]. Saxena et al., [2] reported a positive association between the presence of myopia and children studying or reading for more than 5 hours per day, watching television for more than 2 hours per day, and playing computer, video, or mobile games. Similarly, an inverse association with outdoor activities was noted in children who played for more than 2 hours per day. Another study in northern India found a positive association between myopia and children studying for more than 4 hours per day and playing computer or mobile games for more than 2 hours per day, while a protective effect was observed in children who engaged in outdoor activities for more than 1.5 hours per day [6].

We found a higher prevalence of myopia among male than female children (64 % vs. 36 %). A similar result was observed in a study conducted in Haryana, India (25 % vs. 19 %) [11]. Similarly, 12% (n = 5) of children spent more than 8 hours per day studying, including reading and writing at home and school. This may reflect the competitiveness of the educational system in these schools and is consistent with reports from other countries where higher levels of near work in children have been associated with myopia [12-15]. The odds of being myopic significantly increase with the number of parents with myopia [16,17]. Xiang et al., [16] reported odds ratios of 1.42 for children with one parent with myopia, 2.70 for children with two parents with myopia, and 3.39 for children with two parents with childhood-onset myopia, compared with children without parental myopia.

Children without high myopia spent significantly more hours (> 2 hours per day) in outdoor play or activities (Table 2), which is consistent with reports from other East Asian countries [18,19]. We also found a negative correlation between time spent outdoors and near work. This was expected because children who are outdoors cannot simultaneously be indoors engaging in near activities such as reading or playing video games. Variability in patterns of near and outdoor activity among children may have contributed to the weak negative correlation. This finding aligns with the results of Li et al., [20] who reported a protective effect of outdoor activity in myopic children who spent less time watching television.

This study has several limitations. The hospital-based sampling may not represent the broader school-going population. The cross-sectional design prevents establishing temporal or causal relationships. Behavioral exposures such as study hours, screen time, and outdoor activity were self-reported and may be prone to recall bias. Some exposure categories had very small numbers, which may affect the stability of the odds ratios. In addition, the logistic regression used unadjusted odds ratios, and unmeasured confounders may have influenced the associations.

Conclusion

Our results indicate statistical associations between behavioral patterns, environmental exposures, and high myopia in school-going children. These associations should be interpreted with caution given the hospital-based, cross-sectional design. Identifying potentially modifiable behaviors may inform preventive strategies, though longitudinal studies are required to establish temporal or causal relationships.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.