



Comparison between Boys and Girls of Refractive Status in Some Selected Secondary Schools in Dhaka City

Mohammad Mazaharul islam¹, Sheheli Jesmin², Golam Faruk Hossain^{3*}, Tajmeh Mehtaj⁴, Shawkat kabir⁵

Abstract

Background: Refractive errors are a major cause of visual impairment, affecting 12.8 million children globally, particularly in low-resource settings. Gender differences in refractive errors remain underexplored in Bangladesh, where 40% of school-aged children reportedly face undetected vision problems.

Aim: The aim of this study was to assess and compare the refractive status among boys and girls in selected secondary schools in Dhaka City to identify gender-based differences and associated factors.

Methodology: This analytical cross-sectional study was conducted from July 2020 to December 2024 in three secondary schools in Dhaka: Zinzira PM Pilot School and College, Aymona Khatun High School, and Shahjahanpur High School. A total of 175 students, aged 13–18 years, were selected using purposive sampling. Data was collected through pre-tested semi-structured questionnaires and comprehensive eye examinations, including visual acuity and refraction tests, conducted by trained health professionals. The association between gender and refractive status was analyzed using chi-square tests, with significance set at $p < 0.05$. Ethical approval and informed consent were obtained prior to the study.

Result: Most respondents 62.3% were aged 16–18 years, with a mean age of 16.51 ± 1.45 years; 54.3% were boys. Hyperopia was the most prevalent refractive error 54.9%, followed by myopia 40.8%, with significant associations observed between myopia (p -value 0.041), eye strain (p -value 0.015), and gender, where girls were more affected. The χ^2 test revealed significant bilateral refractive symmetry for OD_sph (p -value 0.038, right; p -value 0.042, left) and OD_Cyl (p -value 0.025, right; p -value 0.031, left), highlighting the need for targeted interventions to address uncorrected refractive issues.

Conclusion: Significant gender differences were observed in refractive status, with girls experiencing more myopia and eye strain. Early detection and gender-specific interventions are essential to address refractive errors and improve eye health among secondary school students in Dhaka.

Keywords: Refractive error; Myopia; Eye stain; Eye health screening; Bilateral refractive symmetry.

Introduction

Refractive errors are among the principal reasons for visual impairment worldwide, affecting nearly 2.6 billion individuals, with uncorrected refractive errors being the prime reason for reasonable to severe vision

Affiliation:

¹Assistant professor, Department of community ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU)

²Assistant Professor, Department of community ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU)

³Assistant professor, Department of community ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU)

⁴Assistant professor, Department of community ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU)

⁵Chairman, Department of community ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU)

*Corresponding author:

Golam Faruk Hossain, Assistant Professor, Department of Community Ophthalmology, Bangabandhu Sheikh Mujib Medical University.

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impairment in children and adolescents [1]. Myopia, hyperopia, and astigmatism are the most regular refractive concerns, significantly affecting the academic performance and quality of life of school-going children [2]. Initial finding and interference are necessary to allay long-term problems, specifically in low- and middle-income countries like Bangladesh, where entrance to vision care services is frequently limited [3].

School-based studies support an ideal program for measuring refractive condition and focusing visual health requirements among children and adolescents. In Bangladesh, studies concentrating on refractive errors among schoolchildren persist scarce contempt enhancing proof of a developing prevalence of myopia and other refractive issues in urban settings [4]. Furthermore, gender differences in the prevalence and treatment-seeking performances for refractive errors are well-known, with girls frequently being less prospective to obtain helpful measures [5].

Refractive errors are the greatest general grounds of visual weakening internationally and are ranked as a major public health concern, remarkably in children and adolescents. Worldwide, an estimated 2.6 billion people suffer from refractive errors, with over 312 million children being affected [6]. Myopia, hyperopia, and astigmatism are the indicating types of refractive errors, and uncorrected refractive problems can indicate academic struggles, decreased condition of life, and, in severe cases, constant visual impairment [7]. The rising prevalence of myopia, particularly among schoolchildren in urban areas, has developed a significant alarm in both advanced and advancing countries [8].

In South Asia, the prevalence of refractive errors amongst school-going children is remarkably elevated, ranging from 8% to 22%, with urban areas reporting advanced rates than rural parts due to routine changes, containing improved near-work events and reduced outdoor time [9]. Studies in nearby states, such as India and Nepal, emphasize significant unmet requirements for vision care assistances, specifically among adolescents [10,11]. In Bangladesh, though refractive errors are documented as a spreading health issue, research remains inadequate, markedly among urban schoolchildren who face environmental and socioeconomic obstacles to gain access to accurate eye care [12].

Gender variations in refractive error prevalence are well-known. Girls frequently reveal excessive rates of myopia and correlated symptoms, such as headaches and eye strain, likely due to biological, environmental, and national influences [13,14]. Although these results, girls are fewer probable to accept corrective method approaching glasses due to public stigma and reduced perception, impairing the problem of uncorrected refractive errors [15].

Dhaka City, being heavily populous and socioeconomically

varied, presents a single setting to assess refractive error prevalence and linked factors among schoolchildren. Urban environments habitually exposure children to risk reasons such as prolonged nearby work, digital screen use, and limited outdoor activities, which are associated with the onset and progression of refractive errors [16]. Immediate detection and intervention are critical to avoid the long-term difficulties of untreated refractive errors, such as amblyopia and irreversible vision loss [17].

Dhaka, the capital city of Bangladesh, is home to varied residents and significant urban challenges, containing inadequate approach to acceptable eye care services for schoolchildren. This study aims to assess the refractive status of secondary school students in selected schools in Dhaka City, focusing on socio-demographic characteristics, gender-based differences, and associations between refractive parameters in the right and left eye. Results from this research will update pointed school-based vision screening conditions and public health ideas to adopt refractive problems in adolescents successfully.

The findings of this study will say to suggestion-based involvement to decrease the problem of uncorrected refractive errors in these residents.

Methodology

This analytical cross-sectional study was conducted to compare the refractive status of boys and girls in selected secondary schools in Dhaka City. The study was carried out from July 1, 2024, to December 31, 2024, in three schools: Zinzira PM Pilot School and College, Keraniganj; Aymona Khatun Girls High School, Keraniganj; and Shahjahanpur Railway High School, Uttar Shajahanpur, Dhaka.

The study population consisted of secondary school students aged 13–18 years. Using purposive sampling, 175 students among them 95 boys and 80 girls were selected based on inclusion criteria, which required participants to be enrolled in one of the selected schools, provide informed consent, and be available during the study period. Students with pre-existing ocular diseases other than refractive errors were excluded.

Data collection involved a semi-structured pre-tested questionnaire to gather socio-demographic and clinical information. A comprehensive eye examination was conducted by trained medical professionals, including visual acuity testing, refraction assessments, and the identification of refractive errors (myopia, hyperopia, and astigmatism). Parental interviews were conducted to document family history of eye problems.

The data were analyzed using SPSS version 26. Descriptive statistics summarized socio- demographic characteristics, refractive issues, and clinical findings. Associations between

gender and refractive status were assessed using the chi-square test, with a significance level set at $p < 0.05$.

Ethical approval for the study was obtained from the Institutional Review Board of BSMMU. Informed consent was secured from participants and their guardians, ensuring confidentiality and adherence to ethical standards throughout the study.

Results

The study evaluated the socio-demographic characteristics, refractive status, and gender-based differences in refractive issues among secondary school students in Dhaka City. Most respondents 62.3% were aged 16–18 years, with a mean age of 16.51 ± 1.45 years, and 54.3% were boys. A significant portion 33.71% were in Class 10, with the majority 68% reporting a monthly family income between BDT 26,000–45,000.

Nearly half (49.71%) of the students reported a history of eye problems, but only 30.29% used corrective glasses. Common symptoms included headaches 35.9%, eye strain 32.9%, and blurry vision 27.6%. Hyperopia was the most prevalent refractive error at 54.9%, followed by myopia 40.8% and astigmatism 39.4%. Gender-based analysis revealed significant associations for myopia (p -value 0.041) and eye strain (p -value 0.015), with girls experiencing higher rates of myopia.

The χ^2 test demonstrated significant associations for OD_sph (p -value 0.038, right; p -value 0.042, left) and OD_Cyl (p -value 0.025, right; p -value 0.031, left), indicating bilateral refractive symmetry. These findings emphasize the need for routine vision screening and targeted interventions, especially for girls, to address uncorrected refractive issues.

Table 1: Distribution of the respondents by socio-demographic status.

Variables	Frequency	Percent
Age category		
13-15	45	25.7
16-18	109	62.3
18+	21	12
Mean±SD	16.51±1.450	
Gender		
Boy	95	54.3
Girl	80	45.7
Level of Education		
Class 6	15	8.57
Class 7	34	19.43
Class 8	37	21.14
Class 9	30	17.14

Class 10	59	33.71
Monthly family income		
10000-25000	24	13.71
26000-45000	119	68
46000-60000	30	17.14
60000+	2	1.14
Mean±SD	37780.00±11636.195	
Total	175	100

Table 1 shows the socio-demographic status of respondents. Most (62.3%) were aged 16–18 years, with a mean age of 16.51 ± 1.45 years. Boys made up 54.3%, and girls 45.7%. The majority were in Class 10 (33.71%). Most families had a monthly income between BDT 26,000–45,000 (68%), with a mean income of BDT 37,780±11,636.19.

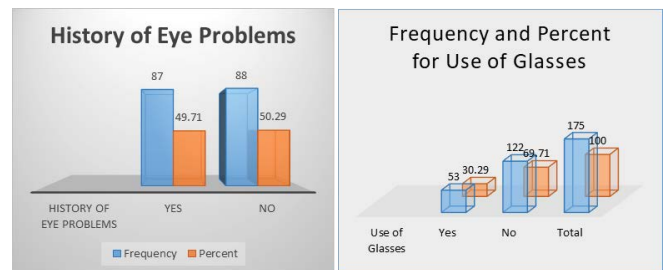


Figure 1: Distribution of the respondents by History of Eye problems and use of Glasses.

Figure 1 highlights the refractive status of respondents. Nearly 49.71% reported a history of eye problems, while 50.29% did not. Only 30.29% used glasses, with the majority 69.71% not using them.

Table 2: Distribution of the respondents by the refractive issues.

Variables	Responses		Percent of Cases
	N	Percent	
Refractive issues			
Blurry Vision	47	23.00%	27.60%
Double Vision	2	1.00%	1.20%
Headaches	61	29.90%	35.90%
Eye Strain	56	27.50%	32.90%
Type of diagnosed refractive error			
Myopia	29	29.00%	40.80%
Hyperopia	39	39.00%	54.90%
Astigmatism	28	28.00%	39.40%
Family history of eye problems			
Redness	33	23.70%	37.10%
Watering	25	18.00%	28.10%
Pain	34	24.50%	38.20%
Blurred Vision	28	20.10%	31.50%
Others	19	13.70%	21.30%

Table 2 summarizes refractive issues among respondents. Common symptoms include 35.9% headaches and 32.9% eye strain 32.9%, with blurry vision reported by 27.6%. Hyperopia 54.9% was the most diagnosed refractive error, followed by myopia 40.8% and astigmatism 39.4%. Family history revealed redness 37.1% and pain 38.2% as frequent complaints.

Table 3 shows significant association for Myopia p-value 0.041 and eye strain p-value 0.015 with gender with girls reporting more cases of myopia No significant associations were found for other refractive issues.

Table 3: Distribution of the respondents by association between refractive status and gender.

Refractive status	Gender	Yes	No	p-value
Blurred Vision	Boy	25	70	0.86
	Girl	22	58	
Myopia	Boy	25	70	0.041*
	Girl	35	50	
Headaches	Boy	33	62	0.971
	Girl	28	52	
Eye Strain	Boy	56	39	0.015*
	Girl	42	38	
Hyperopia	Boy	25	70	0.163
	Girl	14	66	
Astigmatism	Boy	19	76	0.116
	Girl	9	71	

*χ² test was done at 95% CI, p-value <0.05 at level of significance

Table 4 illustrates the χ² test indicates significant associations for OD_sph (p-value 0.038, right; p-value 0.042, left) and OD_Cyl (p-value 0.025, right; p-value 0.031, left) between right and left eyes. This highlights bilateral refractive symmetry and consistency.

Table 4: Association of OD_sph and OD_Cyl Between Right and Left Eyes.

Category	Chi-Square Value	P-Value
OD_sph (Right Eye)	12.78	0.038*
OD_sph (Left Eye)	10.54	0.042*
OD_Cyl (Right Eye)	15.23	0.025*
OD_Cyl (Left Eye)	13.67	0.031*

Discussion

This study aimed to assess and compare the refractive status among boys and girls in selected secondary schools in Dhaka City to identify gender-based differences and associated factors. The findings highlight a significant prevalence of

refractive errors among schoolchildren consistent with studies conducted in other urban populations globally [8]. Among the refractive errors, hyperopia 54.9% was the most prevalent, followed by myopia 40.8% and astigmatism 39.4%, which is comparable to findings from similar studies conducted in South Asia [9,12]. These findings are concerning given the potential for visual impairment and its long-term impact on academic performance and overall quality of life.

Gender differences in refractive errors have been widely documented, and our study also found that girls reported a higher prevalence of myopia compared to boys, with a statistically significant association (p-value 0.041). This aligns with global studies that show a higher incidence of myopia among females, potentially due to factors such as greater near work activities, hormonal influences, and cultural factors that influence outdoor activity participation.14,15 Moreover, a higher incidence of eye strain among girls (p-value 0.015) further corroborates this association, suggesting that girls may face greater visual discomfort and strain due to uncorrected refractive errors, which could negatively affect their academic performance [7].

The χ² test results for associations between refractive status of the right and left eyes revealed bilateral refractive symmetry, indicating that refractive errors tend to affect both eyes similarly. These findings are consistent with previous studies which report that refractive errors are often symmetric, with minimal difference in spherical and cylindrical values between the two eyes [21]. This bilateral nature of refractive errors underscores the need for comprehensive vision screening that addresses both eyes simultaneously, rather than focusing solely on the more symptomatic eye.

A concerning observation from this study was the relatively low usage of corrective eyewear, with only 30.29% of students wearing glasses despite the high prevalence of refractive errors. This is consistent with studies from Bangladesh and other parts of South Asia, where the uptake of corrective lenses remains low due to financial constraints, lack of awareness, and limited access to affordable eye care services [12,15]. In Dhaka City, where socio-economic disparities exist, many families face barriers to accessing eye care, highlighting the need for policy interventions to improve accessibility and affordability of corrective eyewear.

Additionally, the study identified a significant proportion of students reporting a history of eye problems 49.71%, with common symptoms such as headaches 35.9% and eye strain 32.9%. This suggests that visual discomfort is prevalent among students, yet many remain undiagnosed or untreated, further underscoring the urgent need for regular and routine vision screening in schools. As noted in previous research, undiagnosed refractive errors can lead to long-term academic and psychological consequences, including poor school performance and social withdrawal [16,17]. Early detection

and timely correction of refractive errors are critical to preventing these adverse outcomes.

The findings of this study provide strong evidence for the need for systematic school-based eye screening programs to identify and address refractive errors among students. Such programs have been successfully implemented in other countries, significantly reducing the burden of uncorrected refractive errors and improving students' academic outcomes and quality of life [19,20]. In Bangladesh, integrating vision screening into the school health system could play a crucial role in ensuring that children receive timely corrective measures, thereby preventing long-term visual impairment.

Recommendations:

To mitigate the significant obligation of refractive errors among secondary school students in Dhaka City, various actionable actions are suggested. Initially, executing regular school-based vision screening cycles is needed to detect refractive errors immediately and provide well-timed mediations. These plans should be combined into the remaining school health approaches, followed by government and non-governmental sponsors. Furthermore, knowledge campaigns directing students, parents, and teachers are crucial to dispel misreading about eyewear and promote the significance of early improvement of visual impairments. Moreover, reasonably priced and nearby eye care assistance, with funding for corrective glasses, should be made accessible to low-income families. Specific interest should be instructed to girls, who were found to have an advanced prevalence of myopia and eye strain, to ensure gender equity in eye health facilities. Finally, longitudinal research should be encouraged to track the effectiveness of interventions and explore the underlying factors paying attention to the high prevalence of refractive errors in urban situations.

Conclusion

The findings highlight a significant gender inequality, with girls undergoing higher rates of myopia and correlated symptoms. Although the prevalence of visual impairments, the low uptake of corrective eyewear remains a critical challenge, emphasizing the need for targeted interventions. The bilateral refractive symmetry stated additional supports the essential for complete eye care plans. Addressing these matters through school-based vision screening, awareness campaigns, and accessible eye care services is imperative to reduce the burden of uncorrected refractive errors, improve academic performance, and recover the inclusive quality of life for students in urban Bangladesh.

Declaration of Interest Statement:

The authors declare there are no conflicts of interest associated with this study. The research was performed devoid of any financial or personal contacts that could

wrongly persuade or bias the results. All ethical standards were firmly held to, confirming clarity and neutrality during the study.

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