

Prevalence of Refractive Errors among the Madrassah Students of Karachi and Sukkur

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Abstract

Background: Visual impairment caused by refractive errors is one of the most common issues faced by school-age children. Despite ongoing developments in access to health care, multiple factors, including awareness and recognition of issue, still contribute to persistence of uncorrected refractive errors especially among madrasah students. Many studies have estimated the prevalence of refractive errors in school-going children but data from madrasahs are lacking so this study aims to find the prevalence of refractive errors in madrasahs of Karachi.

Objective: To determine the prevalence of refractive errors among the students of five registered madrasahs in Karachi and Sukkur.

Methods: This cross sectional study was conducted in five madrasahs across Karachi and Sukkur, during August 2024 to December 2024. After taking approval from Institutional Review Board, informed consent and assent were obtained for each participant. In children aged 7–15 years, Subjective refraction was performed using standard Snellen's visual acuity chart at 6 meters' distance. Individuals identified as ametropic during subjective refraction were subsequently referred for objective refraction.

Results: Refractive errors are more common in females than males ($p < 0.05$), and in urban population than rural ones ($p < 0.05$). Myopia was found to be the most common refractive error (57.7%) followed by astigmatism (22.1%) and then hypermetropia (20.1%).

Conclusion: Screening Madrasah children for refractive errors is crucial due to the high prevalence and prolonged near-work associated with their curriculum.

Key words: Refractive error, madrasah, myopia, hypermetropia, astigmatism.

Introduction

Refractive error ranks among the primary causes of visual impairment, with recent findings indicating that a significant portion of the global population suffers from blindness attributable to high refractive error due to inadequate corrective measures.¹ Refractive error's role in causing blindness has often been overlooked, largely due to definitions of blindness relying on best corrected

visual acuity (BCVA).² However, if blindness were defined based on presenting distance visual acuity, refractive error would emerge as the second most significant cause of treatable blindness in many regions across the globe.³

Visual impairment in childhood stemming from refractive errors stands as one of the prevalent challenges among school-age children.⁴ In this age group, uncorrected refractive errors are the second leading cause of treatable blindness. The exact scale of this issue remains uncertain on a global level, with variability arising from factors such as age demographics, differing blindness criteria, and examination techniques.⁵ Globally, an estimated 153 million individuals aged five and above are succumbed to visual impairment caused by uncorrected refractive errors, including 8 million who are blind.⁶

Although numerous screening initiatives are conducted in schools, there remains a deficiency in accurate data regarding the prevalence of uncorrected refractive errors among Madrasah students of Karachi. For instance, various relevant studies conducted in Pakistan reported prevalence

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Authors Contribution

MH conceptualized the project. SA & NA did the data collection. MH, SA & NA did the literature search, performed the statistical analysis, drafting, revision and writing of manuscript

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rates of 19.8% in Lahore, 20.43% in Kohat and 17.24% in Southern Punjab.^{7,8} In another study, the prevalence of refractive error was notably higher among students attending public high schools, with 244 individuals (59.2%), compared to those attending private schools, where 168 individuals (40.8%) were affected.⁹ A recent study conducted in madrassahs of Haripur showed that 41% students had refractive errors.¹⁰ Furthermore, a study conducted in Karachi in 2008, reported the prevalence of refractive errors in school children to be 8.9%.¹¹ According to existing literature, there is no reliable data till date regarding the prevalence of refractive errors in madrassah students of Karachi. Multiple factors contribute to the persistence of uncorrected refractive errors, including limited awareness and recognition of the issue at community and public health levels. Among individuals aged 5-15 years, the absence of screening programs and the limited availability and affordability of refractive corrections emerge as primary factors. Nevertheless, mythological beliefs empowered by culture and religion also impact the situation as these play major role in developed countries where aforementioned primary factors are resolved.

Hence the objective of the study was to find the prevalence of refractive errors among the students of five registered madrassahs in Karachi and Sukkur.

Methods

This descriptive cross-sectional study was conducted in five of the largest registered madrassahs in Karachi and Sukkur over a four-month period. The parental/guardian consent was secured for student screening. Data collection occurred from August 2024 to December 2024. Eligible participants included madrassah students of both genders, aged 7-15 years, while those with significant media opacity, recent ophthalmological surgery, intravitreal injections, prior laser treatment, or non-refractive ocular conditions affecting vision were excluded. A non-probability consecutive sampling technique was employed, enrolling all students meeting the inclusion criteria within the study period after obtaining informed consent and assent.

A multidisciplinary team comprising two senior optometrists and two medical doctors, equipped with a comprehensive diagnostic kit, conducted regular visits to the madrassahs over a four-month period. The kit included essential tools such as cycloplegic drops, retinoscope, trial set for subjective refraction, direct and indirect

ophthalmoscopes, and Snellen chart, enabling the team to conduct thorough eye examinations and detect refractive errors among the students. The doctors took a detailed medical history, including personal and family history, and recorded data on a pre-designed proforma. In children aged 7-15 years, subjective refraction was performed using a standard Snellen's visual acuity chart at a 6-meter distance. The pinhole test was used to differentiate between uncorrected refractive error and organic causes of visual impairment. Improvement with the pinhole test indicated refractive error, while lack of improvement suggested other underlying ocular conditions. Students diagnosed with ametropia on subjective refraction were subsequently referred for objective refraction.

In students under 12 years old, cycloplegic refraction was performed using streak retinoscopy following the administration of 0.5% cyclopentolate eye drops, allowing for an objective assessment of refractive error, which was subsequently validated through a post-mydratic subjective verification. Conversely, students above 12 years underwent non-cycloplegic streak retinoscopy, with refractive error further refined subjectively. A comprehensive ocular assessment was conducted on all students, encompassing extraocular motility evaluation, Hirschberg test, cover-uncover and alternate cover tests, red reflex examination, optic disc evaluation via direct ophthalmoscopy, and fundus examination utilizing indirect ophthalmoscopy. Students diagnosed with ocular pathologies, including strabismus, cataract, pterygium encroaching upon the visual axis, retinoblastoma, persistent hyperplastic primary vitreous, toxoplasmosis, or retinitis pigmentosa, were referred to a tertiary care hospital for further management and treatment. Students having scissors reflex on retinoscopy were examined on slit lamp to rule out any other causes of irregular astigmatism like corneal scarring and were then sent for corneal topography to rule out keratoconus and other ectasia. All those students who had refractive errors were prescribed glasses and amblyopia therapy if indicated. The refractive errors were categorized based on specific dioptric values. Myopia was defined as a refractive error of -0.5 diopters (DS) or greater, with further stratification into mild (0.5-3D), moderate (3-6D), and severe (>6D). Hyperopia was defined as a refractive error of +0.5 DS or greater, with mild (0.5-2D), moderate (2-5D), and severe (>5D) categories. Astigmatism was defined as a refractive error of 0.5 diopters cylinder (DC) or greater, and could be myopic, hypermetropic, or mixed.

Data was entered and analyzed using SPSS version 23. Quantitative variables were

assessed for normality by Shapiro Wilk test. Mean and standard deviation/median and interquartile ranges were computed for age of the students and refractive error. Frequency and percentages were computed for the gender, presence and/or absence of refractive error and the type of refractive error. P-value less than or equal 0.05 was taken as significant.

Results

A total of 4,515 madrassah students were approached. About 400 students were not included in the study as it was not approved by their parents/guardians. The demographics of the students are shown in Table-1.

Table 1. Demographics of the Madrassah Students.

Demographics		n	%
Gender	Male	3549	78.6
	Female	966	21.4
City	Karachi	3075	68.0
	Sukkur	1440	38.0
Ethnicity	Rural	1844	40.8
	Urban	2671	59.1

Out of 4,515 students, 3075 (68%) were from Karachi and 1440 (38%) were from Sukkur. Females were 966 (21.4%) and males were 3549 (78.6%). The enrolled students had age between 7 to 15 years with a mean of 10.39 years. 1844 (40.8%) students belonged to rural areas while 2671 (59.1%) belonged to urban areas.

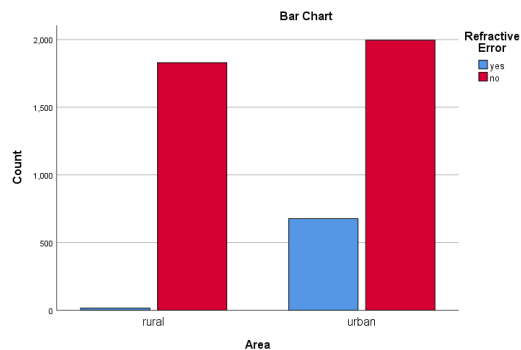


Figure1: Distribution of Refractive error in urban and rural students.

Out of 4515 students, 691 (15.3%) had refractive error. Out of these 691 students, both eyes were involved in 624 students (90.3%) followed by left eye only in 55 students (7.9%) and only right eye in 12 students (1.73%). The most common refractive error was Myopia (n =399, 57.7%) followed by Astigmatism (n =153, 22.1%) and Hypermetropia (n

=139, 20.1%). Out of the 153 students having astigmatism, myopic astigmatism was detected in 86 students (56.2%) and hypermetropic astigmatism was found in 67 students (43.8%). Glasses were prescribed to all of the above. Refractive errors were more common in urban than rural population ($p < 0.05$) (Figure-1) and more common in females than in males ($p < 0.05$) (Figure-2). Table-2 shows the prevalence rates distributed across the different groups of refractive errors.

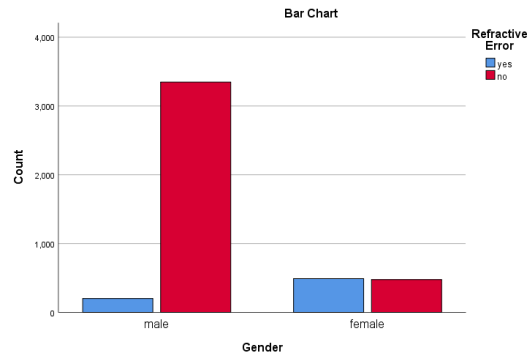


Figure 2: Distribution of Refractive Error in male and female students.

Table 2: Frequencies of different grades of myopia and hypermetropia.

Refractive Error	n	%
Mild myopia	201	50.4
Moderate myopia	146	36.6
Severe myopia	52	13.0
Mild hypermetropia	71	51.1
Moderate hypermetropia	61	43.9
Severe hypermetropia	7	5.0

Discussion

Screening for refractive errors in children is imperative to prevent irreversible vision loss and ensure optimal visual development.¹² Untreated refractive errors can lead to amblyopia, strabismus, and compromised academic performance, ultimately affecting self-esteem and overall quality of life.¹³ Conversely, early detection through comprehensive eye examinations enables prompt correction, thereby enhancing visual acuity, concentration, and participation in activities.¹⁴ Regular screenings, commencing in infancy and continuing through school age, facilitate timely intervention, mitigating the risk of complications and fostering improved cognitive, social, and emotional development. By prioritizing pediatric eye care, we can empower children to reach their full potential, unencumbered by visual limitations.

Many studies across the globe have been conducted to estimate the prevalence of refractive errors in children. A study of 2523 children, aged 5-17 years in 4 ethnic groups, found an overall prevalence of refractive errors of 50.4%, with astigmatism (28.4) being the most common followed by hypermetropia (12.8%) and myopia (9.2%).¹⁵ But Asian had the highest prevalence of myopia and the least prevalence of hypermetropia in their study which is consistent with this study. Another study including 3524 children in China reported myopia as the most common refractive error, with high myopia (≤ -6.0 D) reported in 0.9%. The present study revealed a relatively higher prevalence of high myopia.¹⁶ Another cross sectional study conducted in schools in Lahore found the prevalence of refractive error to be 24.4% with myopia being the predominant one. They found a higher prevalence in urban areas as compared to rural similar to the present study.⁷ Refractive errors, particularly myopia, are more prevalent in urban populations compared to rural ones due to lifestyle differences. Urban children tend to spend more time indoors, engaging in near-work activities such as reading, screen time, and homework, which increases their risk of developing myopia. Conversely, rural children spend more time outdoors, exposed to natural light, which has a protective effect against myopia development. Additionally, urbanization is associated with reduced physical activity, increased socioeconomic status, and altered dietary habits, further contributing to the disparity.¹⁷

Various studies including ours have reported myopia to be more common in female children than males due to earlier puberty onset, which accelerates eye growth and increases axial length, and reduced outdoor activities exacerbating myopia risk. Furthermore, research indicates that estrogen levels may play a role in myopia development, with higher estrogen levels associated with increased myopia risk.¹⁸

Previous studies conducted among Madrasah students in Pakistan had comparable results to this study but they had smaller sample sizes.^{10,19} A huge proportion of the children are studying in madrassah but they are way distant from screening programs than school-going children as evident by the studies that enroll schools more often. Given their huge number they cannot be neglected in screening programs. Screening Madrassah children for refractive errors is crucial due to the high prevalence and prolonged near-work associated with their curriculum. Many Madrassah students come from disadvantaged backgrounds, facing barriers to eye care access. Uncorrected refractive errors hinder academic performance, potentially affecting future

opportunities. Early detection and correction can prevent permanent vision loss from amblyopia or other complications. Integrating eye screenings into existing health programs can enhance overall well-being.²⁰ By addressing refractive errors, Madrassah students can fully engage with their studies, promoting empowerment and social mobility. This proactive approach bridges healthcare disparities, improves education outcomes, and enhances quality of life for vulnerable populations.

This study revealed a notable prevalence of refractive errors among the surveyed madrassah students, underscoring the need for targeted interventions; while spectacles remain the most straightforward corrective measure, the observed reduction in myopic shift among participants receiving low dose atropine and orthokeratology highlights the potential of these modalities to actively control progression, and the addition of behavioral visual training further suggests a multifaceted approach can mitigate worsening refractive status. Importantly, integrating refractive correction with amblyopia therapy not only improved visual acuity in students with co existing amblyopia but also promoted binocular function, indicating that addressing both the optical deficit and neural deficits concurrently yields synergistic benefits; these results collectively argue for school based programs that combine optical correction, pharmacologic slowing, corneal reshaping, and vision therapy to curb the rising burden of refractive errors in this population.

Conclusion

This study provides valuable baseline data on refractive errors among children in Madrassahs of Karachi and Sukkur, highlighting crucial information. Key findings reveal that refractive errors are disproportionately prevalent among students from urban areas and female students. Notably, the present study sheds light on the often-overlooked population of madrassah students, underscoring the need for targeted eye care interventions in these communities. These findings underscore the urgent need for implementing comprehensive, age-appropriate, and culturally sensitive screening programs to detect and correct refractive errors in a timely manner, particularly among students aged 7-15 years.

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Availability of Data: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval: The Institutional Review Board of Dow University of Health Sciences, Karachi approved the study via letter no. IRB-3546/DUHS/Approval/2024/220.

Conflict of Interest: None declared.

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