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Prevalence of Refractive Error among School Going Children in District Level in Bangladesh

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Abstract:
Background: *Refractive error is one of the most common causes of visual impairment around and it is quite common among school-going children. Children of age 05 years-15 years are large number portions of the country but few studies on such ground had been carried out previously.* ***Objectives:*** *The aim of the study was to evaluate the prevalence of refractive error among school going children in district level in Bangladesh.* ***Methods:*** *This cross-sectional study was conducted in schools & Madrasha within the Sadar Upozila, Faridpur district. The study involved 3057 school children aged 5–15 years, randomly selected from 12 institutions during February 2020 to December 2020. A total of 196 patients were referred to the hospital among them 150 participated in the study.46 (23.5%) students did not participate further and were classified as dropouts. Statistical analyses of the results were be obtained by using window-based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-24).****Results:*** *In this study, the prevalence of the population with refractive error was 196(6.41%). Among them 150 reported to hospital for corrective measures and participated in the study the dropout rate stands at 46 (23.5%). According to the age distribution, (42%) participants were between the ages of 5 and 7,(36.66%) were between the ages of 8 and 10, and (21.33%) were between the ages of 11 and 15. In terms of gender, (58%) of the patients were male and (42%) were female. According to the parents' occupation status, (31.33%) were housewives, (40.66%) were service holders, (6%) were day laborers, (15.33%) were business owners and (6.66%) were other occupations. According to the factors, (52.66%) children played outside, (26.66%) parents wore spectacles. It was observed that 69(46%) had myopia, 51(34%) had astigmatism 24(16%) had Hyperopia and 6 (4%) had Amblyopia* ***Conclusion:*** *Improving awareness among parents and teachers, implementing routine eye exams in schools, and enhancing access to affordable corrective eyewear are critical steps toward reducing the prevalence of refractive errors among school-going children in Bangladesh. It is essential to integrate eye health into national health policies and ensure that all children have access to necessary eye care services to promote better visual health and educational outcomes.*
Keywords: *Refractive error, Visual impairment, Eyewear.*

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I. Introduction

Eye problems are a significant public health issue among children in Bangladesh, impacting their overall well-being and socio-economic development. This abstract offers a comprehensive overview of the prevalence, causes, impact, and interventions related to ocular health issues in Bangladeshi children. Research indicates a high prevalence of conditions such as refractive errors and amblyopia, necessitating targeted interventions. Factors contributing to these issues include limited access to healthcare, poor living conditions, and socio-economic disparities. Untreated eye problems adversely affect children's education and long-term development, exacerbating social inequalities. Effective interventions, including school-based screening programs and public awareness campaigns, show promise in addressing this challenge. Collaborative efforts involving healthcare

providers, policymakers, and community stakeholders are essential to improve access to care and promote eye health equity in Bangladesh. Further research is needed to assess intervention effectiveness and develop innovative strategies to alleviate the burden of visual impairment among rural children. [1]

Eye health significantly influences children's overall well-being, particularly in Bangladesh where socio-economic factors contribute to prevalent eye problems. Refractive error is the most common cause of vision impairment and the second leading cause of blindness worldwide. [2] According to the World Health Organization (WHO), uncorrected refractive errors cause visual impairment in approximately 153 million people over the age of five. [3] Uncorrected refractive defects can cause visual impairment in adults and children, with both short- and long-term implications. [4] Furthermore, an uncorrected refractive defect may reduce a child's interaction and learning, impairing his or her learning process in the classroom. [5] Refractive errors are considered avoidable conditions that might cause vision problems in children.

The eyes reflect the spirit and serve as the body's window to the outside world. The goal of learning begins in childhood, and the accuracy of a child's vision can significantly impact or change his/her learning limit. Refractive error (RE) is a critical component of the priority disease "childhood blindness" (CB) in the Vision 2020 campaign to eliminate preventable blindness. [6] The prevalence of refractive error in school-aged children (RESC) in various studies is exceptional because they use different definitions, estimating approaches, announcing frameworks, and affiliations with unique age groups. Some contrasted age, gender, and ethnicity, while others linked it to socioeconomic status, geographic areas (urban, rural), and classified them differently. Bangladesh has the most blind children in the world, with an estimated 1.3 million. [6] Despite the fact that this accounts for a minor proportion of total blindness, the World Health Organization's (WHO) "Vision 2020: the right to sight" program prioritizes the control of blindness in children. [7] In 2002, the National Institute of Ophthalmology (NIO) conducted a survey to determine the prevalence of blindness in Bangladesh, which revealed that 40,000 children (approximately 8 per 10,000 children) were blind and 1.3 million had refractive defects. [8]

Multiple factors contribute to children's eye issues, including limited access to healthcare and specialists, poor living conditions, and environmental pollutants. Socio-economic disparities and cultural beliefs also hinder appropriate eye care seeking behavior, exacerbating visual impairments. Untreated eye problems hinder children's learning abilities, leading to academic underachievement and limiting socio-economic prospects. Long-term visual impairments resulting from childhood conditions further perpetuate social inequalities and hinder overall development. Addressing rural children's eye problems requires collaborative efforts. School-based vision screening programs and mobile eye clinics can improve access to care. Public awareness campaigns debunking myths and promoting early intervention empower parents to prioritize their children's eye health. The aim of this study is to synthesize existing research on the prevalence, causes, and interventions related to eye issues among Bangladeshi children.

II. Methodology

This cross-sectional study was conducted in Schools & Madrasha within the Sadar Upozila, Faridpur district. The study involved 3057 school children aged 5–15 years, randomly selected from 12 institutions. Ethical clearance was obtained from the Institutional Ethical Committee of Diabetic Association Medical College Faridpur & BNSB Zahurul Haque Eye Hospital, Faridpur, Bangladesh. The institutional heads of the selected schools were informed about the project, and their permission was obtained. Additionally, parents or guardians were notified and provided written consent for their children to participate in the study. The research protocol followed the ethical principles outlined in the Declaration of Helsinki for research involving human subjects. **Inclusion and Exclusion Criteria:** Inclusion Criteria were students from the selected schools who were willing to participate, with parental or guardian consent, cooperative students and students aged 5–15 years. Exclusion Criteria were children below 5 years or above 15 years of age and students with other ocular co morbidities. **Study Tools and Data Collection:** A pilot study was conducted to refine the questionnaire used for data collection. The questionnaire consisted of two parts: (1) Demographic and Socioeconomic Information: Age, sex, parent's education, parent's occupation, family income, daily meal intake, computer use, sleeping hours, outdoor activity, family history of refractive error and spectacle use. (2) Ocular Health: Presence of any eye complaints and a detailed ocular examination for diagnosing morbidity and detection of refractive error and prescribe needful corrections. Visual acuity was assessed using a Snellen's chart. After explaining the procedure, each child sat 6 meters away from the chart. One eye was covered with an occluder, and the child was asked to read the chart starting from the top line. The process was repeated for the other eye. In cases where visual acuity was below 6/9, pinhole vision testing was performed to distinguish between refractive errors and posterior chamber pathologies (visual acuity improves with a pinhole in refractive errors but remains unchanged in posterior chamber

pathologies). For younger children who could not read letters, alternative charts like "E," "C," or pictorial charts were used.

Near vision was examined with a Jaeger's chart held at a distance of 25–30 cm. The external eye was inspected with a torch for abnormalities in the ocular adnexa, lids, conjunctiva, cornea, anterior chamber, and iris. Tests included checking direct and consensual light reflexes, extraocular movements across cardinal gaze positions, the Hirschberg's test, cover-uncover test, and retinal examination.

Children diagnosed with refractive error were referred to BNSB Zahurul Haque Eye Hospital for Refraction and spectacle which was dispensed to them free of cost. Refractive errors were confirmed through post-cycloplegic refraction and fundus examination. Definitions for refractive errors were as follows: (a). Myopia: Spherical equivalent of at least -0.50 diopter (D). (b). Hypermetropia: Spherical equivalent of +0.50 D or more. c. Astigmatism: Cylindrical error of ±0.50 D or more. Amblyopia was diagnosed in cases where visual acuity remained 6/12 or worse after cycloplegic refraction and fundus examination. Visual acuity, refractive error type, and correction details were documented. **Data Analysis:** The collected data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS software (version 17). Statistical significance for categorical variables was assessed using Chi-square or Fisher's Exact tests.

III. Result

Table I: Frequency of type of refractive errors in study population.

Total sample size n(%)	Referred sample size n(%)	Selected sample size n(%)
3057(100)	196(6.41)	150(4.90)

Table-I shows prevalence of the study population, it was observed that total sample size was 3057(100%). The referred sample size students those were diagnosed with refractive errors of this study was 196(6.41%) and the selected sample size was 150(4.90%) students those reported to the BNSB Zahurul Haque Eye Hospital for corrective measures.

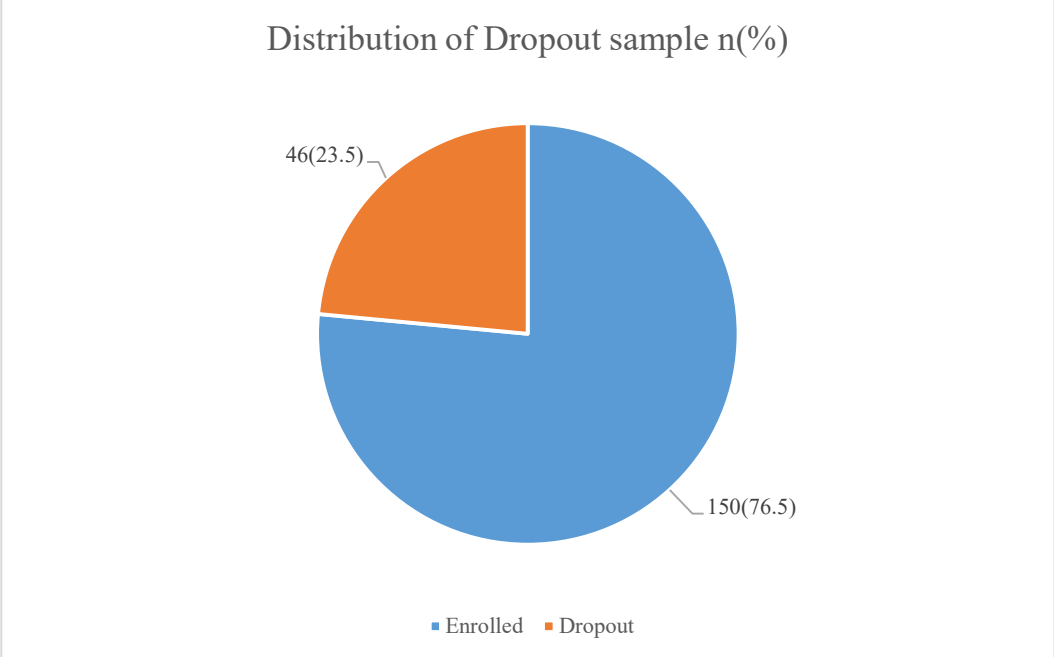

Figure I: Distribution of Dropout sample.

Figure I shows 196 (100%) students diagnosed with refractive error were referred for corrective measures among 46 (23.5 %) students did not participate further and were classified as dropouts.

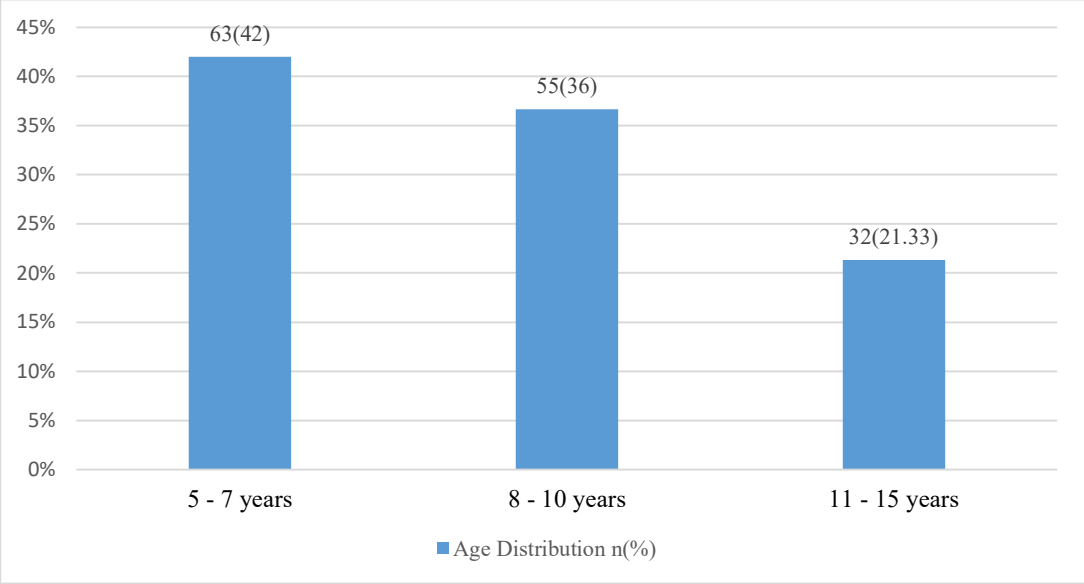

Figure II: Age distribution of the study population.

Figure II shows age distribution of the study population, it was observed that 63(42%) patients were belonged to age 5-7 years, 55(36.66%) patients were belonged to age 8-10 years and 32(21.33%) patients were belonged to age 11-15 years respectively.

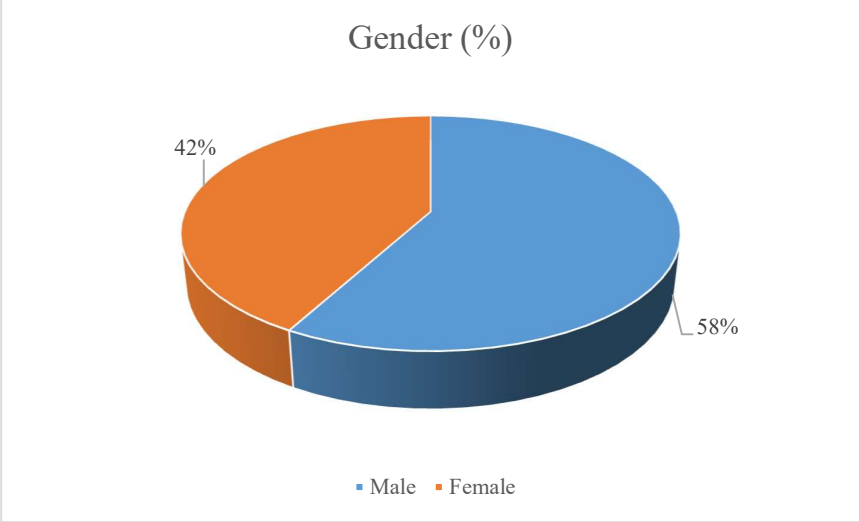

Figure III: Sex distribution of the study population

Figure III shows sex distribution of the study population, it was observed that majority 87(58%) patients were male and 63(42%) were female.

Table II: Parents Education status of the study population.

Parent's occupation	n=150	%
House wife	47	31.33
Service Holder	61	40.66
Day labour	09	6
Business	23	15.33
Others	10	6.66

Table-III shows Parents occupation status of the study population, it was observed that 47(31.33%) were House wife, 61(40.66%) were Service Holder, 9(6%) were Day labour, 23(15.33%) were Business and 10(6.66%) were others occupation respectively.

Table IV: Family monthly income of the study population

Family monthly income	n=150	%
Low (≤ 10,000 tk)	64	42.66
High (> 10,000 tk)	86	57.33

Table-IV shows Family monthly income of the study population, it was observed that 64(42.66%) had low income and 86(57.33%) had high income.

Table V: Type of daily meal intake of the study population.

Type of daily meal intake	n=150	%
3 times	59	39.33
4 times	38	25.33
>4 times	53	35.33

Table-V shows type of daily meal intake of the study population, it was observed that 59(39.33%) weretake 3 times, 38(25.33) were take 4 times and 53(35.33%) were take >4 times.

Table VI: Distribution of the study population according to duration of using computer, video games or watching television.

Time duration	n=150	%
<2 hours	52	34.66
2 hours	57	38.00
>2 hours	41	27.33

Table-VI shows distribution of the study population according to duration of using computer, video games or watching television, it was observed that 52(34.66%) had <2 hours, 57(38%) had 2 hours and 41(27.33%) had >2 hours respectfully.

Table VII: Distribution of the study population according to Sleeping hour.

Sleeping hour	n=150	%
6 hours	22	14.66
7 hours	30	20
8 hours	98	65.00

Table-VII shows distribution of the study population according to sleeping hour, it was observed that 22(14.66%) had taken 6 hours, 30(20%) had taken 7 hours and 98(65%) had taken ≥ 8 hours.

Table VIII: Distribution of the study population according to Variables.

Sleeping hour	n=150	%
Physical exercise/play outside	79	52.66
Parents using spectacles	40	26.66

Table-VIII shows distribution of the study population according to variables, it was observed that 79(52.66%) were play outside, 40(26.66%) parents using spectacles.

Table IX: Distribution of refractive errors among study population.

Variables	n=150	%
Myopia	69	46.00
Astigmatism	51	34.00
Hyperopia	24	16.00
Amblyopia	06	4.00

Table-IX shows distribution of the study population according to variables, it was observed that 69(46%) had myopia, 51(34%) had astigmatism and 24(16%) had Hyperopia and 6 (4%)

had Amblyopia

IV. Discussion

This cross-sectional study was conducted in schools & Madrasah within the Sadar upazila, Faridpur district. The study involved 3057 school children aged 5–15 years, randomly selected from 12 institutions during February 2020 to December 2020. A total of 196 patients were referred to the hospital among them 150 participated in the study. The current study was school going children-based study of refractive error in Bangladesh and aimed to evaluate the prevalence of refractive error among school going children in district level in Bangladesh. In this study, we found the prevalence of refractive error was 196(6.41%).The term prevalence refers to the proportion of individuals within a specific population who have a particular eye disease or condition at a given time. These studies are crucial for public health planning and resource allocation, as they help identify which diseases are most common and which populations are most at risk. It also aids in determining the need for screenings, treatments, and preventive measures.

The prevalence of refractive errors (RE) among school-going children in district-level areas of Bangladesh is a significant public health concern, with increasing attention on its impact on children's education and overall quality of life. Refractive errors, which include myopia (nearsightedness), hyperopia (farsightedness), and astigmatism, occur when the eye is unable to focus light properly on the retina, leading to blurred vision. These conditions can affect a child's ability to perform well in school, as they may struggle with reading, writing, and engaging in other visual activities. Uncorrected refractive defects contribute significantly to a visual impairment, which can result in considerable ocular morbidity in children and amblyopia. Building awareness among teachers, students, community leaders, and guardians can assist in evaluating the children's visual state and preventing visual impairment. [10]

According to the variables included in our study, 69 (46%) had myopia, 51 (34%) had astigmatism, 24 (16%) had hyperopia and 6(4%) had amblyopia. A study found that myopia was the most prevalent refractive error, followed by astigmatism and hypermetropia. [11] A cross-sectional descriptive study of 2000 students in the Bhaktapur and Lalitpur districts of Kathmandu Valley found that the prevalence of refractive error was 8.60%, with female students having a substantially greater frequency than male pupils. [12] Another cross-sectional study in India of youngsters aged 12 to 17 years reported that 8.8% had refractive error. Furthermore, it supports previous research by Rose et al., who discovered that a reduced frequency of myopia among Chinese children raised in Sydney compared to Chinese children raised in Singapore was connected with more hours spent outside. [13] The study revealed that, according to variables, 79 (52.66%) children played outside, 40 (26.66%) parents wore spectacles.

The present study found that, 22 (14.66%) people slept for 6 hours, 30 (20%) for 7 hours, and 98 (65%) for 8 hours or more. Logistic regression analysis revealed that parents who wear spectacles are one of the risk variables for refractive error. Previous research has shown that myopic parents can cause their children's myopia.[14] Several studies have shown that the prevalence of refractive errors is significant in urban centers, and there is growing evidence of this trend extending into district-level schools. Some studies in Bangladesh have found that nearly 10-20% of children in school-going age suffer from uncorrected refractive errors. However, the prevalence may vary depending on the district, with urban areas showing higher rates compared to rural regions, although rural districts may still face substantial challenges in detection and management.

In Dhaka, children whose parents wore spectacles were much more likely to have this condition. It is not pleasant to watch children over the age of three wearing spectacles. Furthermore, when it comes to gender, male children rely more on machine-based activities than female youngsters. [15]According to the age distribution in this study, 63 (42%) patients were aged 4-7 years, 55 (36.66%) were aged 8-10 years, and 32 (21.33%) were aged 11-15 years. The majority, 58%, were male patients. Meal intake was also found to be significantly related to refractive defects. In our current study, 59 (39.33%) were taken 3 times, 38 (25.33%) were taken 4 times, and 53 (35.33%) were taken >4 times.

Studies consistently report a high prevalence of eye problems among rural Bangladeshi children. For instance, Islam et al. found refractive errors in over 30% of children aged 5-15, while Ahmed et al. reported a 15% prevalence of amblyopia. These figures highlight the substantial burden of eye disorders in rural areas, necessitating targeted interventions. Another study was conducted in 2002 among children aged 5 to 15 years in Bangladesh's Khulna region, and it was estimated that the prevalence of refractive error among males and females was 1.1% and 0.95%, respectively, with poor vision at 0.15%. The same study found that the prevalence of refractive error was 1.38% in children aged 11 to 15, compared to 0.62% in children aged 5 to 10.[16]

The present study found that, a total of 196 students were diagnosed with refractive errors of these, 150 students reported to the BNSB Zahurul Haque Eye Hospital for corrective measures. However, 46 students did not participate further and were classified as dropouts. The dropout rate stands at 23.5%, indicating a significant portion of students did not follow through for corrective treatment. Probable Causes of Dropout may be, some parents may have preferred to consult other healthcare providers for confirmation of the diagnosis or alternative treatment options. Families may have opted to visit different hospitals or Eye specialists based on factors like proximity, trust, or cost considerations. Some students or their parents might not fully understand the importance of correcting refractive errors, leading to neglect of follow-up care. Concerns about wearing glasses or fear of medical procedures may have contributed to the dropout rate.

The prevalence of refractive errors among school-going children in district-level areas of Bangladesh is a growing concern that requires urgent attention. Addressing this issue involves increasing public awareness, improving access to eye care services, and implementing nationwide screening programs in schools. By identifying refractive errors early and providing affordable corrective measures, the government and health organizations can improve the quality of life and educational prospects for children in these areas.

Limitations of the study

The present study was conducted in urban setting with a very short period due to time constraints and funding limitations.

V. Conclusion

Eye problems among Bangladeshi children pose significant public health challenges, necessitating comprehensive strategies. Enhancing access to care, raising awareness, and addressing socio-economic determinants are crucial steps towards reducing visual impairment in this vulnerable population. Further research should focus on evaluating intervention effectiveness and developing innovative approaches to promote eye health equity in rural communities

VI. Recommendation

This study can serve as a pilot to much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence. This study highlights the need for targeted interventions to reduce dropout rates. Future programs should include: Awareness campaigns to educate families about the importance of vision correction. Improved follow-up mechanisms, such as reminders and counseling, to ensure students receive necessary care. Addressing these factors can help enhance the overall effectiveness of school sight-testing programs.

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