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Preschool Vision Screening: Prevalence and Associated Factors of Amblyopia among School Going Children in Dhaka City

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Abstract **Original Research Article**

***Background*:** Amblyopia is a decrease in best-corrected visual acuity in one or both eyes due to form deficiency or abnormal binocular interaction. It affects infancy and adulthood for the individual and society as a whole. Amblyopia affects academic success, career choice, visuomotor skills, social interaction, psychological development, and economic participation. Unilateral amblyopia increases the likelihood of bilateral vision loss. Ocular media opacity, strabismus, anisometropia, hypermetropia, astigmatism, myopia, and blepharoptosis are risk factors for amblyopia. Ocular screening programs in young children, primarily preschoolers, may detect amblyopia and amblyogenic risk factors like as strabismus, refractive errors, and media opacities early. It prevents and treats amblyopia. It helps children's emotional growth. Diagnosis and treatment of amblyopia at a younger age may result in a better and more stable final VA because to shorter treatment durations, faster VA improvement, and greater treatment adherence. ***Objective*:** The purpose of this study was to determine Preschool vision screening, prevalence and associated factors of amblyopia among school going children in Dhaka city. ***Methods and Material*:** Between January 1 and June 30, 2022, a cross-sectional survey of a community of Dhaka city residents in the school age range was carried out. Through interviews and physical exams, data were gathered using a pretested structured questionnaire and checklist. Using SPSS 23, descriptive and inferential analysis was performed, and variables with a p value of less than 0.2 were included into multivariate logistic regression. In the multivariable binary logistic regression, significant predictors were defined as variables with a p value of < 0.05. ***Result*:** Majority of the student are of 4-5 years age, among the participant 50.8% were male and 45.8% were female. Study showed that majority of the family has 1-2 (49.5%) and 3-4 (45.3%) children. Majority of the mother had $\geq$ 37 weeks gestational period and normal vaginal delivery, 78% and 77.5%, respectively. Maximum of study population sibling has visual problem, 69.1%, with few families' member wore spectacles, 7.1%. Over 95%, study participant did not had history of systemic illness, as well as 96.1% children were completely vaccinated. Majority of the participant does not have strabismus (99.2%) or no history of eye complaints, spectacle use, visual deprivation or no anisometropia. Only 3 participant presented visual acuity less than 6/60. Moderate myopia was found among 10.0% while only 0.7% high hyperopia was found among the participant. Ametropic amblyopia is prevalent among the study, (6.1%). Second most prevalent amblyopia type is anisometropia, (2.9%). Male are mostly suffered from amblyopia, 5.9%, and then that of female, 4.9%. The prevalence of amblyopia is 10.9%. There was significant association between amblyopia and gender, p=0.023. The deprivation in present or past is statistically significant with the development of amblyopia. Amblyiopiatic among patients with past history of eye complaint, distant visual acuity (<6/60), and refractive degree are statistically significant. ***Conclusion*:** The prevalence of amblyopia among school age children at Dhaka city, is higher than the WHO cut point. Gender, having history of visual deprivation, history of eye pain, distance visual acuity <6/60, refractive error was significant association with amblyopia.

Keywords: Amblyopia, visual acuity, strabismus, myopia.

INTRODUCTION

Amblyopia, a Greek word meaning "blunt or blurry vision", is defined as a decrease in best-corrected visual acuity (BCVA) in one or both eyes due to form deprivation or aberrant binocular interaction in the absence of visual system disease [1]. It is a prevalent condition among youngsters and has far-reaching effects on childhood and adulthood for the individual and society as a whole. Amblyopia has a significant influence on academic achievement, profession selection,

visuomotor abilities, social interaction, psychological development, and economic involvement [2]. Amblyopia is a significant public health issue since its visual impairment is permanent and severe [3]. The recent meta-analysis study indicated that there would be 99.2 million persons with amblyopia globally in 2019, rising to 175.2 million by 2030 and 221.9 million by 2040 [4]. Understanding the prevalence rate is essential for organizing healthcare services effectively. Significant research has been conducted on the prevalence of amblyopia, with findings ranging from 1 to 6 percent in children [5] and 1.43 to 5.64 percent in adults [6]. Considered to be affected by age, geography, ethnicity, diagnostic criteria, and other variables. Children with unilateral amblyopia are at increased risk for bilateral vision impairment [7]. While the prognosis for delayed treatment commencement is miserable, amblyopia may be eliminated via early intervention. Common risk factors for amblyopia include ocular media opacity, strabismus, anisometropia, hypermetropia, astigmatism, myopia, blepharoptosis, and impaired unassisted distant visual acuity [8]. Mother without formal education, birth weight 2.50 kg, child history of past eye complaint, child history of past eye surgery, history of past spectacle use, family history of wearing spectacles, family history of crossed eyes, family history of eye surgery [9], gestational period 37 weeks, admission to the neonatal intensive care unit, maternal smoking during pregnancy [10], child history of seizure, and being a twin [11] are also factors that are positively associated with amblyopia.

Especially for their long-term health, school screening programs are vital and advantageous for youngsters [12]. Early diagnosis of amblyopia and amblyogenic risk factors, including strabismus, refractive errors, and media opacities, may be made possible through ocular screening programs in young children, mainly preschool-aged children. Therefore, it aids in the prevention and treatment of amblyopia. Additionally, it promotes the emotional development of youngsters [11]. Moreover, huge populations may be tested more quickly, affordably, and efficiently via school screening programs.

Children with impaired vision, particularly at the level of blindness, would be unable to attend school, which might lead to an underestimation of the prevalence of visual impairment in the whole nation [13]. Similarly, if close work and other components of education are connected with the development of myopia, then individuals who do not attend school would be less likely to acquire myopia or visual impairment. This would result in an overestimation of the prevalence of myopia across the rest of the nation [14]. The examination of the incidence and causes of visual impairment, on the other hand, permits the creation of preventive ophthalmologic programs that may give more targeted therapies aimed at preserving ocular health [15]. Early identification of ocular diseases in youngsters protects visual acuity (VA) and binocular vision from irreversible impairment.

Diagnosis and treatment of amblyopia at a younger age may result in a better and more stable final VA due to shorter treatment durations, quicker improvement of VA, and more overall adherence to treatment regimens.

The total global pooled prevalence of amblyopia was 1.36% for screened and non-screened preschool children, respectively [16] however, there are no known community-based statistics on the prevalence of amblyopia and the variables associated with amblyopia among school-age children, especially in Bangladesh.

Aim: The purpose of this study was to determine Preschool vision screening, prevalence and associated factors of amblyopia among school going children in Dhaka city.

METHOD AND MATERIAL

In Dhaka, Bangladesh, between January 1 and June 31, 2022, a cross-sectional study was conducted to evaluate the prevalence of amblyopia and to discover the variables related with it among school-aged children. This research included all children between the ages of 3 and 5. Children with recent eye diseases, such as severe vision-impairing injuries or recent ocular surgery, were excluded from the research. In the lack of community-based data on amblyopia in Bangladesh, the prevalence, margin of error, design effect, and non-response rate were assumed to be 50% with a 95% confidence interval. The sample size was estimated to be 592. The sample was obtained using purposive sampling. Data were gathered through interviews and physical examinations utilizing a checklist and a pretested structured questionnaire that was created from various literatures.

A Snellen chart set at 6 meters was used to measure the distance VA. All three groups underwent retinoscopy and cycloplegic refraction using 0.5% cyclopentolate eye drop. All research subjects had a subjective refraction after 03 days starting the cycloplegic medication. To look for any ophthalmic pathology in the eye, direct ophthalmoscopy was done. The ocular deviations were found using a cover test, and the angles of deviation were calculated using a prism bar. Two senior clinical optometrists with training performed these meticulous physical evaluations. The participants' parents were fully informed, and their formal permission was acquired. The study's participants and their guardians were informed that participation was entirely voluntary. They were told that the data acquired for the survey will be utilized for research and as a basis for

formulating policies. Volunteers for the research were initially questioned at home before bringing their kids to the hospital for a medical checkup. The parents or guardians of the participating children received the final subjective refraction prescription if the kid had a refractive error during subjective refraction.

Statistical Analysis

The statistical analysis was done using SPSS version 23. The variables were expressed in both frequencies and percentage and Pearson's Chi-square test was used to compare the various factors, with CI 95% and P< 0.05.

RESULT

Table 1 shows the distribution of sociodemographic variable of the study population where majority of the student are of 4-5 years age (50.8%), among the participant 54.2% were male and 45.8% were female. Maximum student has already started the schooling and are from primary/secondary schooling, 69.1%. Majority are from Muslim religion, 79.9%. Study showed that majority of the family has 1-2 (49.5%) and 3-4 (45.3%) children with family profession of employment (52.2%) and monthly income of 35001-55000 taka, (36.3%).

Table 1: Sociodemographic distribution

Variable	n	%
Age		
3-4	256	43.3
4-5	301	50.8
>5	35	5.9
Gender		
Male	321	54.2
Female	271	45.8
Religion		
Muslim	526	79.9
Hindu	53	8.9
Buddha	11	1.9
Christian	2	0.3
Family Income (taka)		
> 15000	102	17.2
15000-35000	197	33.3
35001-55000	215	36.3
55001<	78	13.2
Family profession		
Unemployed	4	0.68
Job holder	309	52.2
Business	192	32.4
Professional employment	87	14.7
Family (children) size		
1-2	293	49.5
3-4	268	45.3
5<	31	5.2

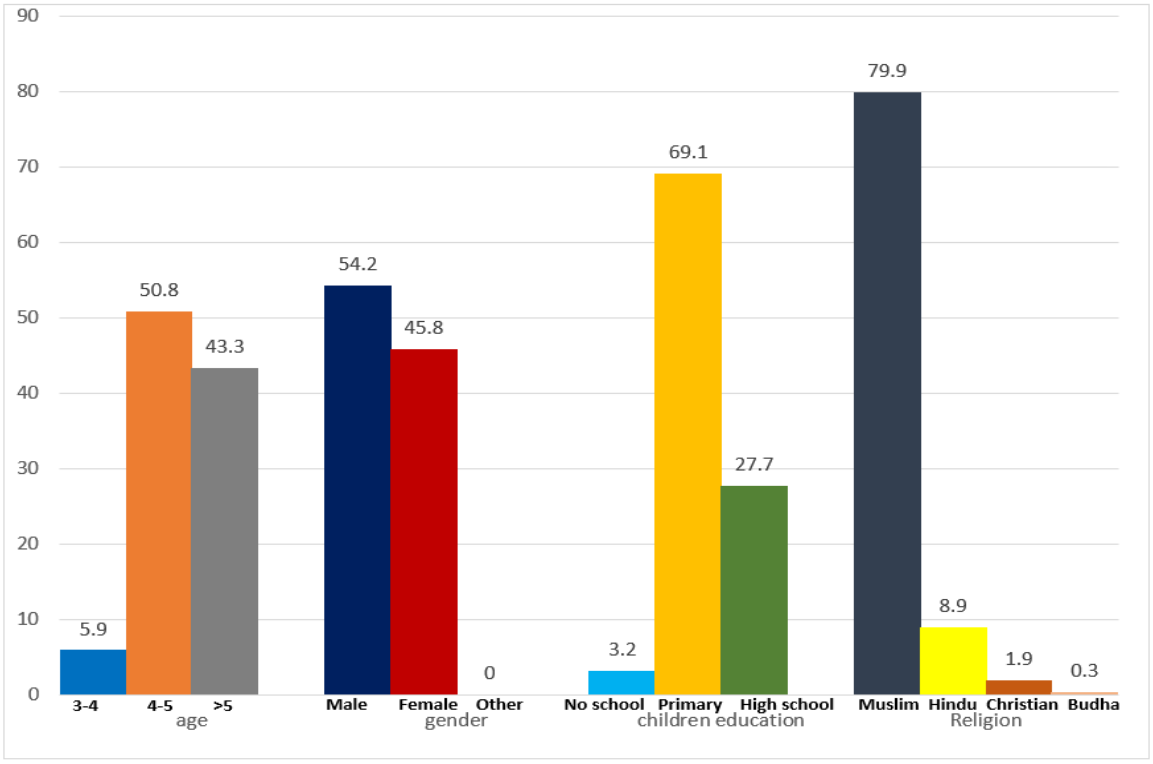

Fig. 1: Sociodemographic distribution of children

Majority of the mother had ≥ 37 weeks gestational period and normal vaginal delivery, 78% and 77.5%, respectively. Very few child were admitted to NICU, 15.9% and majority gave birth to child weight between 2500-3400g, 79.2%. Maximum mother had good health during pregnancy and many had exclusive breastfeeding, 77.7% and 61.3%, respectively. (Table 2, fig 2-4). Maximum of study population sibling has visual problem, 69.1%, with few family member wore spectacles, 7.1%. Only 2 person was found with strabismus.

Table 2: Maternal and family medical history

Variable	***n***	***%***
Gestational period		
< 37 weeks	130	22.0
≥ 37 weeks	462	78.0
Delivery mode		
Normal vaginal delivery	459	77.5
Cesarean section	133	22.5
Admission to NICU		
Yes	94	15.9
No	498	84.1
Child birth weight		
< 2500g	90	15.2
2500-3400 g	469	79.2
>3400	33	5.6
Exclusive breast feeding		
Yes	363	61.3
No	229	38.7
Maternal health condition during pregnancy		
Yes	460	77.7
No	132	22.3
Sibling with known visual problem		
Yes	409	69.1
No	183	30.9
First-degree family member using spectacles		
Yes	42	7.1
No	550	92.9
Family history of strabismus		
Yes	2	0.22
No	590	99.6

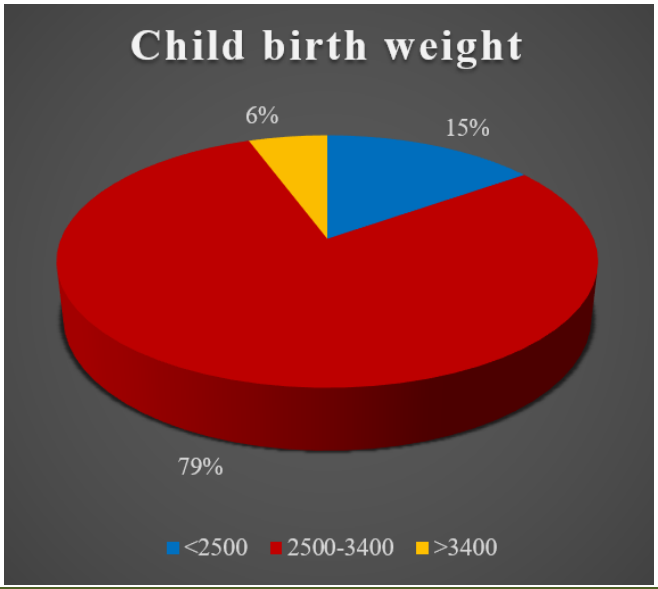

Fig. 2: Child birth weight

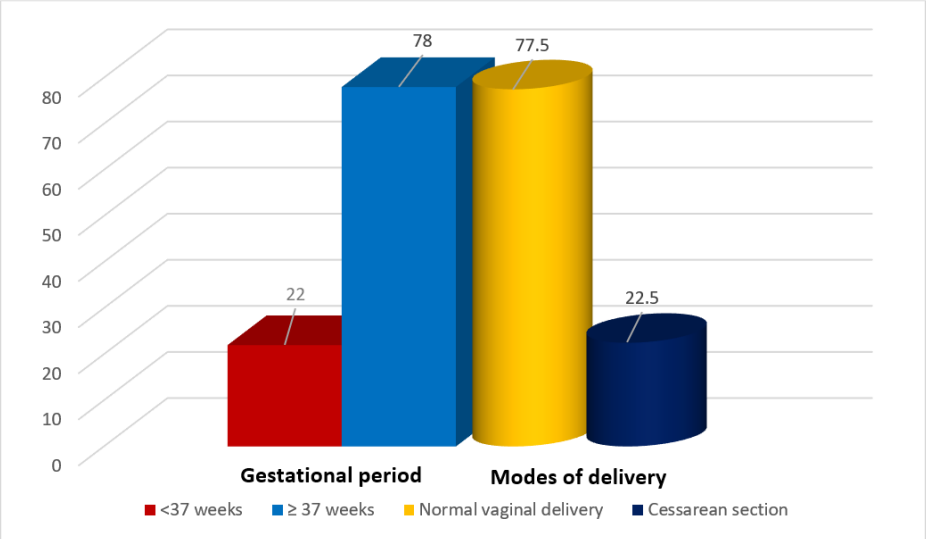

Fig. 3: Distribution of maternal gestation period and modes of delivery

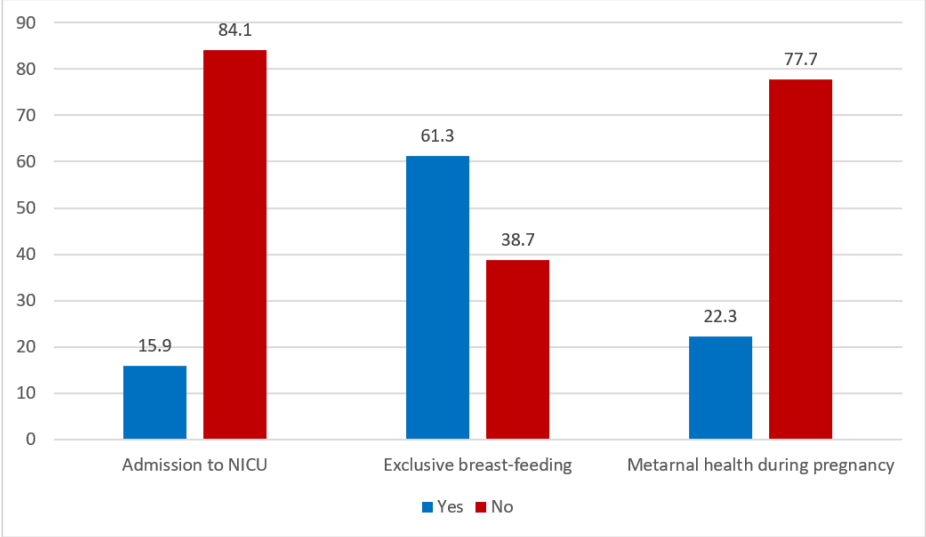

Fig. 4: Distribution of maternal health history

Over 95%, study participant did not had history of systemic illness, as well as 96.1% children were completely vaccinated. Majority of the participant does not have strabismus (99.2%) or no history of eye complaints, spectacle use, visual deprivation or no anisometropia. Only 3 participant presented visual acuity less than 6/60. Moderate myopia was found among 10.0% while only 0.7% high hyperopia was found among the participant (Table 3).

Table 3: Clinical characteristic of study participants

Variables	***n***	***%***
SYSTEMIC CLINICAL CHARACTERISTICS		
Child history of known systemic illness		
Yes	25	4.2
No	567	95.8
Child immunization history		
Completed all	569	96.1
Not completed	23	3.9
OCCULAR CLINICAL CHARACTERISTIC		

Variables	***n***	***%***
Strabismus		
Yes	5	0.84
No	587	99.2
History of past eye complaints		
Yes	103	17.4
No	489	82.6
History of spectacle use		
Yes	45	7.6
No	547	92.4
Previous/current history of visual deprivation		
Yes	10	1.7
No	582	98.3
Anisometropia		
Anisometropia <1D	44	7.4
Anisometropia ≥ 1D to <2D	42	7.1
Anisometropia ≥ 2D	30	5.1
No anisometropia	476	80.4
Presenting distance visual acuity of the better eye		
Better than or equal to 6/18	520	87.8
Worse than ≤ 6/18 to ≥ 6/60	69	11.7
<6/60 to ≥3/60	2	0.33
<3/60	1	0.20
Degree of refractive error		
Low degree/No RE	489	82.6
Moderate myopia	59	10.0
High myopia	23	3.9
Moderate hyperopia	17	2.9
High hyperopia	4	0.7

Table 4, fig 5, shows the prevalence of the type of amblyopia found among the study participant. Ametropic amblyopia is prevalent among the study, (6.1%). Second most prevalent amblyopia type is anisometropia, (2.9%). Male are mostly suffered from amblyopia, 5.9%, then that of female, 4.9%. The prevalence of amblyopia is 10.9%.

Table 4: Prevalence of the type of amblyopia

Types of amblyopia	***Male***		***Female***		***TOTAL***
	n	%	n	%	***n (%)***
Strabismic amblyopia	3		5		8 (1.4)
Anisometropiac amblyopia	10		7		17 (2.9)
Ametropic amblyopia	21		15		36 (6.1)
Deprivational Amblyopia	1		2		3(0.5)
TOTAL	35	5.9	29	4.9	64 (10.9)

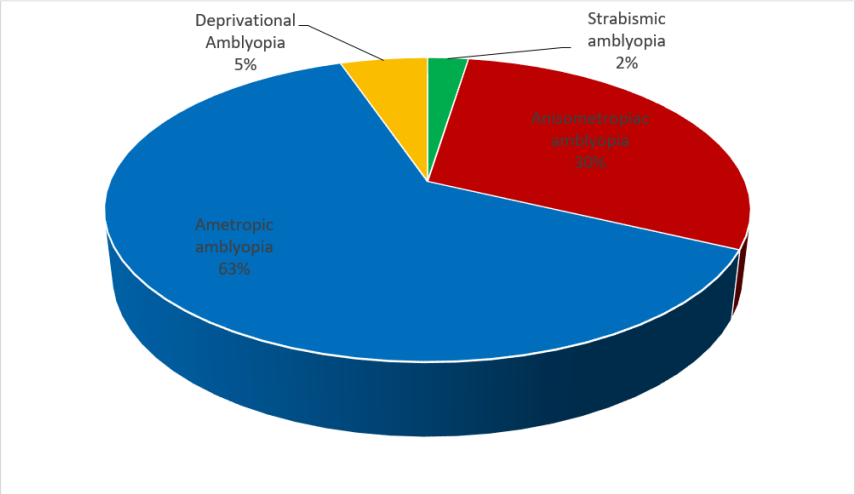

Fig. 5: Prevalence of the type amblyopia

There was significant association between amblyopia and gender, p=0.023. The deprivation in present or past is statistically significant with the development of amblyopia. Amblyopia among patients with past history of eye complaint, distant visual acuity (<6/60), and refractive degree are statistically significant (Table 5).

Table 5: Risk factors associated with amblyopia among the study participant

Factors	Amblyopia	P value
Gender		
Male	35	**0.023**
Female	29	
Age		
3-4	15	
4-5	29	0.893
>5	20	
Deprivation (present or past		
Yes	15	
No	49	**0.002**
Strabismus		
Yes	9	
No	55	0.323
Anisometropia		
Anisometropia <1D	9	
Anisometropia ≥ 1D to <2D	11	0.065
Anisometropia ≥ 2D	12	
No anisometropia	32	
Gestational period		
< 37 weeks	5	
≥ 37 weeks	59	0.912
Delivery mode		
Normal vaginal delivery	41	
Cesarean section	23	0.057
Admission to NICU		
Yes	49	
No	15	0.213
Exclusive breast feeding		
Yes	57	0.076
No	7	
Systemic illnessduring pregnancy		
Yes	9	

No	55	0.072
Family history of strabismus		
Yes	1	
No	63	0.087
History of past eye complaints		
Yes	24	
No	40	**0.034**
Presenting distance visual acuity of the better eye		
Better than or equal to 6/18	3	
Worse than ≤ 6/18 to ≥ 6/60	26	**0.027**
<6/60	35	
Degree of refractive error		
Low degree/No RE	29	
Myopia	7	
Hyperopia (+2.00D to +5.0D)	11	**0.000**
Hyperopia (> +5.00DS)	17	

DISCUSSION

This research showed that 10.9% of individuals were affected by amblyopia. 2.9% of the research participants were diagnosed with anisometropic amblyopia, 6.1% with ametropic amblyopia, 1.4% with strabismic amblyopia, and 0.5% with deprivational amblyopia. This conclusion is not consistent with the findings of two Indian [17], one in Ethiopian [18] research, which indicated 4.8%, 4.7%, and 6.5%, respectively. The similarities may be attributable to parallels in the operational definition for the studies conducted in India and similarities in the socio-demographic characteristics of study participants for the research conducted in Gondar, Ethiopia. Another research in China revealed that the prevalence of amblyopia was 1.84 percent, which is substantially higher than the majority of other Asian studies [19]. However way to lower than our study. Two meta-analyses estimated the worldwide prevalence of amblyopia to be 1.44 and 1.75 percent, respectively [4]. Other studies conducted in Egypt, Lagos state Nigeria [20], Southern India [21], Eastern Europe [22] and Qassim province of Saudi Arabia [23], which reported 1.49 percent, 1.41 percent, 1.11 percent, 2.80 percent, 2.5 percent, and 3.55 percent, respectively which are also way to lower than our study. These variations may be attributable to the different research designs. Ours was community-based research, while all the other studies were performed in schools, excluding those youngsters of school-age who dropped out of school due to impaired eyesight.

However, this study's results are remarkably comparable to those of previous studies conducted in southwest Nigeria [24], Menelik II Hospital in Addis Ababa, Ethiopia [25], and Saudi Arabia, which showed 12,9%, 9.5%, and 9.5%, respectively.

This research found a substantial association between gender and the prevalence of amblyopia, contrary to a number of prior investigations [26].

According to our study, anisometropia and ametropia are significant contributors to the prevalence of amblyopia. According to a number of studies, anisometropia of 1.0 D or above was strongly related with an elevated risk of amblyopia [27]. In our investigation, there was a statistically significant association with refractive error. In another investigation, refractive errors, including as hyperopia of 2.00 D or more and astigmatism of 2.00 D or less, were also identified as major amblyopia risk factors. In the research, myopia was not shown to be substantially related with an increased risk of amblyopia [19]. It may be due to the fact that myopia was less prevalent among younger children (4.05%).

Limitation

Pre-school Screening is difficult & unreliable without appropriate methodology. Further community based study of pre-school & school going children will reveal better outcome.

CONCLUSION

The prevalence of amblyopia among school age children at Dhaka city, is higher than the WHO cut point. Gender, having history of visual deprivation, history of eye pain, distance visual acuity <6/60, refractive error was significant association with amblyopia. Early identification of ocular diseases in youngsters protects visual acuity (VA) and binocular vision from irreversible impairment.

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