

PREVALENCE AND ETIOLOGY OF AMBLYOPIA AMONG PRIMARY SCHOOL CHILDREN IN WOLLISO TOWN: SOUTH WEST SHEWA ZONE, ETHIOPIA.

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ABSTRACT

Background: Amblyopia is a unilateral or bilateral condition which results in visual reduction whilst the eye seems to be healthy. The main purpose of this study was to determine the prevalence and etiology of amblyopia in school children.

Methods: A school based prospective cross-sectional study design was employed. A total of 1,226 school children aged between 7 and 15 years were screened. Best corrected visual acuity and detailed ophthalmic evaluation were performed in all participants. A diagnosis of amblyopia was based on a best-corrected visual acuity of 6/12 or less in one or both eyes, or a bilateral difference of at least two best-corrected visual acuity lines.

Results: Prevalence of amblyopia was 5.14 % (95% CI: 3.9%-6.4%) and the majority of them were from public schools (82.5%). There was statistical association between students from public school and amblyopia ($p=0.003$). A total of 44 (41.9%) children had severe amblyopia. Underlying amblyogenic causes were anisometropia (49.2%), isometropia (36.5%), sensory deprivation (11.1%) and strabismus (3.2%).

Conclusion: In this study, the prevalence of amblyopia among school children was 5.14%. Refractive error is a major risk factor for amblyopia. We found significant statistical difference in amblyopia prevalence between public and private school children.

Key words: Amblyopia, cross-sectional study, prevalence, refractive error, school children

INTRODUCTION

Amblyopia is a unilateral or, less commonly, bilateral reduction in corrected visual acuity in the absence of visible organic abnormalities and is due to misdirected, blurred, or absent retinal images during development of the visual system (1). It is the second leading cause of bilateral visual impairment in children after refractive errors, and has been reported as the leading cause of unilateral visual impairment in pediatric patients (2,3).

Anisometropia, constant unilateral strabismus, bilateral isoametropia, amblyogenic unilateral or bilateral astigmatism and ocular media opacities are causes of Amblyopia (4).

The overall prevalence of amblyopia varies between 1.6 to 3.6% for preschool and school population and from 3.25% to 5.3% in clinical population in different regions of the world (5).

Amblyopia, being unilateral, commonly even severe cases may not be detected by parents or care givers (6). And failure to detect and treat amblyopia at young age, when the prognosis for successful treatment is best, leads to permanent visual impairment, adverse effects on school performance, poor fine motor skills, weak social interactions, and self-image (7). An amblyopic individual is at a significantly higher risk of becoming blind compared to an individual with normal visual acuity and individuals with childhood-onset unilateral amblyopia have a greater lifetime risk of eventual bilateral visual impairment and age-related macular degeneration (8).

There are very few studies focused on amblyopia from sub-Saharan Africa countries. The prevalence of amblyopia among school children in Ghana and Nigeria were 9.9%, and 0.3% respectively. And anisometropia was the major amblyogenic factor in these studies (9, 10).

Understanding the prevalence, burden and pattern of Amblyopia is important for adequate healthcare planning in an effort to establish a routine school eye screening. In Ethiopia there is paucity of published data on prevalence and pattern of amblyopia. Hence, this study was conducted to estimate the prevalence and determine the causes of amblyopia among children aged 7-15 years in Wolliso town, Southwest Ethiopia.

SUBJECTS AND METHODS

This school based cross-sectional study was carried out in May 2018 in Wolliso town, Southwest Ethiopia. For this research purpose public schools were defined as schools supported by either public or government funds and whereas private schools were defined as schools run and supported by private individuals or a corporation.

The department of Ophthalmology of Addis Ababa University's Institutional Review Boards gave approval for the research and informed written consent was obtained from parents and/or legally authorized representatives of the study participants.

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Requisition letters were sent to all the selected schools seeking permission from the respective school heads. All study procedures adhered to the principles outlined in the Declaration of Helsinki for human subject research. Those children with visual impairment were referred to the nearby hospital and managed accordingly.

Using Leslie-Kish formula a sample size of 1226 was calculated (11) and 4 schools (2 publics and 2 private) were selected using a random cluster sampling method. A multistage random sampling technique was used in recruiting the students, aged range from 7-15 years, in each grade level/class using the class registers as the sampling frame.

Pre-survey trainings were conducted to the research team to familiarize themselves with the standard operating procedures involved in the study. The first step of the study was screening of the students within the school compound. A large room inside the school premises was selected for the screening program. Monocular distance visual acuity was tested using a logarithm of minimum angle of resolution (logMAR) chart. Step 2 was conducted at the nearby hospital. The parents/guardians of students whose Best Corrected Visual Acuity (BCVA) worse than or equal to 6/12 (or $\leq 6/12$) in at least one eye, in absence of any organic lesion according to Amblyopia Treatment Studies (12), were requested to bring their children to the nearby, Saint Lukas hospital, for further evaluation. In the outpatient department, a detailed history about past and present ocular problems and treatments was obtained from the parents by the principal investigator of the study. Distance visual acuity was re-checked using the Snellen's chart. Assessment of ocular alignment, ocular motility and associated deviation, and slit lamp examination for the assessment of any anterior segment pathology was performed. A detailed fundus examination was done with 90D lens to rule out any posterior segment pathology.

Cycloplegic refraction by streak retinoscope was performed after pupillary dilation using 1% cyclopentolate eye drops.

Operational Definition For the purpose of this study, amblyopia was defined as BCVA $\leq 6/12$ the affected eye without any underlying structural abnormality of the visual pathway, a 2-line difference between the two eyes, and the presence of an amblyogenic factor. The severity of amblyopia was further graded into mild (BCVA 6/12-6/18), moderate (BCVA 6/18-6/36) and severe (BCVA $<6/36$) (12). Standard definitions for various types of amblyopia were used for diagnosis (12). Bilateral amblyopia was defined as best VA in both eyes $\leq 6/12$.

Anisometric amblyopia includes patients who had amblyopia in the presence of anisometropia that is 1.5 D or greater in spherical equivalent, or a 1.5 D or greater difference in astigmatism between the eyes in the absence of any measurable heterotropia at distance or near.

Strabismic amblyopia included that due to conflicting visual inputs between the eyes due to squint. Combined amblyopia includes either patients with a heterotropia at distance or near along with anisometropia of 1.5D or more in spherical equivalent or a 1.5 D or more difference in astigmatism in any meridian between the eyes. (5, 12)

Data generated were collected using a structured data collection form, and statistical analysis was done using SPSS 21.0 version (SAS Institute, Cary, NC 2010) software. Statistical association between categorical variables was computed using Fisher's exact test and Pearson chi-square (χ^2) test. $P < 0.05$ was considered statistically significant.

RESULTS

In total, we screened 1,226 children of which 63 (5.14 %; 95% CI: 3.9%-6.4%) were found to have amblyopia. No student was reported to have been treated for amblyopia previously. The mean age of children with amblyopia was 10.45 ± 2.09 years with age range between 7 to 15 years. Almost half amblyopic children 30 (47.6 %) were between 10-12 years old (Table 1).

TABLES AND FIGURES

Table 1: Age at presentation and gender distribution of amblyopia among school children at Wolliso town, Southwest Ethiopia, May 2018.

	Sex		Total N (%)
	Male N (%)	Female N (%)	
Age			
7-9	5 (7.9)	9 (14.3)	14 (22.2)
10-12	11(17.5)	19 (30.1)	30 (47.6)
13-15	8 (12.7)	11(17.5)	19(30.2)
School			
Public	20 (31.7)	32 (50.8)	52 (82.5)
Private	4 (6.4)	7 (11.1)	11 (17.5)
Total	24 (38.1)	39 (61.9)	63 (100%)

Thirty-nine of the subjects, 61.9% were female. There was no significant difference in amblyopia prevalence between males and females ($P = 0.367$).

Fifty-two (82.5%) subjects with amblyopia were from public schools (Table 1). There was statistical association between students from public school and amblyopia. ($p=0.003$).

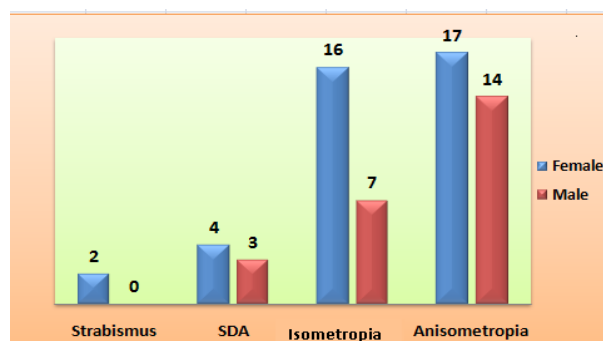
From 63 children identified as amblyopic, 42(66.67 %) had bilateral and 21 (33.33 %) had unilateral amblyopia. Hence a total number of 105 amblyopic eyes of 63 children were studied. Among unilateral amblyopic children 9 had in the right and 12 had in the left eye as shown in table 2.

Table 2: Laterality and causes of amblyopia among school children at Wolliso town, Southwest Ethiopia, May 2018.

FIGURE 1: Distribution of amblyogenic factors with gender among school children , May 2018, Wolliso Town, Southwest Ethiopia.

Anisometropic amblyopia and isometropic amblyopia were the commonest types of amblyopia accounting 31 (49.2%) and 23(36.5%) of the subjects respectively

	Sex		Total N (%)
	Male N (%)	Female N (%)	
Laterality			
Right Eye	2 (3.2)	7 (11.1)	9 (14.3)
Left Eye	6 (9.5)	6 (9.5)	12 (19)
Both Eyes	16 (25.4)	26 (41.3)	42 (66.7)
Cause			
Anisometropic	14 (22.2)	17 (27)	31 (49.2)
Isometropic	16 (25.4)	7 (11.1)	23 (36.5)
Sensory Derivational	3 (4.8)	4 (6.3)	7 (11.1)
Strabismus	2 (3.2)	0 (0)	2 (3.2)



(Fig 1). For both anisometropic and isometropic amblyopia, myopia was the commonest type of refractive error, contributing 43 (80%) of the subjects.

From seven sensory derivational amblyopia five had unilateral, one had bilateral corneal opacity and one had ptosis. Both Strabismic cases were exotropia.

As far as the severity of amblyopia is concerned, mild amblyopia was seen in 39(37.14 %), moderate amblyopia in 22(20.95%), and severe in 44(41.90%). Relatively severe amblyopia was higher than mild and

moderate as shown in table 3. Majority of severe amblyopia patients had sensory derivational amblyopia. Severity of amblyopia was statistically associated with derivational amblyopia ($p=0.013$). All the types of amblyopia were significantly more common in the public school students ($P=0.016$).

DISCUSSION:

Amblyopia is the most common cause of monocular vision loss in children with an estimated prevalence of 1.6 to 3.6% (1). Early diagnosis and treatment of amblyopia result in better outcomes (13). In this population-based study, we reported the prevalence and pattern of amblyopia among school children aged 7–15 years at Wolliso town, Southwest Ethiopia.

Prevalence of amblyopia varies due to different age-group of studied populations and different factors prevailing in that region, like literacy rate, frequency of visual screening programmes and geographical factors. Accordingly, the prevalence of amblyopia worldwide varies. In a multi-ethnic pediatric eye disease study (MEPEDS) conducted on African-Americans and Hispanics, amblyopia was detected in 2.6% of Hispanic/Latino children and 1.5% of African-American children (14). A study from Iran (2010) reported the prevalence of amblyopia was 2.32 in boys and 2.26% in girls (8). The criteria for diagnosis of amblyopia are almost the same in these studies. Prevalence of amblyopia among African countries varies from 0.3 to 9.1% (9, 10, 15).

The sampled population, study design (clinical/population based), the criteria used to define amblyopia and location could account for the difference in these studies. With similar study design with ours, a cross-sectional study in Indian school children aged between 5 and 15 years showed that the prevalence of amblyopia was 1.1% (16). The results of these studies is very low compared to our study. The higher prevalence of amblyopia in the Ethiopian studies might be due to poor awareness amongst general population on importance of visual assessment and lack of regular school screening programs nation wide and limited knowledge on the conditions by guardians.

We found no significant difference in the prevalence of amblyopia between different age groups. These finding is comparable with many other studies in children and adults, where these studies have shown no increase or decrease in the prevalence of amblyopia with age (17,18). Most studies, like ours, have reported that the difference in the prevalence of amblyopia is not significant for sex and the difference mostly results from sampling errors or differences in the response rate and participation of women and men in screening programs (6,19).

Our findings showed a higher prevalence of amblyopia in females than males which is also in line with studies from other countries (20, 21). Gender biases in eye health service delivery might be a reason for such difference in female students.

Two third of the cases in this study had bilateral amblyopia, which is quite different from other studies made by Fu et al (5), (66.7%) and Chia et al.(3) (69.7%) . Bilateral amblyopia is predominant because isometric amblyopia is common causes of amblyopia in our study.

The results of our study showed that the prevalence of amblyopia was 4 times higher in public school participants as compared with those with private school children. It is obvious parents with better socioeconomic status send their children to private schools. And higher socioeconomic status in parents/ guardians have a direct positive effect on use of effective health care services, leading to a decrease in the prevalence of visual disorders, including amblyopia (22).

The main cause of amblyopia varies between studies, depending on how the amblyopia is defined and the characteristics of the study sample. The type of amblyopia seen in different aspect countries also varies. Our findings showed nearly half, 49.2%, of the amblyopic cases had anisometric amblyopia and 36.5% had isometric amblyopia. Hence, in this study the amblyopia caused by the refractive error was 85.7 %, which was comparable with a report from china , (85.2%), (18) and India (86.9%) (23). In the present study, the prevalence of strabismus was 3.17%, similar to other studies (24, 25). It is possible that Strabismic amblyopia is detected early due to the obvious deviation of eyes and therefore can be managed in a timely manner compared to other forms of amblyopia which may go undetected for a long time.

And besides lack of a school screening programs can be the reason for higher number of refractive error as a cause for amblyopia.

Limitation

Our study has some limitations. Small-angle strabismus and intermittent strabismus may have been missed given the nature of both conditions.

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This could have underestimated the prevalence of strabismus. The other limitation of the study is that we used a Snellen chart to measure visual acuity rather than an Early Treatment Diabetic Retinopathy Study chart, so the impact of “the crowding effect” could not be measured. Consequently, some children with mild amblyopia may have been missed, while others with more severe amblyopia may have been misclassified as having moderate amblyopia.

Conclusions

The result of this study showed that the prevalence of amblyopia among school children in Wolliso town, Southwest Ethiopia was higher than other Sub Saharan African countries. The lack of a regular vision screening program in the study area could be considered as the main causes for late diagnosis of amblyopia. Therefore, a regular school based vision screening initiatives program is recommended.

Competing interest

The authors declare that this manuscript was approved in its form and that no competing interest exists.

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