

Prevalence and Associated Factors of Amblyopia Among School Age Children at Bahir Dar City, Northwest Ethiopia: A Community-Based Cross-Sectional Study

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Introduction: Worldwide, amblyopia prevalence among children is in the range of 0.13% to 12.9%. However, there are no known community-based data regarding amblyopia prevalence and its associated factors among school age children in Ethiopia. The aim of this study was to determine the prevalence of amblyopia and to identify factors associated with amblyopia among school age children in Bahir Dar city, northwest Ethiopia.

Methods and Materials: A cross-sectional study among a school age community of Bahir Dar city was conducted from April 1 to May 29, 2018. Data were collected using a pretested structured questionnaire and checklist through interview and physical examination. Bivariable logistic regression was done, and variables with p value <0.2 were entered to multivariable logistic regression using SPSS 20. Variables with p value of <0.05 in the multivariable binary logistic regression were considered as significant predictors.

Results: In total 601 (94.8%) subjects participated. Amblyopia was prevalent in 6.5% of school age children in Bahir Dar city. The odds of being amblyopic among participants who had anisometropia $>2D$ were about 9.3 times (AOR=9.35, CI: 2.86–30.60) more as compared to those who had no anisometropia. The odds of being amblyopic among participants having a refractive error $>+5D$ hypermetropia were about 22 times (AOR=21.77, CI: 7.15–66.34) more as compared to participants who had no hypermetropia.

Conclusion: The prevalence of amblyopia among school age children at Bahir Dar city is higher than the World Health Organization cut point. Having anisometropia greater than 1 diopter, anisometropia >2 diopter, having anisometropia less than 1 diopter, having a history of strabismus, having a hyperopia of $> +5$ diopter, $> +2$ diopter, having a positive history of visual deprivation and having a positive history of strabismus in the family were the significant factors positively associated with amblyopia.

Keywords: amblyopia, prevalence, school, children, Bahir Dar, Ethiopia

Introduction

Amblyopia, a Greek word meaning “blunt or blurry vision”, is defined as a reduction of best corrected visual acuity (BCVA) in one or both eyes caused by form deprivation or abnormal binocular interaction with no pathology in the visual system.^{1–3} It is a common problem in children⁴ and has a wider range of impacts on childhood and adulthood life of an individual and community at large. Amblyopia has a drastic impact on individuals' academic performance,⁵ career choice, visuo-motor skills, social interaction, psychological development and economic

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participation.^{5,6} Children with unilateral amblyopia are also more at risk for a bilateral visual impairment.⁷ While the prognosis for late treatment initiation is not promising, early treatment can eliminate amblyopia.⁴ Ocular media opacity,^{8–10} strabismus,^{8,9,11–16} anisometropia,^{13–15,17} hypermetropia, astigmatism,^{8–15,17} myopia,^{8,9} blepharoptosis^{8,10,16} and reduced unaided distance visual acuity^{8,9,18} are the common risk factors for amblyopia. Civil servant mother at time of child birth,¹⁹ mother without formal education,¹⁹ birth weight ≤ 2.50 kg,^{13,19} child history of past eye complaint,¹⁹ child history of past eye surgery,¹⁹ history of past spectacle use,¹⁹ family history of wearing spectacles,^{16,19} family history of crossed eyes,¹⁹ family history of eye surgery,¹⁹ gestational period < 37 weeks,^{13,15,16} admission to NICU,¹³ maternal smoking during pregnancy,¹³ child history of seizure¹⁶ and being a twin¹⁶ are also factors that are positively associated with amblyopia. Worldwide, the prevalence of amblyopia in children was estimated between 0.13% and 12.9%.^{5,14,19–31}

Even though the World Health Organization in its “vision 2020” strategy projected a 1–2% and 3% prevalence of amblyopia among screened and non-screened preschool children, respectively,^{32,33} there are no known community-based data regarding prevalence of amblyopia and the factors associated with amblyopia among school age children particularly in Ethiopia. The purpose of this study was to determine amblyopia prevalence and to identify factors associated with amblyopia in the community of school age children in Bahir Dar city, northwest Ethiopia.

Methods and Materials

Study Design, Setting and Sampling

A cross-sectional study to determine amblyopia prevalence and to identify factors associated with amblyopia among a school age community of Bahir Dar city was conducted from April 1 to May 29, 2018. Bahir Dar, the capital city of Amhara regional state of Ethiopia, is found 578 km northwest of Addis Ababa, the capital of Ethiopia. An estimated 243,300 people live in Bahir Dar city.³⁴ There were approximately 53,725 households and 86,872 school age children (age range between 6 and 18 years old) living in six administrative sub-cities and 17 kebeles. There are three governmental hospitals, five private health sectors that provide eye-care services in Bahir Dar city.³⁴ All children in the age range of 6–18 years old that were living in the city longer than 6 months were included in

this study. However, children with recent eye disorders including severe trauma that affect vision or with recent ocular surgery were excluded from the study. The sample size was calculated by Open Epi software. Because of the absence of community-based data on amblyopia in Ethiopia, 50%, 5, 1.5 and 10% were taken as prevalence, margin of error, design effect and non-response rate, respectively. The calculated sample size was 634. Multistage sampling was used to get the sample. First, the Bahir Dar City Statistical Agency gave us the list of all¹⁷ kebeles in the city. Then four kebeles were selected randomly by lottery method of SRS. The total number of households and population in the selected kebeles was 12,015 and 44,438, respectively.³⁵ The household of the participant was selected using a proportionally allocated systematic random sampling technique with a sampling fraction of 19. A lottery method was used to select the participating child when more than one child was eligible for participation in that house. The houses were revisited if the participating child and/or guardians/parents were not present in the house. The next three consecutive households were visited for schoolage children, when there was no school age children in the selected house.

Operational Definitions

Amblyopia: Amblyopia was categorized as “Yes” if a child has a best corrected distance visual acuity less than 6/9 in at least one eye or greater than or equal to two lines differences between the two eyes best corrected distance visual acuity in the absence of ocular pathology, and “No” if a child has best corrected distance visual acuity of 6/9 or better in both eyes or if the eye has/had a known ophthalmic pathology that would account for the reduction of vision.

School age children: Children aged between 6 and 18 years.

Prematurity: Birth before 37 weeks of gestation.

Cigarette smokers: Mothers were categorized as “Smokers” if they currently smoke at least one cigarette daily and as “non smokers” if they smoke less than one cigarette per day.

“Alcohol drinkers” were those who reported drinking any alcoholic beverage at least three times per week and above, but less than daily.

Refractive error: Depending on the result of the best vision sphere of the cycloplegic refraction result of the eye, refractive error was categorized as “Hypermetropia” if the child’s eye

has a best vision sphere of $\geq +0.50$ DS and “Myopia” if the child’s eye has a best vision sphere of ≥ -0.50 DS.

Strabismus: Depending on the cover–uncover test result strabismus was categorized as “Yes” if the uncovered eye during the cover–uncover test has any type of movement, and “No” if the uncovered eye has no movement during the cover–uncover test.

Mother's systemic illness: Systemic illness was categorized as “Yes” if the mother had a known positive history of diabetes mellitus and/or hypertension, and “No” if the mother had no known history of diabetes mellitus or hypertension.

Deprivation: deprivation was categorized as “Yes” if a child had a positive history of visual deprivation due to cataract and/or secondary or primary blepharoptosis which may or may not exist at the time of data collection, and “No” if the child had no positive history of visual deprivation due to cataract and/or blepharoptosis.

Data Collection Procedures and Tool

Data were collected using a pretested structured questionnaire that was developed from different literatures and a checklist through interview and physical examination. The questionnaire was pretested on 5% of the sample size outside the study area, and necessary modifications were made. Cronbach’s alpha was used to assess the reliability of the tool, and the scale was 0.72. Socio-demographic, socio-economic, maternal-related factors, gestation-related factors, developmental, familial and personal systemic and ophthalmic clinical factors were collected through the questionnaire at the subjects' home. After interviewing the parents/guardians, the children were brought in to FelegeHiwot Comprehensive Specialized Hospital for physical examination.

Distance VA was taken using a Snellen chart at 6 meters. Dry retinoscopy and cycloplegic refraction using 0.5% cyclopentolate eye drops were done for all study participants. A subjective refraction was done after 36 hours of installation of the cycloplegic drug for all study participants. Direct ophthalmoscopy was performed to detect any ophthalmic pathology in the eye. A cover test was done to detect the ocular deviations, and angles of deviation were estimated using a prism bar. These physical examinations were performed carefully by two trained senior clinical optometrists. The interview was conducted by four trained junior optometrists. One chief optometrist supervised the process and procedures of data collection. The parents/guardians of the participants were informed in detail, and

a written consent was obtained. The participants/guardians of the participants were briefed that participation in this study was voluntary. They were informed that information gathered for the study will be used for academic purposes and it will also be an input for policy making purposes. Participants who volunteered to participate in this study were first interviewed at their home and then brought their child to the hospital for physical examination. During subjective refraction, the final subjective refraction prescription was given to the participating children's parents/guardians if the child had a refractive error.

Statistical Analysis

The collected data were cleaned and coded and entered to EPI info 7. Finally it was exported to and analyzed by SPSS version 20. Summary statistics, frequencies and cross-tabulations were performed for the descriptive analysis of the data. The effect of independent variables on the outcome variable was analyzed using binary logistic regression analysis. Multivariable logistic regression was done on all variables that had p value <0.2 in the bivariable logistic regression by using the “Backward: Conditional” method. Hosmer–Lemeshow goodness of fit test, variation inflation factor and Cronbach’s alpha were used to check the fulfillment of necessary assumptions, multicollinearity and reliability, respectively. The strength and direction of association were determined by adjusted odds ratio (AOR) with 95% level of significance.

Variables that had a p value <0.05 were taken as significant.

Results

Socio-Demographic Characteristics of Study Participants

In total 601 subjects participated in the study. The response rate was 91.79%. More than half (52.1%) of them were male, and about half (55.4%) of respondents were above 12 years old. A majority (28.1%) of study participants were in the age range of 13–15 years old. The mean age (in years) of study participants was 12 (SD=4.44 years) (Table 1).

Socio-Economic Characteristics of Study Participants

The majority of participating children had parents who were both employed (52.7%), and most households (43.9%) had 3–6 children (Table 2).

Table 1 Socio-Demographic Characteristics of the Study Participants at Bahir Dar City, Northwest Ethiopia, 2018 (n=601)

Variable	Frequency	Percentage (%)
Sex		
Male	313	52.1
Female	288	47.9
Age (years)		
6–9	108	18
10–12	160	26.6
13–15	169	28.1
15–18	164	27.3
Educational status		
Not attending school	6	1
Kindergarten	9	1.5
Primary school (grades 1–8)	445	74
Secondary school (grades 9–12)	141	23.5
Ethnicity		
Amhara	564	93.8
Tigre	15	2.5
Agaw	14	2.3
Oromo	6	6
Others*	2	0.3
Religion		
Orthodox Christian	510	84.9
Muslim	67	11.1
Protestant	23	3.8
Catholic	1	0.2
Educational status of household head		
Unable to read and write	21	3.5
Can read and write without formal education	104	17.3
Primary school	174	29
Secondary school	58	26
College and above	144	24

Notes: n = sample size; others * = Gurage and Benishangul Gumuz.

Gestation, Birth and Maternal Characteristics of Study Participants

Out of the total participants, 21.5% were born before 37 weeks of gestation, 27.5% were admitted to the neonatal intensive care unit and 5.2% weighed less than 2.5 kg at birth (Table 3).

Family-Related Factors of Study Participants

A positive family history of strabismus was reported for 2.2% of study participants. Nearly 15% of the parents of study participants used spectacles, either for assisting their

Table 2 Socio-Economic Characteristics of the Study Participants at Bahir Dar City, Northwest Ethiopia, 2018 (n=601)

Variable	Frequency	Percentage (%)
House ownership		
Yes	449	74.7
No	152	25.3
Family monthly income (in Birr)		
≤2000	140	23.3
2001–5000	283	47.1
5001–10,000	129	21.5
10,001–15,000	22	3.7
>15,000	27	4.5
Family size		
1.2 Children	222	45.3
3.6 Children	240	43.9
Greater than 6 children	89	14.8
Parental employment		
Neither employed	19	3.2
Only mother employed	23	3.8
Only father employed	79	13.1
Both employed	478	79.4
History of medical visit		
Yes	317	52.7
No	284	47.3

Note: n = sample size.

vision or for protection purpose. About a quarter of the siblings of the study participants had a known visual complaint (Table 4).

Clinical Characteristics of Study Participants

More than 93% of study participants had completed their immunization. Only 1% of children had a presenting visual acuity less than 6/60. Myopia was found in the range of –0.50D to –22.00DS, and hyperopia was found between +0.50 and +9.00. The median of the myopia was –2.00DS (IQR 1.62 to –2.38). The median hyperopia was +2.12DS (IQR +1.00 to +3.88DS). High hyperopia was found in 2.5% of study participants (Table 5).

Prevalence and Types of Amblyopia

Amblyopia was prevalent in 6.5% (95% CI: 4.7–8.7%) of school age children in Bahir Dar city.

Anisometric amblyopia and ametropic amblyopia are the commonest types of amblyopia. Some of the participants (15 children out of 39 amblyopic children)

Table 3 Gestation, Birth and Maternal Characteristics of the Study Participants at Bahir Dar City, Northwest Ethiopia, 2018 (n=601)

Variable	Frequency	Percentage (%)
Gestation period		
<37 weeks	129	21.5
≥37 weeks	472	78.5
Mode of delivery		
Normal vaginal delivery	414	68.9
Cesarean section/forceps	187	31.1
Twin		
Yes	9	1.5
No	592	98.5
Admission to NICU		
Yes	165	27.5
No	436	72.5
Child birth weight		
<2500 grams	31	5.2
2500–3400 grams	511	85
>3400 grams	59	9.8
Exclusive breast feeding		
Yes	492	81.9
No	109	18.1
History of medical visit		
Yes	317	52.7
No	284	47.3
Maternal alcohol consumption during pregnancy		
Yes	35	5.8
No	566	94.2
Maternal systemic illness* during pregnancy		
Yes	22	3.7
No	579	96.3

Notes: n = sample size; systemic illness* = diabetes mellitus and/or hypertension.

had more than one cause for amblyopia. Ten of 15 children had both refractive and anisometric amblyopia. Three children had refractive and strabismic amblyopia. One child was found to have deprivational, refractive and strabismic amblyopia, and one more child had strabismic and anisometric amblyopia (Figure 1).

Factors Associated with Amblyopia

Variables that were significant in the bivariable logistic regression analysis included: age, sex, visual deprivation,

Table 4 Family-Related Amblyogenic Characteristics of the Study Participants at Bahir Dar City, Northwest Ethiopia, 2018 (n=601)

Variable	Frequency	Percentage (%)
Sibling with known visual problem		
Yes	154	25.6
No	447	74.4
First-degree family member using spectacles		
Yes	89	14.8
No	512	85.2
Family history of strabismus		
Yes	13	2.2
No	592	97.8

Note: n = sample size.

anisometropia, strabismus, gestational age, NICU admission, mode of delivery, refractive error, exclusive breast feeding, systemic illness during pregnancy, presenting visual acuity of the child, family history of strabismus and past eye complaint; these were entered into the multivariable logistic regression model. In the multivariable binary logistic regression, the odds of being amblyopic among participants with a present or past positive history of visual deprivation were 8.3 times (AOR=8.34, CI: 2.45–28.44) more as compared to those who had no a present or past positive history of visual deprivation. The odds of being amblyopic among participants who had anisometropia of greater than 2D were about 9.3 times (AOR=9.35 CI: 2.86–30.60) more as compared to those who had no anisometropia. The odds of being amblyopic among participants having a refractive error > +5D hypermetropia were about 22 times (AOR=21.77, CI: 7.15–66.34) more as compared to those participants who had no/mild refractive error (Table 6).

Discussion

This study showed that 6.5% (95% CI: 4.7–8.7%) of study participants had amblyopia. Among all study participants, anisometric amblyopia was found in 3.8% (95% CI 2.3–5.3%), ametropic amblyopia was found in 3.2% (95% CI 1.8–4.7%), strabismic amblyopia was found in 1% (95% CI 0.3–1.8%) and deprivational amblyopia was also found in 1% (95% CI 0.3–1.8). This result is in line with two studies done in India^{23,37} and one in Gondar, Ethiopia,²¹ which reported 4.8%, 6.6% and 4.7%, respectively. The similarities could be due to similarities in the

Table 5 Clinical Characteristics of the Study Participants at Bahir Dar City, Northwest Ethiopia, 2018 (n=601)

Variables	Frequency	Percentage
SYSTEMIC CLINICAL CHARACTERISTICS		
Child history of known systemic illness*		
Yes	93	15.5
No	508	84.5
Child immunization history		
Completed all	560	93.2
Not completed	41	6.8
OCULAR CLINICAL CHARACTERISTICS		
Strabismus		
Yes	19	3
No	583	97
History of past eye complaint		
Yes	87	14.5
No	514	85.5
History of spectacle use		
Yes	32	5.5
No	569	94.7
Previous/current history of visual deprivation		
Yes	15	2.5
No	586	97.5
Anisometropia		
Anisometropia <1D	25	4.2
Anisometropia ≥1D to <2D	29	4.8
Anisometropia ≥2D	22	3.6
No anisometropia	525	87.4
Presenting distance visual acuity of the better eye		
Better than or equal to 6/18	551	91.7
Worse than ≤6/18 to ≥6/60	41	6.8
<6/60 to ≥3/60	6	1
<3/60	3	0.5
Degree of refractive error		
Low degree/no refractive error	511	85
Moderate myopia	28	4.7
High myopia	25	4.2
Moderate hyperopia	20	3.3
High hyperopia	17	2.8

Notes: n = sample size; child history of known systemic illness = DM and/or hypertension and/or asthma and/or HIV.

operational definition for the studies done in India and similarities in the socio-demographic factors of study participants for the study that was done in Gondar, Ethiopia.

However, the result of this study is higher than studies done in Egypt, Lagos state Nigeria,¹⁹ Southern India,²² Eastern Europe,²⁹ Saudi Arabia⁵ and Qassim province of Saudi Arabia,²⁴ which reported 1.49%, 1.41%, 1.1%, 2.8%, 2.5% and 3.5%, respectively. These differences might be due to the difference in study set up. Ours was a community-based study, whereas all these studies were conducted in schools, which missed those school age students who left schooling because of their poor vision. The reason for the difference between this study and the study in Egypt might be due to variations in the socio-demographic characteristics of study participants. In addition the study in Egypt includes 7–9-year-old primary school children only. Ageing increases the tendency of being amblyopic, thus the result of this study is higher because it includes older students up to 18 years old.

The result of this study is lower than other studies done in southwest Nigeria,²⁵ Menelik II

Hospital, Addis Ababa, Ethiopia²⁶ and Saudi Arabia,²⁷ which reported 12.9%, 9.1% and 9.5%, respectively.

This can be explained by the variation in the study set up. All those researches were done at hospitals, which means participants are those who had eye complaints. Thus, the result in this research is expected to be lower than those researches.

In this study, the odds of being amblyopic among school age children who had anisometropia greater than 1D were about 10.44 times (AOR=10.44, 95% CI: 3.57–30.56) more than those who had no anisometropia. This result is in line with studies done in Australia¹⁴ and in China.^{15,17} The agreement between this study and the studies in Australia and China¹⁷ could be due to similarities in the study setting, as all of these researches are community-based studies. This research and one study conducted in China¹⁵ followed similar technical procedures during examining and diagnosing amblyopia, and this could be a reason for the agreement between the study findings.

In this study the odds of being amblyopic among participants who had anisometropia of greater than 2D were 9.3 times (AOR=9.35 CI: 2.86–30.60) more as compared to those who had no anisometropia. This result is in line with a study done in China,¹⁷ and this can be explained by similarities in the study setting and design. This result is also supported by another study done in a sample of 6-year-old Australian children.¹³

In this study, the odds of being amblyopic among participants who had anisometropia of less than 1D were

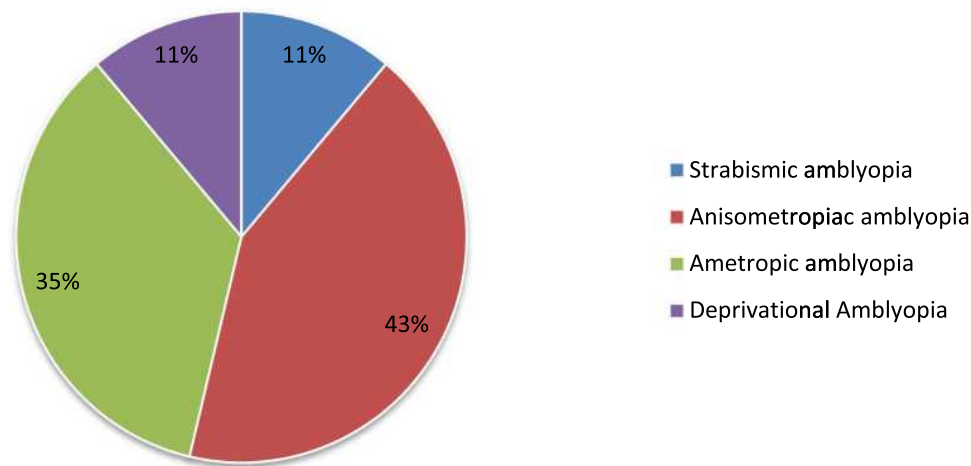


Figure 1 Types of amblyopia among study participants at Bahir Dar city, northwest Ethiopia, 2018 ($n=39$).

about 4 times (AOR=4.12, 95% CI: 1.23–13.87) more as compared to those who had no anisometropia.

This research revealed that the odds of being amblyopic among participants having a refractive error of $> +5D$ hypermetropia were about 22 times (AOR=21.77, 95% CI: 7.15–66.34) more than those participants who had no/mild refractive error. This finding is consistent with a study done in China,¹⁷ and this could be due to the nature of the study setting. Both studies were done in a community setting, unlike other studies that were done in school settings; this similarity may lead in to similar findings.

The odds of being amblyopic among participants with a refractive error $> +2D$ hypermetropia were about 7.31 times (AOR=7.31, 95% CI: 1.93–27.79) more as compared to those participants who had no/mild refractive error. This community-based study is in agreement with other community-based studies in Australia¹⁴ and China.¹⁷ These similarities in the designs of researches could be the reason for the agreement of the findings in the researches.

The odds of being amblyopic among participants with a present or past positive history of visual deprivation were 8.3 times (AOR=8.34, CI: 2.45–28.44) more as compared to those who had no present or past positive history of visual deprivation.

The odds of being amblyopic among participants with strabismus were 6.21 times (AOR=6.21, 95% CI: 1.70–22.70) more than those who had no strabismus. This result is in line with another study in Australian preschool children.¹⁴ This result is also supported by another study done in a population-based sample of 6-year-old Australian children,¹³ which reported that participants

with strabismus were 65 times more likely to be amblyopic than those who had no strabismus.

The odds of being amblyopic among participants with a positive family history of strabismus were about 8 times (AOR=7.95, 95% CI: 2.09–30.22) more than those who had no positive family history of strabismus. This result also agreed with a study done in Kosofe Town, Lagos state, Nigeria.¹⁹ This can be explained by similarities in the socio-demographic characteristics of study participants.

However, in the present study gestational age <37 weeks, admission to NICU and history of maternal cigarette smoking were not significantly associated with amblyopia. In contrast these factors were reported as significant positive factors for amblyopia in the studies done in Australia.¹³ This might be justified by variations in the socio-economic and socio-demographic characteristics of the study participants.

Generally, this research provides important information regarding the prevalence of amblyopia and its associated factors among school age children in Bahir Dar city, northwest Ethiopia. However, it has the following limitations. Questions regarding the child's history, like birth weight of the child, history of admission to NICU, exclusive breast feeding, maternal alcohol consumption during pregnancy and history of eye diseases, need memory of the more distant past, so that the study might suffer from recall bias. This study also missed astigmatism as one factor for amblyopia, which was reported in studies from other countries. As this was a cross-sectional study, it has all the limitations of cross-sectional study design.

Table 6 Factors Associated with Amblyopia Among the Study Participants at Bahir Dar City, Northwest Ethiopia, 2018 (n=601)

Variable	Amblyopia		COR (95% CI)	AOR (95% CI)
	Yes	No		
Sex				
Male	19	269	1.04 (0.54–1.98)	
Female	20	293	1	
Age category (years)				
6–9	8	100	1	
10–12	9	151	0.75 (0.28–2.00)	
13–15	9	160	0.70 (0.26–1.88)	
15–18	13	151	1.08 (0.43–2.69)	
Deprivation (present or past)				
Yes	6	14	7.12 (2.57–19.71)	8.34 (2.45–28.44) ***
No	33	548	1.00	1.00
Strabismus				
Yes	4	25	2.45 (0.81–7.45)	6.21 (1.70–22.70) **
No	35	537	1.00	1.00
Anisometropia				
No anisometropia	17	455	1.00	
≤1D	5	52	2.57 (0.91–7.26)	4.12 (1.23–13.87)*
>1D	9	34	7.08 (2.94–17.08)	10.44 (3.57–30.56) ***
>2D	8	21	10.19 (3.95–26.23)	9.35 (2.86–30.60) ***
Gestational age				
<37 weeks	4	58	0.99 (0.34–2.89)	
≥37 weeks	35	504	1	
Mode of delivery				
Spontaneous vaginal	24	380	1.00	
Cesarean section	15	182	1.35 (0.67–2.55)	
NICU admission				
Yes	23	142	4.25 (2.18–8.27)	
No	16	420	1	
Refractive error				
No/low refractive error	20	488	1.00	1.00
Myopia	2	29	2.77 (0.99–7.73)	
Hyperopia (+2.00D to +5.0D)	5	12	7.16 (2.40–21.36)	7.31 (1.93–27.79) **
Hyperopia (> +5.00DS)	9	22	15.65 (6.06–40.45)	21.77 (7.15–66.34) ***
Exclusive breast feeding for 6 months				
Yes	31	461	1.00	
No	8	101	1.18 (0.53–2.64)	
Systemic illness during pregnancy				
Yes	5	17	1.00	
No	34	545	4.72 (1.64–13.55)	
Presenting distance visual acuity				
>6/18	10	485	1	
6/18–6/60	13	56	11.26 (4.72–26.89)	
<6/60	16	21	36.95 (14.98–91.15)	

(Continued)

Table 6 (Continued).

Variable	Amblyopia		COR (95% CI)	AOR (95% CI)
	Yes	No		
Family history of strabismus				
Yes	4	13	4.83 (1.49–15.58)	7.95 (2.09–30.22) **
No	35	549		
Past eye complaint				
Yes	9	78	1.86 (0.86–4.07)	
No	30	484		

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; systemic illness = DM and/or hypertension; family history = first-degree family members. *P* values are presented for the multivariable binary logistic regression analysis.

Based on the study findings, we recommend the Federal Ministry of Health, regional health bureaus and Bahir Dar city health authorities to set up a regular school age community screening program. It is imperative for the national, regional and zonal health sectors to develop a plan for community screening to detect amblyopia early. Depending on the findings of this study, the community and eye care workers are also recommended to further investigate children with strabismus, anisometropia and a history of visual deprivation due to media opacity (cataract), blepharoptosis or other causes for evaluation and appropriate management of amblyopia. Researchers are also recommended to conduct studies on amblyopia prevalence and associated factors among children including preschoolers and young adults in the community setting and involving a larger sample size as well as considering other factors like astigmatism in the analysis.

Conclusion

The prevalence of amblyopia among school age children at Bahir Dar city, northwest Ethiopia is higher than the WHO cut point.^{32,33} Having anisometropia greater than 1D, anisometropia > 2D, having anisometropia less than 1D, having a history of strabismus, having a hyperopia of > +5D, having a hyperopia of > +2D, having a positive history of visual deprivation and having a positive familial history of eye deviation were the significant factors positively associated with amblyopia.

Abbreviations

AOR, adjusted odds ratio; BCA, best corrected visual acuity; CI, confidence interval; COR, crude odds ratio; D, diopter; DS, diopter sphere; ETB, Ethiopian Birr; EPI INFO, epidemiological information; kg, kilogram; NICU, neonatal intensive care unit; SD, standard deviation; SPSS,

Statistical Package for Social Sciences; SRS, simple random sampling; VA, visual acuity; WHO, World Health Organization.

Data Sharing Statement

The data used in this study can be accessed from the principal investigator upon reasonable request.

Ethical Approval and Consent to Participate

In this study the ethical Declaration of Helsinki was absolutely respected. The University of Gondar Institutional Review Board approved the ethical issue of the study. The College of Medicine and Health Sciences, School of Medicine Ethical Review Committee gave us ethical clearance. We obtained an informed written consent from the parents/guardians of each respondent. Verbal assent was also taken from the participants in the age range of 14 to 18 years old. After interviewing the guardians at their home, they were told to visit the eye care unit of FelegeHiwot Comprehensive Specialized Hospital for the physical examination. Children with a kind of eye problem were managed accordingly. Participants with refractive error were given their prescription to treat their optical disorders. Participants' information was gathered anonymously and confidentially.

Consent for Publication

For this study it is not applicable.

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Author Contributions

MM conceptualized the idea, wrote the protocol, analyzed and interpreted the data and drafted the manuscript. ASA was involved in revising the protocol, coordinating the data collection and critically revised the manuscript. YAM critically read and commented on the protocol and the manuscript, and coordinated the data collection. All authors have read and approved the manuscript. All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published and agree to be accountable for all aspects of the work.

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Disclosure

The authors reported no conflicts of interest for this work.

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