



Prevalence of Amblyopia among Primary School Children in Enugu, Nigeria

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ABSTRACT

Amblyopia causes impairment of visual acuity, depth perception, and contrast sensitivity and this leads to loss of binocular single vision. This study was conducted to determine the prevalence of amblyopia among primary school pupils in Enugu East Local Government Area of Enugu State, Nigeria. This was a cross-sectional study. A simple random sampling technique was used to select 500 primary school pupils who were examined. Data was obtained using ocular examinations which included visual acuity and pin hole visual acuity testing, cover test. Subjective refraction and fundoscopy were also performed. Amblyopia was defined as best corrected visual acuity $\leq 6/9$ in one eye or both eyes without ocular pathology in either eye. Data obtained was analysed using the Statistical Package for Social Sciences version 25 and was tested using the Chi-square test with p-value set at 0.05 ($p < 0.05$). A total of 500 pupils participated in the study, out of which 248 (49.6%) were males and 252 (50.4%) females. The mean age of the participants was 8.95 ± 2.16 years and the age range was from 5-15 years with 307 (61.4%) pupils within the ages of 5 to 9 years and 193 (38.6%) pupils within the ages of 10 to 15 years. Amblyopia was detected in 21 (4.2%) of the screened pupils. Amblyopic subjects were significantly older than non-amblyopic children ($P = 0.002$). The female pupils were more amblyopic than their male counterparts, although the gender variation was not statistically significant. Isometropic amblyopia ($n = 8, 38.1\%$) was the most common type of amblyopia ($p = 0.001$). Bilateral amblyopia was observed in 61.9% of the amblyopic pupils. The prevalence of amblyopia in this study was high and therefore adequate public enlightenment about the causes, consequences and prevention of amblyopia should be advocated by eye care service providers and the government.

Keywords: Prevalence; Amblyopia; Children; Ocular Examination.

INTRODUCTION

Vision development is a continuous dynamic process that occurs due to changes within the visual system and it retains its plasticity within first decade of life. Amblyopia occur when there is inadequate stimulation of the brain due to insufficient exposure to sharply focused images and different quality images from the two eyes (Janti, *et al.*, 2014). When there is mismatch between the images to each eye while the eyes look normal, one eye is favored while the information from the other eye is suppressed (Myron & Jay, 2014). Amblyopia is clinically defined as a reduction of Snellen's visual acuity of greater than two lines between the two eyes or an absolute reduction in acuity below 6/9 in either eye after best possible correction, without obvious pathology (William & Bernarad, 2015). It is also said to be a visual disorder characterized by a reduction in the best corrected visual acuity (BCVA) in an eye with no organic pathology which develops early in life during the critical periods of visual development. It causes impairment of visual acuity, depth perception, and contrast sensitivity and this leads to loss of binocular single vision (Noorden & Campos, 2010). It is most frequently caused by ocular misalignment (strabismus), blur induced by unequal refractive error (anisometropia), and in some cases by light deprivation. Amblyopia normally affects only one eye in most patients. However, it is possible to be amblyopic in



both eyes, if both fail to receive clear visual images (Eileen, 2013). Reducing the amblyopia rate can decrease the severity of bilateral vision loss because persons with amblyopia are at an increased risk of injury to the healthy eye and suffer loss of function when this occurs (Carlton *et al.*, 2008). Children with amblyopia may not be aware, nor complain of defective vision (De Santis, 2014). School screening is an effective tool being advocated for the early detection of refractive error, strabismus, and amblyopia in order to prevent childhood blindness, which is one of the goals of Vision 2020.

Amblyopia has been generally reported to have a prevalence rate of 2% among children of 4 to 5 years worldwide (Solebo *et al.*, 2015), and it is one of the causes of visual impairment in children. Several studies have investigated the prevalence of amblyopia in children of various ages in varying rates. In Australia, it was determined to be 1.8% in children of 6 years (Robaei *et al.*, 2006), 3.6% among British children of 7 years (Williams *et al.*, 2010), and 1-4% among school going children in the United States (Doshi & Rodriguez, 2014). In Nigeria, available data show a low prevalence rate, as was seen among school children in Jos Plateau State, where the prevalence of amblyopia was found to be 1.1% (Onyekwe *et al.*, 2011). A similar prevalence rate was found in a study by Ajaiyeoba *et al.*, (2004) in South Western Nigeria, in which amblyopia accounted for 1% of the visual problems in primary school pupils and 2% in secondary school students. It was reported in 25% of strabismic children in Ilorin, Kwara State (Azonobi *et al.*, 2002), and 0.3% among secondary school students in Calabar, Cross River State (Megbelayin, 2012). There scanty report on the prevalence of Amblyopia in Enugu State. An urban vision screen in Enugu found amblyopia in only 0.1% of the children (Nkanga & Dolin, 2014). There is no evidence of such report in Enugu East Local Government Area, Enugu. The purpose of this study was to determine the prevalence of Amblyopia among primary school children in Enugu East Local Government Area of Enugu State, Nigeria.

MATERIALS AND METHODS

Study Design

This was a descriptive cross sectional study which was employed to determine the prevalence of amblyopia among primary school children aged 5 – 15 years in Enugu East Local Government Area of Enugu State and conducted within three months from the 1st of January to the 31st of March 2018.

INCLUSION CRITERIA AND EXCLUSION CRITERIA

All pupils within the age range of 5 – 15 years who consented to the eye examinations and who were available on the days of examinations were tested and included for the study. Whereas pupils who were not within the age range of 5 – 15 years, or who were absent on the days of examination, or whose parents/guardian did not give a written consent for examination or who didn't want to partake in the screening/examination or who were sick or had a systemic disease were all excluded.



SAMPLE SIZE AND SAMPLING TECHNIQUE

The schools were divided into four groups based on their location within the four major districts and using the simple random sampling technique, one school was selected from each district making a total of four schools. In each selected school, 125 pupils (21 pupils from each class) were randomly chosen. Hence, five hundred (500) pupils were randomly selected from four (4) primary schools in the four educational districts of Enugu East Local Government Area of Enugu State.

INSTRUMENTATION

Instruments used for collection of data included: Visual acuity chart, Trial box, Pen torch, Retinoscope, Ophthalmoscope.

PROCEDURES FOR DATA COLLECTION

Simple demographic data was obtained on site through case history. Screening was conducted on the pupils for Amblyopia. The following procedures were also carried out:

Visual acuity assessment: Visual acuity (VA) at distance was tested using the Snellen acuity chart. Picture acuity chart was used to determine the VA for pupils who expressed difficulty with the Snellen chart. Pinhole testing was performed for pupils whose distant VA was 6/9 and below. An improvement in VA was taken to indicate a probable refractive error while non-improvement suggested an organic cause or Amblyopia.

Ophthalmoscopy: Examination of the fundus, red reflex and anterior segment components such as crystalline lens, aqueous humor and iris were examined using a direct ophthalmoscopy. If the size of crystalline lens opacity was more than 1mm, the subject was suspected of having a cataract. In addition, the optic nerve and macula were examined using direct ophthalmoscopy to exclude possible fundus lesions.

Ocular Alignment Assessment: The cover test or Hirschberg test was used to assess ocular alignment in subjects with visual acuity more or less than 6/60, respectively. These tests were performed at far (6m) and near distances (33cm) with an accommodative fixation target to detect deviation, if present. Ocular motility was checked in all gazes to detect any muscular dysfunction (Terry, 2009).

Subjective Refraction: Refractive error was objectively assessed using a retinoscope and refined subjectively using both spherical and cylindrical lenses. Subjective refraction was carried out to determine the best corrected visual acuity (BCVA) of the pupils. Visual acuity after best possible correction was considered to categorize into amblyopia. The BCVA and the types of refractive errors were recorded for each pupil. Children with refractive errors were given prescriptions for their spectacle corrections while those with other ocular morbidities were treated and referred appropriately

DIAGNOSTIC CRITERIA

Amblyopia was diagnosed based on anyone of the following criteria with the eye(s) appearing normal on fundoscopy.

- Best corrected visual acuity in that eye was at least two lines worse than the better eye.



- Best corrected visual acuity could not be improved to 6/9 in either eye or both the eyes.
- Past history of patching was present in one eye or both eyes.

ETHICAL CONSIDERATIONS

The study protocol was approved by the Head of Optometry department. It was then approved by the Committee on Human Research and Ethics of Madonna University Nigeria. Approval was sought and obtained from the Chairman, Enugu State Universal Basic Education Board (ESUBEB). Permission was also obtained from each school head master and class room teachers. Students and parents were enlightened on the purpose of the study, benefits and procedure a day before the examination. Informed consent forms were sent to the parents and consents obtained through their signing.

DATA ANALYSIS

All examination forms were cross-checked in the field for completeness. Data was entered and analyzed using the Statistical Package for Social Sciences version 25.0 (IBM Corp., Armonk, NY, USA). The prevalence of amblyopia was calculated in percentages and presented in tables as descriptive statistics. Also, correlation test (Chi-square test) was utilized to investigate relationships between variables such as age and gender with amblyopia. Statistical significance was set at $P < 0.05$.

RESULTS

Demographics

A total of Five hundred (500) primary school children participated in this study with a participation rate of 100%. Two hundred and fifty-two ($n=252$), (50.4%) were females and two hundred and forty-eight ($n=248$), (49.6%) were males. The mean age of the participants was 8.95 ± 2.16 years with age range from 5 years to 15 years.

THE PREVALENCE OF AMBLYOPIA

The prevalence of amblyopia in this study was 4.2%. Amblyopia was found to be present in Twenty-one (21) subjects out of the 500 subjects that were examined.

Table 1: Showing the Prevalence of Amblyopia.

AMBLYOPIA	FREQUENCY	PERCENT
PRESENT	21	4.2%
ABSENT	479	95.8%
TOTAL	500	100%

PREVALENCE OF AMBLYOPIA IN RELATION TO AGE

The prevalence of amblyopia was statistically significant with age ($p=0.002$). Amblyopia was more common in older age group of 10-15 years ($n=15$; 71.4%) than those within the age range of 5-9 years ($n=6$), (28.6%).



Table 2: Showing the Distribution of Amblyopia in Relation to Age

AGE GROUP	FREQUENCY	PERCENT	SIGNIFICANCE
(5-9)YEARS	6	28.6%	0.002
(10-15)YEARS	15	71.4%	
TOTAL	21	100	

Fishers exact and Pearson's chi-square test for age (95% CI, p-value 0.002).

PREVALENCE OF AMBLYOPIA IN RELATION TO GENDER

The results of this study showed that females (n=13), (61.9%) had a higher prevalence of amblyopia compared to males (n=8), (38.1%). However, this difference was not statistically significant (p=0.197).

Table 3: Showing the Distribution of Amblyopia in Relation to Gender

GENDER	FREQUENCY	PERCENT	SIGNIFICANCE
MALE	8	38.1%	0.197
FEMALE	13	61.9%	
TOTAL	21	100%	

Fishers exact and Pearson's chi-square test for gender (95% CI, p-value 0.197)

DISCUSSION

The prevalence of amblyopia in this study was 4.2%. This study is within range of the results obtained by Aldebasi, (2015) in Saudi Arabia, Saba *et al.*, (2016) in Karachi Pakistan, Destaye *et al.*, (2017) in Gondar town, Northwest Ethiopia, and Ejimadu & Paul, (2015) in Port Harcourt Nigeria which were 3.90%, 6.7%, 4.7% and 5.6% respectively. But lower than that obtained by Alarape *et al.*, (2017) in Ikeja, Lagos Nigeria which was 12.9%. However, our results are different from those obtained by Rajavi *et al.*, (2015) in Tehran Iran, Segun *et al.*, (2015) in Kosofe, Lagos and Akpe *et al.*, (2015) in Benin city, Edo state both in Nigeria which were 2.3%, 1.4%, and 0.23%, signifying a lower prevalence of amblyopia in children than our result. The marked difference and variation between the prevalence rate from our study and other studies might be due to the fact that, school children with eye problems in different study areas may not have the same opportunities for early case detection and treatment. The reason for this difference can also be attributed to the different working definitions for amblyopia used, the different visual acuity testing criteria used in screening these children, the difference in study location and population size screened, the difference in the age groups screened, and the region of the country where these children were screened. Ethnic differences could also account for this disparity. This study also showed that amblyopia was common among the older age group with the highest prevalence (71.4%) reported in children within ages 10-15 years and this was statistically significant (p=0.002). This conforms to results from a similar study conducted by Aldebasi, (2015) in Qassim Province, Saudi Arabia, Abdelrazik and Khalil, (2014) in Minia County, Egypt where the prevalence of amblyopia was statistically higher in the older age group compared to the younger age group. In contrast, Rajavi *et al.*, (2015) in Tehran, Iran found out that amblyopic subjects were significantly younger than non-amblyopic children. This might be because of lower eye health awareness by parents to have regular eye check-up. Age of presentation has critical implications on treatment outcome of affected children. Although many studies



have shown that children may respond to treatment at older ages, but treatment may be less effective than it would have been in younger ages (Scheiman *et al.*, 2007).

In relation to Gender, the prevalence of amblyopia was higher in females (61.9%) than in males (38.1%). This was in line with similar studies done by Destaye *et al.*, (2017) in Northwest Ethiopia, Saba *et al.*, (2016) in Karachi, Pakistan, Akpe *et al.*, (2015) in Edo State, Nigeria, Alarape *et al.*, (2017) in Ikeja Lagos State, Nigeria and Ejimadu & Paul, (2015) in Port Harcourt, Rivers State, Nigeria. However, it contradicts with a study carried out by Segun *et al.*, (2016) in Kosofe Town of Lagos State in which the prevalence of amblyopia was slightly higher in males than in females. The observed discrepancies may be due to different socio-economic setting and ethnicity of study populations of the study settings. There was no statistically significant difference (0.197) between males and females in this study. Such a finding was similar to studies conducted by Aldebasi, (2015) in Saudi Arabia and Chia *et al.*, (2010) in China.

CONCLUSION

In conclusion, this study showed a high prevalence of amblyopia among primary school children in Enugu East Local Government Area of Enugu State. We recommend that concerted effort be made to strengthen the school health program where children will have periodic eye examination at school entry, half way through it and before leaving the primary school. This way, there will be early detection and subsequent referral to appropriate centers where children with visual impairment and other handicaps will be promptly managed.

RECOMMENDATION

It is recommended that concerted effort be made to strengthen the school health program where children will have periodic eye examination at school entry, half way through it and before leaving the primary school. This will ensure early detection and appropriate referral. Increased awareness and public enlightenment about the causes, consequences and prevention of amblyopia is also advocated.

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