

Prevalence of Refractive Error Among Early Primary School Age Children in Ado-Odo Ota Local Government Area, Nigeria.

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Research article

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Abstract

Introduction Refractive error is one of the major causes of blurred vision. It is a common eye disorder even in children. The World Health Organization had estimated refractive error to cause visual impairment to about 153 million people around the world with over 1.4 million children affected. Eighty percent (80%) of whom live in developing countries. The right to sight, a global initiative launched by World Health Organization, has the main aim of eliminating avoidable visual impairment and blindness at a global level. In order to achieve this goal, visual screening in pre-school and school children has long been a tradition in developed nations of the world. The significance of this cannot be overemphasized, especially with the already established correlation between school performance and visual status. However, in developing countries visual screening for children is not yet well established, thereby leaving many children with undetected refractive error, which could result in visual impairment. This study was aimed at evaluating the prevalence of refractive error among early primary school age children at Ado-Odo Ota Local Government Area(LGA) in Ogun State, Nigeria.

Methodology: The study was designed as a cross-sectional study. It employed a multi-staged sampling method to recruit 205 pupils aged 5-9 years attending schools in Ado-Odo Ota as study participants to determine the prevalence of refractive error among the pupils attending primary schools in this area. Following ocular pathology screening for the children, subjects found fit were refracted both objectively and subjectively using auto-refractor and trial lenses respectively.

Result: A prevalence of 30.73% of refractive error was recorded. Myopia had the highest prevalence (24.88%), followed by astigmatism 3.42% and hyperopia with the least prevalence of 2.44%. Older children had higher frequencies of refractive error than the younger ones with the males having more refractive error than the females (19.51% and 11.22%) respectively.

Conclusion: The study concluded that refractive error is significantly present among this population and recommended that parents should ensure that their children are screened for refractive error, and that government should introduce school health programs to curb the growing menace of visual impairment due to uncorrected refractive error.

Background

Refractive error is one of the leading causes of visual impairment globally, affecting over 153 million people around the world (1). Clinical evidence has shown that refractive error is common even among children with over 12.8 million children affected (1). Eighty percent of them live in developing countries. Hyperopia, astigmatism and myopia are common refractive errors seen in children (2) (3). Hyperopia, which is the formation of images behind the retina, is the single most common refractive finding in children between 6months and 7 years, with the prevalence rate of 8.4% among 6 year olds and a potential causal factor of reduced vision (4). Similarly, myopia which results in the formation of images before the retina, has also been found to be very prevalent among 5-15 years old children, with recent

epidemiological studies showing an increase in its prevalence over the past half century (5). Refractive error requires detection and treatment in the form of glasses, contact lenses or, more recently, refractive surgery. Uncorrected or inadequately corrected refractive error can hamper learning abilities in children, and can also cause blindness early in life (Childhood blindness). Childhood blindness may occur as early as 7 years and can affect such a child's quality of life and learning, as it can hinder education, personality development, career opportunities and other life decisions. Early onset blindness tends to place a heavy socioeconomic burden on the individual's family and the society. This is further worsened by the fact that when blindness occurs early in life the person involved tends to be blind for a very long time (most likely till death). However, despite the recognized importance of correcting refractive anomalies in children, uncorrected or inadequately corrected refractive error has been seen to cost a sizeable number of children their right to sight early in life.

Due to the significant impact of refractive error, the World Health Organization, launched a global initiative "the right to sight" which aims to eliminate avoidable visual impairment and blindness at a global level (6). In order to achieve this goal, it is important to plan and implement policies and programs which will facilitate eye screening for primary school children and the populace at large. Sadly, the state of eye care in Africa is alarmingly low when compared with the state of eye care in the rest of the world. High practitioner-to-patient ratio, inadequate facilities, meager government funding and lack of educational programs are the norms of eye care in Africa. Children who are a vulnerable population and majorly dependent on their care givers/parents for decisions are significantly affected by refractive errors as they are at the receiving end of the poor policies and implementation in Africa. This is a reflection of the few number of studies carried out amongst this population in different regions of Africa, hence the need to carry out more research showing the prevalence of refractive error amongst children.

Ogun State is one of the 36 States in Nigeria, located in the southwestern geographical zone. It is predominately a semi-urban State, with an estimated population of 5,217,716 people. With 33.0% of it being children between age 5 to 14 years old (7). Just like every other state in Nigeria, Ogun State is faced with the problem of insufficient data for planning on the prevalence of refractive error among children. It is against this background that this study was designed to investigate the prevalence rate of refractive error in children and parental willingness to access eye care services for their children in Ado/Odo-Ota, Ogun State, Nigeria.

Methods

DESCRIPTION OF STUDY AREA

This study was conducted in four primary schools in "Ado-Odo/Ota Local Government Area". Ado-Odo/Ota is one of the 19 Local Government Areas of Ogun State, Nigeria. It was created on May 19, 1989 following the merger of Ota, part of the defunct Ifo/Ota Local Government with Ado-Odo/Igbesa Areas of the Yewa South Local Government. Ado-Odo/Ota borders on metropolitan Lagos, it is the second largest Local Government in Ogun State and it is headquartered at Ota (7). It has 16 administrative or political

divisions which include Agbara (I), Agbara (II), Igbesa, Iju-Ota, Atan, Alapoti, Ketu, Igbesa, Ere, Ijoko, Adie Owe, Sango Ota, Ota (1), Ota (II), Ota (III) Ilogbo, Ijoko. It has an area of 878km² and a population of 526,565 at the 2006 census (7). It is primarily an agricultural society producing food crops and cash crops especially cocoa.

RESEARCH PROCEDURE

The study employed a cross sectional research method. Samples were drawn from the 16 administrative arms of the local government from four different schools using a multi-stage sampling method. Sample size was calculated using a single proportion formula. The study assumed an estimated refractive error prevalence rate of 13.5%, using a precision rate of 0.05diopter and a confidence interval of 95%. The calculated sample size was 189 and the sample size was increased to 216 assuming a 15% non-response. Random sampling method was used to draw four public schools with mixed population (male and female pupils) from the list of schools provided by the local government. List of pupils from Primary 1-3 from each selected school were obtained, and sampling was proportioned according to the population of pupil's in each level, after which systematic selection of students using the nth number for reference was done for each level. A total of 54 pupils were selected from each school, based on academic level and gender. A grand total of 216 pupils were selected, however 205 pupils participated in this study.

Approval was sought and received from University of Lagos Research Ethics Committee. Consent was obtained from the participating schools and written informed consent from parents/guardians of pupils who participated in the research. Questionnaires showing ocular and family history were distributed for children to take home for filling by their parents and guardians before the day of data collection. During data collection, participants were treated in ways to maintain confidentiality, justice and benevolence. After consents were acquired and the questionnaires returned, the pupils were screened for any ocular pathologies which may interfere with the findings of the study. Screening involved an initial visual acuity measurement (unaided and pinhole) using the LogMar Chart at 6 meters, Slit-lamp Biomicroscopy (Marco G2), tonometry using Pulsair Intellipuff air non-contact tonometre. Objective refraction using Topcon Autorefractor was used to determine the level of refractive error after which subjective refraction was done. Level of refractive error was calculated based on spherical equivalent (which involved the addition of half of the cylindrical component of the refractive error to its spherical component). Myopia was defined as visual acuity less than 6/9 which improved with pinhole acuity and resulted into a spherical equivalent of -0.50Dioptres and above after objective and subjective refraction. Hyperopia was defined as a visual acuity of 6/9 which improved with pin hole and a spherical equivalent of at least +1.00Ds. Astigmatism was defined as a cylindrical component greater than 0.75Dcyl (notated with a negative sign). Data was analyzed using SPSS version 24 software program. Percentages were used to describe the prevalence of refractive error. The results of this findings maybe limited based on the fact that the students ages were supplied by the parents and verified using the school register, however dates of birth were not verified using government/ hospital issued birth certificates.

Results

A total of 216 pupils drawn from 4 public schools across Ado/Odo-Ota LGA of Ogun State, were recruited for the study, seven children were absent from school during the time of the eye examination, 5 had pathological conditions which needed ophthalmological attention and referral. A total of 205 who obtained consent from their parents using the informed consent form and participated in this study representing 94.9% response rate. Out of this number, 124 (60.49%) pupils were male and 81 (39.51%) were female with an age range of 1 - 9 years as shown in table 1. The mean age of the population was approximately 7.9 while the median age was 8 years. The modal age was 8 years with a range of 5-9 years. Children between primary one to primary three were the focus of the study. Eighty-two (82), that is (40.00%) of the children were in primary one, sixty-one (29.76%) were in primary two and 62 (30.24%) children were from primary three this is.

Table 1 Distribution of study participants according socio demographic details

Demographic details	Male {N(%)}	Female {N(%)}	Total {N(%)}
AGE			
5	3 (48.9)	4 (57.1)	7 ()
6	11 (55.0)	9 (45%)	20 (9.8)
7	27 (61.4)	17(38.6%)	44 (21.5)
8	41 (62.1)	25 (37.9%)	66 (32.2)
9	42 (61.8)	26 (34.4%)	68 (33.2)
CLASS			
Primary 1	47	35	82
Primary 2	46	21	61
Primary 3	37	25	62

N-Frequency, %-Percentage

PREVALENCE OF REFRACTIVE ERROR

Table 2 Refractive findings in the study participants

Auto refraction findings	N (%)
Hyperopia	5(2.44)
Myopia	51(24.88)
Astigmatism	7(3.42)
Emmetropia	142(69.27)
Total	2015 (100)

N-Frequency, %-Percentage

Out of the 205 pupils who participated in this study, 63 (30.7%) had refractive error in either the right eye or left or right eye with the refractive error ranging from +4.00Ds to -6.00ds. Myopia was the most prevalent refractive error occurring in 51 (24.88%) participants. Astigmatism was present in 7 (3.42%) eyes. Hyperopia was the least refractive error present in the population 5 (2.44%) as presented in Table 2 above.

Table 3 Distribution of refractive error according to age

age	MYOPIA		HYPEROPIA		ASTIGMATISM	
	NO	%	Hyperopia	%	N	%
5	0	0	0	0	2	28.57
6	0	1.96	1	20	0	0
7	6	11.76	3	60	1	14.29
8	19	37.25	0	0	1	14.28
9	25	49.01	1	20	3	42.86
Total	51	100	5	100	7	100

N-Frequency, %-Percentage

From table 3 above, myopia was the most prevalent refractive error seen across all ages. It was highest among the nine year olds with a prevalence rate of 49.01%. While the prevalence rate of myopia among the eight year olds was 37.25%. Hyperopia was present in the six, seven and nine years olds with the highest prevalence rate of 60% in the seven year olds. Astigmatism was notably most prevalent among the nine year olds (57.1%).

Table 4 Distribution of refractive error according to gender in the study population

Gender	Myopia	Hyperopia	Astigmatism	Emmetropia	Total N (%)
	N (%)	N (%)	N (%)	N (%)	
Male	33 (16.10%)	2 (0.96%)	5 (2.44%)	84 (40.49%)	124(71.4)
Female	18 (8.78%)	3 (1.46%)	2 (0.96%)	58 (28.29%)	81(28.6)
Total	51 (24.88%)	5 (2.44%)	7 (3.40%)	144(68.78%)	205(100)

N-Frequency, %-Percentage

As shown in table 4, the prevalence of female pupils with refractive error is less 23 (11.22%) when compared to their male counterparts, which was 40 (19.51%). Myopia had the highest frequencies in both male and female; 33(16.10%) and 18(8.78%) respectively. The prevalence of astigmatism was more in males 5 (2.44%) when compared to females 2

(0.96%). However, hyperopia was greater in females 3 (1.46%) when compared to males 2 (0.98%).

Discussion

The visual experience of a child plays a significant role in his/her mental, social, emotional, physical and intellectual development. Refractive error has been one of the leading causes of visual impairment among school children. This has made the prevalence of refractive error amongst school children a topic of public health interest in research. As such, many studies, including the current research has been conducted to determine the prevalence of refractive error among this population in different geographical areas.

In this study, the prevalence of refractive error was evaluated amongst primary school children between the ages of 5 and 9 years, attending primary schools in Ado-Odo / Ota LGA of Ogun state, Nigeria. Out of the 217 pupils recruited, 205 pupils were screened, using pin hole, auto-refractor and subjective refraction method to determine the presence of refractive error. About 63 (30.74%) of the study population (205 children screened) were diagnosed of refractive error of ($\geq \pm 0.50D$ SE), but none of them had corrective glasses on and none had record of any previous eye screening. The prevalence of 30.74% refractive error seen in this study is similar to the result of a study conducted in Western Saudi Arabia among 3-10 years old children which reported a prevalence of 34.9% of uncorrected refractive error among this population (2). Also, this prevalence is comparable to what was reported in Imphal, Manipur India, where the prevalence of 29.14% refractive error among school children was also reported (8). These similarities may be explained by the fact that both studies adopted a similar working definition for refractive error, that is: Myopia (visual acuity $\leq 6/9$ in any eye for far vision that improves after pinhole testing), hyperopia (visual acuity of $< N5$ at near that improves after pinhole testing) (2)(8). However, the prevalence of 30.7% as reported in this study is higher compared to the prevalence of 13.5%, 24.6.9% and 22.5% reported in Al Hassa, Saudi Arabia, North-West Rajasthan and Abia State, Nigeria respectively(9) (10)(11). The reason for these variations may be explained by differences in the methodologies used, definition of working terms (such as hyperopia, myopia and astigmatism), age range, sample size, geographical areas, environmental factors, genetics, diet and ethnicity/tribe, of the studied population in these studies.

From the study, the prevalence of refractive error varied according to type. For instance, astigmatism ($\geq -0.75DC$) was found present among 3.4% of the entire population of pupils studied. This was less than what was gotten in Abia State, Nigeria where astigmatism was the least prevalent (7.8%) refractive error present in school children between 5-15 years of age (12). Myopia ($\geq 0.50Ds$) was the most common type of refractive error encountered, constituting 24.89% in both eyes. This reflects in its totality about 80.96% of the entire refractive error encountered in the study. This is higher than the prevalence of myopia (65.7%) reported in a study conducted in Saudi Arabia among 6-14 year olds school children living in Saudi Arabia (9). It is also higher than the prevalence reported in the studies conducted in Malaysia, Nepal and Jordan which found that myopia represented 77.5%, 59.8%, and 63.5% of screened errors respectively among 6-14 year olds school children, making it also the most prevalent refractive

error among these populations (9). Hyperopia on the other hand, was the least refractive error encountered with a prevalence rate of 2.44%. This is lower in comparison to the prevalence of hyperopia (58.1%) reported in Zahedan District, Southeastern Iran, among 5-to-15 year -old children (13). However, the findings of this study is higher when compared to the prevalence of hyperopia reported in Northwest Ethiopia wherein hyperopia of 1.47% was found (14). Similarly, the prevalence of hyperopia in this study is also higher than the prevalence reported in a study conducted in Qassim, Saudi Arabia, in which a prevalence rate of 0.7% was obtained (15). Variation in the prevalence rate of this studies maybe attributable to the difference in sample size, population studied and the operational definition of hyperopia as employed by the studies.

This study also found an age variation in the distribution of refractive error across the studied population. Among the affected population, refractive error was most prevalent among 9 year olds (49.01%) compared to the rest of the population. Myopia, as a refractive error was also found to vary with age. It increased from 0% in the 5 year olds to 49.01% in the 9 year olds. This observation of variation in myopia with age was not unexpected, because many studies in the past demonstrated a correlation between age and myopia (16). The most notable factor in this correlation between age and myopia is the growth-related increase in axial length. Increased axial length during the first and second decades of life has been documented to result in increase in myopia as found in cross-sectional and prospective studies. When compared to other studies there seem to be an agreement that myopia varies with age, however there were significant variations in its distribution across specific ages and/or age groups. For instance, the current study recorded a 0%, 11.76% and 49.01% prevalence of myopia (≥ 0.50) in 5, 7 and 9 year-old children respectively. Variations in distribution of myopia was also noted in the study by Jokbe et al., conducted on German children and adolescents, which recorded prevalence of myopia as 0% in children aged 2–6 years, 5.5% in children aged 7–11 years, 21.0% in adolescents (aged 12–17 years) and 41.3% in adults aged 18–35 years (17). Reasons for these variations in the distribution of myopia across the age groups may be explained by the growing demand for more near work as children grow in age and in their academic demand. Also the high increase in the usage of electronic gadgets to play games by children especially the older age group has also increased the rate of near work among this population.

Finally, the difference in the distribution of refractive error among the different sexes was in drastic contrast to other studies. Whereas, the current study indicates a higher prevalence of refractive error amongst the male pupils (19.51%) than female pupils (11.22%), studies by other researchers had indicated a higher prevalence of refractive error among females than males (13) (2) (3). However, this is similar to the work of Shukla et al who reported a higher prevalence of refractive error among male than female pupils (18). The findings here are in line with previous studies; while few studies have shown this relation in school-age children, most studies in older age groups agree that the prevalence of myopia is higher in males (19). This may be due to the higher frequency of male to female ratio of the studied population. However, factors like gestational period weight, family history of refractive error and duration of near work among the children were not studied. These factors may have been contributory to the variations in prevalence of refractive error amongst the male and female children.

Conclusion And Recommendation

This study was aimed at evaluating the prevalence of refractive error among early primary school children aged between 5-9 years, in Ado-Odo/ Ota LGA of Ogun State, Nigeria. The study found that about one third of the children screened were affected by uncorrected refractive error, however none of them had any form of correction in place for the error detected despite the magnitude. Because visual experience is an important component of learning and development, the importance of good vision amongst school going children cannot be over emphasized, hence there is need for concerted effort towards ensuring programs that can screen and provide children with adequate corrections while in school. In order to achieve this, there is need for the Ministry of Education in conjunction with the Ministry of Health to sensitize the public on the need for visual screening for children. There is also need to enforce school health policy on visual assessment before school admission, as well as carry out biannual eye screening for pupils, this may help to enhance early detection and management of refractive error and any other eye problems.

Declaration

Ethics approval and consent to participate: Ethical approval to conduct this research was gotten from the Lagos University Teach Hospital, Health Research Ethics Committee. This has been added as a supplementary document. Also written informed consent to participate in the study was gotten from the parents of pupils and verbal assent was gotten the pupils who participated in the study.

Consent to Publish: This article does not show any picture or disclose names of participants as such there is no need to acquire consent for publication from the study participants.

Availability of Data: the data collected during this research work is safely saved and can be made available on request

Competing interests: None

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Authors' contributions: This paper was written by Ogbonna Grace Obumneke

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Figures

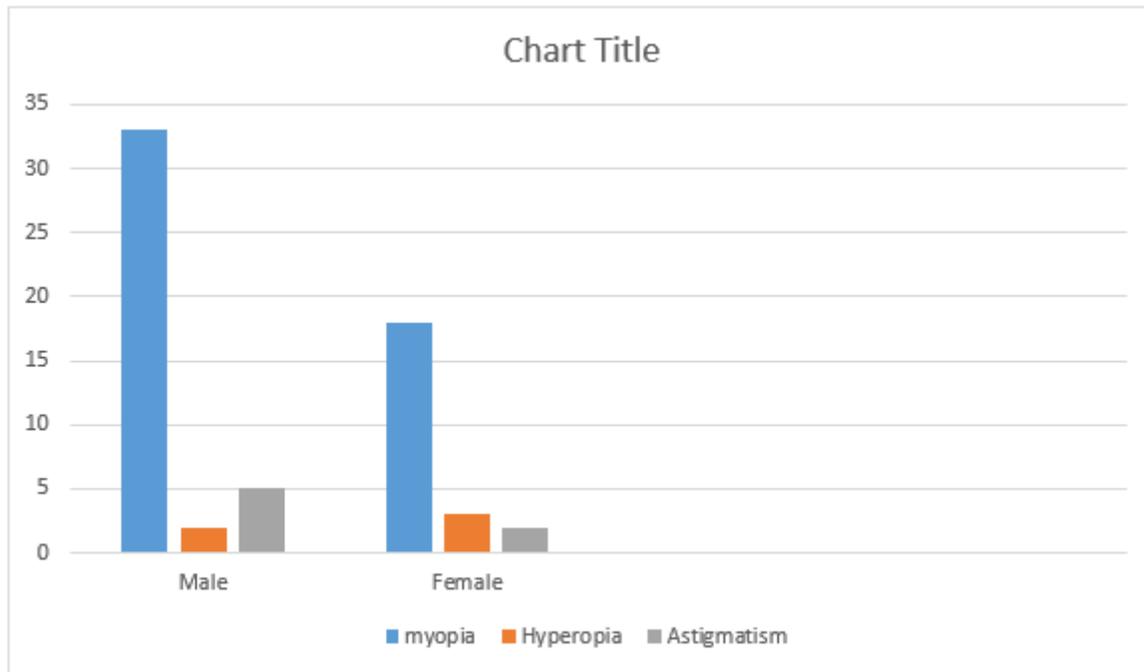


Figure 1

Distribution of refractive error based on gender