
TYPES AND MAGNITUDE OF REFRACTIVE ERRORS AMONG SECONDARY SCHOOL STUDENTS IN OBIO/AKPOR LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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ABSTRACT

The aim of this study is to know the types and magnitude of refractive errors among secondary school students in Obio/Akpor Local Government Area of Rivers State. A cross-sectional study in which 200 randomly selected students aged 10-17 years (mean age=13.52±2.045) from seven (7) randomly selected secondary schools was conducted. Unaided visual acuities of the subjects were measured at far and near using the Snellen's distant and near acuity charts. The refractive errors were measured using a keeler streak retinoscope and trial lens and frames for objective and subjective refractions. Findings were recorded on a prepared data sheet. Data were analyzed with the descriptive and inferential statistics of the statistical packages for Social sciences (SPSS version 21). The prevalence of refractive errors was 97.50%. The distribution of refractive errors were as follows: 58.3% of the participants were astigmats which was found to have the highest prevalence, 22.46% of the participants were myopic, and the least prevalent was hyperopia with 19.25% participants. In the frequency of distribution of refractive errors, age 13 years (16%) was the highest and age 17 years (6.5%) was the lowest. From the result of this study, regular vision screening program of students is necessary, both in the rural and urban areas and thereby recommended, to know the distribution and burden of refractive errors as it affects the academic performance of school children.

INTRODUCTION

Kumah,(2016) defined refractive error as a condition in which the eye in its relaxed state is unable to sharply see images due to failure of the optical system to bring parallel rays of light reflected off object(s) of regard to a sharp focus on the retina. As a result, there is relatively poor vision as images of objects are seen to be blurred. According to Pedro-Egbe *et al.*, (2012), refractive error is a major contributor to visual impairment which is a significant cause of morbidity in children worldwide. Khurana (2012), posited that the state of refraction can either be emmetropia (optically normal eye) or ametropia (a condition of refractive error), and are usually correctable by use of spectacles, contact lenses or refractive surgery. In a study carried out on refractive status of primary school children in Mopani district of the Limpopo province of South Africa by Mabaso *et al.*, (2006) a total of 388 children aged between 8 and 15 years were randomly selected from five randomly selected schools. In conclusion, the prevalence of hyperopia, myopia and astigmatism was 73.1%, 2.5% and 31.3% respectively. Hyperopia (Nearest spherical equivalent power (FNSE) ranged from +0.75 to +3.50D for the right and left eyes with means of +1.05 +/- 0.35D and +1.08 +/- 0.34D

respectively. Myopia (FNSE) ranged from -0.50 to -1.75D for the right eye and -0.50 to -2.25D for the left eye with means of -0.75 +/- 0.55D and -0.93 +/- 0.55D respectively. Correcting cylinders for the right eyes ranged from -0.25 to -4.50D (mean = -0.67 +/- 0.47D) and for the left eyes from -0.25 to -2.50D (mean = -0.60D +/- 0.30D). With-the-rule (WTR) astigmatism (66.5%) was more common, followed by against the rule (ATR) astigmatism (28.1% and oblique (OBL) astigmatism (5.4%). With-the-rule astigmatism was more common in females than males; ATR astigmatism and OBL astigmatism were more common in males. Hence, because of lack of data on the magnitude and types of refractive errors among secondary school students in Obio/Akpor LGA of Rivers state, the researchers decided to embark on this study.

METHODOLOGY

Ethical Consideration

- The permission to carry out this cross-sectional study was sort for and obtained first from the ethical committee, Department of Optometry, Faculty of Health Sciences, Madonna University Research Project committee.
- Written consent was obtained from all study subjects and principals of each school.
- Measures were taken to ensure confidentiality of data.
- The entire study and its procedures were thoroughly explained to the subjects.

RESEARCH DESIGN

This study is a cross-sectional study carried out in Obio/Akpor Local Government of Rivers state to determine the types and magnitude of refractive errors among secondary school students.

STUDY POPULATION

The target population for this study were the students in the seven (7) randomly selected secondary schools; 5 students from each class in Obio/Akpor Local Government Area in Rivers State, between November 2017, and January 2018.

AREA OF STUDY

This research was carried out in Obio/Akpor Local Government in Rivers state. Obio/Akpor is a local government area in the metropolis of Port Harcourt, one of the major centers of economic activities in Nigeria, and one of the major cities in the Niger Delta, located in Rivers state. The local government area covers 260km and at the 2006 census held a population of 464,789. Its postal code or ZIP code is 500102. Obio/Akpor has its headquarters at Rumuodomaya and the original indigenous occupants of the area are the Ikwerre people.

INCLUSION AND EXCLUSION CRITERIA

The inclusion criteria included students of the seven (7) randomly selected schools in Obio/Akpor Local Government Area in Rivers State, between the ages of 10 to 17 years. Those that gave their consent for the study were included. Students who did not give their consent for the study were excluded.

SAMPLING SIZE AND SAMPLING TECHNIQUE

The sample size was 200 secondary school students comprising one hundred (100) males and one hundred (100) females. They were randomly selected from seven (7) randomly selected schools which include:

- Rosystems International secondary school.
- Haruk International College.
- Emilo Piazza group of schools.
- Adonai Best Education Centre.
- Jephthah Comprehensive secondary school.
- Brainfield group of schools.
- New Covenant group of schools.

The sampling technique used was simple random sampling technique.

INSTRUMENTATION

Instruments used in this study include the following: Snellen chart, near visual acuity chart, occluder, trial frame and loosed lenses, keeler streak retinoscope.

PROCEDURE FOR DATA COLLECTION

Detailed case history was taken for each subject. The procedure involved in the test was explained to each subject. Measurement of distance visual acuity at six meters (6m) and near visual acuity at forty centimeters (40cm) using the Snellen's distant and near acuity chart was performed in a bright light illumination. Subsequently, in a dimly lit illumination, refractive error measurement was carried out using a keeler streak retinoscope, trial loosed lens and trial frame for both objective and subjective refractions. Both eyes of all study participants were examined.

PROCEDURE FOR DATA ANALYSIS

Data was analyzed using descriptive statistics of the statistical package for social science (SPSS Version 21). Data collected were represented using tables and multiple bar charts.

RELIABILITY AND VALIDITY

The instruments used in this study are recognized and approved by the Optometrist and Dispensing Opticians Registration Board of Nigeria (ODORBN) and World Council of Optometry (WCO).

RESULTS AND DATA ANALYSIS

Demographic Characteristics of Study Participants

A total of 200 secondary students participated in this study. They consisted of 100 (50%) males and 100 (50%) females. The students were aged between 10 and 17 years (mean = 13.52 ± 2.045 years). The modal age was 13 years. The mean age for the males was 13.53 ± 2.134 years, while that for the females was 13.50 ± 1.96 years. There was no statistically significant difference between the mean age of the male and female students ($t = 0.103$, $p = 0.918$).

Table 1: Frequency distribution of the students according to gender, age and class

		Count	%
Gender	Male	100	50.0%
	Female	100	50.0%
Total		200	100.0%
Age (years)	10	17	8.5%
	11	23	11.5%
	12	25	12.5%
	13	34	17.0%
	14	33	16.5%
	15	27	13.5%
	16	26	13.0%
	17	15	7.5%
Total		200	100.0%
Class	JSS 1	35	17.5%
	JSS 2	35	17.5%
	JSS 3	35	17.5%
	SSS 1	35	17.5%
	SSS 2	30	15.0%
	SSS 3	30	15.0%
Total		200	100.0%

Fig. 1

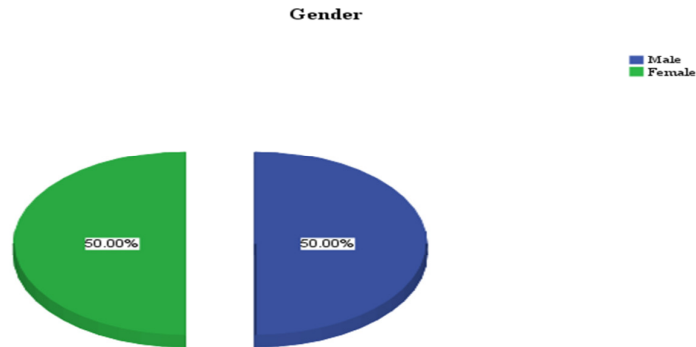


Figure 1: Illustration of gender distribution of the study participants in percentage

Students in JSS 1, JSS 2, JSS 3 and SSS 1, had equal participation of 35 students (17.5%) each, while those in SSS 2 and SSS 3 had a participation of 30 (15%) students each.

Fig. 2

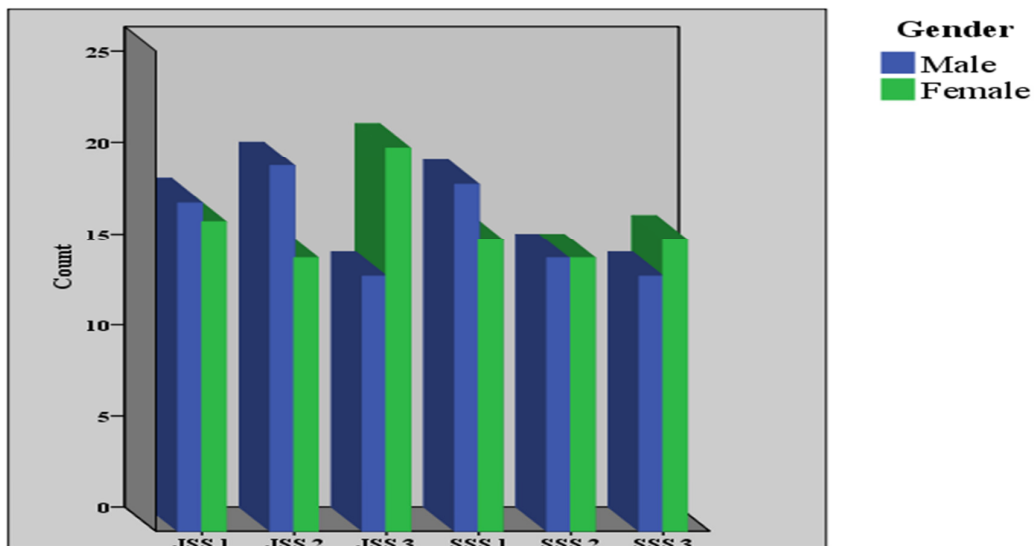


Figure 2: Clustered bar chart showing the distribution of students by class and gender

Fig. 3

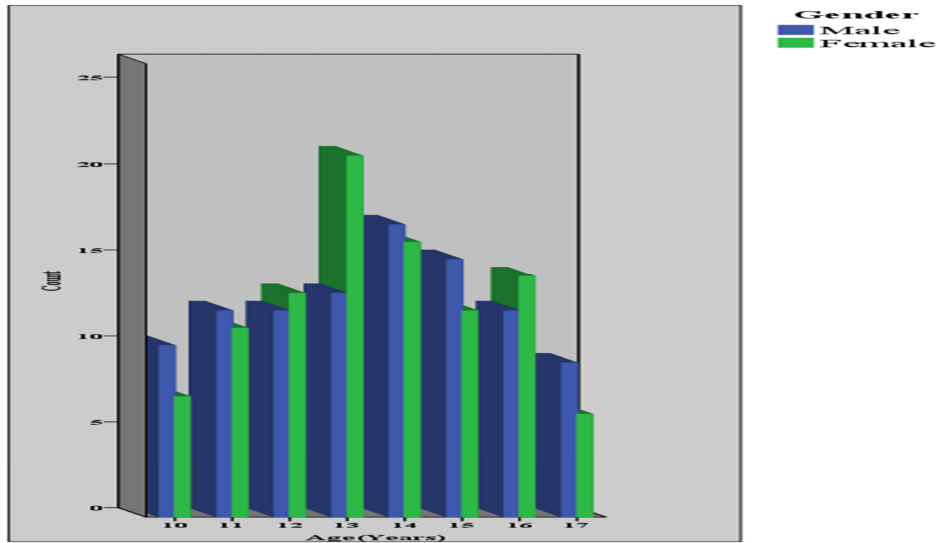


Figure 3: Clustered bar chart showing the distribution of students by age and gender

Both objective and subjective refractions were carried out on all the students examined. The results were used to identify the various types of refractive errors. The distribution of refractive errors by gender, class and age are presented in tables 2,3 and 4 below.

Table 2: Distribution of refractive errors by gender

		Male	Female	Total
Refractive Error (Right Eye)	Emmetrope	6(6%)	7(7%)	13(6.5%)
	Low Myopia	11(11%)	18(18%)	29(14.5%)
	Moderate Myopia	8(8%)	5(5%)	13(6.5%)
	High Myopia	0(0%)	0(0%)	0(0%)
	Low Hypermetropia	17(17%)	19(19%)	36(18.5%)
	Moderate Hypermetropia	0(0%)	0(0%)	0(0%)
	High Hypermetropia	0(0%)	0(0%)	0(0%)
	Astigmatism	58(58%)	51(51%)	109(54.5%)
Refractive Error (Left Eye)	Emmetrope	5(5%)	5(5%)	10(5%)
	Low Myopia	16(16%)	19(19%)	35(17.5%)
	Moderate Myopia	5(5%)	6(6%)	11(6.5%)

High Myopia	0(0%)	0(0%)	0(0%)
Low Hypermetropia	20(20%)	18(18%)	38(19%)
Moderate Hypermetropia	0(0%)	0(0%)	0(0%)
High Hypermetropia	0(0%)	0(0%)	0(0%)
Astigmatism	54(54%)	52(52%)	106(53.0%)

Table 3: Distribution of refractive errors by class

		JSS 1	JSS 2	JSS 3	SSS 1	SSS 2	SSS 3
Refractive Error (Right Eye)	Emmetrope	3	3	1	0	3	3
	Low Myopia	10	6	4	2	3	4
	Moderate Myopia	1	1	2	2	5	2
	High Myopia	0	0	0	0	0	0
	Low Hypermetropia	5	7	6	11	2	5
	Moderate Hypermetropia	0	0	0	0	0	0
	High Hypermetropia	0	0	0	0	0	0
	Astigmatism	16	18	22	20	17	16
Refractive Error (Left Eye)	Emmetrope	4	2	1	1	0	2
	Low Myopia	10	9	8	1	4	3
	Moderate Myopia	1	0	2	1	4	3
	High Myopia	0	0	0	0	0	0
	Low Hypermetropia	4	8	5	12	3	6
	Moderate Hypermetropia	0	0	0	0	0	0
	High Hypermetropia	0	0	0	0	0	0
	Astigmatism	16	16	19	20	19	16

Table 3 shows that 187 students representing 93.5% of the students had refractive errors. This comprises of 36(18.5%) hyperopia, 42(21%) myopia and 109(54.5%) astigmatism. Of the 187 students with refractive errors, the commonest refractive error was astigmatism accounting for 58.3 % followed by myopia and hyperopia with 22.46 % and 19.25% respectively.

Table 4: Distribution of refractive errors among the ages of the students

		Age(Years)								
		10	11	12	13	14	15	16	17	Total
Refractive Error (Right Eye)	Emmetrope	2	4	0	2	1	1	1	2	13
	Low Myopia	4	3	3	7	5	3	4	0	29
	Moderate Myopia	0	1	1	3	2	1	3	2	13
	High Myopia	0	0	0	0	0	0	0	0	0
	Low Hypermetropia	4	5	10	4	7	2	3	1	36
	Moderate Hypermetropia	0	0	0	0	0	0	0	0	0
	High Hypermetropia	0	0	0	0	0	0	0	0	0
	Astigmatism	7	10	11	18	18	20	15	10	109
Refractive Error (Left Eye)	Emmetrope	2	5	0	0	0	2	0	1	10
	Low Myopia	3	6	6	9	5	2	3	1	35
	Moderate Myopia	0	1	0	3	2	2	2	1	11
	High Myopia	0	0	0	0	0	0	0	0	0
	Low Hypermetropia	4	4	7	6	8	3	3	3	38
	Moderate Hypermetropia	0	0	0	0	0	0	0	0	0
	High Hypermetropia	0	0	0	0	0	0	0	0	0
	Astigmatism	8	7	12	16	18	18	18	9	106
Total	17	23	25	34	33	27	26	15	200	

In table 4, students who were aged 13, had more refractive errors (16%) while those who were aged 17, had the least refractive errors (6.5%).

On the magnitude of refractive error presented using the American Optometrist Association (AOA) grading standard, 13(6.5%) and 29(14.5%) had moderate and low myopia respectively. While 36(18.5%) had low hyperopia.

Chi square analysis revealed that the type of refractive error was not dependent on gender ($\chi^2=3.02$; $p=0.55$).

Refractive Error (Right Eye) * Gender Crosstabulation

			Gender		Total
			Male	Female	
Refractive Error (Right Eye)	Emmetrope	Count	6	7	13
		Expected Count	6.5	6.5	13.0
	Low Myopia	Count	11	18	29
		Expected Count	14.5	14.5	29.0
	Moderate Myopia	Count	8	5	13
		Expected Count	6.5	6.5	13.0
	Low Hypermetropia	Count	17	19	36
		Expected Count	18.0	18.0	36.0
	Astigmatism	Count	58	51	109
		Expected Count	54.5	54.5	109.0
Total		Count	100	100	200
		Expected Count	100.0	100.0	200.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.020 ^a	4	.555
Likelihood Ratio	3.043	4	.551
N of Valid Cases	200		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.

Chi square analysis was also carried out to check whether there was a significant difference in refractive error among the ages of the participants (e.g., whether the refractive errors of those who were age 10, were significantly different from those of other ages presented). The result revealed that there was no statistically

significant difference in refractive errors among the ages presented ($\chi=32.87$, $p=0.240$). Thus, refractive error was not dependent on the age of the students.

Age(Years) * Refractive Error (Right Eye) Crosstabulation

		Refractive Error (Right Eye)					Total	
		Emmetrope	Low Myopia	Moderate Myopia	Low Hypermetropia	Astigmatism		
Age (Years)	10	Count	2	4	0	4	7	17
		Expected Count	1.1	2.5	1.1	3.1	9.3	17.0
	11	Count	4	3	1	5	10	23
		Expected Count	1.5	3.3	1.5	4.1	12.5	23.0
	12	Count	0	3	1	10	11	25
		Expected Count	1.6	3.6	1.6	4.5	13.6	25.0
	13	Count	2	7	3	4	18	34
		Expected Count	2.2	4.9	2.2	6.1	18.5	34.0
	14	Count	1	5	2	7	18	33
		Expected Count	2.1	4.8	2.1	5.9	18.0	33.0
	15	Count	1	3	1	2	20	27
		Expected Count	1.8	3.9	1.8	4.9	14.7	27.0
	16	Count	1	4	3	3	15	26
		Expected Count	1.7	3.8	1.7	4.7	14.2	26.0
	17	Count	2	0	2	1	10	15
		Expected Count	1.0	2.2	1.0	2.7	8.2	15.0
Total		Count	13	29	13	36	109	200
		Expected Count	13.0	29.0	13.0	36.0	109.0	200.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.872 ^a	28	.240
Likelihood Ratio	34.854	28	.174
Linear-by-Linear Association	3.800	1	.051
N of Valid Cases	200		

DISCUSSION

Visual impairment due to uncorrected refractive errors is an outstanding problem in developing countries, yet in some areas in Africa, there is no information about the magnitude of and risk factors associated with visual impairment. Therefore the aim of this study was to determine the types and magnitude of refractive errors among secondary school students in Obio/Akpor LGA in Rivers State. The study population was two hundred (200) secondary students both males and females. The age of the participants ranged from 10-17 years. The study included equal number of participants (100 male and 100 female subjects), age group 13 years had the most prevalent refractive errors (16%) compared to other age groups. Table 3 shows that 187 students representing 93.5% of the students had refractive errors, which was significantly higher than that in the study by Mohammad *et al.* (2014) in which the prevalence of refractive errors was 37.01%. In a study done by Sujatha *et al.*, (2013), the prevalence of astigmatism was 1.6% which is too low compared to the prevalence of astigmatism in this study which was found to be 58.3%. Prevalence of myopia was found to be 22.46% which is significantly lower than that in the study by Assefa *et al.*, (2012) where myopia was 31.6% and Gauri *et al.*, (2011) in which myopia was more prevalent by 44.79% in the study.

CONCLUSION

In this study, prevalence of refractive error was 93.50%, with astigmatism being the most prevalent accounting for 58.3%, myopia 22.46% and hyperopia 19.25%. This study created a great deal of vision care awareness amongst the secondary school students. Also, it was observed that refractive error was not significantly dependent on gender and age.

RECOMMENDATIONS OF THE STUDY

Based on the observations, analysis and findings from this study, the following recommendations are made.

- Regular eye examination and school vision screening should be a routine, for the detection and correction of any refractive error. This program may

start with primary school children for early detection of refractive errors and other departures from optimally functioning eyes, as this would help to actualize VISION 2020: THE RIGHT TO SIGHT INITIATIVE of the World Health Organization (WHO).

- Most children had refractive errors which had lasted for a long time without actually knowing what the problem was all about. If there was such a thing like vision screening exercise among these school children, not only would the refractive errors be detected but also other oculo-visual problems. This means that a lot is still expected from eye care practitioners in the area of awareness. They should intensify efforts in creating awareness on refractive errors and eye health in general. This can be done through eye health seminars and workshops.
- The students on their own part should ensure that they read with proper illumination of 10 feet candle and maintain good ocular hygiene.
- Regular professional attention for children with oculo-visual problems should be sought whenever observed by parents or teachers.

REFERENCES

- Assefa, W.Y., Wasie, T.B., Shiferaw, D., Tsegaw, A. and Eshete, Z. (2012) Prevalence of Refractive Errors among School Children in Gondar Town, Northwest Ethiopia *Afr J. Ophthalmol.* 19 (4), 372-376.
- Gauri, S.S., Digen, S. and Purushottam, J. (2011) Refractive Error among School Children in Jhapa, Nepal. *Journal of Optometry.* 4 (4), 49-55.
- Khumah, D. B., Baafi, A.R., Pascal, O.D. and Baafi, E.B. (2016) Refractive Errors among Administrative Staffs of Senior High Schools in the Kumasi Metropolis. *Optom Open Access.* 1 (106), 76-207.
- Khurana, A.K. (2012) Refractive Errors. *Comprehensive Ophthalmology.* New Delhi: New Age International Publishers Limited. 4th Edition, pg. 52-88.
- Mabaso, R. G., Oduntan, A.O. and Mpolokeng, M.B.L. (2006) Refractive Status of Primary School Children in Mopani District, Limpopo Province, South Africa. *South African Optometry.* 65(4), 125-133.
- Mohammad, K., Mohammad, A. A., Isa, M. Z., Bahram, K., Mohadeseh, M.N. and Ahmad, K. (2014) Refractive Errors in School-age Children in Qazvin, Iran. *Biotechnology and Health Science.* 12 (22), 87.
- Pedro-Egbe, C. N. and Opubiri, I. (2012) Screening of Primary School Children for Refractive Errors in South-south Nigeria. *Ethopia Journal Health Science.* 22 (2), 129-134.
- Sujatha, R. M .A., Pavithra, M. B. and Maheshwaran, R. (2013) A Study on the Prevalence of Refractive Error among School Children of 7-15 Years Age Group in the Field Practice Areas of a Medical College, Bangalore. *International Journal Medical Science Public Health.* 2 (3), 641-645.