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Original Research

Prevalence of Migraine and Association between Migraine Headache and Refractive Errors among Adolescents in Secondary Schools in Ibadan, Nigeria

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Abstract

Background: Migraine is frequently overlooked and underdiagnosed among school-aged children and adolescents, despite its potential to cause significant morbidity, negatively affect quality of life, and lead to school absenteeism. Its sporadic nature and low fatality often result in an underestimated public health burden. While migraine and headache associated with refractive errors are reported globally among adolescents, data from African settings remain limited. This study aimed to determine the prevalence of migraine headache and its association with refractive errors (type and severity) among secondary school students.

Methodology: This cross-sectional, descriptive, multi-school study involved secondary school students selected via multistage sampling with probability proportional to size. Eligible students underwent visual acuity testing, ocular examination, and refraction. Migraine was assessed using criteria from the International Classification for Headache Disorders and an interviewer-administered semi-structured questionnaire.

Results: A total of 775 students from 6 schools participated, including 352 (45.4%) males and 423 (54.6%) females, with a mean age of 14.5 ± 1.85 years. The prevalence of migraine headache was 18.3%, with gender-specific rates of 10.2% in males and 25.1% in females. There was a significant association between migraine and both the type and severity of refractive error. Students with mild refractive error had 3.42 times higher odds of migraine (95% CI, 1.74–6.75) than those with moderate error. Astigmatism was associated with 1.53 times, increased odds, of migraine (95% CI, 0.98–2.40) compared to myopia.

Conclusion: Migraine is common and underdiagnosed among secondary school students and is significantly associated with refractive errors. Periodic school eye screenings that assess both refractive errors and migraine headaches, with appropriate referral pathways, are recommended.

Keywords: Prevalence; Migraine; Migraine Headache; Refractive Errors; Adolescents; Nigeria.

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Introduction

Headache is the most prevalent neurological symptom worldwide with headache disorders, including migraine and tension-type headache being among the most frequent.[1]Headache is also one of the most common concerns reported by children.[2] A primary headache is an independent disease, not a secondary symptom, thus, it does not exhibit any pathological finding on clinical or investigative methods. This is true of migraine, tension-type headache, cluster headache and chronic paroxysmal hemicrania, and of various headache types not accompanied by structural lesions (International Headache Society, IHS Groups 1-4).[3]

The prevalence of refractive error varies widely, ranging from 2-10% worldwide, according to the World Health Organization.[4] In Nigeria, the prevalence of severe visual impairment due to uncorrected refractive error is 0.17% amongst adults aged 40 years and above, while uncorrected refractive error was noted as the commonest cause of mild and moderate visual impairment accounting for 77.9% and 57.1% respectively.[5] Various prevalence rates of refractive errors have been reported among secondary school students in Nigeria.[6, 7] Migraine is a common, chronic, multi-factorial, neuro-vascular disorder typically characterized by recurrent attacks of unilateral, pulsating headache and autonomic nervous system dysfunction. Migraine may additionally be associated with aura; focal neurological symptoms that may precede or sometimes accompany the headache. The prevalence of migraine headache varies across populations based on the methodology and the diagnostic criteria applied. [8-12] In Nigeria, the prevalence of migraine ranges from 2.4 – 69.2%.[13]

The burden of headaches in children is significant and can affect a child's quality of life, impacting their education and play.[14-20] There has been some evidence of an association between refractive errors and migraine headaches.[21-25] Despite the known prevalence of migraine headache in children and the evidence of association between migraine headache and refractive errors worldwide, very little is known about this association in an African setting.

The objectives of this study were to determine the prevalence of migraine headaches among secondary school students and describe the association between migraine headaches and refractive errors among secondary students.

Methodology

This was a cross-sectional descriptive, study conducted among secondary school students in 6 co-educational schools, which were one public and one private school each from the 3 senatorial zones of the state.

Multistage sampling technique, with probability proportional to size, was used to select a representative sample of 775 students, following sample size calculation using the Leslie-Kish formula. Ethical approval and permission to conduct this study was obtained from both the joint Ethical Committee of the University. Written informed consent was obtained from the parents/guardian of each student, while the students themselves gave their assent.

All eligible students had ocular examinations and refraction done. Based on the study criteria, myopia was defined as a spherical error of ≥-0.50DS (Dioptre Sphere); hypermetropia was defined as a spherical error of ≥+2.00DS; while astigmatism was defined as a cylindrical error of ≥-0.75DC (Dioptre Cylinder) [5]. Refractive errors were grouped into myopia, hypermetropia, astigmatism or a combination of the spherical and cylindrical errors for type; and mild, moderate and severe for the grade based on the refraction result in quantifiable terms.

Participants were all screened for migraine headache based on the International Classification for Headache Disorders (ICHD-II) criteria and a semi-structured interviewer administered questionnaire. For migraine without aura: at least five lifetime attacks fulfilling outlined criteria (A, any two of B and any

one of C) was diagnostic, while for migraine with aura: at least 2 lifetime attacks fulfilling outlined criteria (any three of the four criteria) was diagnostic of migraine headache among the participants, see Table 1.

Table 1: Screening Tool for Migraine Headache ICHD-II [3]

Migraine Without Aura (ICHD-II Code 1.1)			
A	Duration of Headache		
	1. Do the headache attacks last between 4 hours and 3 days?	YES	NO
B	Any Two of the Following Characteristics:		
	2. Is the headache located in one side of the head?	YES	NO
	3. Is the headache banging in nature?	YES	NO
	4. Is the headache of moderate to severe pain intensity?	YES	NO
	5. Is the headache caused or worsened by routine physical activity eg walking or climbing a stair?	YES	NO
C	During headache, at least one of the following:		
	6. Do you feel like vomiting, or do you vomit?	YES	NO
	7. Do you experience sensitivity to light or sound?	YES	NO
	How many times in your life have you experienced these headaches attacks based on the above criteria?		
Migraine with Aura (ICHD-II Code 1.2.1)			
Presence of at least Three of the Following:			
1.	Do you experience one or more warning signs of the headache of which you fully recover from?	YES	NO
2.	Do you experience at least one warning sign of headache which develops gradually over more than 4 minutes or 2 or more signs occurring quickly after each other?	YES	NO
3.	Do all the warning signs of the headache last within 1 hour?	YES	NO
4.	Does the headache follow, occur before or accompany the warning sign?	YES	NO
How many times in your life have you experienced these headaches attacks based on the above criteria?			

**Credits: ICHD-II – International Classification of Headache Disorders [3]*

A pretest was carried out among 30 students outside of the study population.

Data was analysed using the Statistical Package for Social Sciences version 16 (IBM SPSS Version 16); and a p-value of <0.05 was considered significant.

Results

Socio-demographic Characteristics of Respondents

Seven hundred and seventy-five students in total, participated in this study of which 352 (45.4%) were males and 423 (54.6%) were females with a male to female ratio of 0.8:1. The mean age of the students was 14.5±1.85 years. Figure 1 shows the age and sex distribution of the studied population. Of the 775 participants, 476 (61.4%) students were from public schools, while 299 (38.6%) of them attended private schools.

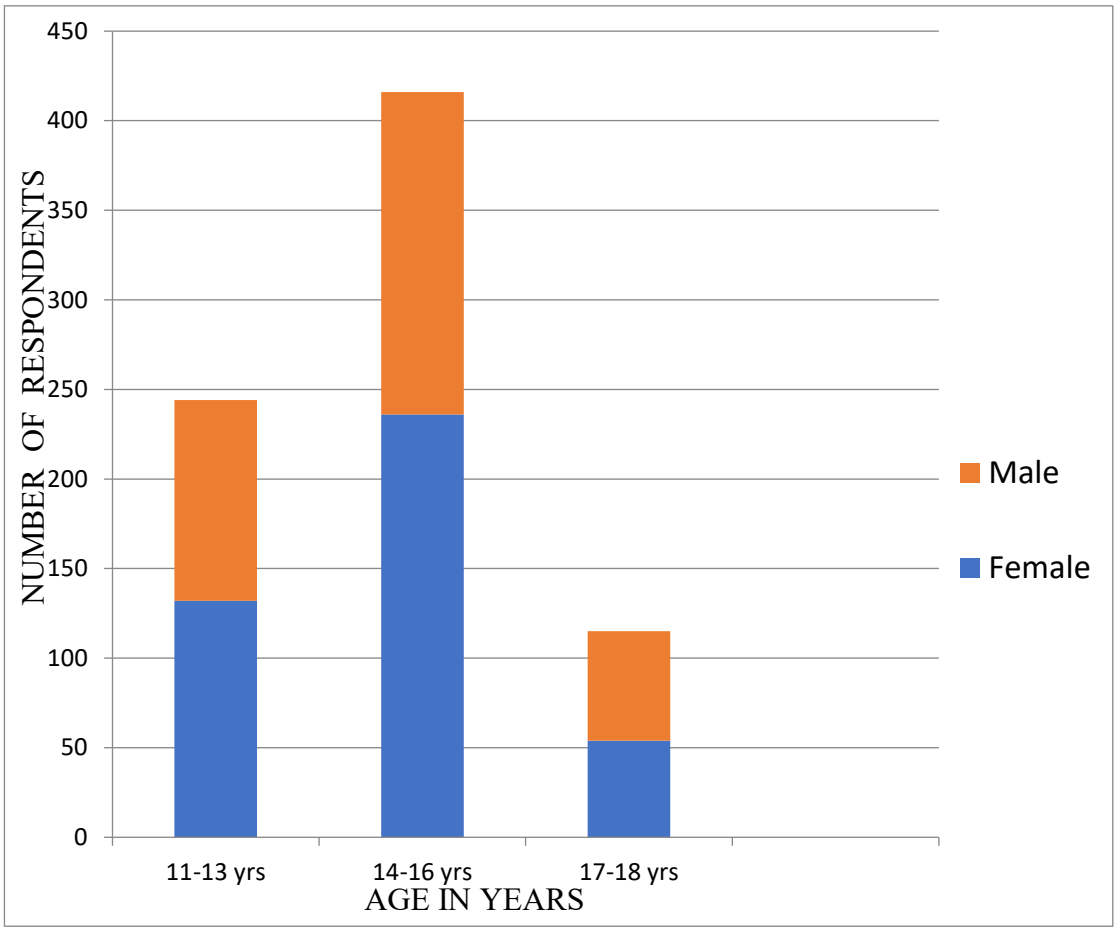

Figure 1: Age and Sex Distribution of Respondents (p<0.001%)

Refraction Results

The prevalence of refractive errors among eyes in this study was 83%. Majority 573 (89%) and 577 (88.4%) of the respondents had mild refractive errors in the right and left eyes respectively, while moderate and severe refractive errors in right and left eyes were found in 71 (11%) and 76 (11.6%) students respectively. The mean spherical equivalent value in right and left eyes was -0.35±1.02DS and -0.30±0.87DS respectively, with myopia ranging from -0.50DS to -5.50DS, hypermetropia from +2.00DS to +3.25DS and astigmatism from ±0.75DC to ±3.00DC. Three hundred and eighty-nine (60.4%) and 383

(58.7%) of the respondents had astigmatism in the right and left eye respectively. Figure 2 shows the refraction results which were statistically significant (p value <0.001).

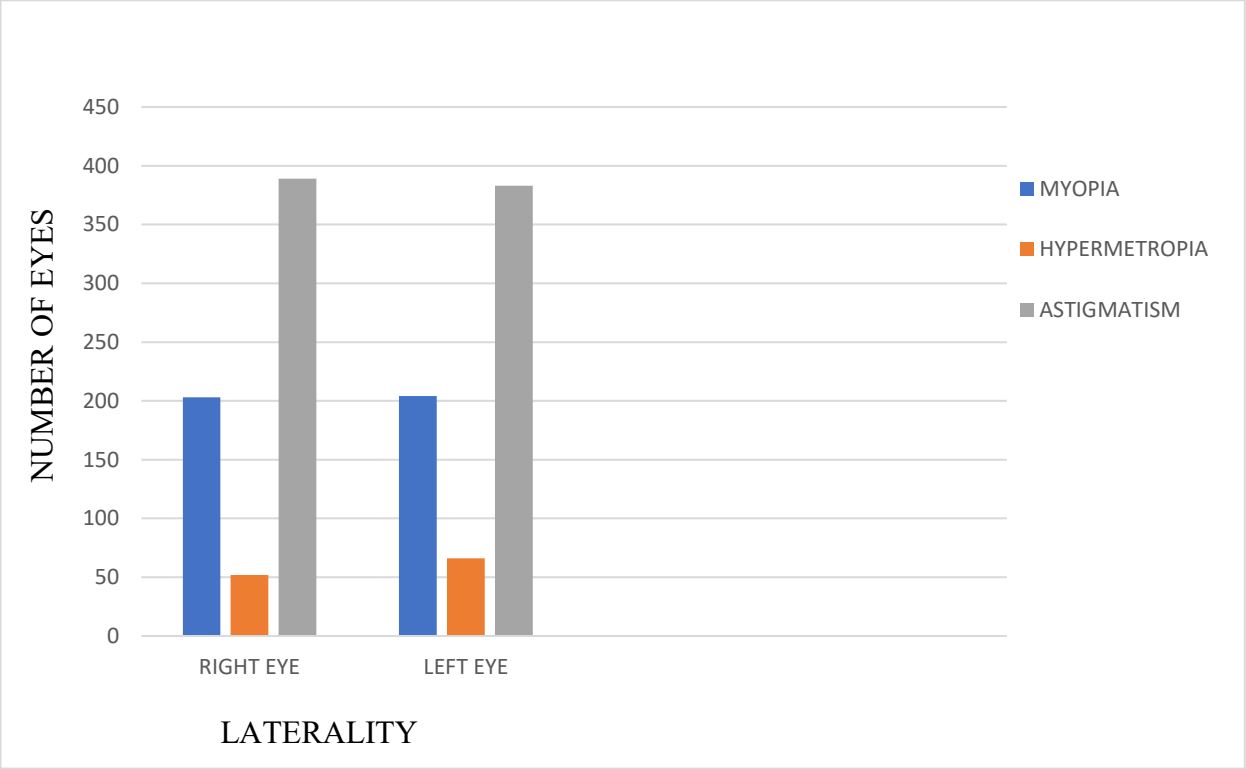

Figure 2: Results for Type of Refractive Error (p<0.001%); CI (1.041 – 1.081)

Prevalence of Migraine Headache

The prevalence of migraine headaches was 18.3% (142/775 participants). The prevalence of migraine headache was higher among females 25.1% (106/423 females) when compared to males 10.2% (36/342 males) (p <0.001). Migraine without aura was more common, present in 97 (12.5%) respondents, while migraine with aura was present in only 45 (5.8%) respondents (p<0.001) as shown in Table 2.

Table 2: Prevalence of Migraine Headache by ICHD-II

	Frequency	**Percentage**
	775	**100.0**
Migraine without aura		
Present	97	12.5
Migraine with aura		
Present	45	5.8
Migraine by ICHD-II		
Present	142	18.3
Absent	633	81.7

P value - <0.001 CI (-0.726 to -0.654)

Migraine Headache and Refractive Error

One hundred and twenty-five (16.1%) of the respondents had both migraine headaches and refractive errors, leaving 17 (2.2%) migraineurs without refractive errors, while 188 (24.3%) had neither migraine headache nor refractive error as shown in Table 3. Majority 104 (82.3%) of the migraineurs had mild refractive error compared to 21 (16.8%) who had moderate refractive error which was significant (p value =0.003). Fifty (40%) of the migraineurs had compound astigmatism, being the commonest type of refractive error and 3 (2.4%) had simple hypermetropia, the least common refractive error which was significant (p value=0.017) see Table 3.

Table 3: Association between Refractive Error and Migraine Headache

Refractive error	Migraine headache Frq (%)	No Migraine headache Frq (%)	Total
Yes	125 (16.1)	445 (57.4)	570 (73.5)
No	17 (2.2)	188 (24.3)	205 (26.5)
Total	142 (18.3)	633 (81.7)	775 (100.0)
X^2= 1.371 P value = 0.242			

Grade of Refractive Error	Migraine headache Frq (%)	No Migraine headache Frq (%)	Chi Square	P value
Mild	104 (83.2)	470 (90.6)	11.974	**0.003**
Moderate	21 (16.8)	48 (9.2)		
Severe	0 (0.0)	1(0.2)		
TOTAL	125 (100.0)	519 (100.0)		
Type of Refractive Error				
Simple Myopia	34 (27.2)	169 (32.7)	11.997	**0.017**
Simple Hypermetropia	3 (2.4)	49 (9.4)		
Simple Astigmatism	32 (25.6)	104 (20.0)		
Compound Astigmatism	50 (40.0)	160 (30.8)		

Mixed Astigmatism	6 (4.8)	37 (7.1)
Total	125 (100)	519 (100)

Bivariate and Multivariate Analysis

Performing tests of association for predicting factors for migraine headache revealed that gender, type of school, grade and type of refractive error were statistically significantly associated with the presence of migraine headache, illustrated in Table 4.

Table 4: Association between Predicting Factors and Migraine Headache

Variables	Migraine Present	Migraine Absent	Total	Chi square	P value
Sex	**142**	**633**	**775**		
Male	37 (26.1)	316 (49.9)	353 (45.5)	27.022	**< 0.001**
Female	105 (73.9)	317 (50.1)	422 (54.5)		
Type of school	**142**	**633**	**775**	4.515	**0.034**
Public	98 (69.0)	377 (59.6)	475 (61.3)		
Private	44 (31.0)	256 (40.4)	300 (38.7)		
Grade of Refractive error	**125**	**519**	**644**	10.860	**0.001**
Mild	104 (83.2)	470 (90.6)	574 (89.1)		
Moderate	21 (16.8)	49 (9.4)	70 (10.9)		

Following logistic regression to determine extent of association, gender and grade of refractive error were still significant. Mild refractive error was associated with 3.42 times greater odds (OR, 3.42; 95% CI, 1.74-6.75) of migraine headaches. Astigmatism and hypermetropia were associated with 1.5 times greater odds of migraine but were not significant. Shown in Table 5.

Table 5: Logistic Regression Model for Variables Predicting Migraine Headache

	Odds ratio	P value	95% CI	
			Lower	Upper
Gender				
Female	2.95	**<0.001**	1.96	4.45
Male [r]				

Grade of Refractive error				
Mild	3.42	**<0.001**	1.74	6.75
Moderate [r]				
Type of Refractive error				
Astigmatism	1.53	0.061	0.98	2.40
Hypermetropia	1.58	0.192	0.79	3.15
Myopia [r]				

r – reference category

Discussion

In this study, the prevalence of migraine was found to be 18.3%, similar to 13.5% reported by Ofovwe and Ofili [18] in Benin and 16.7% reported by Ogunyemi [26] in Ilorin. However, higher than previous reports from Nigeria 5.7-6.8% [17,19] among children and 5.3-6.3% in all age groups reported by Osuntokun [12] and Longe,[27] owing largely to differences in methodologies (Okogbo [17] presented results from a small hospital based sample of 51 patients; Orji and Iloeje [19] used criteria proposed by Prensky and Sommer to diagnose migraine headache among schoolchildren). The prevalence of migraine from this study was in sharp contrast much lower than 33.8% reported by Amayo et al [28] in Kenya among medical students (attributed to increasing stress levels associated with medical school training).

The prevalence rate from this study was also higher than the 10.6% reported from Scotland by Abu-Arefeh and Russel [14] among school children with a similar age group, and those reported from USA and Asia, which ranged from 6.3-9.7%. [15,16] A possible explanation for this finding might be related to the most common trigger factors associated with migraine headache in our environment which are emotional stress [18] and sunlight. [19] Over the past decade there has been increasing levels of emotional stress from socioeconomic challenges peculiar to developing economies while sunlight is higher in the tropical regions compared to the temperate region. The findings from this study supported by previous reports, [18,26] highlight the fact that migraine headache exists among Africans and that the magnitude of migraine in most African countries is underestimated given that most people are not aware of it as an independent disease entity. The gender specific prevalence rate of migraine from this study was 10.2% for boys and 25.1% for girls in keeping with the previously reported propensity for migraine among females. [9 – 19]

There have been varying reports on the relationship between migraine headache and refractive errors despite paucity of published literature regarding this subject. Some studies have shown that there is no significant difference between individuals diagnosed with migraine headaches and controls with respect to refractive error. [22,29] Other studies have reported an association between migraine headache and refractive error with subjects experiencing relief of headaches following the use of spectacles. [24,30,31,32] In this study there was a statistically significant association between the presence of migraine headache and the grade and type of refractive error. Mild refractive error was significantly associated with a greater odds of migraine compared to those with moderate refractive error in contrast to findings by Akinci et al [30] where moderate and severe refractive error were significantly higher in the headache group than in controls. This variation may be attributed to an attempt by these subjects with mild refractive error to produce clearer images, majority of whom were uncorrected compared to moderate refractive error where the vision is slightly more impaired. Astigmatism was found to be more common and associated with a greater odds of migraine headache compared to those without migraine headache from this study which was similar to findings reported by Harle and Evans [24] and Akinci et al [30] and the migraine group had higher degrees of astigmatism possibly due to ciliary spasm which may be associated with headaches. There was also a significant association between a history of wearing

spectacles and the presence of migraine headache with an increased odds of migraine headache in subjects who had a history of wearing spectacles. Headaches associated with refractive errors (HARE), which is a diagnosis of exclusion, as an entity of headaches classified by the IHS [3] and reported by several studies [33-35] may, sometimes, be confused with migraine headaches. However, the strict definition of migraine headache in this study using the ICHD-II tool (see Table 1) provided the right diagnostic guide.

Limitations

This study did not include neuroimaging that would have further excluded secondary causes of headache, which occasionally masquerade as migraine headache. However, the survey tool used was highly sensitive and specific for the diagnosis of migraine.

Conclusion

Migraine headache is common and underdiagnosed among secondary school students in Ibadan, Nigeria, in addition, it is significantly associated with refractive errors. Mild refractive error was significantly associated with migraine headache compared to moderate refractive error. Astigmatism increased the odds of migraine headaches.

Thus, to minimize the impact of this association the following are recommended. Public enlightenment campaigns targeting the populace on migraine and its negative effects to increase awareness about migraine headaches as a clinical entity. Strengthening of the school health system to identify students suffering from migraines and refractive error for referral to appropriate health care facilities. Further studies are encouraged to establish the relationship between migraine headache and refractive error among individuals especially considering paucity of information about this relationship in Nigeria and by extension to Sub-Saharan Africa.

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