Original Research Article

Refractive errors and spectacle use behaviour among medical studentsin a Nigerian medical school

ABSTRACT

Aim: To determine the prevalence of refractive errors and spectacle use behaviour among medical students in University of Calabar Teaching Hospital, Nigeria.

Study design: Cross sectional study

Place and duration of study: Department of Ophthalmology, University of Calabar Teaching Hospital, Calabar, Cross River State, Nigeria, between April 2010 and July 2010.

Methodology: The study population consisted of fifth year medical students. Subjects had cycloplegic auto refraction with Topcon autorefractor during their rotation in ophthalmology at the Ophthalmology department of the University of Calabar Teaching Hospital. A spherical equivalents (SE) ≥ +0.50D were determined as hyperopia; SE of ≥-0.50D myopia and ≥-0.50D cylinder as astigmatism. Statistical analysis, which included chi-square test, was carried out with Statistical Package for Social Sciences (SPSS) version 20.0.

Results: Sixty-six (79.5%) of subjects had a form of refractive error; 63.6%%, 16.7% and 19.7% were myope, hyperope or simple astigmat, respectively. The prevalence of ametropia was 82% in female and 78% in males. The association between refractive errors and gender was not statistically significant (p = 0.35, 95% CI, 0.34-0.36). (*P* = 0.35, 95% Confidence Interval [CI], 0.31-0.40). Minus spherical errors ranged from -0.16 to -5.25 diopters (D) and plus spherical errors ranged from +0.25 to +1.00D, spherical equivalent between -0.25D and -2.75D being the most common type (85.5%). Eight students (12.1%) were wearing glasses at the time of the study corresponding with 10 (15.2%) who had eye pains while reading.

Conclusion: The prevalence of refractive errors among fifth year medical students of the University of Calabar was high and eyeglasses were worn by students who were symptomatic.

Key Words: *Medical students, Myopia, Glasses, Refractive error.*

INTRODUCTION

University of Calabar is a government University in South-South Region ofNigeria with a long standing medical school. The student population comprises largely of black Africans. As per WHO report,

uncorrected refractive error remains the second commonest cause of global visual impairment next only to cataract.[1,2]For students, uncorrected refractive errors pose a considerable impact on learning, academic achievement and by extension employability. Yet information on refractive errors is still sparse in Calabar and its environs. Available studies[1-5] on refractive errors have focused mainly on primary and secondary school children in Nigeria and other parts of Africa. Little is known about refractive errors and refractive spectacle use pattern among University students in our African settings. This cross-sectional study was to determine the prevalence, pattern of refractive errors and spectacle use behaviour among fifth year medical students in the University of Calabar, Nigeria.It is hoped that the information from this study willadd to the existing body of knowledge on this subject.

MATERIALS AND METHODS

Study involved fifthyear medical students (MBBS course) from the University of Calabar Medical School. Students went through ophthalmology posting in 4 groups of about 20 students in each group. Each group had one month rotation through the department. Participants gave informed consent to participate without being coerced. They could decline to participate without being penalized for doing so. The studyprotocols were in keeping with the tenets of Helsinki declaration. Students were assessed for refractive errors at ophthalmology department of the University of Calabar Teaching Hospital using stand-alone TOPCON RM-8000B (TOPCON Corporation, Tokyo, JAPAN) auto-refractometer.
Cycloplegia was achieved by a short acting cycloplegic tropicamide 0.5% three times at 5 minutes interval. A short acting cycloplegic agent was deliberately chosen to allow for resumption of near activities as soon as possible. Students who were dilated where used by their colleagues to learn direct funduscopy for that day. Another batch took turns the days ahead. Average of three readings were recorded for each eye. Additional demographical data was obtained via a proforma filled by the students. The duration of the data collection was 4 months when the 4 groups had rotated through our department. All 83 medical students undertaking ophthalmology rotation were examined.Spherical equivalents were calculated by the addition of half of cylinder powers to the spheres.

Refractive error was diagnosed if spherical equivalent was $\pm$0.50 or greater or a sphere/cylinder of $\pm$0.50 diopters spheres or greater. Those errors which required only cylindrical correction were considered as simple astigmatism which were in minus cylinder forms. Compound myopic or mixed astigmatism was diagnosed if cylindrical errors were associated with minus or plus spherical errors respectively. Myopic errors less than – 5.00D or lesswere considered as low myopia and those equal to – 6.00D or more were considered as high myopia. Prevalence of refractive errors was determined by finding the average of students who had refractive errors against the total numbers of students in the class. Astigmatism was considered with-the-rule (WTR) if the plus cylinder acts at 90^0 meridian or at 20^0 on its either side or

against-the-rule (ATR) if the plus cylinder acts at 180^0 meridian or 20^0 on its either side. Outside this range (20^0 to 70^0 and 100^0 to 160^0), the astigmatism was considered oblique.

For all analyses, cycloplegic autorefraction data of the right eyes were considered. However, data from both eyes were tabulated side by side for ease of comparison. Statistical analysis was performed using SPSS (SPSS 20.0 for Windows; Chicago, IL). Univariate analyses utilized chi-square test or Fischer Exact Probability test were used to compare proportions. Factors related to both eyes were entered into a multivariate logistic regression analysis. With 95% confidence interval (CI), a two-tailed P value of less than 0.05 was considered statistically significant.

RESULT

A total of 83 students {55 (66.3%) males and 28 (33.7%) females}, age between 20 to 34 years (25.5 ± 3.3) were included in the study. Sixty-six (79.5%) (95% CI, 75.3% to 82.50%) subjects who met the pre-determined criteria were designated to have a form of refractive error in which 42 (63.6%), 11 (16.7%) and 13 (19.7%) of students were myopes, hyperopes or simple astigmats, respectively. Of those with ametropia, 43 (65.2%) were males and 23 (34.8%) were females.The prevalence of ametropia was 82.1% in females and 78.1% in males. The association between refractive errors and gender was notstatistically significant(p = 0.35, 95% CI, 0.34-0.36).

Anisometropia (difference in spherical equivalent of 2.00D or more between the two eyes) was not recorded. Minus spherical errors ranged from -0.16 to -5.25 diopters and plus spherical errors ranged from +0.25 to +1.00 diopters, spherical equivalent between -0.25 diopters [D] and -2.75D) being the most common type (85.5%). The mean spherical equivalent in the whole group was -0.95 ± 1.2 D (right eye), -0.79 ± 1.0 D (left eye) and -0.87 ± 1.1 D (both eyes). This was statistically significant (p = 0.017, CI, 0.015-0.020 by Fischer's Exact Probability Test). After adjusting for age and sex in a multivariate linear regression, the difference between the eyes became inconsequential, p = 0.50 (right eye) and p = 0.41 (left eye). There was no student with high myopia.

Table 1 and Figure 1 give the vision status and age distribution respectively. Figure 2 shows reasons students were not using glasses. Only 16 (19.6%) had worn glasses before while 67 (80.7%) had not worn glasses before. Seventy-five (90.4%) were not wearing glasses at the time of the study, 8 (12.1%) were wearing glasses at the time of the study. Seventy-nine (95.2%) will use glasses if there was need for them. Ten students (15.2%) had eye pains while reading. Fifty-nine (71.1%) had at least a family member using glasses. Table 2 shows the pattern of refractive errors seen in the students.

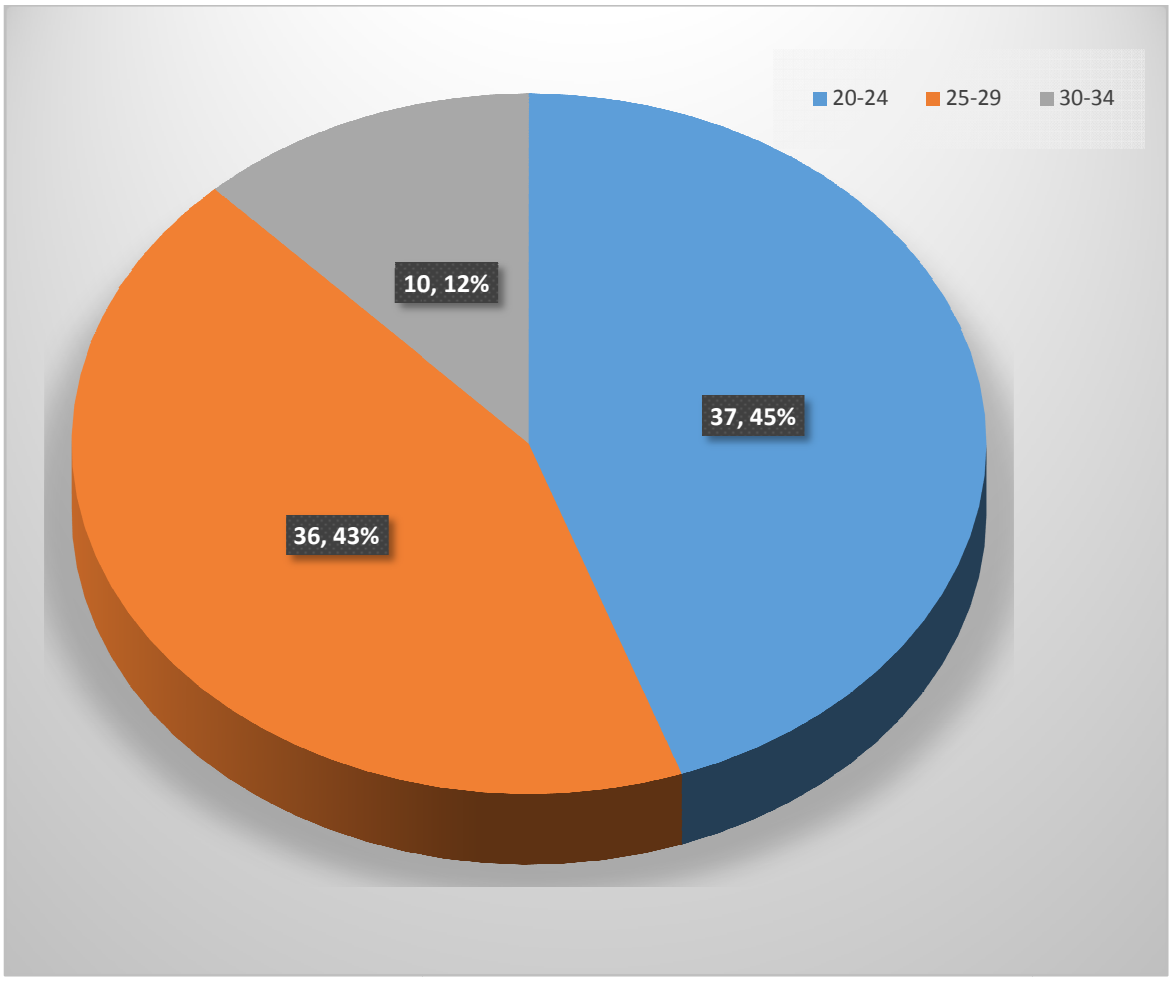

Figure 1: Age (years) distribution

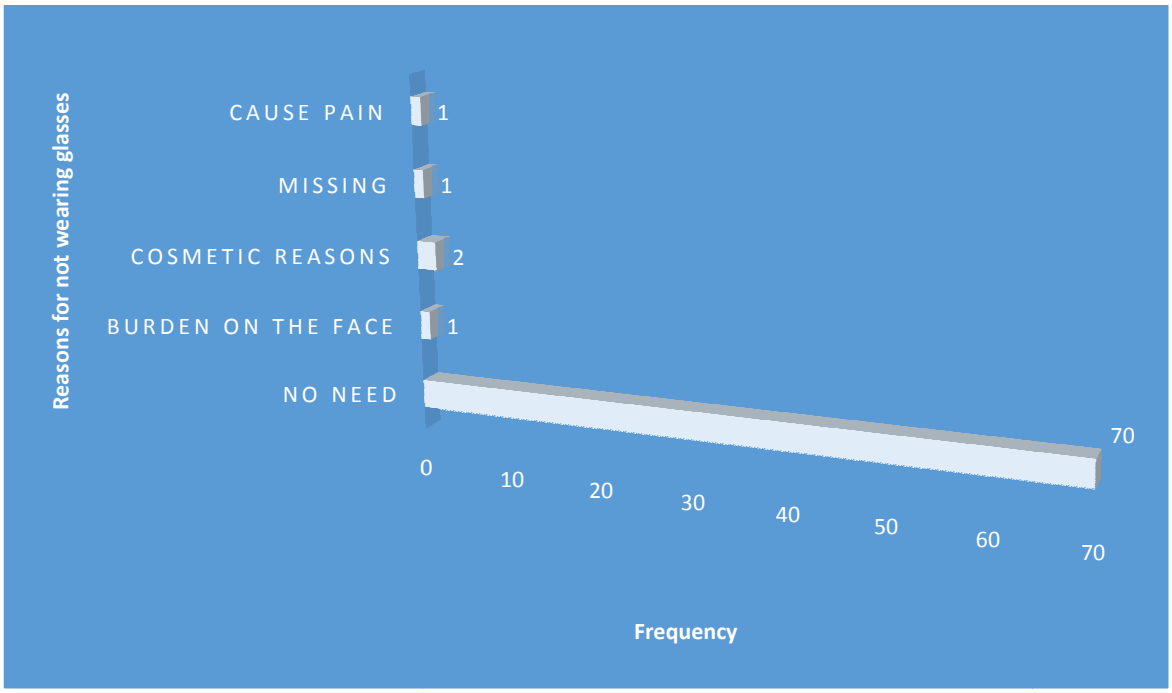

Figure 2: Reasons for non-use of refractive spectacles

125 **Table 1: Visual acuity**

	RIGHT EYE	LEFT EYE
VISUAL ACUITY	**Frequency (%)**	**Frequency (%)**
≥6/18	79 (95.2)	78 (94)
<6/18-6/60	2 (2.4)	2 (2.4)
<6/60-3/60	1 (1.2)	2 (2.4)
<3/60-NPL	1 (1.2)	1(1.2)
TOTAL	83 (100)	83 (100)

126

127 **Table 2: Pattern of refractive errors**

128

Spheres(diopters)		
	Right eye (%)	**Left eye (%)**
+1.25 to +0.25	16 (19.3)	19 (22.9)
<+0.25	0 (0)	1 (1.2)
plano	12 (14.5)	14 (16.9)
<-0.25	1 (1.2)	0 (0)
-0.25 to <-1.25	33 (39.8)	27 (32.5)
-1.25 to <-2.25	12 (14.5)	16 (19.3)
-2.25 to <-3.25	5 (6.0)	2 (2.4)
-3.25 to <-4.25	2 (2.4)	4 (4.8)
-4.25 to < -5.25	1 (1.2)	0 (0)
-5.25 to <-6.25	1 (1.2)	0(0)
TOTAL	**83 (100)**	**83 (100)**
Cylinders(diopter cylinder)		
+1.00 to +0.25	0 (0)	0 (0)
<+0.25	0 (0)	0 (0)
None	11 (13.3)	15 (18.1)
<-0.25	2 (2.4)	1 (1.2)
-0.25 to <-1.25	59 (71.1)	57 (68.7)
-1.25 to <-2.25	10 (12.0)	10 (12.0)
-2.25 to <-3.25	0 (0)	0 (0)
-3.25 to <-4.25	1 (1.2)	0 (0)
TOTAL	**83 (100)**	**83 (100)**
Spherical equivalents(diopters)		
+1.00 to +0.25	2 (2.8)	5 (7.4)
<+0.25	0 (0)	1 (1.5)
plano	3 (4.2)	5 (7.4)
<-0.25	8 (11.1)	3 (4.4)
-0.25 to <-1.25	33 (45.8)	34 (50.0)
-1.25 to <-2.25	16 (22.2)	10 (14.7)
-2.25 to <-3.25	5 (6.9)	5 (7.4)
-3.25 to <-4.25	3 (4.2)	3 (4.4)
-4.25 to <-5.25	1 (1.4)	1 (1.5)
-5.25 to <-6.25	1 (1.4)	1 (1.5)
TOTAL	**72 (100)**	**68(100)**

Types of astigmatism		
With-the-rule (WTR)	18 (25.0)	15 (22.1)
Against-the-rule (ATR)	29 (40.3)	28 (41.2)
Oblique	25 (34.7)	24 (35.3)
TOTAL	**72 (100)**	**68 (100)**

129

130

DISCUSSION

Overall prevalence of ametropia in our study was 79.5%, myopia being the most common type (63.6%). Reports on prevalence of myopia in medical students in Asian countries showed higher rates of 82 and 89.8% in Singapore[6, 7], 92.8% in Taiwan[8], and 87.6% in Malaysia[9]. In contrast, similar studies on medical students in Norway, Denmark and Turkey yielded relatively lower prevalence rates of 50.3%, 50%, and 32.9% respectively[10-12]. Consistently high prevalence rates of myopia have been reported among medical students across several studies in many countries[13-16]. Reasons adduced to this included high level of educational attainment[17],above average intelligence[18], long and intensive study regimen[7], and prolonged near-work[6-9]. Medical and law students are a group of young adults who spend prolonged periods on reading and close work. With their intensive study regimen that spans on the average 5 to 6 years, they have been reported to be at high risk for myopia[6-11].The exact pathogenic mechanisms of the myopisation of ocular refractive apparatus by near-work are yet to be fully agreed upon. Prolonged near-work was thought to lead to progressive myopia through the direct physical effect of prolonged accommodation. But according to current theory prolonged near work leads to myopia via the blurred retinal image that occurs during near focus. This retinal blur initiates a biochemical process in the retina to stimulate biochemical and structural changes in the sclera and choroid that lead to axial elongation[19] .

The afore-mentioned Singaporean studies[6, 7]carried out among medical student population reported significantly lower prevalence of hypermetropia (1.3%) than our study. While several studies have linked myopia with excessive near-work, much is yet to be learnt on the effects of near-work and hypermetropia. The risk factors for ametropia may be interrelated and statistical adjustment may not explain or completely remove the influence of other risk factors such environmental risk factor and pervasive influence of genetics. A previous study[9] based in Malaysia among medical student population has examined the prevalence of myopia with respect to ethnicity and reported myopia in 93% of Chinese ametropes than in Indian students (82% of Indian ametropes). In that study, near-work alone could not explain the disparities found in Chinese and Indian students. This fact may buttress the discordance in prevalence figures in the current and the above studies among Asians and Caucasians[6-12]. It seems reasonable to assert that the pattern of refractive errors and its severity appear multifactorial and polygenic (genetic and racial traits), while near-work plays a significant myopiagenic effect.

Despite extensive literature search of major data-bases, there is paucity of studies on refractive errors among African University students with which to compare our study. Nonetheless, the results of this study show a greater prevalence of refractive errors and myopia than would be expected in a general population in African settings. Epidemiological studies among African school children have reported refractive errors prevalence that ranges from 5.6%-13.5%, myopia (range, 4.3%-7.0%) being the commonest refractive error[4, 20, 21]. However, the mean ages of these African studies are much lower than

that recorded in the current study. But the differences in age alone cannot account for the huge discrepancy in refractive errors and myopia prevalence. Indeed Framingham Offspring Eye Study[22] found the prevalence of myopia to decrease with age in 1585 offspring of 1319 parents. This is expected on account of decreasing growth of the eye after high school. The alarming prevalent figures recorded in our cohorts perhaps hinge on the extensive near-work by these medical students, considering the relative similarities, in terms of genetics and other environmental factors, between our study and afore-mentioned African studies.

Despite a slight female preponderance, statistical analysis of our data revealed no significant relationship between sex distribution and refractive errors. This is similar to previous studies among medical students[11, 12]and engineering students[[23]. This also correlates with a Greek study which though reported a higher prevalence rate of myopia in female, showed no overall statistical significance[24]. The role of gender on refractive errors is inconclusive[25, 26]. It can be assumed that since growth spurt appears much earlier in girls, the eye tends to attain longer axial length and consequently higher axial myopia. Post-pubertal periods, boys catch up and ocular measurements in both sexes then even out.

ATR was the commonest astigmatism in our study. This is in consonance with several studies[27-29] that the prevalence of ATR astigmatism significantly increases with age, and WTR astigmatism significantly decreases with age. Lian-Hong et al[30] reported that age 9 years is the critical period for the transition from WTR to ATR astigmatism. The mean age of our study was 25.5 ± 3.3 years, meaning the critical age for WTR astigmatism has been exceeded.

The glasses acceptance rate in this study paralleled the numbers that had eye pains while reading. This lays credence to a study in Benin-City, South-South Nigeria among 500 University students by Ebeigbe et al[31] that undergraduates would use refractive spectacle if they have asthenopic symptoms.

CONCLUSION:

Myopia was the predominant refractive error detected among medical students in our cohort, although multiple conceivable confounding variables such as ethnicity, culture, nutrition, socioeconomic status among others may have inadvertently influenced this outcome. Longitudinal studiesamong students involved in prolonged reading to confirm the late onset of myopia and its progression during the course of study as compared to other students are advocated.

ACKNOWLEDGEMENTS

This was a non-funded study

CONSENT

All subjects gave their informed consent

COMPETING INTEREST

Authors have declared that no competing interests exist.

REFERENCES

1. Megbelayin EO. Barriers to uptake of prescribed refractive spectacles amongst Nigerian students. Int. Res. J. Basic Clin. Stud. 2013; 1(5): 71-77.
2. Faderin MA, Ajaiyeoba AI. Refractive errors in primary school children in Nigeria. Nig. J. Ophthalmol 2004.; 9(1):10-13.
3. Kawuma M, Mayeku R. Prevalence of Refractive errors among children in lower primary School in Kampala district. Afr. Health Sci 2002; 2: 69-72.
4. Ntim-Amponsah CT, Ofosu-Amaah S. Prevalence of Refractive Error and other Eye Diseases in Schoolchildren in the Greater Accra Region of Ghana. J pediatr Ophthalmol strabismus 2007; 44(5): 294-297.
5. Ajaiyeoba AI, Isawumi MA, Adeoye AO, Oluleye TS. Prevalence and causes of blindness and visual impairment among school children in southwestern Nigeria. Ann Afr Med 2006; 4: 197-203.
6. Chow YC, Dhillon B, Chew PT, Chew SJ. Refractive errors in Singapore medical students. Singapore Med J 1990; 31: 472–473.
7. Woo WW, Lim KA, Yang H, Lim XY, Liew F, Lee YS, Saw SM. Refractive errors in medical students in Singapore. Singapore Med J 2004; 45: 470–474.
8. Lin LL, Shih YF, Lee YC, Hung PT, Hou PK. Changes in ocular refraction and its components among medical students—a 5-year longitudinal study. Optom Vis Sci 1996; 73: 495–498.
9. Gopalakrishnan S, Prakash MVS, Kumar Jha KR. A Study of Refractive Errors among Medical students in AIMST University, Malaysia. Indian Med J 2001; 105(11): 365-374.
10. Fledelius HC. Myopia profile in Copenhagen medical students 1996–98. Refractive stability over a century is suggested. Acta Ophthalmol Scand 2000; 78: 501–505.
11. Midelfart A, Aamo B, Sjohaug KA, Dysthe BE. Myopia among medical students in Norway. Acta Ophthalmol (Copenh) 1992; 70: 317–322.
12. Onal S, Toker E, Akingol Z, Arslan G, Ertan S, Turan C et al. Refractive Errors of Medical Students in Turkey: One Year Follow-Up of refraction and Biometry. Optm Vis Sci 2007; 84: (3); 175–180.

13. Saw SM, Zhang MZ, Hong RZ, Fu ZF, Pang MH, Tan DT. Nearwork activity, night-lights, and myopia in the Singapore-China study. Arch Ophthalmol 2002; 120: 620–627.
14. Lin LLK, Shih YF, Lee YC, Hung PT, Hou PK. Changes in ocular refraction and its components among medical students – a 5-year longitudinal study. Optom Vis Sci 1996; 73: 495–498.
15. Grosvenor T & Scott R: Three-year changes in refraction and its components in youth-onset and early adult-onset myopia. Optom Vis Sci 1993; 70: 677–683.
16. Kathrotia RG, Avnish DG, Dabhoiwala ST, Patel ND, Pinkesh VR, Elvy R. Oommen ER. Pevalence and Progression of Refractive Errors among Medical Students. Indian J Physiol Pharmacol 2012; 56(3); 284-287.
17. Saw SM, Katz J, Schein OD, Chew SJ, Chan TK. Epidemiology of myopia. Epidemiol Rev 1996; 18:175-187.
18. Akrami A, Bakmohammad N, Seyedabadi M, Nabipour I, Mirzaei Z, Farrokhi S et al. The association between schoolchildren intelligence and refractive error. European Review for MedPharmSci 2012; 16; 908-912.
19. Diether S, Gekeler F, Schaeffel F. Changes in contrast sensitivity induced by defocus and their possible relations to emmetropization in the chicken. Invest Ophthalmol Vis Sci 2001; 42: 302-307.
20. Wedner SH, Ross DA, Todd J, Anemona A, Baliva R et al. Myopia in secondary school students in Mwanza city, Tanzania: the need for a national screening programme. Br J Ophthalmol 2002; 86: 1200-1206.
21. Adegbehingbe BO, Oladehinde MK, Majengbasan TO, Onakpoya HO, Osagiede EO. Screening of Adolescents for Eye Diseases in Nigerian high schools. Ghana Med J 2005; 39: 138-142.
22. The Framingham Offspring Eye Study Group. Familial aggregation and prevalence of myopia in the Framingham Offspring Eye Study. Arch Ophthalmol 1996; 114:326-332.
23. Kinge B, Midelfart A. Refractive errors among engineering students in Norway Ophthalmol Epid 1994; 1(1): 5-13.
24. Mavracanas TA, Mandalos A, Peios D, Golias V, Megalou K, Gregoriadou A, *et al*. Prevalence of myopia in a sample of Greek students. Acta Ophthalmol Scand 2000; 78: 656-659.
25. Wallman J. Nature and nurture of myopia. Nature 1994; 371: 201–202.
26. Mutti DO, Zadnik K, Adams AJ. Myopia. The nature versus nurture debate goes on. Invest Ophthalmol Vis Sci 1996; 37: 952–957.
27. Fan DSP, Rao SK, Cheung EYY, Islam M, Chew S, Lam DSC. Astigmatism in Chinese preschool children: prevalence, change, and effect on refractive development. Br. J. Ophthalmol., 2004; 88: 938-941
28. Gudmundsdottir E, Jonasson F, Jonsson V. “With the rule” astigmatism is not the rule in the elderly. Acta. Ophthalmol. Scand 2000; 78*:* 642–*646*.

29. Attebo K, Ivers RQ, Mitchell P. Refractive errors in an older population: The Blue Mountains eye study. Ophthalmol 1999; 06*:* 1066-1072.
30. Lian-Hong P, Lin C, Qin L, Ning K, Jing F, Shu Z. Refractive Status and Prevalence of Refractive Errors in Suburban School-age Children. Int. J. Med. Sci., 2010; 7(6): 342 -353
31. Ebeigbe JA, Kio F, Okafor LI. Attitude and Beliefs of Nigerian Undergraduates to spectacle Wear. Ghana Med J 2013; 47(2); 70-73.