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Prevalence of Anisometropia, Strabismus and Amblyopia among First Year Optometry Students in Kwame Nkrumah University of Science and Technology, Ghana

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ABSTRACT

Purpose: To determine the prevalence of anisometropia, amblyopia, and strabismus among first year optometry students in Kwame Nkrumah University of Science and Technology (KNUST).

Methods: This was a descriptive cross sectional study. The study population included all first year optometry students in KNUST during the 2016/2017 academic year. Uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA) were recorded for each participant. Anisometropia was defined as spherical equivalent (SE) refraction difference of 1.00D or more between the two eyes. Amblyopia was distinguished as a reduction of BCVA to 6/9 or less in one eye or 2-line interocular optotype acuity differences in the absence of pathological causes. Cover tests were done to investigate strabismus. All data was entered into and analyzed using the Statistical Package for Social Sciences version 23, USA. Descriptive analysis and Chi-squared test were employed. Statistical significance was set at p<0.05.

Results: A total of 67 students were involved in the study. The mean age of the participants was 20.96 years. The prevalence of anisometropia was 5.97% (95% confidence interval (CI), 1.49-11.94). The prevalence of anisometropia in males and females were 5.26% and 6.90% respectively (p = 0.272). 1.49% of the participants (95% CI, 1.62-6.34) were amblyopic. The prevalence of strabismus was 1.49% (95% CI, 1.62-6.34).

Conclusion: The results of this study showed that the prevalence of anisometropia, amblyopia, and strabismus among the first year optometry students was low. We advise that all newly admitted students to the university should undergo comprehensive eye examinations every academic year.

KEYWORDS

Amblyopia; Anisometropia; Strabismus; Vision Screening.

INTRODUCTION

Vision is certainly the most important of all the human senses. It allows us to learn more about the surrounding world than we do with any of the other four senses. Good vision is critical and essential to conducting activities of daily living easily. It is generally claimed that visual input accounts for 75% of information acquisition, hence good vision is very important in the academic lives of students [1]. Therefore, any condition which impairs the vision of students can have an adverse effect on the students' academic performance and quality of life as a whole.

Amblyopia, an ocular condition that degrades spatial vision and stereopsis, is associated with strabismus, anisometropia, or form deprivation early in life. In adults, amblyopia is usually diagnosed by a significant reduction in optotype (Snellen) visual acuity, which cannot be improved by refractive correction and has no obvious organic cause. It has become customary to identify patients as strabismic or anisometrope amblyopes if those conditions are evident when the patients are examined. Strabismus and anisometropia can cause amblyopia, but they can also both arise as a consequence of amblyopia [2]. In this

study, anisometropia refers to a difference in refractive error between the eyes, in any meridian, of greater than 1.0 diopter while Strabismus is defined as the misalignment of the eyes.

The global estimates of the prevalence of amblyopia and strabismus in children and teenagers range from 0.20% to 6.2% and 0.13% to 4.7%, respectively. The prevalence of anisometropia at various ages averages approximately 2% (range, 1% to 11%) [3-11]. A study conducted on Iranian school children indicated that 2.29%, 2.02%, and 2.31% of them had amblyopia, strabismus, and anisometropia, respectively [12]. The disparities noted could be as a result of difference in the study designs, population samples and disease classification adopted in each study [13]. Many of these studies are subject to selection bias especially those from a clinical setting.

There is scarcity of data on the magnitude of amblyopia, anisometropia and strabismus in both children and adults in Ghana. The purpose of this study was to determine the prevalence of anisometropia, amblyopia, and strabismus among first year optometry students in the Kwame Nkrumah University of Science and Technology (KNUST), Ghana.

MATERIALS AND METHODS

Study Design

The study was done in Kwame Nkrumah University of Science and Technology, a public university located in Kumasi, Ghana. This was a cross sectional study of first year optometry students in the university. All the first year optometry students for the 2016/2017 academic year were involved in this research.

SCREENING PROCEDURE

Participants had their uncorrected visual acuity tested using the snellen chart bearing the letter optotypes distanced at 6.0 meters from the student. Their visual acuities were then tested again with their correction on if available. An objective non-cycloplegic refraction was performed to measure refractive errors in both eyes of each subject using the streak retinoscope and trial lenses. Refinement of sphere, cylinder and axis was performed until the best corrected vision was obtained. Unilateral cover test (cover-uncover test) was carried out twice at 6 m and 40 cm with and without correction to check for ocular deviations. The students underwent ophthalmological examinations which included: diagnostic tests for strabismus (cover tests), refraction, biomicroscopy, tonometry and funduscopy. All findings obtained were recorded on examination forms designed for this study and diagnoses made accordingly.

DIAGNOSTIC CRITERIA

For this study, anisometropia was defined as spherical equivalent difference of 1.00D or more between two eyes. Amblyopia was defined as best corrected visual acuity (BCVA) of 6/9 or less or a 2-line interocular-optotype acuity difference with no pathology. Cover-uncover test was used to evaluate presence of ocular deviations/strabismus at both distant and near fixations. Prisms were used to measure amount of deviation if present. Myopia was defined as a refractive error of −0.50 D or worse and hyperopia as +1.00D for non-cycloplegic refraction and astigmatism was defined as a cylinder power ≥ ± 0.50 D.

ETHICAL CONSIDERATION

The study protocol was approved by the Head of Optometry and Visual Science department. It was then reviewed and approved by the Committee on Human Research, Publications and Ethics of the Kwame Nkrumah University of Science and Technology. A short lecture session was given to the student participants to explain the purpose, benefits, risks and procedure. Informed consent was sought from the student participants.

DATA ANALYSIS

Examination forms were cross-checked in the field for completeness of data. All data was entered into and analyzed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA) version 23. The prevalence of anisometropia, amblyopia, and strabismus were calculated in percentages and presented in a table as descriptive statistics. Chi-square test was employed to find significant differences between comparable categori¬cal groups. Statistical significance was set at $p < 0.05$.

RESULTS

Demographics

A total of 67 students participated in this study. This included 38 (56.7%) males and 29 (43.3%) females. Mean age of subjects was 20.96 ± 2.30 years (range, 17-25 years).

Prevalence of Anisometropia

The prevalence of anisometropia was 5.97%. No significant relationship was found between the prevalence of anisometropia and gender (p = 0.272). 94.03% (63 students) of the study population were isometropic. The prevalence of anisometropia decreased with increasing age. The association was statistically significant (p=0.0023). The distribution of anisometropia by gender and age group is found in table 1.

Prevalence of Strabismus

The prevalence of strabismus in the study was 1.49%. Only one male student out of the study population had strabismus

(alternate exotropia). There was no case of esotropia seen. Majority of the participants (98.51%) were orthotropic. The only student who had strabismus fell within the 17-19 years age group. The distribution of the prevalence of strabismus is shown in table 1.

Prevalence of Amblyopia

The prevalence of amblyopia in the study was 1.49%. One female student was found to be amblyopic while none of the male participants were amblyopic. There was no significant difference in the prevalence of amblyopia between males and females (p = 0.20). The association between prevalence of amblyopia and age was also not statistically significant (p =0.30).

Table 1: Distribution of Anisometropia, Strabismus, and Amblyopia by Gender and Age groups.

Variable			
	Gender	Number	Percentage
Anisometropia	Male	2	2.99
	Female	2	2.99
	Total	4	5.97
	Age Group		
	17-19	3	4.48
	20-22	1	1.49
	23-25	0	0.00
	Total	4	5.97
Strabismus	Gender		
	Male	1	1.49
	Female	0	0.00
	Total	1	1.49
	Age Group		
	17-19	1	1.49
	20-22	0	0.00
	23-25	0	0.00
	Total	1	1.49
Amblyopia	Gender		
	Male	0	0.00
	Female	1	1.49
	Total	1	1.49
	Age Group		
	17-19	0	0.00
	20-22	0	0.00
	23-25	1	1.49
	Total	1	1.49

DISCUSSION

The prevalence of anisometropia in this study was 5.97%. The results from other similar studies found the prevalence of anisometropia to be between 2% and 12% [7, 12, 14-16]. Hence, our results were mid-range compared with these studies. The high prevalence of anisometropia in our study was attributed to the high numbers of myopia in the study population. There was no significant relationship found between the prevalence of anisometropia and gender in our study. This was consistent with other population based studies [2, 12, 14, 15]. However, Quek et al in 2004 reported a higher prevalence of anisometropia in older females [17]. The varying prevalence rates of anisometropia among the various studies can be attributed to the differences in study design, population characteristics and different definitions.

Amblyopia was found to be prevalent in 1.49% of the study population. The only amblyopic case was found to be caused by anisometropia. This was similar to results from other studies [18, 19]. Many clinical studies have shown about a third of amblyopia to be caused by anisometropia, a third by strabismus, and a third by a combination of both disorder types [20]. However, these data are age-dependent, since strabismic amblyopia often presents earlier than anisometropic amblyopia because of parental observation of squint. Compared with children in The Multiethnic Pediatric Eye Disease Study (MEPEDS) and Baltimore Pediatric Eye Disease Study (BPEDS), this prevalence was less than for Hispanic/Latino (2.6%, 95% CI, and 1.8–3.4) and more similar to that found in white (1.8%, 95% CI, 0.9–3.1) and African-American (0.8%, 95% CI, 0.3–1.6, in the MEPEDS, and 1.5%, 95% CI, 0.9–2.1, in the BPEDS)[11, 21]. Unfortunately, differences in study design and the lack of a consistent definition of amblyopia makes comparison with other studies difficult [22].

The prevalence of strabismus in this study was 1.49% which was in the mid- range of other studies [8, 11, 12, 21, 22]. Our results indicated that 1.49% of the students had exotropia and none had esotropia. This finding was similar in other studies where the number of exotropic cases was greater than that of esotropic [23, 24]. According to Duane, strabismus distribution is from 2 to 4% for esotropia and from 0.5 to 1% for exotropia [25]. Racial differences are observed. Esotropia is more common in the white population, while exotropia is more common among blacks and Asians. In mixed-race individuals, the division between convergent and divergent strabismus is more regular. However the results in this study contrasted that in many Caucasian studies [26-28]. More recently, Yu et al. and Matsuo et al. reported that the exotropia-esotropia ratio appears to be increasing in Hong Kong and Japan presumably as their populations become less hyperopic[10, 29].

LIMITATIONS

The smaller sample size of this study was a sig¬nificant limitation. We only included first year optometry students because

of limited financial and human resources. Therefore the results from this study cannot be generalized.

CONCLUSIONS

The results of this study showed that the prevalence of anisometropia, amblyopia, and strabismus among optometry students is low and falls within the range of most related studies. We advise that all newly admitted students to the university should undergo comprehensive eye examinations every academic year. This will help identify and treat binocular vision anomalies which negatively affect academic performances.

REFERENCES

1. Ovenseri-Ogbomo G, C Abraham and F Kio. (2013). Visual Impairment and Ocular Findings among Deaf and Hearing Impaired School Children in Central Region, Ghana. Journal of Medical and Biomedical Sciences. 2(2): 16-22.

2. Birch EE and WH Swanson. (2000). Hyperacuity deficits in anisometropic and strabismic amblyopes with known ages of onset. Vision Research. 40(9): 1035-1040.

3. Carlton J, Karnon J, Czoski-Murray C, Smith KJ, et al. (2008). The clinical effectiveness and cost-effectiveness of screening programmes for amblyopia and strabismus in children up to the age of 4–5 years: a systematic review and economic evaluation. Health Technol Assess.

4. Quah B, Tay MT, Chew SJ and Lee LK. A study of amblyopia in 18-19 year old males. Singapore Med J. 1991. 32(3): 126-129.

5. Preslan MW and A Novak. (1996). Baltimore vision screening project. Ophthalmology. 103(1): 105-109.

6. He M, Zeng J, Liu Y, Xu J, et al. (2004). Refractive error and visual impairment in urban children in southern China. Investigative ophthalmology & visual science. 45(3): 793-799.

7. Lim H, Yu YS, Park SH, Ahn H, et al. (2004).The Seoul metropolitan preschool vision screening programme: results from South Korea. British journal of ophthalmology. 88(7): 929-933.

8. Chia A, Dirani M, Chan YH, Gazzard G, et al. (2010). Prevalence of amblyopia and strabismus in young Singaporean Chinese children. Investigative ophthalmology & visual science. 51(7): 3411-3417.

9. Rosman M, Wong TY, Koh CL and Tan DT. (2005). Prevalence and causes of amblyopia in a population-based study of young adult men in Singapore. American journal of ophthalmology. 140(3): 551-552.

10. Matsuo T and C Matsuo. (2007). Comparison of prevalence rates of strabismus and amblyopia in Japanese elementary school children between the years 2003 and 2005. Acta medica Okayama. 61(6): 329-334.

11. 11. Group M-e.P.E.D.S. (2008). Prevalence of amblyopia and strabismus in African American and Hispanic children ages 6 to 72 months: the Multi-ethnic Pediatric Eye Disease Study. Ophthalmology. 115(7): 1229-1236.

12. Yekta A, Fotouhi A, Hashemi H, Dehghani C, et al. (2010). The prevalence of anisometropia, amblyopia and strabismus in schoolchildren of Shiraz, Iran. Strabismus. 18(3): 104-110.

13. Ohlsson J. (2005). Defining amblyopia: the need for a joint classification. Strabismus. 13(1): 15-20.

14. Huynh S, Wang XY, Ip J, Robaei D, et al. (2006). Prevalence and associations of anisometropia and aniso-astigmatism in a population based sample of 6 year old children. British journal of ophthalmology. 90(5): 597-601.

15. Tong L, Saw SM, Chia KS and Tan D. (2004). Anisometropia in Singapore school children. American journal of ophthalmology. 137(3): 474-479.

16. Hashemi H, Khabazkhoob M, Yekta A, Mohammad K, et al. (2011). Prevalence and risk factors for anisometropia in the Tehran eye study, Iran. Ophthalmic epidemiology. 18(3): 122-128.

17. Quek TP, Chua CG, Chong CS, Chong JH, et al. (2004). Prevalence of refractive errors in teenage high school students in Singapore. Ophthalmic and Physiological Optics. 24(1): 47-55.

18. Sapkota YD, Adhikari BN, Pokharel GP, Poudyal BK, et al. (2008). The prevalence of visual impairment in school children of upper-middle socioeconomic status in Kathmandu. Ophthalmic epidemiology. 15(1): 17-23.

19. Newman DK and MM East. (1999). Preschool vision screening: negative predictive value for amblyopia. British Journal of Ophthalmology. 83(6): 676-679.

20. Webber AL and J Wood. (2005). Amblyopia: prevalence, natural history, functional effects and treatment. Clinical and experimental optometry. 88(6): 365-375.

21. Friedman DS, Repka MX, Katz J, Giordano L, et al. (2009). Prevalence of amblyopia and strabismus in white and African American children aged 6 through 71 months: the Baltimore Pediatric Eye Disease Study. Ophthalmology. 116(11): 2128-2134.

22. Arnold RW. (2009). Amblyopia and strabismus prevalence. Ophthalmology. 116(2): 365-366.

23. Matsuo T and C Matsuo. (2005).The prevalence of strabismus and amblyopia in Japanese elementary school children. Ophthalmic epidemiology. 12(1): 31-36.

24. Tinley C. and R Grötte. (2012). Comitant horizontal strabismus in South African black and mixed race children—a clinic-based study. Ophthalmic epidemiology. 19(2): 89-94.

25. O'Hara A and Nelson L. (1995). Heredity of strabismus. Tasman MDW. Duane's Ophthalmology. [monography on CD-ROM]. New York: Lippincott.

26. Ohlsson J, Villarreal G, Sjöström A, Abrahamsson M, et al. (2001). Visual acuity, residual amblyopia and ocular pathology in a screened population of 12–13-year-old children in Sweden. Acta Ophthalmologica. 79(6): 589-595.

27. Robaei D, Rose KA, Kifley A, Cosstick M, et al. (2006). Factors associated with childhood strabismus: findings from a population-based study. Ophthalmology. 113(7): 1146-1153.

28. Robaei D, Rose KA, Ojaimi E, Kifley A, et al. (2006). Causes and associations of amblyopia in a population-based sample of 6-year-old Australian children. Archives of ophthalmology. 124(6): 878-884.

29. 29. Yu C, Fan DS, Wong VW, Wong CY, et al. (2002). Changing patterns of strabismus: a decade of experience in Hong Kong. British Journal of Ophthalmology. 86(8): 854-856.