

Prevalence, distribution and determinants of myopia in Owerri, Nigeria

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Abstract

Background: Uncorrected myopia is a significant cause of visual impairment and avoidable blindness. Incidence of open-angle glaucoma has been shown to occur more often in myopia. This cross-sectional analytical study determined the prevalence, distribution and determinants of myopia in the adult population of Imo State, Nigeria with a view to establish a reference data for research purposes and future intervention in this locality. **Materials and Method:** A total of 3451 adults living in Owerri consisting of 2606 persons as test group and 845 persons as controls were randomly selected using standard optometric methods including subjective refraction. **Results:** Refractive error (ametropia) was found in 79.5% study and 76.8% control. Myopia was found in 23.4% study and 19.6% control. Highest prevalence of myopia was observed in females aged 40-49 years. Fifty percent of study and 68.1% of control group had myopia of -0.50DS to -3.00DS while 4.0% and 2.4% of study and control group respectively had myopic astigmatism. In all, 27.7% study and 16.2% control had myopia > 5.00DS. The highest degree of myopia found in this study was - 24.00DS. **Conclusion:** This study provided information on the prevalence, distribution and determinants of myopia in Owerri, Nigeria and the data could be a basis for improved visual health care in the south-eastern sub-region of Nigeria.

Key words: Ametropia, myopia, refractive error, visual impairment

INTRODUCTION

Ocular refraction is a physiologic parameter as well as a measure of ocular function and visual health. Myopia is one of the basic types of ametropia (refractive error). The natural history of refractive errors among older adults has not been widely studied until the past decade. Most research work on myopia was focused on children,

as this condition was mainly considered to occur at a younger age. More recent population studies involving predominantly European-origin participants have shown that refractive shifts continue in older adulthood (Ching *et al.*, 2003; Wu *et al.*, 2005).

The prevalence of myopia varies with age, race and gender (Adeoti and Egbewale, 2008; Saw *et al.*, 2006). Myopia is inherited and is often discovered in children when they are between 8 and 12 years old (Borish, 1975). During the teenage years, when the body grows rapidly, myopia may become worse. Between the ages of 20 and 40, there is usually little change (Wallaman and Winawer, 2004). Myopia can be classified as low, moderate, high, severe, simple, pathological, transient or temporary, nocturnal or night, pseudomyopia or false myopia, etc., Pathological myopia is caused by failure of development of one of the components of refraction. Transitory (temporary) myopia can be caused by disease, drugs or trauma. Nocturnal myopia is a type of visual impairment which is manifested

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as a decrease of visual acuity in dim light, such as twilight or night time hours (Borish, 1975; Emerole *et al.*, 2011). Pseudomyopia is a condition of tonic spasm of accommodation in which an emmetrope or hyperope frequently appears to be a myopic (Borish, 1975; Emerole *et al.*, 2011; Saw *et al.*, 2006). Animal experiments seem to indicate an association of myopia onset with confined space and reduced illumination (Borish, 1975). In addition to heredity, there is an apparent increase of myopia in both incidence and amount with near point stress, close work and increased years of school work (Borish, 1975).

Uncorrected myopia causes blurring of vision at far; photophobia; asthenopia; protruding eyes in higher degrees of myopia; myopic crescent from separation of the choroid from the disc margin in high myopia and retinal detachment (Borish, 1975; Saw *et al.*, 2006). Myopia of -6.00D to -10.00D is high. When myopia is above -10.00D, it is classified as severe (Borish, 1975; Saw *et al.*, 1996; Saw *et al.*, 2006). In high myopia there is a higher risk of retinal detachment (Borish, 1975; Saw *et al.*, 1996). Aqueous outflow was reported to be reduced in myopic eyes and the incidence of open-angle glaucoma twice as great in myopic eyes over -3.00DS (Borish, 1975). Uncorrected myopia is a significant cause of refractive blindness and visual impairment. Without appropriate optical correction of myopia, millions of people lose educational opportunity and are excluded from productive working lives with severe economic and social consequences (Holden, 2007; Mutti *et al.*, 2002). The improvement in distant vision with correction of myopia enhance a better vision and this helps to reduce the incessant loss of lives from road traffic accidents caused by poor distant vision among motor vehicle drivers. Eye glasses or contact lenses (concave) are the most common methods of correcting myopia. Refractive surgery is another option (Asogwa, 1978; Emerole, 2006; Nwosu and Alozie, 2006).

In spite of the consequences of uncorrected myopia, there is a paucity of information in the literature known about the prevalence, distribution and determinants of myopia in the adult population of Imo State, Nigeria (Nigerian Optometric Association, 2007). The present study was aimed at determining the prevalence, demographic associations, patterns and physiologic determinants of myopia in Owerri, Imo State, Nigeria, in order to provide a baseline data for further studies and establishing reference values for future intervention.

MATERIALS AND METHODS

A total of 3451 consisting of 2606 subjects (test) were recruited between September 2007 and November 2009 from persons living in autonomous communities of Owerri while the control group of 845 from Ihiagwa autonomous

community in Owerri-West Local Government area of Imo State using a Multi-stage random sampling technique. The controls were persons who did not present with any of the eye defects.

Interviewer administered Structured questionnaire used to determine demographic characteristics, dietary habit, alcohol consumption, tobacco use, previous ocular and medical history. Those with conditions interfering with accurate ocular refraction such as corneal opacity, visually impairing opaque media, diabetes mellitus, hypertension, pseudophakics and aphakics were excluded from the analysis.

All the subjects underwent a complete ophthalmic examination which included measurement of distant near and pin-hole vision in subjects with visual acuity less than 6/6 (with Snellen's chart and near reading charts); tonometry; ophthalmoscopy; retinoscopy; subjective refraction and perimetry to investigate other possible causes of impairment or reduction in vision. Refractive errors (ametropia) in an eye were defined. Myopia was defined as spherical dioptric power less than -0.50D ($< -0.50DS$). Moderate high myopia was defined by cutoff of less than -3.00DS ($< -3.00DS$). There was high correlation between the right and left eyes of the same individual, that is, fellow eyes ($P < 0.001$) and when the data obtained from the right eyes and left eyes were similar, data from right eyes only were reported except in the analysis of anisometropia. Refraction data are based on subjective refraction. Analysis of the results was done using EPI INFO Version 3.5, 2008 statistical data package.

RESULTS

Prevalence of Myopia and Refractive Status of Subjects

About 23.4% and 19.6% of study and control group respectively were myopic. A prevalence of 79.5% and 76.8% ametropia was found in the study and control groups. Twenty one per cent and 23.2% of study and control groups were emmetropic. The differences between the two groups as shown in Tables 1 and 2 were not statistically significant.

Demographic Characteristics of Subjects

A majority of the myopic were females aged 40-49 years. There was no statistically significant difference between

Table 1: Prevalence of myopia in subjects

Refractive status	No. (%)		P value
	Study group n=845	Control group n=2606	
Myopic	610 (23.4)	166 (19.6)	0.60
Non-myopic	1996 (76.6)	679 (80.4)	0.60

the two groups in the proportion of myopic males and females as shown in Table 3. In the present study a high prevalence of ametropia was noted among rural dwellers (61.2% and 61.3% of study and control groups, respectively). About 41.8% and 30.8% of study and control groups respectively had tertiary education. Students (22.9%) were in the majority in the study group while skilled persons were in the majority in the control group. It was also observed that 57.4% of subjects in the study group were unmarried while 49.7% of subjects in the control group of this study were married (Emerole *et al.*, 2011).

Myopia by Magnitude

The majority (50.0% and 68.1% of study and control groups) had myopia of -0.50DS to -3.00DS. It was observed that 13.4% and 3.0% of study and control groups respectively had myopia > 10.00DS. The difference in magnitude of myopia between the two groups as shown in Table 4 was statistically significant.

Myopic Astigmatism by Type

Four percent and 2.4% of study and control groups respectively had myopic astigmatism. Simple myopia was in the majority in both groups. The differences between the two groups as shown in Table 5 were not statistically significant.

Ametropia and Risk Factors Affecting Vision

In the present study 67.6% and 49.2% of ametropics in study and control groups respectively used chloroquine as a first-line drug for malaria. In the study group 62.2% and control group 31.6% were in the habit of consuming food items of low nutritional value. About 33.6% and 27.4% of ametropics in the study and control groups respectively consumed alcohol while 19.9% and 15.1% of ametropics in the study and control groups used tobacco. Twenty percent and 29.7% of ametropics in the study and control groups respectively had past history of ocular trauma (Emerole *et al.*, 2011).

DISCUSSION

The prevalence of myopia in this study was 23.4% and 19.6% of study and control groups, respectively. A prevalence of 39.2% myopia was found in patients in attendance at the Mercyland Specialist Hospital Osogbo, Western Nigeria (Adeoti and Egbewale, 2006). In a similar study in Sumatra, Indonesia, a prevalence of 48.1% myopia was found (Raju *et al.*, 2004). The prevalence of myopia was higher (39.2%) in Mercyland Specialist Hospital Osogbo, Western Nigeria and in the study in Sumatra, Indonesia (41.8%) when compared to the prevalence in the present study (study group, 23.4% and control group, 19.6%). Data from 29,281 persons in the USA, Western Europe

Table 2: Refractive status of subjects

Refractive status	No. (%)		P value
	Study group n=2606	Control group n=845	
Hyperopia	917 (35.2)	293 (34.7)	1.00
Myopia	610 (23.4)	166 (19.6)	0.60
Astigmatism	545 (20.9)	190 (22.5)	0.73
Emmetropia	534 (20.5)	196 (23.2)	0.73

Table 3: Myopia by age and gender

Age (years)	Male		Female		P value
	Study group (n=265)	Control group (n=80)	Study group (n=345)	Control group (n=86)	
20-29	49 (18.5)	7 (8.8)	68 (19.7)	14 (16.3)	0.73
30-39	44 (16.6)	12 (15.0)	63 (18.3)	24 (27.9)	0.85
40-49	66 (24.9)	37 (46.2)	85 (24.6)	30 (34.9)	1.00
50-59	58 (21.9)	14 (17.5)	77 (22.3)	10 (11.6)	1.00
60-69	48 (18.1)	10 (12.5)	52 (15.1)	8 (9.3)	0.57

Table 4: Myopia by magnitude

Magnitude of myopia	No. (%)		P value
	Study group n=610	Control group n=166	
-0.5D.S to -3.00D.S	305 (50.0)	113 (68.1)	0.00*
>-3.00D.S to -5.00D.S	136 (22.3)	26 (15.7)	0.28
>-5.00D.S to -10.00D.S	87 (14.3)	22 (13.2)	0.84
>-10.00D.S	82 (13.4)	5 (3.0)	0.00*

Table 5: Myopic astigmatism by type

Myopic astigmatism	No. (%)		P value
	Study group n=610	Control group n=166	
Myopic astigmatism	25 (4.1)	4 (2.4)	0.40
Myopia	585 (95.9)	162 (97.6)	0.40

and Australia over 40 years of age showed prevalence of myopia [≤ 1.00 DS] 25.4%; 26.1% and 16.4% respectively for these population samples (The Eye diseases Research Prevalence Group, 2004). Nworah and Ezepue (1992) discovered a little excess of uncorrected myopia (a prevalence of 18.6% myopia was found in the pilot study among patients attending the eye clinic of the University of Nigeria, Teaching Hospital, Enugu). Comparable results on the prevalence and distribution of myopia are difficult to come by from the few studies on refraction in Africa. This is because of different methodologies and materials studied (Adeoti and Egbawale, 2008; Emerole *et al.*, 2011; Mutti *et al.*, 2002; Nworah and Ezepue, 1992; Raju *et al.*, 2004; The Eye diseases Prevalence Research Group, 2004).

Among subjects found to be myopic in this study a majority were aged 40-49 years. Ageing modifies a pre-existing

error making it more symptomatic (Nworah and Ezepeue, 1992). About 55.6% and 51.8% of myopes in the study and control groups respectively were females. The higher prevalence of female myopes (over 50%) may be because the female gender was in the majority in the present study. This also agrees with earlier studies (Nworah and Ezepeue, 1992; Nwosu and Alozie, 2006; Patel and West, 2007). Women as a result of pregnancy, childbirth, motherhood and demand on women's vision resulting from domestic chores and peasant farming appear more health aware and health conscious than the men (Emerole *et al.*, 2011). The Barbados' eye studies provided the first longitudinal data on refractive error changes in a large adult African-origin population. Over the 9-year follow-up period, refraction changes varied according to age. Persons 40 to 49 years of age at baseline experienced a hyperopic shift, whereas persons 60 years of age or more had refractive error shifts toward myopia, with more than 50% of participants having myopic shifts (Ching *et al.*, 2003; Wu *et al.*, 2005).

About 61.0% of ametropics in both study and control groups had location of residence in a rural area. Students were in the majority (22.9%) in the study group while skilled persons (21.5%) were in the majority in the control group. There was no significant interaction between occupation and ametropia. In this study a majority of the subjects (41.8%) in the study group had tertiary education. There were more literate subjects in the study group. In addition to heredity there is an apparent increase of myopia in both incidence and amount with near work and increased years of school work. Education is casually referred to as the major industry in Imo State, Nigeria. In the Barbados eye study 9.8% of the participants were in near work-related occupation. In the study on the prevalence and impact of presbyopia on a rural Tanzanian population, secondary education was significantly associated with a higher prevalence. Among patients in an eye clinic study in Western Nigeria, myopia was the most common ametropia (Bekibele *et al.*, 2007; Borish, 1975; Patel and West, 2007; Wu *et al.*, 2005). A majority of the subjects in the study group (51.4%) were single or unmarried while a majority of the subjects in the control group (49.7%) were married. In the Shihpai eye study (elderly Chinese population in Taiwan aged 65 years or more) 73.7% were married. The population in the present study is a relatively younger population in relation to the population in the Shihpai eye study (Ching *et al.*, 2003). Comparable results on myopia and its determinants are difficult to come by from the few studies on refraction in Africa in the literature. This is because of different methodologies used and materials studied (Nworah and Ezepeue, 1992).

Myopia of -0.0DS to -3.00DS was found to be 50.0% and 68.1% in study and control groups, respectively.

Myopia >3.00DS was found in 50.0% and 31.9% of study and control groups, respectively. The higher prevalence of myopia >-3.00DS in the study group may explain why they sought intervention. There were more subjects who had myopic astigmatism than hyperopic astigmatism, but it was not statistically significant. Simple myopia was in the majority (95.9% and 97.6% of study and control groups, respectively). The highest degree of myopia found in this study was -24.00DS (the range of myopic refractive power in the present study was -0.25DS to -24.00DS). The association of myopia and environment has been noted. Environmental factors such as dust, irritants, radiations, seasons and smoke are implicated in some cases of ocular allergies, cataract, macular burns and visual impairment (Borish, 1975; Emerole, 1992; Emerole, 2006; Timothy and Nneli, 2007).

The role of nutrition and drugs on health and disease is equally noted (Ganong, 2001). A majority of ametropics in this study (67.6% and 49.2% of study and control groups respectively) especially the rural dwellers used chloroquine as a first-line drug for malaria. Many of the ametropics in this study (62.2% and 31.6% of study and control groups respectively) were in the habit of consuming food items with low nutritional value. Malaria is endemic in Nigeria. Abuse of chloroquine affects the components of refraction especially in the absence of adequate nutrition (Borish, 1975). There was past history of ocular trauma in 20.3% and 29.7% of ametropics in the study and control groups, respectively. This did not significantly affect the prevalence of myopia. Comparable results on determinants of myopia are difficult to come by from the few studies on refraction in Africa (Nworah and Ezepeue, 1992).

Thirty-three percent and 27.4% of ametropics in the study and control groups respectively consumed alcohol. Although alcohol consumption was more in the study group, the difference between the groups was not statistically significant. In a similar study among an elderly Chinese population in Taiwan (the Shihpai eye study) approximately 11.7% of the persons in the study were current alcohol users. However, in the present study alcohol intake did not significantly affect the prevalence of myopia hence corroborating the work of Ching *et al.* (2003).

In this present study 19.9% and 15.1% of the study and control groups respectively indulged in tobacco usage. In the Shihpai eye study 17.6% of the participants were current smokers. There was no statistically significant difference in tobacco use between the study and control groups. Tobacco use by some of the ametropics in this study did not significantly affect the prevalence of myopia and this agrees with the report of Ching *et al.* (2003).

CONCLUSION

This study has provided information on the prevalence, distribution and determinants of myopia in the adult population of Imo State, Nigeria. This data could help in planning for effective eye care services and in provision of low-cost/economically friendly spectacles to reduce visual impairment due to myopia.

RECOMMENDATION

Periodic visual examination to identify those with myopia for early corrective measures; and health education is recommended.

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