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Prevalence of myopia and its socio-demographic distribution amongst secondary school going adolescents in Lurambi Sub-County, Kakamega, Kenya

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ABSTRACT

BACKGROUND: Globally the prevalence of myopia has increased alarmingly and is expected to affect an estimated 2.56 billion people in the world by the end of 2020. It is believed to be the leading cause of visual impairment in Kenya, contributing 59.5% of all causes of visual impairment. Still, agreement on the exact prevalence in Kenya and whether socio-demographic factors have an influence on myopia is unknown.
This study was aimed at evaluating the prevalence of myopia and its socio-demographic distribution amongst randomly selected school-going adolescent.
This study was conducted in Lurambi Sub-County in Kakamega, Kenya.
MATERIAL AND METHODS: The study adopted a school-based cross-sectional descriptive study design. Using a multi -stage sampling technique, 733 participants from a population of 7,400 secondary school students within Lurambi Sub-County were randomly selected. A standard optometric vision-assessment protocol was applied to those who met the inclusion criteria and cycloplegic refraction was conducted to elicit those who had myopia.
RESULTS: The prevalence of myopia was found to be 7.5% of which 29 (52.7%) were male while 26 (47.3%) were female and there was no association between gender and myopia ($p = 0.572$). Myopia was found to be more prevalent in urban 49 (87.3%) as compared to rural 7 (12.7%) areas and there was no association between place of residences and myopia ($p = 0.381$). Similarly, 15–18 years was the dominant age group 39 (70.9%) and there was no association between age and having myopia ($p = 0.926$). The study also found that there was no association ($p = 0.207$) between school class of the participants and having myopia, although most myopic cases were in the form four class 15 (27.3%).
CONCLUSION: Myopia was found to be mostly prevalent in the urban setting and upper classes as compared to rural and lower classes. This may link myopia to other risk factors such as near work and outdoor activities, but more research needs to be done in these areas.

KEY WORDS: myopia; Kenya; prevalence; socio-demographic

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INTRODUCTION

Myopia is estimated to be the leading cause of visual impairment (VI) of all Uncorrected Refractive Error (URE) and it is believed to be the most common eye condition worldwide [1]. Nearly 1.89 billion people are myopic in the world [2], and this number is projected to rise to 2.56 billion by 2020 if nothing is done to address the situation [3]. Myopia is a public health problem worldwide [4], and it is one of the five ocular problems that have been identified by the World Health Organization as an immediate priority for the global initiative of preventable blindness [5]. Myopia and high myopia can result in other vision-threatening conditions like myopic macular degeneration, retinal detachment, cataract as well as choroid degenerative conditions [6]. The risk is comparable to the risk of smoking and hypertension to cardiovascular health [7]. Myopia has also been associated with poor socioeconomic status and quality of life [The prevalence of URE in Africa has been estimated to be 2.3%, and that of myopia is not well documented [9]. In Kenya, studies on the prevalence of myopia and its risk factors are scarce. It is, however, believed to be the leading cause of visual impairment in Kenya and it contributes to 59.5% of refractive errors in Kenya [10]. Despite this, its exact prevalence is not well known.

MATERIAL AND METHODS

This study was conducted in secondary schools around Lurambi Sub-County, Kenya. Lurambi Sub-County is one of the most cosmopolitan sub-counties which is located in the western part of the country (Kenya), and it is inhabited by people from different parts of the country and different ethnic groups. A school-based cross-sectional study design was adopted. All participants that were selected were aged between 10 to 19 years. Significant myopia in this study was defined as myopia ≥ –0.50D. In addition, the participant with defined myopia must present with Snellen Visual Acuity (VA) of 6/9 or worse for distance VA in any eye, equivalent to 0.1 or worse logarithm of the minimum angle of resolution (logMAR). The multistage sampling technique took place in two stages as follows:

- stage one — this involved purposive sampling of two clusters. The 22 schools in Lurambi Sub-County were classified into two; urban schools and rural schools. The urban schools were identified by their locality. Those schools that were found within Kakamega Municipality of Lurambi Sub-County were classified as urban schools and those that were found in the rural part of Lurambi Sub-County formed the second cluster which were rural schools. This was to ensure maximum coverage of all levels of socio-demographic and socio-economic features of the study area. The two clusters had a total of 22 secondary schools with students' enrolment having been estimated to be 7,400 in 2020;
- stage two — this involved a computer-generated random system in order to sample the schools. Since there was a disproportionate number of students in the schools, a proportionate sampling technique was employed to ensure that all the schools and every student in each cluster had an equal chance of being selected. To achieve this and considering that some schools had student populations as low as 25 while others had student population as high as 1500, all the schools in the two clusters were shared into groups of near-equal student numbers. The grouping was based on an increasing additive order, and each of the groups were serially numbered. Using the computer-generated random system (http://www.random.org/integers/), two groups were selected for screening, one in the rural group and one in the urban group. The purpose of eye screening was to identify children with myopia and those with normal sight.

Free eye screening was conducted in each of the schools that formed part of the study in both rural and urban areas. The study population was subjected to visual acuity screening and all those who had visual acuity of 6/9 or worse in any of the two eyes qualified for the next stage of the examination. To avoid loss of school-time during the screening sessions, pre-arrangement was agreed upon with the school headteacher or principal for a make-up class for the children that were to be included in the study. Also, lunch plans to cater for extended hours for the children was provided in the study budget.

Permission was sought from the different authorities, namely the legal guardians of the children through the different school heads for each of the selected schools in the selected groups, the Sub-County education officers, and the county education officer before the commencement of the study. The final years optometry students were briefed on the research and they assisted in assessments and examination of the participants. Written informed consent/assent was obtained for all the adolescents

or from the legal guardians. For minors, permission was sought through the headteacher before conducting a detailed assessment. Ethical approval was granted by the ethical review committee of Masinde Muliro University of Science and Technology and the approval letter is available upon request. The consent had the full content of the study. The assessment included the steps below.

STEP 1

Visual acuity testing was done with all participants that formed part of the study. Those having a visual acuity of 6/9 or worse were subjected to the pinhole test to elicit if the refractive error was the reason for the reduced visual acuity. Those with visual acuity better than 6/6 were classified as normal. The children and their teachers (for minors) presenting as their legal proxies were counselled on their identified visual condition. The children were also informed of the importance of their continued participation in the study. Those with minor allergies or infections were dispensed free of charge (on the study budget).

STEP 2

Children presenting with Snellen VA of 6/9 or worse in any of the eyes underwent direct ophthalmoscopy using Keeler professional direct ophthalmoscope, to rule out any non-refractive ocular pathology. If any pathology was found, these children were excluded from the study. However, the children were referred to either the Academic Vision Centre or Sabatia Eye Hospital (SEH) which is the only eye hospital in the western part of Kenya. If no pathology was found, children underwent cycloplegic refraction, and where cycloplegia was not possible, non-cycloplegic Mohindra retinoscopy was performed, using a Keeler streak retinoscope, to elicit if the refractive error was myopia, while controlling for accommodation. If the participants had any other refractive error apart from myopia and myopic astigmatism in which the spherical equivalent was calculated, the participants or their legal guardians were counselled on the need for spectacle correction. They were also then excluded from the study and were referred to MMUST Academic Vision Centre (AVC) for spectacle correction that was subsidized.

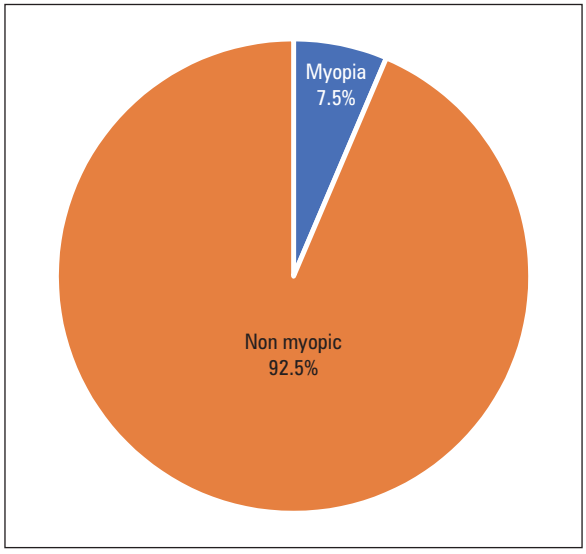

FIGURE 1. Prevalence of myopia

STEP 3

The basic socio-demographic data and contact details of the participants and their legal guardians were collected.

RESULTS

The current study sampled a total of 733 students, of whom 55 were found to be myopic giving an overall prevalence of 7.5% (Fig. 1). Of these students, 29 (52.7%) were male while 26 (47.3%) were female. Further details of the gender, domicile and age are presented in Table 1.

This study found the prevalence of myopia in males to be 29 (4.0%) while that of females was found to be 26 (3.5%). Myopia was found to be more prevalent in urban 49 (6.7%) as compared to the rural 6 (0.8%) schools (Tab. 4).

AGE AND MYOPIA

Myopia was found to occur in the range from 14 to 19 years while the most dominant age of

Table 1. Descriptive statistics for students

		Frequency	Percent
Gender	Female	326	44.5
	Male	407	55.5
Domicile	Rural	383	52.3
	Urban	349	47.6
Age	11–14 years	60	8.2
	15–18 years	520	70.9
	Above 18 years	153	20.9

Table 2. Distribution of myopia in terms of age

		Age							Total
		13.0	14.0	15.0	16.0	17.0	18.0	19.0	
Myopia	Count	0	3	7	15	12	9	9	55
	Percentage of total	0.0%	0.4%	1.0%	2.1%	1.6%	1.2%	1.2%	7.5%

Table 3. Magnitude of myopia distribution

Magnitude of myopia		Right eye n (%)	Left eye n (%)
Myopia values	–10.00	1 (1.8%)	2 (3.6%)
	–4.00	1 (1.8%)	1 (1.8%)
	–3.75	1 (1.8%)	1 (1.8%)
	–3.50	2 (3.6%)	3 (5.5%)
	–3.25	2 (3.6%)	1 (1.8%)
	–2.50	1 (1.8%)	1 (1.8%)
	–2.25	1 (1.8%)	1 (1.8%)
	–2.00	3 (5.5%)	3 (5.5%)
	–1.75	1 (1.8%)	2 (3.6%)
	–1.25	4 (7.3%)	3 (5.5%)
	–1.00	5 (9.1%)	5 (9.1%)
	–0.75	16 (29.1%)	16 (29.1%)
	–0.50	16 (29.1%)	16 (29.1%)
	–0.25	1 (1.8%)	0 (0%)
	Total	55 (100%)	

those who had myopia was found to be 16 years 15 (2.1%).

MAGNITUDE OF MYOPIA

About one third 16 (29.1%), of the participants, had mild (–0.50D) myopia while 16 (29.1%) had moderate myopia (–0.75D). One participant (1.8%) had –10.00DS.

SOCIAL-DEMOGRAPHIC DISTRIBUTION OF STUDY PARTICIPANTS

The socio-demographic characteristics, as shown in Table 1 found no association between gender and myopia ($p = 0.572$). Males constituted just over half of the study participants 29 (52.7%). The 15–18-year group was the dominant age group and there was no association between age and myopia ($p = 0.926$). In addition, most of the participants came from an urban setting 49 (87.3%) although there was no association between place of residence and myopia ($p = 0.381$).

There was no association between the school class group of the participants and having myopia ($p = 0.207$). Most of the participants who were myopic, were form four 15 (27.3%) although there was an equal distribution of myopia in terms of the class of the respondents. A significant number of the parents of the respondents 24 (43.6%) were unemployed and 39 (70.9%) were married. While 23 (41.8%) of the parents of the participants had primary and 22 (40.0%) had secondary education qualifications, there were no significant differences between the highest level of education and myopia ($p = 0.283$).

DISCUSSION

The overall prevalence of myopia in this study was found to be 7.5%, which is a higher value compared to previous studies [11] of 1.7%, [12] 5.6% and 1.7% of [13]. This can be attributed to the study population in this study as compared to other studies. It is well established that myopia is highly prevalent in adolescents as compared to other age groups (14). The high prevalence has been attributed to the eyeball elongation due to environmental factors such as near work and reduced outdoor activities [15].

Females and males in the study constituted 45% and 55% respectively of the total of 733 students who participated in the study. Myopia was found to be only slightly more prevalent in males 29 (52.7%) compared to females, 26 (47.3%). The difference in prevalence among male and female was not significant ($p = 0.576$). The study was concurrent with [11] that found that there was no statistically significant difference in the prevalence of myopia among females and males. Although a study by [13] found myopia to be slightly more prevalent in females compared to males at 1.8% and 1.7% respectively, the difference not to be statistically significant.

This study found that myopia was mostly prevalent in the age group of 15–18 years and the mean age of participants who were myopic was 16 years. This can be because of the eyeball elongation due to hereditary/familial or due to environmental or other causes that are related to the growth of the eye, specifical overgrowth of the eye and dis-correlation between axial length and cor-

Table 4. Cross-tabulation of socio-demographic factors with myopia				
Socio-demographic variable		**Myopia n (%)**	**Myopia percentage of total sample (n = 733)**	**p value**
Gender	Male	29 (52.7%)	29 (4.0%)	0.576
	Female	26 (47.3%)	26 (3.6%)	
Age	11–14 Years	5 (9.1%)	5 (0.6%)	0.926
	15–18 Years	39 (70.9%)	39 (5.3%)	
	Above 18 years	11 (20.0%)	11 (1.5%)	
Residence of the client	Urban	49 (89.0%)	49 (6.7%)	0.381
	Rural	6 (11.0%)	6 (0.8%)	
Current Class of The Respondent	Form One	15 (27.3%)	15 (2.0%)	0.207
	Form Two	15 (27.3%)	15 (2.0%)	
	Form Three	10 (18.1%)	10 (1.4%)	
	Form Four	15 (27.3%)	15 (2.0%)	
Parents'/Caregivers' occupation	Self-Employed	10 (18.2%)	10 (1.4%)	0.750
	Employed	13 (23.6%)	13 (1.8%)	
	Unemployed	24 (43.6%)	24 (3.2%)	
	Farming	8 (14.5%)	8 (1.1%)	
Parents' marital status	Married	39 (70.9%)	39 (5.3%)	0.507
	Divorced	6 (10.0%)	6 (0.8%)	
	Separated	10 (18.2%)	10 (1.4%)	
Fathers' education level	Primary	23 (41.8%)	23 (3.1%)	0.283
	Secondary	22 (40.0%)	22(3.0%)	
	Tertiary	10 (18.2%)	10(1.4%)	
Mothers' education level	Primary	22 (40.0%)	22(3.0%)	0.283
	Secondary	22 (40.0%)	22(3.0%)	
	Tertiary	11(10.0%)	11(1.5%)	

Data are presented as frequencies (n) and percentages (%), categorical variables were compared using Chi-square test. Significance set at $p < 0.05$

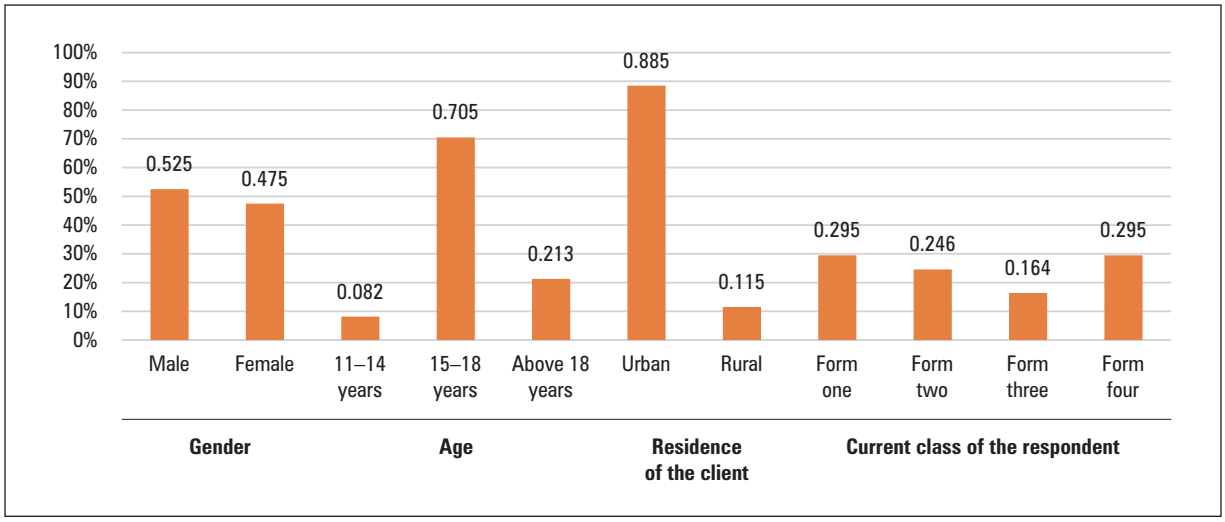

FIGURE 2. Student's socio-demographic factors cross-tabulation with myopia

neal curvature soon after puberty [16]. The finding of this study is slightly different to [3] study that was conducted in Uganda of myopia being highly prevalent in 11–14 yearsMost of the study population came from the rural area since the Kakamega county setting is mostly rural. The urban setting is located in the square radius of 10 kilometers from the town center. Most secondary schools are also found in a rural area with few schools found in the urban area. This study found that myopia was mostly prevalent in students that come from urban areas 49 (6.7%) compared to the students that come from rural areas 6 (0.8%) even though the most domiciled area was a rural area. These results are similar to a recent study [17], that found a higher prevalence of myopia in urban areas compared to the rural areas. Another study by [18] found that the prevalence of childhood myopia was lowest (6.9%) in the outer suburban region and highest (17.8%) in the inner-city region. Although the comparison of the prevalence of myopia in the two settings is difficult due to the impact of other confounding factors such as education, schooling and outdoor activities, these factors make it difficult to entirely associate the difference with the urban or rural environments alone. One suggestion for the reason for the high prevalence of myopia in urban setting has been attributed to the rise in technology and the increased usage of mobile phones, tablets, computers and televisions, especially among children and youths. This and the reduction in outdoor activities have been found to have some influence on the onset, development and progression of myopia [19]. Children in urban settings, in this era, spend less time with outdoor activities unlike children in the 1980's and early 1990's. This is due to the lack of playing grounds since most of the areas that were set aside in urban areas as children playing grounds are now high rise buildings. This has made children prefer indoor activities and indoor games instead of the outdoor games and activities [20].

The prevalence of myopia was found to increase with the older class of the respondents, from being least prevalent in lower forms to the higher prevalence in Form Four class. This can be attributed to the educational pressures in upper classes that are Forms Three and Four [21]. This can be equated to the global trends that have found myopia to be highly prevalent in those that are involved with intensive near work activities [22]. Educational pressure has been shown to have a significant relationship with myopia [23], since in order to get good grades one has to study hard which involves a lot of near related activities that have been found to sometimes have an influence on myopia [24].

CONCLUSION AND RECOMMENDATIONS

The prevalence of myopia in this study was found to be 7.5% and was higher in males as compared to females. It was also found to be more prevalent in those aged 11–15 years of age. Most of those who were found to be affected were those from urban areas and the prevalence was higher in the upper school level classes compared to those in lower classes. Although there was no association between socio-demographic (gender, age, class of respondent and place of residence) with myopia the prevalence tends to demonstrate a clear increase with age.

It is recommended that further studies be conducted on other risk factors such as near work activities, the use of new technologies and increasing time spent indoors and how they may influence myopia

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Authors' contributions

This research was undertaken for the MSc in Optometry and Vision Science degree. A.R. was the project leader responsible for the experimental and project design under the supervision of M.B. and P.C.F. AR conducted the clinical research while M.B. and P.C.F. provided guidance on study design, methodology and research procedures. A.R. was responsible for the writing of this paper with support and editorial input from M.B. and P.C.F.

Disclosures about a potential conflict of interests

I declare that there is no conflict of interest in this study.

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