Profile of Refractive Errors Among Mansoura University Students

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Running title: Mansoura University Students' Refractive Errors

Abstract

Introduction: To assess the prevalence of refractive errors, identifying the associated factors, and to correlate demographic characteristics (sex, and family history) with different types of refractive errors among Mansoura University students.

Methods: A descriptive cross-sectional study included 400 students from Mansoura university students including both practical and theoretical faculties during the year 2019.The recruited sample was attending to Students' Hospital, Mansoura University. All included students underwent measurement of uncorrected (UCVA), and the best corrected visual acuity (BCVA) in decimal notation. Cycloplegic objective refraction was measured using auto-refractometer with cyclopentolate 1% (Alcon). A questionnaire was used to detect Socio-demographic characteristics of studied students (age, gender, academic year, and residency), Medical History, comorbidities, and refractive errors history (family history of refractive error, wearing glasses/contact lenses, and duration of use).

Results: Myopia was found in (34%) of the students. The most prevalent type of myopia was low myopia (75%). Hyperopia was found in (3%) of the students. Astigmatism was found in (39%) of students. The majority of students with refractive errors were female accounted for (50.4%), while males accounted for (49.6%). The rural to urban errors prevelance was not significant (51.9%,48.1%respectively). The medical faculties showed the highest prevalence of refractive errors (34.1%), followed by Engineering, Computer science, and Education (15.5%), (14.4%) respectively.

Conclusion: The highest rates of errors among Mansoura university students were myopia and astigmatism specially at medical colleges. The profile of refractive status of that specific population needs further attention, as long-term vision impairment will face the future adult population unless specific actions are taken.

Keywards: Astigmatism, Hyperopia, Mansoura University Students, Myopia, Prevalence, Refractive Errors.

Introduction

Refraction errors (RE) constitutes the primary cause of visual affection, and considered to be the second cause of eye morbidity all over the globe.[1,2] The prevalence of such RE is increasing significantly and there is a prediction that myopic individuals will increase up to 3352 millions by the year 2050. Thus, the number of people with visual impairment due to refractive errors would be estimated at 6.8 millions.[3]

The global distribution of myopia varies, although genetics plays an important role, it does not explain the higher prevalence among younger generations specially, educated students.[4] Therefore, environmental factors are believed to have an effective role in the etiology of myopia. On the other hand, some studies reported lower myopic progression among those who have outdoor activities.[5-8] Nevertheless, there is a lack for studies that tackle the prevalence of myopia in the Middle East. Additionally, a meta-analysis study reported that the number of blind cases due to cataract (which is the primary cause for blindness) has decreased from 1990 to 2010 in the Middle East and North Africa, while blindness due to uncorrected refractive errors have drastically increased. Moreover, it was found that uncorrected refractive errors with cataract are the most effective factor causing moderate to severe visual impairment in 2010.[9]

Refractive errors in Egypt are of the major health problems that are linked to environmental risk factors such as socioeconomic level, heavy traffic, and environmental pollution. nonetheless, there are few studies demonstrating its prevalence.[10,11]

This study aimed to assess the prevalence of refractive errors, identifying the associated risk factors, and to correlate personal characteristics (age, sex and family history) with different types of refractive errors among Mansoura University students, Dakahlia governorate, Egypt.

Subjects and methods

This study was a descriptive cross-sectional study, that was carried out during the year 2019.

Target population:

The target population was Mansoura university students including both practical and theoretical faculties during the year 2019 where all recruited students were attending to Students' Hospital- Mansoura University.

Sample Size calculation:

The sample size of this study was 383 participants (at 95% confidence intervals, and 80% Study power).

The sample size was increased to 400 participants to increase the study power and account for potential drop outs.

Data were collected via a semi-structured questionnaire, which included the following:

•Socio-demographic characteristics of studied students.

•Medical History, and co morbidities.

•Assessment of Frequency of errors of refraction by Nidek-310A

The protocol of this study was approved by IRB of Mansoura UNiversity. Consent was obtained from each participant sharing in the study. Personal privacy and confidentiality were maintained through all levels of the study.

Statistical analysis

Analyzing the data was done using the Statistical Package of Social Science (SPSS) program (version 24). One-sample Kolmogorov-Smirnov test was used to test the normality of the data. Qualitative data were described using number and percent. Association between categorical variables was tested using Chi-square test, while Monte carlo test was used when expected cell count less than 5. Continuous variables were presented as mean±SD (standard deviation). P values less than 0.05 (5%) was considered to be statically significant.

Clinical Examinations

All students underwent measurement of uncorrected, and the best corrected visual acuity (BCVA) in decimal, using Nidek auto chart projector CP-670 bearing the tumbling Eopto type. Cycloplegic refraction was measured in all students using the Nidek 310-A autorefractometer, cycloplegia obtained by using cyclopentolate1%

(Alcon), twice instillation, with interval 10 minutes in between the two instillations, then the refraction was obtained 30 minutes from the last instillation. Complete ocular examination was done to assess anterior and posterior segments of the eye, using slit- lamp biomicroscopy (Slit Lamp Haag-Streit BM 900, Haag- Streit, Bern, Switzerland), and direct ophthalmoscopy (HEINE BETA 200 ophthalmoscopy, HEINE Optotechnic, Germany)

In this study spherical equivalent (SE) that based on cycloplegic refraction was used to detect refractive errors. SE was calculated by the standard formula (the algebraic sum of the dioptric powers of the sphere and half of the cylinder). Eyes of patients which found myopic in one eye and emmetropic, hyperopic or astigmatic in the fellow eye, (s) was considered myopic.

Myopia and hyperopia were defined as a SE equal to or worse than-0.5 D and +0.5 D, respectively, Myopes were further divided into three refractive error sub-groups (that were based on their refractive SE); low myopia (SE between- 0.50 and - 2.99 D), moderate myopia (SE between -3.00 and -5.99 D), and high myopia SE (SE $\geq$ - 6.00 D). Hyperopes were also divided into three refractive error sub-groups (that were based on their refractions SE); low hyperopia (SE between 0.00 to +3.00D), moderate hyperopia (SE between +3.12 to +4.99D) and High hyperopia (SE $\geq$ + 5.00 D). Astigmatism was defined as a cylinder power worse than 0.5 D. Anisometropia was defined as a SE difference of at least 1D between two eyes. Amblyopia is considered if there was a unilateral or bilateral BCVA of 0.6 decimal or less, or if there was at least two visual acuity lines difference between the two eyes without detected

any ocular pathology. Amblyopic depth is classified as mild (from1.00 to 0.50 decimal), moderate (from 0.50to 0.25 decimal), and severe amblyopia (worse than 0.25 decimal).

Results

Socio-demographic data and clinical characteristics are shown in (table1), the study included 400 students who attended to Students hospital. As regards age, mean (SD) age of students was 20.35 (1.21) ranged from 18 to 23 years old. 48 % of them were males and 52% were females, 48.5% from urban residence and 51.5% from rural areas.

As regards distribution of students according to colleges, 129 students (32.2%) were from medical colleges, 13 (3.2%) from Science, 66 (16.5%) from Engineering, and Computer science, 37 (9.2%) from Commerce, 19 (4.8%) from Agriculture, 60 (15.0%) from Education, Educational Quality, Kindergarten, and Sport education, 40 (10.0%) from Literature, 32 (8.0%) from Law and 4 (1.0%) from Tourism and Hotels.

Sixteen students had an ocular problem; one of them optic atrophy, 5 students had left eye amblyopia, 3 students had right eye amblyopia, and 7 students had bilateral amblyopia. Also, the studied sample included 211 students (52.8%) were wearing spectacles for correction of refractive errors, 53 students (13.25%) were prescribed for wearing spectacles for 1st time and 136 (34%) with no refractive error where the median duration for wearing spectacles was 5 years. As regards the parental history there were 267 (66.8%) students with negative history, 107 students (26.8%) with one parent wearing spectacles and 26 (6.5%) with both parents wearing spectacles.

Table (1): Socio-demographic data and clinical characteristics among the studied students

Socio-demographic data clinical characteristics	Study group (n=400)
Age/years Mean ± SD Min-Max	
	20.35±1.21
	18.0-23.0
Gender Male Female	
	192(48.0%)
	208(52.0%)
Residence Urban Rural	
	194(48.5%)
	206(51.5%)
College Medical*	
Science	129(32.2%)
Engineering	13(3.2%)
Computer information	66(16.5%)
Education*	60(15.0%)
Literature	40(10.0%)
Commerce	37(9.2%)
Agriculture	19(4.8%)
Law	32(8.0%)
Tourism and Hotels	4(1.0%)
Academic year	
1st year	56(14.0%)
2nd year	129(32.2%)
3rd year	115(28.8%)
4th year	68(17.0%)
5th year	25(6.2%)
6th year	7(1.8%)
Systemic disease	
Free	393(98.2%)
Diabetic	6(1.5%)
Rheumatoid arthritis	1(0.3%)
Ocular problem	
No	384(96%)

L.t amblyopia	5(1.2%)
Rt. amblyopia	3(0.8%)
Bilateral amblyopia	7(1.8%)
Optic atrophy	1(0.3%)
Wearing spectacles	
Yes	211(52.8%)
No (1st spec.)	53(13.25%)
No (with no refractive error)	136(34%)
Duration of wearing spectacles	
Median (Min-Max)	5.0(1.0-14.0)
Parent's history	
Negative	267(66.8%)
One parent	107(26.8%)
Both parents	26(6.5%)

***Medical colleges** include (medicine, pharmacy, dentist, veterinary and nursery) **Education colleges** include (Education, Educational Quality, Kindergarten education, and Sport education)

Refractive errors: the overall prevalence of refractive errors in this study was 264 (66%) of the recruited students, among whom;136 (51.5%) students were myopic,12 (4.6%) were hyperopic, and 116 (43.9%) were astigmatic. Moreover, 36 (9.2%) students suffered from anisometropia. Table (2), shows details of the prevalence of refractive errors among the study group,

Table (2): Prevalence of error of refractions among the study group

Error of refraction	Study group (n=400)
Error of refractions Refractive errors Emmetrope	**264(66%)**
	136(34%)
Myopic	**136(51.5%)**
Mild	102(75%)
Moderate	31(22.8%)
Sever	3(2.2%)
Hyperopic	**12(4.6%)**
Astigmatism	**116(43.9%)**
Anisometropia	37(9.2%)

According to the age, among the 264 students with refractive errors, the majority of refractive errors were recorded at 20 years old in 82 students (31.1%), followed by 21 years old (23.1%), while most of the students with refractive errors were females that accounted for (50.4%), and males (49.6%). There was no significant difference in refractive error prevelance between rural residence (206 students) and urban residence (194 students). The medical faculties accounted for the highest prevalence of refractive errors (34.1%), followed by Engineering, Computer science and

Education (15.5%), and (14.4%) respectively, (figure1) shows prevalence of refractive errors among different Faculties, while (figure 2) shows prevalence of different types of refractive errors among different Faculties. In terms of the academic year, the prevalence of refractive errors was higher in the 2nd, and 3rd year that accounted for (30.3%), (29.9%) respectively. Table (3) shows relation between refractive errors and students 'characteristics.

Prevalence of myopia:

Among the 264 students with refractive errors, myopia was detected in 136 students with a prevalence of 34% from the studied sample. Further categoriztion, according to the grade of myopia showed that; low myopia was the most prevalent subtype which accounted for (75%) from the total myopic students followed by moderate myopia (22.79%), and high myopia which represented only (2.2%), the prevalence of myopia was higher in the medical faculties (36%) from the total myopic students, and myopia was more prevalent in female (60.9%) than males (42%).

Prevalence of hyperopia:

Among the 264 students with refractive errors, hyperopia existed in 12 students only with a prevalence of 3% from the studied sample, while the hyperopia was more prevalent in male (5.3%) than females (3.8%).

Prevalence of astigmatism:

Among the 264 students with refractive errors, astigmatism existed in 116 students with a prevalence of 29 % out of the studied sample. The prevalence of astigmatism was higher in the medical faculties (31%) from the total astigmatic students.

Table (3): Relation between refractive errors and students 'characteristics

| Students' characteristics	Total refractive error(n=264)	Total Myopic (n=136)	Myopic			Hyperopic (n=12)	Astigmatism (n=116)	P value
			Low (n=102)	Moderate (n=31)	High (n=3)			
Age/years								
18-	14(5.3%)	8(57.1%)	7(50%)	1(7.1%)	0(0%)	1(7.1%)	5(35.7%)	
19-	50(18.9%)	30(60%)	20(40%)	9(18%)	1(2%)	3(6%)	17(34%)	0.764 0.281
20-	82(31.1%)	42(51.2%)	30(36.6)	11(13.4)	1(1.2%)	5(6.1%)	35(42.7%)	0.713 0.411
21-	61(23.1%)	34(55.7%)	28(45.9)	5(8.2%)	1(1.6%)	1(1.6%)	26(42.6%)	0.082 0.704
22-	46(17.4%)	17(37%)	12(26.1)	5(10.9%)	0(0%)	2(4.3)	27(58.7)	
23y	11(4.2%)	5(45.5%)	5(45.5%)	0(0%)	0(0%)	0(0%)	6(54.5%)	
Gender								
Male	131(49.6%)	55(42%)	46(35.1)	8(6.1%)	1(0.8%)	7(5.3%)	69(52.7%)	0.009*
Female	133(50.4%)	81(60.9%)	56(42.1)	23(17.3)	2(1.5%)	5(3.8%)	47(35.3%)	
Residence								
Urban	127(48.1%)	69(54.3%)	51(40.2)	16(12.6)	2(1.6%)	5(3.9%)	53(41.7%)	0.666
Rural	137(51.9%)	67(48.9%)	51(37.2)	15(10.9)	1(0.7%)	7(5.1%)	63(46%)	
Faculties								
Medical	90(34.1%)	49(54.4)	37(41.1)	11(12.2)	1(1.1%)	5(5.6%)	36(40%)	
Science	11(4.2%)	9(81.8%)	7(63.6%)	2(18.2%)	0(0)	0(0%)	2(18.2)	
Engineering	41(15.5%)	20(48.8)	16(39%)	4(9.8%)	0(0%)	1(2.4%)	20(48.8%)	0.608 0.141
☐Computer	38(14.4%)	19(50%)	14(36.8)	4(10.5%)	1(2.6%)	0(0%)	19(50%)	0.698 0.308
Education	23(8.7%)	9(39.1%)	7(30.4%)	2(8.7%)	0(0%)	2(8.7%)	12(52.2%)	0.321 0.076
Literature	24(9.1%)	9(37.5%)	8(33.3%)	0(0%)	1(4.2%)	3(12.5%)	12(50%)	0.623 0.564
Commerce	13(4.9%)	6(46.2%)	4(30.8%)	2(15.4%)	0(0%)	0(0%)	7(53.8%)	
Agriculture	24(9.1%)	15(62.5)	9(37.5%)	6(25%)	0(0%)	1(4.2%)	8(33.3%)	
Academic year								
1styear	33(12.5%)	17(51.5%)	14(42.4)	3(9.1%)	0(0)	2(6.1%)	14(42.4%)	
2ndyear	80(30.3%)	44(55%)	28(35%)	14(17.5)	2(2.5%)	6(7.5%)	30(37.5%)	0.900 0.169
3rdyear	79(29.9%)	46(58.2%)	39(49.4)	7(8.9%)	0(0%)	2(2.5%)	31(39.2%)	0.303 0.458
4thyear	46(17.4%)	20(43.5%)	15(32.6)	4(8.7%)	1(2.2%)	2(4.3%)	24(52.2%)	0.03*
5thyear	21(8.0%)	6(28.6%)	3(14.3%)	3(14.3%)	0(0%)	0(0%)	15(71.4%)	1.0
6thyear	5(1.9%)	3(60%)	3(60%)	0(0%)	0(0%)	0(0%)	2(40%)	
Parent's history								
Negative	180(68.2%)	90(33.7%)	67(37.2)	22(12.2)	1(0.6%)	7(3.9%)	83(46.1%)	
One parent Both	67(25.4%)	39(58.2%)	28(41.8)	9(13.4%)	2(3%)	4(6%)	24(35.8%)	0.498 0.282
parents	17(6.4%)	7(41.2%)	7(41.2%)	0(0%)	0(0%)	1(5.9%)	9(52.9%)	0.767
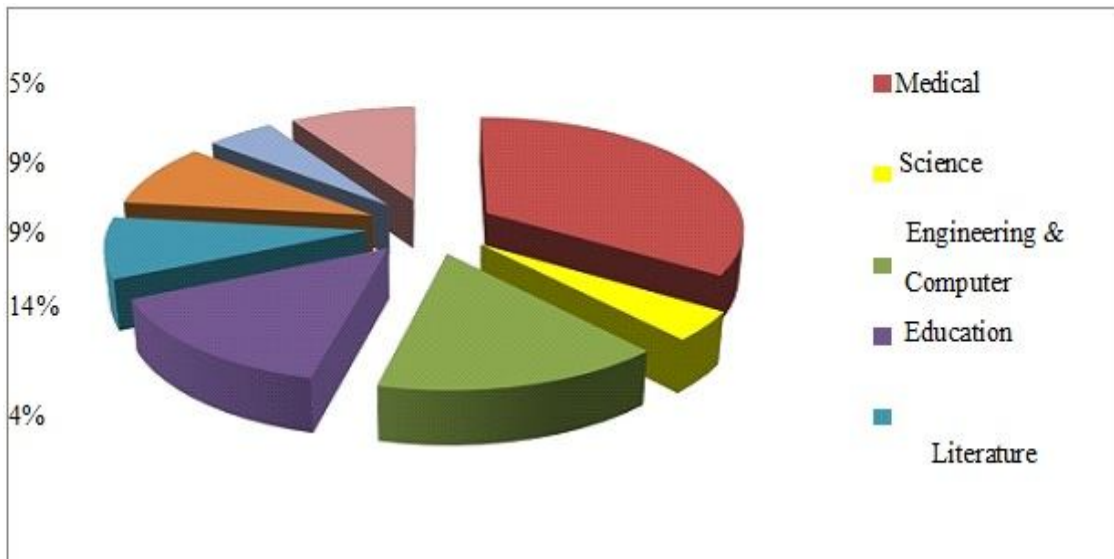
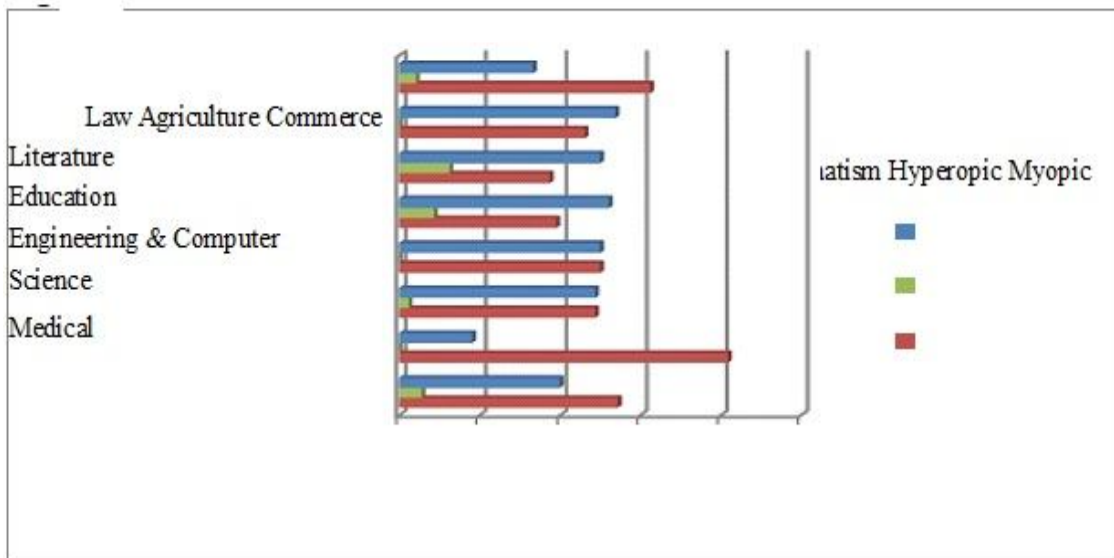Figure (1): Prevalence of refractive errors among different Faculties

Figure (2): Prevalence of different refractive errors among faculties

Discussion

This study was performed on a large-scale data on errors of refraction among Mansoura University students in Egypt. The overall prevalence of refractive errors was 66%, among that myopia and astigmatism represented 51.5 % and 43.9% respectively. compared to another university-based study conducted in Assiut University in Upper Egypt, the prevalence of refractive error was only

10.46 % among those, astigmatic subjects represented 80.72% of them compared to only 16.81 % for myopia.[11] That difference may be explained by the time when that study was held, as it was in 2015 where several studies reported that the prevalence of refractive errors,especially myopia, has increased recently.[1,3]

In the middle east, the total prevalence of myopia (34%), and hyperopia (3%) in the current study were lower

than that reported in Saudi college students [13]. The prevalence of myopia was (47.9%), while that of hyperopia was (6.5%). In another study on medical college students[14], the prevalence of myopia was estimated at (53.7%), where hyperopia was estimated at (3.7%). Although their definitions of both myopia and hyperopia were higher than ours SE ≤ 0.75, SE ≥ 1.0 respectively.

That difference might be due to the fact that refraction in Saudi students was done using non-cycloplegic refraction, where a number of studies have demonstrated that the non-cycloplegic refraction may overestimate the prevalence of myopia.[15-18] therefore, in the current study we used the cycloplegic refraction. This was supported by another study made on Turkish medical students, where the prevalence of myopia was 32.9% and that of hyperopia was 16.9%. In that study, the authors used cycloplegic refraction by tropicamide on whole subjects and their cut off values of myopia was defined as SE ≤0.75 D[19] different than ours which was SE < 0.5.

However, hyperopia was consistent with our findings which was SE > 0.5, also in another study on Iranian college students aged 18-19 years old, the prevalence of myopia, hyperopia, and astigmatism were (42.22%), (5.55%) and (32.22%), respectively[20] , the authors used first a non-cycloplegic autorefraction, that was followed by a non-cycloplegic refraction using a retinoscope. Finally their results were quite similar to ours, especially in the prevalence of astigmatism as our prevalence was 31.3%, on the other hand the prevalence of astigmatism in this study was completely different from the referred to study on Medical Students of Saudi Arabia.[14] The authors reported a prevalence of 1.2% only, may be that goes back to their definition of astigmatism (cylinder power ≥ 1.0)which may explainthat difference. Another meta-analysis study on Iranian University students defined astigmatism as a cylinder power > 0.5 D.[20] Iranian made·[21] The estimated pool prevalence of astigmatism was variable according to WHO regions; in adults, the highest estimated pool prevalence of astigmatism was in

America (45.6%), and the lowest estimated pool prevalence was found in Africa (11.4%),

While South-East Asia the pool prevalence of astigmatism was estimated at (44.8%). moreover, some studies explained that high prevalence may be related to the characteristic palpebral fissure and eyelid shape in this community.[22] The high prevalence of astigmatism in the current study might be due to astigmatism which highly correlated with myopia. Myopia by its turn was assoaied with higher education, hence it is expected to have that high prevalence among University students.[23] However, some studies relate astigmatism to incycotorsion that occurs in the eye during near work.[24]

Myopia considered as a public health problem (especially in East Asian countries), different studies have described the mechanism of developing myopia as; increasing the lens thickness, also the pressure on the globe performed by the ciliary muscle, all wall increase the axial length during accommodation. Optical changes that occur during accommodation such as (increased accommodative lag or increased higher order aberration) also can change the thickness of the choroid, that may all lead to axial length changes during near work.[25] additionally, myopic patients are usually more interested in performing near work, (with modern life style and the excessive use of computers for daily activities), accordingly, the engagement in outdoor activities have been decreased.[26-28] Several number of studies provided evidence on the effect of outdoor activity on decreasing myopia.[28-32] Also it has been reported that the severity of myopia is associated with the level of educational attainment.[33-35]

According to our results, the medical faculties were associated with the highest prevalence of myopia (36%). These findings are in agreement with Singapore medical students study[36] and medical students of Saudi Arabia study.[14] this supports the fact that myopia is not only a genetic disorder but is also influenced by environmental

factors, which may have led to the development and progression of myopia.[37,38]

The prevalence of myopia in the current study was lower than that reported in university students' studies of Denmark and thr United States,[39,40] while it is consistent with other reported studies from Europe, such as those in Portuguese university science students[41], and Spain.[42] It is possible that differences in prevalence of myopia across different countries may be related to ethnic variations, and different genetic predispositions. However, this study did not demonstrate any statistically significant association with familial myopia.

In this study the prevalence of hyperopia was 3%, which was lower than its prevalence among the Iranian university students 7.8 % [(43)] Norwegian university students[44,] Portuguese university students[41] and Chines university student[45] denoting that hyperopia is not prevalent in the Egyptian students.

Among the studied group there were 13% of total students with undiagnosed refractive error with the first time to prescribe spectacle while there were 52.8% students already wearing spectacles for a duration ranging from 1 to14 years with a median of 5 years denoting that among the Egyptian students, the refractive errors usually presents in high school students which is also associated with the increased demand to perform near vision activities.

In the present study, the prevalence of refractive errors among the students from rural area was estimated at 51.9% which is slightly exceeding that among students from urban areas (48.1%). This may be due to the fact that rural students spend more time on near work indoor activities.[46]

In our study females were associated with greater myopia risk, this agrees with the literature. Some studies attempted to provide plausible explanation to that as females may spend more time on near work activities rather than outdoor activities.[46-48]

Our study provided detailed data on the prevalence and associations of refractive errors among the Egyptian university students. The obvious strength of our study was to explore a relatively large number of subjects with a standardized methodology, and the use of cycloplegic refraction. The study limitation was that, the parental refractive error history was subjectively obtained via a questionnaire.

In conclusion, the present study revealed that the prevalence of myopia and astigmatism among Egyptian university students are relatively high. There is a need to attract more attention to such high prevalence to avoid the icrease of visual impairment prevalence due to refractive errors on the long term.

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Ethics declarations

Conflict of interest

Tharwat H. Mokbel, Ahmad Mousa, Eman Elhefney, Manal Kasem, Marwa ElKhattabi, Shereen A.AbdAllah, Ahmed Alnagdy, Doaa Shokry, all authors have no conflicts of interest that are directly relevant to the content of this review.

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