ORIGINAL ARTICLE

Prevalence of Refractive Errors among Medical Students at University of Tabuk, Saudi Arabia

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ABSTRACT

Objectives: **To assess the prevalence of refractive errors and their types among medical students at the University of Tabuk, Saudi Arabia.**

Design: **A quantitative, cross-sectional, descriptive study using self-administered electronic questionnaires.**

Materials and Methods: **We conducted our study among medical students and interns that included 325 participants at the University of Tabuk using a self-administered questionnaire that contains demographics and an assessment of refractive errors. Results were stratified according to gender, age group, and academic year.**

Results: **Around half of the participants wear eyeglasses. 43.2% of the females are myopic, while 30.6% of males have myopia. Hypermetropia was found in 7.7% of females and 6.4% of males. Astigmatism was reported in 13.5% of females and 16.8% of males.**

Discussions: **The percentage of students with eyeglasses at University of Tabuk is higher than in Al-Kharj. Compared with students at Jazan University, our results showed a comparable proportion of myopia, a lower percentage of hypermetropia, and a higher percentage of astigmatism.**

Conclusions: **Refractive errors were documented in many medical students at the University of Tabuk. Further studies regarding visual impairment among undergraduates are needed to identify the associated risk factors so preventive methods can be applied.**

KEY WORDS

myopia, hypermetropia, astigmatism

INTRODUCTION

Refractive error is a significant cause of vision impairment and blindness that can be avoided. Reduced eyesight in adulthood can impact academic performance, career choice, and socioeconomic status[1)].

People with age-related eye problems were no more likely to have impaired daily activities or instrumental activities of daily living. People who had problems reading small print or recognizing people across the street were more likely to have an age-related eye condition after controlling for present visual acuity and the number of comorbidities[2)].

Computers and visual display terminals have become indispensable elements of our daily lives. Smartphones, tablets, electronic book readers, and computers, collectively known as digital devices, have expanded dramatically in recent years, resulting in many ocular and visual complaints connected to their use, commonly recognized as digital eye strain or computer vision syndrome. Eye strain, headaches, blurred vision, and neck or shoulder pain are common symptoms, which often worsen with the amount of video display terminal[3)].

A refractive change toward myopia was linked with time spent reading scientific literature and younger age, although physical activity was inversely connected with a refractive change toward myopia. Myopic eyes improved much faster than emmetropic or hyperopic eyes[4)].

Previous studies with large sample sizes found myopia in 86.8% based on self-reported myopia status, with no statistically significant difference in myopia prevalence across gender[5)]. A transcultural study from the Middle East, Asia, Africa, America, and Europe found that:

Received on December 26, 2022 and accepted on January 9, 2023

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Table 1: Prevalence of Vision Acuity Related Problems among University Students in Tabuk, according to gender

	Questionnaire questions	Response	Female	Male	p-value
Q1	**Do you wear sight correction glasses?**	No	48.4%	52.6%	0.257
		Yes	51.6%	47.4%	
Q2	**Do you wear sight correction contact lenses?**	No	75.5%	94.2%	< 0.001*
		Yes	24.5%	5.8%	
Q3	**Are you able to recognize people's faces without glasses/lenses?**	No	26.5%	31.2%	0.204
		Yes	73.5%	68.8%	
Q4	**Do you have blurred vision?**	No	66.5%	68.8%	0.369
		Yes	33.5%	31.2%	
Q5	**Do you have difficulty recognizing colors?**	No	96.1%	94.2%	0.295
		Yes	3.9%	5.8%	
Q6	**Do you have difficulty to see distant objects?**	No	46.5%	48.0%	0.434
		Yes	53.5%	52.0%	
Q7	**Do you have difficulty seeing (such as reading street signs) while driving?**	No	65.8%	59.5%	0.145
		Yes	34.2%	40.5%	
Q8	**Do you struggle to recognize faces and numbers while watching TV?**	No	60.6%	67.1%	0.137
		Yes	39.4%	32.9%	
Q9	**Do you have difficulty reading magazines or lowercase letters in general?**	No	69.7%	74.6%	0.194
		Yes	30.3%	25.4%	
Q10	**Does dim light affect your ability to read?**	No	50.3%	62.4%	0.018*
		Yes	49.7%	37.6%	
Q11	**Do you find it difficult to engage recreational activities as video games?**	No	81.3%	80.3%	0.470
		Yes	18.7%	19.7%	
Q12	**Do you have visual difficulty moving around the house? Such as climbing stairs.**	No	88.4%	89.0%	0.497
		Yes	11.6%	11.0%	
Q13	**Are you able to take care of yourself with your current vision?**	No	10.3%	17.3%	0.047*
		Yes	89.7%	82.7%	
Q14	**Do you suffer from myopia or hypermetropia?**	Myopia	43.2%	30.6%	0.074
		Hypermetropia	7.7%	6.4%	
		I don't suffer	35.5%	48.0%	
		I don't know	13.5%	15.0%	
Q15	**Do you have astigmatism?**	No	72.9%	68.2%	0.627
		Yes	13.5%	16.8%	
		I don't know	13.5%	15.0%	

*Statistically significant results (p-value < 0.05)

Headaches and burning sensations in the eyes were the most prevalent visual issues reported by computer users. Nearly 72% of students said their computer work was frequently interrupted. Headaches caused 43.85 percent of the students to miss classes. The prevalence of headaches dropped by 38% when the screen was seen from a distance of more than 50 cm. The prevalence of weary eyes has risen[6].

Regarding refractive errors, a study in Jazan, Saudi Arabia, reported the prevalence of refractive errors in medical students to be 48.8%[7]. Another study on undergraduate students in Al-Kharj, Saudi Arabia, found that 83% of the students have refractive errors[8]. Globally, a study in China found that nearly two-thirds of students reported visual disturbance due to refractive errors when examining the two eyes[9]. In Taiwan, refractive errors were reported in more than one-third of students with disabilities, and 22.8% had visual function limitations[10].

The current study aimed to assess the prevalence of refractive errors and their different types, and the effect of refractive errors on daily activities among medical students at the University of Tabuk, Saudi Arabia

MATERIALS AND METHODS:

Design and Subjects:

It is a cross-sectional study conducted among medical students at the University of Tabuk from August to October 2021. The sample size was 331, with a confidence level of 95% and a margin of error of 5%. A simple random sampling technique was applied to select the participants. We included male and female medical students from the University of Tabuk, 18 years and older. The students were from 1st year until the internship. A self-administered questionnaire was used for data collection. It contains questions that include demographic characteristics and an assessment of any visual problems.

Sample Size Calculation

The total number of students in the faculty of medicine at the University of Tabuk was expected to be 730. The sample size, as for cross-sectional studies, was calculated using Kish, L. 1965 formula: n = (Z1-α) 2 (P (1-P)/ D2. Where Z1-α = Z0.95 = 1.962 (from the normal

Table 2: Prevalence of Vision Acuity Related Problems among University Students in Tabuk, according to age groups

	Questionnaire questions	Response	19-20	21-22	23-24	> 24	p value
Q1	**Do you wear sight correction glasses?**	No	61.7%	47.1%	50.9%	38.0%	0.055
		Yes	38.3%	52.9%	49.1%	62.0%	
Q2	**Do you wear sight correction contact lenses?**	No	91.4%	78.8%	87.5%	82.0%	0.107
		Yes	8.6%	21.2%	12.5%	18.0%	
Q3	**Are you able to recognize people's faces without glasses/lenses?**	No	18.5%	27.1%	34.8%	36.0%	0.057
		Yes	81.5%	72.9%	65.2%	64.0%	
Q4	**Do you have blurred vision?**	No	80.2%	61.2%	68.8%	56.0%	0.014*
		Yes	19.8%	38.8%	31.3%	44.0%	
Q5	**Do you have difficulty recognizing colors?**	No	95.1%	90.6%	99.1%	94.0%	0.052
		Yes	4.9%	9.4%	0.9%	6.0%	
Q6	**Do you have difficulty to see distant objects?**	No	60.5%	42.4%	43.8%	42.0%	0.055
		Yes	39.5%	57.6%	56.3%	58.0%	
Q7	**Do you have difficulty seeing (such as reading street signs) while driving?**	No	72.8%	63.5%	60.7%	48.0%	0.039*
		Yes	27.2%	36.5%	39.3%	52.0%	
Q8	**Do you struggle to recognize faces and numbers while watching TV?**	No	74.1%	65.9%	61.6%	50.0%	0.041*
		Yes	25.9%	34.1%	38.4%	50.0%	
Q9	**Do you have difficulty reading magazines or lowercase letters in general?**	No	79.0%	76.5%	69.6%	60.0%	0.081
		Yes	21.0%	23.5%	30.4%	40.0%	
Q10	**Does dim light affect your ability to read?**	No	60.5%	55.3%	58.9%	48.0%	0.510
		Yes	39.5%	44.7%	41.1%	52.0%	
Q11	**Do you find it difficult to engage recreational activities as video games?**	No	87.7%	78.8%	78.6%	78.0%	0.351
		Yes	12.3%	21.2%	21.4%	22.0%	
Q12	**Do you have visual difficulty moving around the house? Such as climbing stairs.**	No	92.6%	88.2%	86.6%	88.0%	0.624
		Yes	7.4%	11.8%	13.4%	12.0%	
Q13	**Are you able to take care of yourself with your current vision?**	No	7.4%	16.5%	17.9%	12.0%	0.179
		Yes	92.6%	83.5%	82.1%	88.0%	
Q14	**Do you suffer from myopia or hypermetropia?**	Myopia	21.0%	34.1%	44.6%	48.0%	0.004*
		Hypermetropia	12.3%	8.2%	2.7%	6.0%	
		I don't suffer	56.8%	42.4%	36.6%	30.0%	
		I don't know	9.9%	15.3%	16.1%	16.0%	
Q15	**Do you have astigmatism?**	No	82.7%	70.6%	66.1%	60.0%	0.099
		Yes	7.4%	14.1%	17.9%	24.0%	
		I don't know	9.9%	15.3%	16.1%	16.0%	

*Statistically significant results (p-value < 0.05)

distribution table. This value is standard). P = prevalence of factor under study (50%), D = the precision (0.05 = 5%). Therefore, the calculated sample size will be = (1.962)2 (0.5(1-0.5) = 330.94. So, the estimated sample size was 330 participants.

Statistical Analysis

The Statistical Package for Social Sciences (SPSS, IBM, version 23, New York) was used for data analysis. The data were presented as percentages or means and SD unless otherwise specified. The Chi-square test was used to compare parameters of vision according to gender (male and female), age group (four groups: 19-20 years, 21-22 years, 23-24 years, and > 24 years), and academic year (four groups: 1st and 2nd, 3rd and 4th, 5th and 6th, and interns).

RESULTS

Our study documented the responses of the participating medical students and stratified the responses according to gender (Table 1), and we found a few statistically significant associations. For example, 24.5% of female students wore contact lenses, whereas only 5.8% of male students wore contact lenses (p-value = < 0.001). Additionally, 50% of the female students stated that dim light affects their reading ability; however, 38% of the male students responded that their reading is affected by dim light (p-value = 0.018).

Table 2 demonstrates the participants' responses to the questions stratified by age group. Statistically significant associations were found when students were asked the following questions: Do you have blurred vision? Participants who answered YES were 19.8% of the 19-20 years group, 38.8% of the 21-22 years, 31.3% of the 23-24 years, and 44% of the participants over 24 years old (p-value = 0.014). More than half of the participants whose ages are more than 24 years answered YES (52%) about having difficulty seeing, like reading signs, while driving. In contrast, most participants in the other age groups responded with NO (72.8%, 63.5%, and 60.7% for the age groups of 19-20, 21-22, and 23-24, respectively) with a p-value of 0.039. The question (Do you struggle to recognize faces and numbers while watching TV?) responses were as follows; 50% of the participant more than 24 years old responded with YES, and most of the participants from the other age groups answered with NO, 74.1% of the 19-20 years, 65.9% of the 21-22 years, and 61.6% of the 23-24 years age group. (p-value = 0.041). Regarding the direct question about being diagnosed with any refractive errors (Do you have myopia or hypermetropia?), 21% of the 19-20 years age group participants are myopic, 34.1% of the 21-22 years have myopia, 44.6%

Table 3: Prevalence of Visual Acuity-Related Problems among University Students in Tabuk, according to the academic year

	Questionnaire questions	Response	1st & 2nd	3rd & 4th	5th & 6th	Interns	p value
Q1	**Do you wear sight correction glasses?**	No	61.7%	43.9%	51.9%	37.5%	0.061
		Yes	38.3%	56.1%	48.1%	62.5%	
Q2	**Do you wear sight correction contact lenses?**	No	90.1%	78.0%	88.9%	93.8%	0.033*
		Yes	9.9%	22.0%	11.1%	6.3%	
Q3	**Are you able to recognize people's faces without glasses/lenses?**	No	19.8%	39.8%	20.4%	50.0%	0.001*
		Yes	80.2%	60.2%	79.6%	50.0%	
Q4	**Do you have blurred vision?**	No	76.5%	56.9%	74.1%	62.5%	0.009*
		Yes	23.5%	43.1%	25.9%	37.5%	
Q5	**Do you have difficulty recognizing colors?**	No	95.1%	94.3%	96.3%	93.8%	0.905
		Yes	4.9%	5.7%	3.7%	6.3%	
Q6	**Do you have difficulty to see distant objects?**	No	59.3%	40.7%	46.3%	43.8%	0.073
		Yes	40.7%	59.3%	53.7%	56.3%	
Q7	**Do you have difficulty seeing (such as reading street signs) while driving?**	No	76.5%	52.0%	64.8%	56.3%	0.004*
		Yes	23.5%	48.0%	35.2%	43.8%	
Q8	**Do you struggle to recognize faces and numbers while watching TV?**	No	79.0%	54.5%	66.7%	43.8%	0.001*
		Yes	21.0%	45.5%	33.3%	56.3%	
Q9	**Do you have difficulty reading magazines or lowercase letters in general?**	No	81.5%	64.2%	74.1%	75.0%	0.054
		Yes	18.5%	35.8%	25.9%	25.0%	
Q10	**Does dim light affect your ability to read?**	No	61.7%	48.8%	61.1%	62.5%	0.168
		Yes	38.3%	51.2%	38.9%	37.5%	
Q11	**Do you find it difficult to engage recreational activities as video games?**	No	87.7%	69.9%	85.2%	100.0%	0.001*
		Yes	12.3%	30.1%	14.8%	0.0%	
Q12	**Do you have visual difficulty moving around the house? Such as climbing stairs.**	No	93.8%	81.3%	91.7%	100.0%	0.008*
		Yes	6.2%	18.7%	8.3%	0.0%	
Q13	**Are you able to take care of yourself with your current vision?**	No	7.4%	14.6%	17.6%	18.8%	0.220
		Yes	92.6%	85.4%	82.4%	81.3%	
Q14	**Do you suffer from myopia or hypermetropia?**	Myopia	21.0%	40.7%	39.8%	62.5%	0.007*
		Hypermetropia	12.3%	6.5%	3.7%	6.3%	
		I don't suffer	54.3%	35.0%	44.4%	18.8%	
		I don't know	12.3%	17.9%	12.0%	12.5%	
Q15	**Do you have astigmatism?**	No	79.0%	64.2%	72.2%	62.5%	0.290
		Yes	8.6%	17.9%	15.7%	25.0%	
		I don't know	12.3%	17.9%	12.0%	12.5%	

*Statistically significant results (p-value < 0.05)

of the 23-24 years are myopic, and the highest percentage of myopia was in the participants who are older than 24 years (48%). Regarding hypermetropia, the highest proportion was in the 19-20 years group with 12.3%, then the 21-22 years with 8.2%, followed by 6% of the >24 years and 2.7% of the 22-23 years participants. These are also statistically significant associations (p-value = 0.004).

In table 3, we classified the participants according to their academic level in medical school into four groups, 1st and 2nd year, 3rd and 4th year, 5th and 6th year, and the interns. We documented eight statistically significant associations found according to the participants' responses to the following questions: *Do you wear sight correction contact lenses?* 22% of the 3rd and 4th years students wear contact lenses, 11.1% of the 5th and 6th years group, 9.9% of the 1st and 2nd years, and the lowest percentage was in the interns (6.3%) (p-value = 0.033); *If you are a glasses/lenses wearer, are you able to recognize people's faces without glasses/lenses*? The majority of the 1st and 2nd years group and 5th and 6th years group answered YES, around 80% in both groups. 60% of the 3rd and 4th years groups recognize faces without glasses/lenses, but only 50% of the interns answered YES to this question (p-value = 0.001); *Do you have blurred vision?* Among the 1st and 2nd year medical students, 23.5% currently complain of blurred vision, 43.1% of the 3rd and 4th years group, 25.9% of the 5th and 6th year students, and 37.5% of the interns have blurred vision (p-value = 0.009); *Do you have difficulty seeing while driving?* 23.5% of 1st and 2nd years find difficulties seeing while driving, 48% of the 3rd and 4th years, 35.2% of the 5th and 6th years, and 43.8% of the interns (p-value = 0.004); *Do you struggle to recognize faces and numbers while watching TV?* 21% of the 1st and 2nd year group said yes, 45.5% of the 3rd and 4th year group, 33.3% of the 5th and 6th year group, and 56.3% of the interns struggled to recognize faces and numbers on TV. (p-value = 0.001); *Do you find it difficult to engage in recreational activities such as video games?* None of the interns found difficulties engaging in recreational activities such as video games; 12.3% of the 1st and 2nd years students have difficulties, 14.8% of the 5th and 6th years group, and 30.1% of the 3rd and 4th years students also answered yes to this question (p-value = 0.001); *Do you have visual difficulty moving around the house, such as climbing stairs?* The interns have no difficulties moving around the house and climbing stairs. In contrast, 18.7% of the 3rd and 4th years group have this difficulty, 8.3% of the 5th and 6th years students, and 6.2% of the 1st and 2nd years (p-value = 0.008); *Do you suffer from myopia or hypermetropia?* Around two-thirds of the interns are myopic (62.5%), whereas 21% of the 1st and 2nd years, 40.7% of the 3rd and 4th years, and 39.8% of the 5th and 6th years are myopic. Also, 12.3% of the 1st and 2nd years students have hypermetropia, 6.5% of the 3rd and 4th years, 3.7% of the 5th and 6th years, and 6.3% of the interns as well (p-value = 0.007).

DISCUSSION

In this study, 325 participants were screened to determine the prevalence of refractive errors among medical students. We found that age, gender, and educational level were closely associated with refractive errors and that most participants wore spectacles to correct their refractive errors.

Spectacles wearing

In our study, we found that 51.6% of female students and 47.4% of male students wore spectacles, while 25% of students at Al-Kharj used spectacles[8]. In contrast, a study in China reported that 69.8% of their students wore spectacles[9]. Additionally, in Taiwan, 34.8 % of the students wore spectacles[10].

Myopia

The literature suggests that myopia is the most common type of refractive error worldwide. Our study found that 43.2 % of female and 30.6% of male students had myopia. In Jazan, around one-third (33.8%) of the 447 medical students tested had myopia[7]. In comparison, 20% of students in Taiwan had myopia[10].

Hypermetropia

Our study found that 7.7% of female and 6.4% of male students had hypermetropia. While in Jazan, 10.5% of their students are hypermetropic[7] However, 16 % of Taiwanese students had hypermetropia[10].

Astigmatism

In our study, 13.5% of female students and 16.8% of male students had astigmatism. While at Jazan University, 10.5% of their students have astigmatism[7].

CONCLUSION

Refractive errors are significant and preventable causes of vision impairment. Our study reports that refractive errors were documented in many medical students at the University of Tabuk. Thus, additional research regarding visual impairment in undergraduate students is warranted to further identify the associated risk factors so preventive methods can be applied.

ACKNOWLEDGEMENTS

The authors are grateful to the students who participated in this study.

ETHICAL STATEMENT

The research ethics committee, with the vice-deanship of postgraduates and scientific research, approved the study at the University of Tabuk.

INFORMED CONSENT

At the beginning of the electronic questionnaire, informed consent was included in addition to a description of the study objectives.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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