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Research Article

The Prevalence and Risk Factors of Myopia among Medical Students of King Saud University, Riyadh City, Saudi Arabia. 2013-2014

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Abstract

Background: Myopia is one type of refractive errors that can be defined as state in which the eye fails to see distant objects properly. Many people in the world were affected by myopia due to many factors. Some researchers showed that medical college is a critical stage for near work activity that leads to the development or progression of myopia.

Objective: To determine the prevalence and risk factors of myopia among medical students of king Saud university.

Materials and Methods: A descriptive - cross sectional study aimed to identify the prevalence and risk factors of myopia among medical students of king Saud university in Riyadh city, Saudi Arabia during the educational year of (2013 - 2014), over 6-month period.

A sample of 419 students from 5 levels was selected using simple random sampling procedure. Selected students were requested to fill in an Arabic version questionnaire. The students were critically examined by an ophthalmology consultant, by using specific instruments and materials for examination process such as snellen chart and radioscopy.

Results: The prevalence of myopia among medical students was 44.4%, and it was more common among females than males (46.8% male and 36.7% female). 146 of myopic students (78.5%) wear glasses with −1.9 ± 1.07 Diopter, and 40 (21.5%) did not wear, Also among those who doesn't have myopia, 48 of them (20.6%) wear glasses due to hypermetropic, Astigmatism or other reasons. We found that, 87 (80.5%) of the students who Changed or started wearing glasses (−1.3 ± 0.77D) only after college enrollment have a positive family history of myopia, while the remaining 21 students (19.5%) don't have a family history. we found that 75 myopic students (40.4%) spent less than 3hours daily watching and using electronic devices, and those who spent more than 3hours daily were 111 students (59.7%). 72 of myopic students (39.3%) were using dim light while reading, and about 111 myopic students (60.7%) were not.

Conclusion: The prevalence of myopia among medical students of king Saud university appears to be high, affecting females more than males. Family history of myopic students showed a strong relationship, which could be one of the main risk factors, and it was also found to be a suitable ground for myopic shift (progression). There's a relationship between myopia and stressful lifestyle, in which heavy near-work activities are frequently encountered in a daily basis. The most common risk factors of myopia were family history and near work activities.

Keywords: *Myopia; Medical Students; Risk Factors*

Introduction

Myopia is one type of refractive errors, which can be defined as a state in which the rays of the light of an object are brought to focus in front of the retina [1]. It is also called nearsightedness [2], in which the eye fails to see distant objects properly. For that it is classified by clinical entity into: simple myopia, nocturnal myopia, pseudo myopia, degenerative myopia, and induced (acquired) myopia [3]. Other systems classified myopia by degree (i.e., low, medium, or high) or by age of onset (i.e., congenital, youth-onset, early adult-onset, and late adult-onset) [4].

The most common symptom associated with myopia is blurred distance vision. In simple myopia and degenerative myopia, the blurred distance vision is not constant. In nocturnal myopia the distance vision is blurred only in dim-light and dark illumination. In pseudo myopia, the blurred distance vision may be constant or intermittent with greater distance blur occurring after near work. The blurred distance vision in induced myopia can vary from transient (lasting a few hours) to constant, depending upon the particular agent or condition causing it [5].

A nearsighted person has trouble reading the snellen chart (the chart for distance). A general eye examination, or standard ophthalmic exam may include, eye pressure measurement, Visual acuity at a distance (snellen) chart, and refraction test, to determine the correct prescription for glasses [6]. Wearing eyeglasses or contact lenses can help to shift the focus of the light image directly onto the retina, producing a clearer image. The most common surgery to correct myopia is LASIK. An examiner laser is used to reshape (flatten) the cornea, shifting the focus [7].

Prevalence: The global prevalence for refractive errors has been estimated from 800 million to 2.3 billion [8,9]. Several studies describe an increasing prevalence of myopia in the recent years [10]. The increasing rates has been remarkable in very young Asian children, which also suggests that early lifestyle risk factors may have a large impact on early myopia development and the overall population prevalence rate of myopia [11]. In addition, some reports, published in the end of last century created an alarming response to show that the academically active professionals are the major sufferer of this disease [12].

In the United States, in 1971 - 1972 the prevalence of myopia in the people aged 12 - 54 was (25%) and by using the same method in 1999 - 2004, myopia prevalence was estimated to have climbed to (41.6%) [13]. In the Europe, the prevalence of myopia (25 - 35%) has been reported. In the United Kingdom, Bullimore and his colleagues found that 55.5% of optometry undergraduates at Aston University were myopic [14]. And in Australia the overall prevalence of myopia has been estimated to be 17% [15]. In East Asian countries such as Hong Kong, Singapore and Taiwan the occurrence of myopia is around 70% [16,17].

In Singapore, the prevalence of myopia is one of the highest rates in the worldwide, affecting 28% of school children at the start of their primary education and 70% of those completing university education [18]. In a study, 157 second year medical students (aged 19 - 23 years) in Singapore, refractive error measurements were determined using a stand–alone auto refractor and additional demographical data was obtained via questionnaires filled in by the students, showed that the prevalence rate of myopia was 89.8% [19].

Study of Jordanian adults aged 12 - 40 years found that over half (53.7%) were myopic [20]. And in KSA out of 151 elementary-school children with refractive errors, 57.6% were myopic [21]. In Saudi Arabia we have not found researches conducted or reports that indicate the prevalence of myopia among medical students in the country.

Despite several decades of research, the etiology of myopia is unknown, the relative contribution of genetic predisposition (nature) versus environmental risk factors (nurture) has been the subject of much study and debate [22-24]. Several lines of evidence point to a strong genetic role. First, racial differences in myopia prevalence between different countries and, in Singapore, the different racial groups, pointed the genetic predisposition of myopia [25]. Second, a consistent association between a parental history of myopia and development of myopia has been documented [26]. Third, data from twin studies showed significantly greater concordance in myopia rates among monozygotic compared to dizygotic twins [27].

Finally, genetic studies have identified several location for certain pathological variants of myopia [28]. In support of an environmental contribution, several environmental risk factors for myopia, including higher educational attainment, and increased amount of near-work activities, are well- documented in children [29] and adult population [30].

Furthermore a systematic cross-sectional study conducted in a South-Indian Medical College to establish refractive errors as a plebeian problem in young medical students. Resulting with, myopia is the predominant refractive errors among the medical students and the numbers of myopic students are increasing year by year [31]. The medical college is a critical stage for which near work activity is more intensive that can lead to progression of myopia in medical students especially to those who have already developed the myopia before college enrollment.

For that, our study was conducted amongst medical students who are relatively more exposed to myopia in performing near work activities. And also because there are no reports denoting myopia condition among medical students in Saudi Arabia, the aim of this study is to estimate the prevalence and predisposing factors of myopia among medical students in king Saud university.

Methodology

Study design and population

This is a descriptive cross-section analytical study, conducted to identify the prevalence and risk factors of myopia among medical students of king Saud university in Riyadh city. The total number of medical students enrolled from the 1st, 2nd, 3rd, 4th and 5th level in the faculty of medicine was 717 including 412 males 305 females during the academic year 2013 - 2014, over 6-month period.

Sample size

The sample size was calculated using the single proportion equation in Raosoft software package, (Online Raosoft sample size calculator, 2017), the required sample size is 345 students at 99% confidence intervals (expected frequency 50%, (Shaw, 2008) margin of error accepted was 5%. The sample was increased to 422 to compensate for drop out (237 male and 182 female students). After collecting the questionnaires we excluded 3 questionnaires because of missing and uncompleted data, so final sample size was 419 students.

Sample Method

By using stratified sampling technique with proportional allocation the sample size was distributed among the five level medical students and between male and female students and determined as a percentage proportionally related to the total number of the students in the college of medicine. The total number of students in the faculty of Medicine is 717 and sample size = 422 (58.9%). During every stage (Educational level, gender) we tried to keep the percentage within a range of 55% - 61%. See tables 1-6 for distribution of the sample.

Level	Student No	Percentage %	Sample size
1st (mean age 19.5 ± 0.5)	168	60.1%	101
2nd (mean age 20.5 ± 0.5)	160	58.1%	93
3rd (mean age 21.5 ± 0.5)	148	60.8%	90
4th(mean age 22.5 ± 0.5)	118	56%	66
5th (mean age 23.5 ± 0.5)	123	58.5%	72
Total	717	58.9%	422

Table 1: *Medical students in king Saud university.*

Level	Sex	Student No	Percentage %	Sample size
1st (mean age 19.5 ± 0.5)	Male	104	60.6%	63
	Female	64	59.4%	38

Table 2: *Students of first year.*

Level	Sex	Student No	Percentage%	Sample size
2nd (mean age 20.5 ± 0.5)	Male	93	58.1%	54
	Female	67	58.2%	39

Table 3: *Students of second year.*

Level	Sex	Student No	Percentage %	Sample size
3rd (mean age 21.5 ± 0.5)	Male	74	60.8%	45
	Female	74	60.8%	45

Table 4: *Students of third year.*

Level	Sex	Student No	Percentage %	Sample size
4th (mean age 22.5 ± 0.5)	Male	71	56.3%	40
	Female	47	55.3%	26

Table 5: *Students of fourth year.*

Level	Sex	Student No	Percentage %	Sample size
5th (mean age 23.5 ± 0.5)	Male	70	58.6%	41
	Female	53	58.5%	31

Table 6: *Students of fifth year.*

*Stage (1): The sample size was distributed proportionally among all the five levels, (55% - 61%) of every level.
*Stage (2): The sample size was distributed proportionally between males and females, (55% - 61%) of both gender. *Stage (3): Then student was selected by simple random method.

Data Collection

The data were obtained by self-administered questionnaire, which was pre-tested on 20 randomly–selected medical students to avoid any mistakes before the final questionnaire, and those 20 students were excluded from our sample. The final questionnaire includes the following variables:

1. Personal Data: sex, educational level (1st, 2nd, 3rd, 4th and 5th year) and age.
2. Questions regarding Myopia and glasses.
3. Questions about daily activities, including the following : (hours of reading and writing, using electronic devices, and using dim light during study), Family history and other risk factors.

After finishing the questionnaire, student's visions were examined by 3 senior teaching assistances, ophthalmology department, king Saud university, under supervision of faculty member Dr. Saleh Bashaiweth, ophthalmology consultant. The students, males and females were examined in a suitable rooms in the college. Myopia was defined as spherical equivalent of −0.50 D or less in either eye. In case the 3 examiners got different readings of refractive error, supervisor's opinion was the final opinion. Vision examinations took part every Tuesday and Thursday of every week until all students were examined, the total number of days was around one month with examination rate of 14 students per day. Examination done by the tools: snellen's chart (6 meter distance), trial set lenses, Retinoscope, Loup (magnifier), ophthalmoscope, light torch, and eye drops.

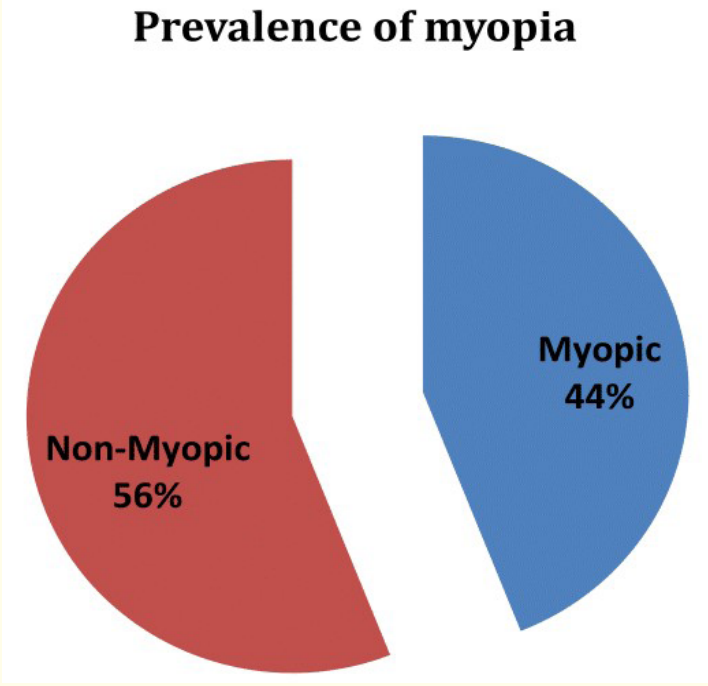
The obtained data was analyzed and checked by using a descriptive statistical tools and presented in tables and graphs using computer applications like Microsoft office word and SPSS.

Ethical consideration

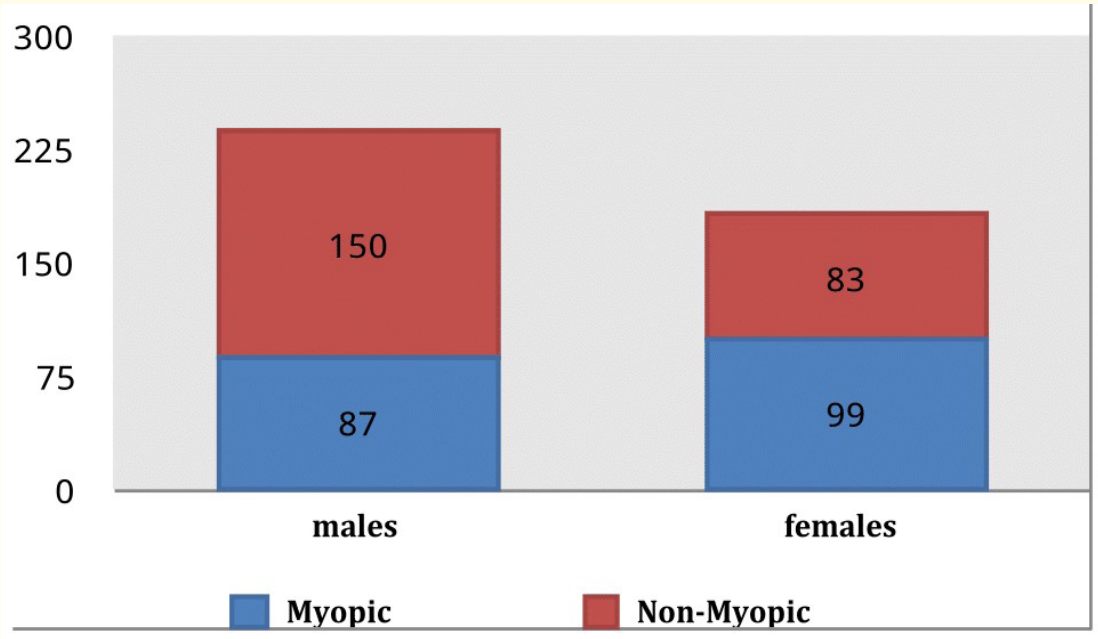
Approval of our study was obtained from king Saud university, faculty of medicine, department of community medicine. Objectives of study were clarified to the participant and we ensured the information will be kept in strict confidence and used for the benefit of the community.

Results

In our study we obtained the following results; the prevalence of myopia among the medical students was (44.4%) 186 out of 419 students (Graph 1). From the 182 female students, 99 students (53.2%) were myopic, and from the 237 male students, 87 students (36.7%) were myopic (Graph 2).



Graph 1: *The prevalence of myopia among medical students of king Saud university in Riyadh city during the year 2014.*



Graph 2: *The prevalence of myopia in relation to the gender among medical students of king Saud university in Riyadh city during year 2014. N.B:*the result of Chi-square test is considered statistical significance here (P = 0.000).*

Regarding distribution of myopic students among the educational levels, the distribution was as following; third year (47.9%), fourth year (47.1%), fifth year (46.4%), first year (43.9%), and second year (37.8%) (Table 7). Regarding the time of onset of myopia among our sample, 54 (29.1%) of myopic students started having myopia during primary school, 67 students (36%) started having myopia during secondary school, and 54 students (29.1%) started having myopia during university, while the rest 11 students (5.9%) cannot remember when it started (Table 8). Among the myopic students, 146 of them (78.5%) wear glasses with −1.9 ± 1.07 Diopter (Table 9), and 40 (21.5%) did not wear (Table 9). Also among those who doesn't have myopia, 48 of them (20.6%) wear glasses due to hypermetropic, Astigmatism or other reasons (Table 9).

Level	Myopic		Non-myopic		Total		P- value
	Number	%	Number	%	Number	%	
1st year (mean age 19.5 ± 0.5)	43	43.9%	55	56.1%	98	100%	0.668
2nd year (mean age 20.5 ± 0.5)	34	37.8%	56	62.2%	90	100%	
3rd year (mean age 21.5 ± 0.5)	45	47.9%	49	52.1%	94	100%	
4th year (mean age 22.5 ± 0.5)	32	47.1%	36	52.9%	68	100%	
5th year (mean age 23.5 ± 0.5)	32	46.4%	37	53.6%	69	100%	

Table 7: *Prevalence of myopia among medical students of king Saud university, in Riyadh, 2014.*

*N.B:*Chi-square result is not considered statistical significance here (P = 0.668)*

Time of onset of myopia	Myopic students	
	Number	%
Primary school (mean age 9.5 ± 1.7)	54	29.1%
Secondary school (mean age 17 ± 1.4)	67	36%
University (mean age 20 ± 1.7)	54	29%
Not available	11	5.9%
Total	186	100%

Table 8: *Distribution of time of onset of myopia among myopic medical students of king Saud university, in Riyadh.*

Wearing glasses?	Myopic		Non-myopic		Total
	Number	%	Number	%	
Yes	146	78.5%	48	20.6%	194
No	40	21.5%	185	79.4%	225
Total	186	100%	233	100%	419

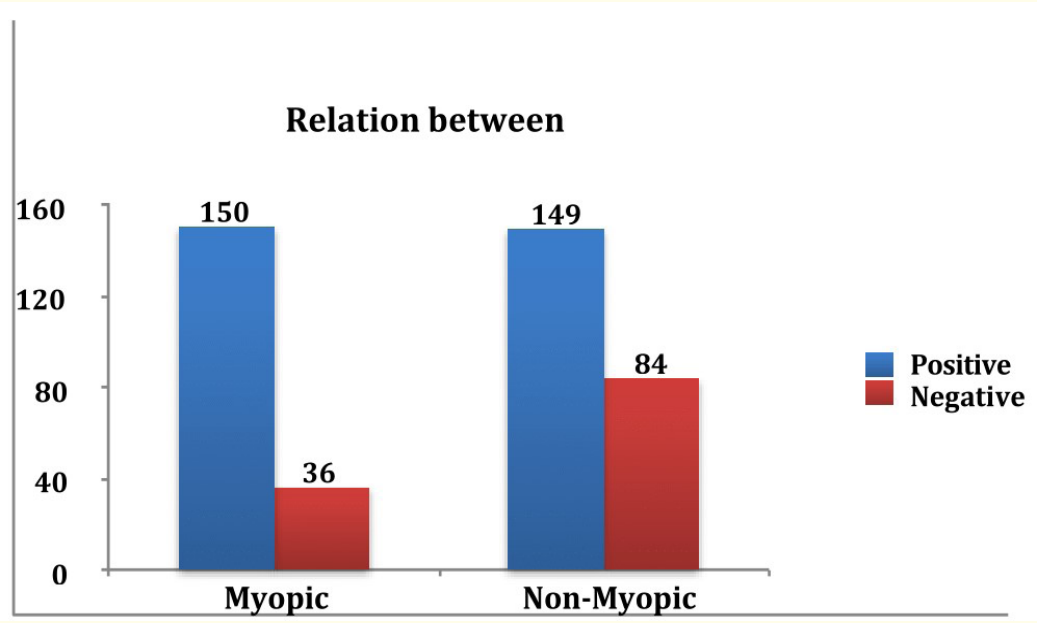
Table 9*: Prevalence of wearing glasses among medical students of king Saud university.*

Among those who had myopia during primary school, 44 of them (40.7%) changed their glasses after starting college, and those who had myopia during secondary school, 48 of them (44.4%) changed their glasses after starting college, while those whose myopia started after enrollment in the medical college of king Saud university, 16 of them (14.2%) progressed with a change their glasses at −1.01 ± 0.47 Diopter (Table 10). And by measuring the relationship between the change of glasses and the family history of myopia, we found that, 87 (80.5%) of the students who changed their glasses have a positive family history of myopia, while the remaining 21 students (19.5%) don't have a family history, (Table 10).

Time of onset of myopia	Changed or started wearing glasses only after starting college		Didn't change glasses after starting college		Total	p-value
	Number	%	Number	%		
Primary school (mean age 9.5 ± 1.7)	44	40.7%				0.000
Secondary school (mean age 17 ± 1.4)	48	44.4%				
University (mean age 20 ± 1.7)	16	14.9%				
Total	108	100%	38	100%	146	
Another family member wearing glasses?						
Yes	87	80.5%	26	68%	113	0.0116
No	21	19.5%	12	32%	33	
Total	108	100%	38	100%	146	

Table 10: *Distribution of onset of myopia and family history in comparison with changing glasses during medical college.*

Regarding the family history of myopia among our sample, the results showed, out of 186 myopic students, 150 of them (80.6%) have a positive family history, while the remaining 36 students (19.4%) don't have any family history of myopia, which indicate a statistically significant relationship between myopia and family history (Graph 3) and (Table 11).



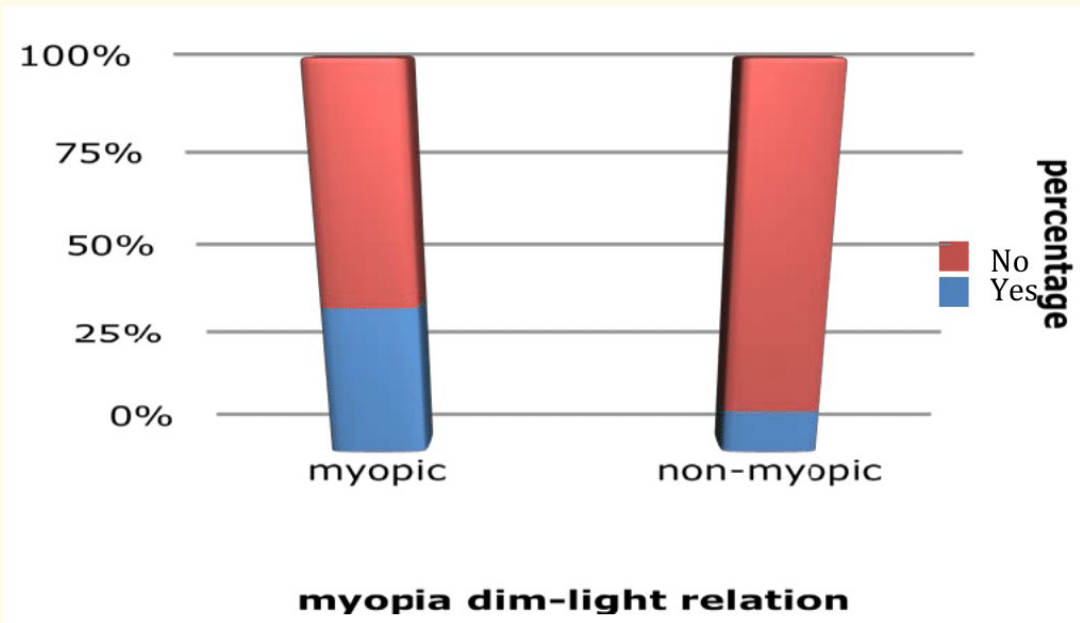
Graph 3: *The prevalence of myopia in relation to family history of myopia among medical students of king Saud university in Riyadh city during the year 2014.*

Family history of myopia	Myopia		Non-myopic		Total	p-value
	Number	%	Number	%		
Yes	150	80.6%	149	63.9%	299	0.0002
No	36	19.4%	84	36.1%	120	
Total	186	100%	233	100%	419	
Reading hours						
Less than 2 hrs	27	14.5%	134	57.5%	161	0.000
More than 2 hrs	159	85.5%	99	42.5%	258	
Total	186	100%	233	100%	419	
Watching hours						
Less than 3 hrs	75	40.4%	77	33.1%	152	0.000
More than 3 hrs	111	59.7%	156	66.9%	267	
Total	186	100%	233	100	419	

Table 11: *Frequency, distribution and percentage of myopia in comparison with risk factors.*

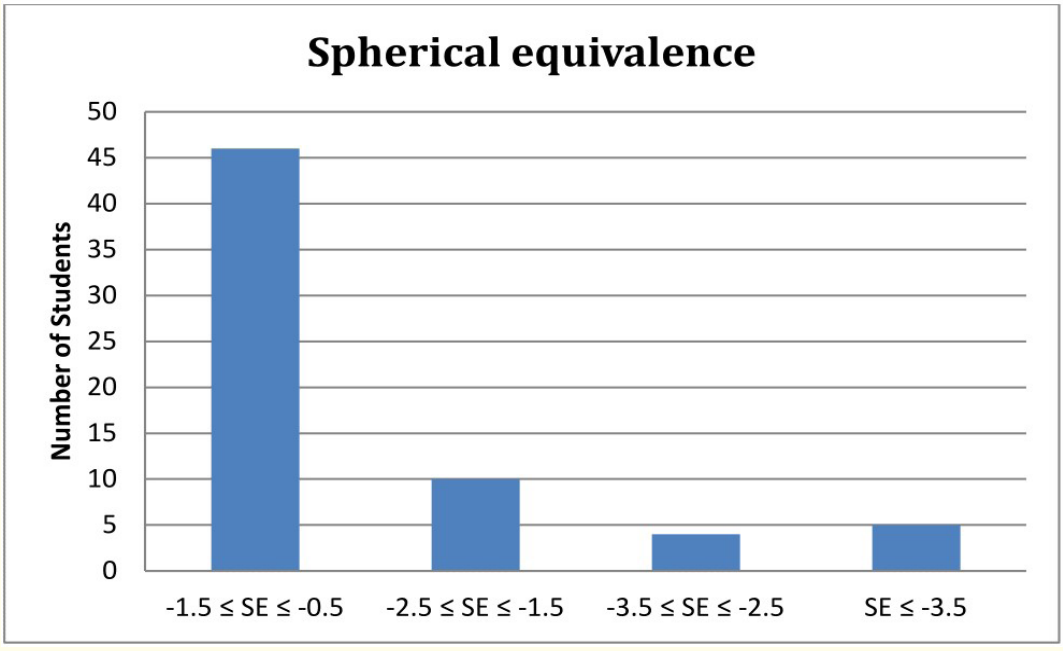
Regarding the heavy near-work activities we found that 75 myopic students (40.4%) spent less than 3hours daily watching and using electronic devices, and those who spent more than 3hours daily were 111 students (59.7%) (Table 11). On the other hand, regarding the hours of reading and writing, we found that about 68 myopic students (36.6%) read less than 2 hours daily, while 118 myopic students (63.4%) read more than 2 hours daily (Table 11).

Regarding the usage of dim light during reading, 72 of myopic students (39.3%) were using dim light while reading, and about 111 myopic students (60.7%) were not, which doesn't show any statically significant relationship between myopia and the usage of dim-light during reading (P = 0.94) (Graph 4).



Graph 4: *The prevalence of myopia in relation to the usage of dim-light during reading among medical students of king Saud university in Riyadh city during the year 2014. N.B:*Chi-square test is not statistical significance here (P = 0.94).*

Regarding the distribution of refractive error values in students who are the first time wearing glasses at college, The mean refractive error was −1.3 ± 0.77 D for the more myopic eye in each Student, and the distribution of the refractive error is shown in graph 5, the majority of refractive error values were ranging between (-0.5 – -1.5). Lastly regarding students who were myopic before college, 73.3% of them reported an increase in refractive errors of −1.6 ± 0.82 Diopter since starting college.



Graph 5: *Distribution of refractive error values in students who are the first time wearing glasses at college, king Saud university, Riyadh 2014.*

Discussion

Our study was conducted among medical students who are relatively more exposed to perform near work activities than other students. Out of 419 students, 186 (44.4%) of them were myopic, and the large percentage of myopic students 150 (80.6%) had positive family history of myopia, with a statically significant relationship (P = 0.000).

Similar studies among medical students in Pakistan, United Kingdom [14], Norway [12] and Denmark [32] yielded prevalence rates of 57.9%, 55.5%, 50.3% and 50%, respectively. It is possible that the difference in myopia prevalence rates across different countries may be attributable to ethnic variations, different environmental factors and genetic predispositions. The prevalence of myopia among Saudi adults reported to be 13.9% [35], which reflects a high prevalence of myopia among Saudi medical students.

A study done among Jordanian people aged (12 - 40) years found that over half (53.7%) were myopic [20] and another one conducted in Saudi Arabia, revealed that out of 151 elementary-school children (aged 12 - 15) with refractive errors 57.6% were myopic [21], meanwhile we could not find researches about prevalence of myopia among medical students in Saudi Arabia, so our research is the first.

In our study, prevalence of myopia was more common among females (53.2%) than males (36.7%), indicating a statistically significant relationship (P = 0.000), an earlier study of 1738 Greek high school students (aged 15 - 18 years) reported that the prevalence rate of myopia was higher in females students as compared to the males (p < 0.001) [34].

In our study, the onset of myopia was mostly in secondary school (mean age 17 ± 1.4) (36%), then in university (mean age 20 ± 1.7) and primary school (mean age 9.5 ± 1.7), both with same percentage (29%), which indicates an early onset of myopia among our sample. The distribution of myopic students among different educational levels was not statistically significant (P = 0.667).

Several studies have been done regarding the genetic involvement with myopia and even the genes and chromosomes have been studied , Many studies supports that the myopia can be congenital as well as environmentally acquired [22].

The family history of myopia has a significant relationship with changing myopic glasses (80.5%), (P = 0.000) but it was not the only factor, because we found that (19.5%) do not have family history and yet they changed their myopic glasses, which indicates that there are another factors such as environmental factors that can play an important role.

From 186 myopic students, 146 students (78.5%) were wearing myopic glasses while the other 40 students (21.5%) did not wear, and had been given glasses prescription after we examined them, on the other hand, among the 233 non-myopic students, 48 students (20.6%) wear glasses either due to hypermetropic, Astigmatism, or other reasons.

We found that many students (58.1%) were forced to change or to wear glasses only after starting collage but not before that, probably due to heavy near-work activity, while in a study conducted in Singapore showed that 28% of the sample started having myopia in their primary education but 70% of them started while completing their university education, and most of them were forced to change their glasses in college [33].

There was a statically significant relationship between increasing hours of reading or/and writing and myopia (P = 0.000), and regarding spending long time using electronic devices, our research found that 111 (59.7%) of myopic students spent more than 3 continuous hours daily in front of a screen, while 75 (40%) of them spent less than 3 continuous hours daily, and this shows a statistically significant relationship with developing myopia (P = 0.000), (Table 11).

Lastly, the majority of myopic students (60.7%) did not use dim-light during near-work activities, while 39.3% of them use it, this statically is not significant (P = 0.92), we mean dim-light have less effect with myopic shift.

Conclusions

The find of this study indicates there is a high prevalence of myopia among medical students of king Saud university, comparing to non-medical Saudi adults, and appears to be affecting females more than males. Family history of myopic students showed a significant correlation with myopia, and with changing myopic glasses, which could be one of the main risk factors. Majority of students were forced to change their glasses after college enrollment because of myopic progression. In addition to family history and gender playing a role in myopia progression, the medical school related environmental activities such as hours spent with close distance reading/writing a day, hours spent on computer screen a day, hours spent watching TV were strongly associated with myopic progression. However, the student grade and of dim-light for reading/writing were not related to myopia progression during this short-term observational study.

Limitation

We encountered many limitations during the study, most important one, the short time we had to conduct our research within, also we did not have the time to sub-stratify the degree of myopia and correlates it with different groups (those with positive family history, those with other causes of myopia and those with accompanying other disease and complications, like retina complications). Limited resources and facilities were a major limitation, as we couldn't afford another faculty consultants and examination's tools, as they were busy covering university clinics, also this study is based on a single center with small sample, the conclusions and recommendations should be comprehended within this context, as they might not be applicable to other groups or general population.

Recommendations

We hope that our research will provide a scope of sightedness within academic levels.

Recommendations for general population:

- Those who suffer blurred vision when seeing far objects or having headache on driving or during sports, should examine their vision.
- Parents family members who wear glasses to see far objects or during driving, should observe their children when watching TV and they should examine their vision.
- The families should avoid their children spending long time in near work, as reading in the dark, watching TV or mobile within very short distance.
- Dim-light should be avoided during reading or watching TV.

Recommendation for medical students and those of academic levels:

- The book-eye distance while reading should be around the range of ~30 cm with a good light.
- Those who are myopic can read without glasses unless they have a marked decrease.
- Since long time may be spent on computer, we recommend a distance of ~30 - 40 cm, with the light against the screen, and antireflection on screen or glasses.
- Those within the academic level and older than 40 years might need near glasses according to the age and computer distance.
- The decision of getting eye (vision) examination and then wearing glasses is compulsive.
- There is a need for further researches within same and similar groups regarding myopia, measuring its prevalence and evaluating other aspects. Also there is a need to address other important and significant questions and risk factors like (stress, life style, associated diseases), as they may play a major roles.

Bibliography

1. Douglas M Anderson. "Dorland's illustrated medical dictionary, 28th Edition". London, Sounders (1994): 1094.
2. Chung KM., *et al*. "Prevalence of visual disorders in Chinese schoolchildren". *Optometry and Vision Science* 73.11 (2006): 695-700.
3. Grosvenor T. "A review and a suggested classification system for myopia on the basis of age-related prevalence and age of onset". *American Journal of Optometry and Physiological Optics* 64.7 (1987): 545-54.
4. Goss DA and Eskridge JB. "Myopia". In: Amos JF, ed. Diagnosis and management in vision care. Boston: Butterworths (1987): 121-171.
5. David A Goss., *et al*. "Care of the patient with myopia". American Optometric Association, 1997, Reviewed February 2001 and 2006 by the AOA Board of Trustees.
6. Wilkinson PS., *et al*. "Ophthalmology. 3rd edition". St. Louis, by Elsevier Chapter 35 (2008).
7. Garg S., *et al*. "Duane's Ophthalmology On DVD-ROM. 1st edition". Philadelphia, Pa: Lippincott Williams and Wilkins, Chapter 49 (2012).
8. Thulasiraj RD., *et al*. "For the millions addressing a priority of "VISION 2020 - The Right to Sight". *Community Ophthalmology* 3 (2003): 19-21.

9. Dunaway D and Berger I. "Worldwide Distribution of Visual Refractive Errors and What to Expect at a Particular Location" (2006).

10. Midelfart A., *et al*. "Prevalence of refractive errors in young and middle-aged adults in Norway". *Acta Ophthalmologica Scandinavica* 80.5 (2002): 501-505.

11. Saw SM., *et al*. "Near-work in early-onset Myopia". *Investigative Ophthalmology and Visual Science* 43.2 (2002): 332-339.

12. Kinge B and Midelfart A. "Refractive changes among Norwegian university students, a third year longitudinal study". *Acta Ophthalmologica Scandinavica* 77.3 (1999): 302-305.

13. Vitale S., *et al*. "Increased Prevalence of Myopia in the United States between 1971-1972 and 1999-2004". *Archives of Ophthalmology* 127.12 (2009): 1632-1639.

14. Guggenheim JA., *et al*. "Myopia, genetics, and ambient lighting at night in a UK sample". *British Journal of Ophthalmology* 87.5 (2003): 580-582.

15. Wensor M., *et al*. "Prevalence and risk factors of myopia in Victoria, Australia". *Archives of Ophthalmology* 117.5 (1999): 658-663.

16. Saw SM., *et al*. "IQ and the association with myopia in children". *Investigative Ophthalmology and Visual Science* 45.9 (2004): 2943-2948.

17. Gilmartin B. "Myopia: precedents for research in the twenty-first century". *Clinical and Experimental Ophthalmology* 32.3 (2004): 305-324.

18. Chua WH., *et al*. "Refractive errors in schoolchildren: the Singapore Myopia Cohort Study". In: Thorn F, Troilo D, Gwiazda J, editors. Proceedings of the VIII International Conference on Myopia, Boston, United States, United States: Conference on Myopia (2006): 11.

19. Lim KA., *et al*. "Refractive errors in medical students in Singapore". *Singapore Medical Journal* 45.10 (2009): 470-474.

20. Mallen EA., *et al*. "Refractive error and ocular biometry in Jordanian adults". *Ophthalmic and Physiological Optics* 25.4 (2005): 302-309.

21. Mohammed A AI Rowaily and Badriah Moaned Alanizi. "Prevalence of Uncorrected Refractive Errors among Adolescents at king Abdul-Aziz Medical City. Riyadh, Saudi Arabia". *Journal of Clinical and Experimental Ophthalmology* 1.3 (2010): 114.

22. Wallman J. "Nature and nurture of myopia". *Nature* 371 (2009): 201-202.

23. Mutti DO., *et al*. "Myopia: the nature versus nurture debate goes on". *Investigative Ophthalmology and Visual Science* 37.6 (1996): 952-957.

24. Saw SM., *et al*. "Myopia: gene-environment interaction". *Annals of Academy Medicine of Singapore* 29.3 (2000): 290-297.

25. Wu HM., *et al*. "Does education explain ethnic differences in myopia prevalence, A population-based study of young and adult males in Singapore". *Optometry and Vision Science* 78.4 (2001): 234-239.

26. Chen CJ., *et al*. "Genetic and environmental effects on the development of myopia in Chinese twin children". *Ophthalmic Pediatrics and Genetics* 6.1-2 (1985): 353-359.

27. Young TL., *et al*. "Evidence that a locus for familial high myopia maps to chromosome 18p". *American Journal of Human Genetics* 63.1 (2008): 109-119.

28. Wong TY., *et al*. "Variations in ocular biometry in an adult Chinese population in Singapore: the Tanjong Pagar Survey". *Investigative Ophthalmology and Visual Science* 42.1 (2005): 73-80.

29. Wong TY., *et al*. "Education, socioeconomic factors, and ocular dimensions in Chinese adults: the TanjongPagar Survey". *British Journal of Ophthalmology* 86.9 (2008): 963-968.

30. Quinn GE., *et al*. "Myopia and ambient lighting at night". *Nature* 399.6732 (2009): 113-114.

31. Al-ameen Charittable, Aims. 1st edition, Bangalore (2012): 233.

32. Ojaimi E., *et al*. "Distribution of ocular biometric parameters and refraction in a population - based study of Australian children". *Investigative Ophthalmology and Visual Science* 46.8 (2007): 2748-2754.

33. Saw SM., *et al*. "Near - work activity, night - lights, and myopia in the Singapore-China study". *Archives of Ophthalmology* 120.5 (2002): 620-627.

34. Mavracanas TA., *et al*. "Prevalence of myopia in a sample of Greek students". *Acta Ophthalmologica Scandinavica* 78.6 (2000): 656-659.

35. Al-Shaaln FF., *et al*. "Prevalence and causes of visual impairment among Saudi adults attending primary health care centers in northern Saudi Arabia". *Annals of Saudi Medicine* 31.5 (2011): 473-480.

Volume 9 Issue 2 February 2018