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FREQUENCY AND UNDERLYING FACTORS OF MYOPIA AMONG MEDICAL STUDENTS

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ABSTRACT

Introduction: Refractive error may be defined as a state in which the optical system of the non-accommodating eye fails to bring parallel rays of light to focus on the retina. Especially myopia has become a very common problem. Myopia is a refractive error in which eye fails to see distant objects properly.

Objectives: To estimate the frequency of myopia among MBBS students of AIMC; to point out the under lying factors of myopia; and to compare these factors among myopics and emmetropes in a Cross Sectional Comparative, study form March 2010 to September 2010.

Materials and Methods: Two hundred and two (202) students from all the five M.B.B.S classes were examined. Around 40 students were selected from each class by systematic random sampling technique, their visual acuity was checked using Snellen's Chart and Diopters were checked in Eye Deptt. To assess factors a semi-structured questionnaire was filled by the interviewer.

Results: Frequency of myopia was observed as 57.6%. Mean refractive error was -2.12D. A total of 61% of females and 51.5% of males were myopic. First and second year students had greater percentage of myopia with 61.1%. Out of 117 myopic students, 71 (60.7%) had positive family history of myopia, whereas 22 (18.8%) did not. (p = 0.000003). The mean reading hours per day of myopics were 3.31, while others had an average of 3.60 hours daily. Difference between daily time spent on writing activity by myopics and non-myopics was insignificant (p = 0.544). The myopics watched television for an average of 2.24 hours daily and the non-myopics had a mean of 2.71 hours of watching television daily. Similarly, our study did not show any significant statistical relationship between working on computer, sleeping habits of students and amount of physical exercise done daily (p = 0.266, 0.968 and 0.305 respectively). Dietary factors did not show any significant relationship with myopia.

Conclusion: Prevalence of myopia was high among AIMC students (57.6%). 1st and 2nd year students had greater percentage indicating that it is increasing in the younger age group. Significance of genetic predisposition was well appreciated in our study.

Key Words: Myopia, emmetropes, underlying factors.

INTRODUCTION

Refractive error may be defined as a state in which the optical system of the non-accommodating eye fails to bring parallel rays of light to focus on the retina. Especially myopia has become a very common problem. Myopia is a refractive error in which eye fails to see distant objects properly.[1] It has become an ocular disorder of major public health and socioeconomic significance throughout the world.[2] Several studies describe an increasing prevalence of myopia in the recent years. Furthermore, racial differences in myopia rates are well documented. Prevalence rates in Asian countries vary from 50% in Chinese children[1] to 84% in Taiwan and Hong Kong.[3] In Europe, the prevalence of myopia seems to be lower than in Asian countries. The prevalence rates vary from 30.3% in middle – aged adults and 35.0% in young adults in Norway[4] and 53% in Norwegian medical students.[5] Guggenheim and colleagues reported[5] a prevalence of myopia of 64% among British students between 18 – 40 years. Although this prevalence is supposed to be typical of university students,[6] the study was likely to have been affected by selection and response bias, with more myopics choosing to participate than non-myopics. In Singapore, the prevalence of myopia is one of the highest worldwide, affecting 28% of school children at the start of their primary education and 70% of those completing university education.[7]

There has long been a concern that blindness and visual impairment from myopia will lead to major public health problems for many countries in Asia.[8] Although blindness registry data indicate that myopia is the fourth leading cause of blindness in

Singapore,[9] this data is not representative of the general population. In fact, well – conducted population – based prevalence surveys in the United States (US) suggest that myopia is not a leading cause of either visual impairment or blindness in adults (although, admittedly, the rates of myopia are lower in the US) 10. A study of 112 adult myopic patients showed that patients with high myopia (refractive error at least –10.0 D) had significantly worse visual function and vision – related quality of life scores.[11] Beyond the medical implications, myopia incurs significant socioeconomic costs. Direct cost related to the correction of myopia, including refractive eyewear and surgery, is estimated to be in excess of SGD $150 million a year.[12] There are also substantial indirect costs related to treatment of myopia complications, such as retinal detachment and contact lens related corneal ulcers. 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.[13-15] Several lines of evidence point to a strong genetic role. First, racial differences in myopia prevalence between different countries and, in Singapore, between different racial groups, point towards a genetic predisposition to myopia.[16] In a recent study in Singapore, higher rates of myopia were seen in Chinese compared to Indian and Malay school children, despite controlling for education.[17] Second, a consistent association between a parental history of myopia and development of myopia has been documented.[18]

This relationship remains after controlling for similar lifestyle habits in parents and children. Third, data from twin studies show significantly greater concordance in myopia rates among monozygotic compared to dizygotic twins.[19] Finally, genetic studies have identified several loci for certain pathological variants of myopia.[20]

In support of an ―environmental contribution of myopia, population – based studies have shown higher myopia prevalence and longer axial lengths in younger compared to older cohorts.[21] Environmental factors could explain the rapid increase in myopia rates in a few decades in populations where the gene pool remains the same. High incidence and progression rates of myopia have been reported in individuals who spend long hours on near – work activity, such as carpet weavers, visual display terminal workers and microscopists.[22] Several environmental risk factors for myopia, including higher educational attainment, higher socioeconomic status and increased amount of near – work activities, are well – documented in children[23] and adult[24] populations. However, the exact mechanism of how these factors induce the development and progression of myopia remains controversial. Recent research has also identified several novel risk factors for myopia. Of these, ―night – light as a potential risk factor has generated the greatest controversy and media attention.[25] Dietary factors have also been recently suggested as possible risk factors for myopia. These risk factors are potentially modifiable and deserve further investigations. However, it is difficult to obtain accurate recall data on night-light habits before 2 years or nutrient data in the young child.

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. Additional demographical data was obtained via questionnaires filled in by the students. The prevalence rate of myopia in Singapore medical students came out to be 89.8% (Spherical equivalence (SE) of at least -0.50D). This shows that prevalence rate of myopia in second year Singapore medical students is one of the highest in the world.[26]

In another study conducted in medical students in Norway,[27] the prevalence of myopia and age at onset among medical students were determined. Of the 140 senior medical students at University of Trondheim, Norway, the prevalence of myopia was found to be 50.3% in the right eye without significant difference between female and male students. A clear relationship was detected between the current amount of myopia and the age at which corrective lenses were first prescribed. However, as much as 43.3% of the myopic students wearing corrective lenses first received these at the age of about 20 years, indicating a relatively high prevalence rate of adult – onset myopia.

Prevalence of refractive errors in Turkish[28] medical students as well as to determine the change in refractive status of medical students within 1 year. Besides general refractive characteristics of the students, the possible relationship between the occurrence of myopia and several factors was also determined. Two hundred and seven medical students (114 female / 93 male) were checked for their refractive status as determined by cycloplegic auto refraction. One year later, medical students who participated to the study were re-examined. Myopia occurred in 32.9% of medical students.

A study to assess the incidence of myopia among high school children and to determine the association of genetics, nutrition and close work to myopia was conducted in Rahim Yar Khan[29] District, Pakistan. 300 school children of 8 – 15 years age from two schools were checked for visual acuity and nutritional status after taking a complete personal and family history. A total 57 students (19%) were found to have myopia in school going children in Rahim Yar Khan between ages 10 – 15 years. The

genetic factor was present in 91% of myopics (P < 0.001). The average amount of near work after school in myopics was considerably more than the emmetropes P < 0.05 for study and P < 0.005 for recreational books. Regarding nutritional status, 30% myopics were malnourished whereas similar percentage of emmetropes was malnourished.

The Sydney Myopia Study among 17 – to 20 – year old students.[30] The mean spherical equivalent refraction was +1.26 D in the right eyes. The boys were slightly more likely to be myopic than the girls, and white children were slightly less likely to be myopic than non-whites. Investigators from six sites in the U.S. pooled their data on refractive errors and ocular biometry in students aged from 16 to 24 years. The students were from different ethnic backgrounds. They found no difference in average spherical equivalent between girls and boys; there was a shift towards myopia with increasing age in both.

In Andhra Pradesh Eye Disease Study.[33] Myopia was less common in those 15 – years of age and younger (about 4%) than in older persons (19%). The first reported myopics were about 5 – years – old.

METHODOLOGY

Two hundred and two (202) students from all five M.B.B.S classes were examined. Around 40 students were selected from each class by systematic random sampling technique, their visual acuity was checked using Snellen's Chart and Diopters were checked in Ophthalmology Deptt. To assess the under lying factors a semi – structured questionnaire was filled by the interviewer. Data was analyzed using SPSS. Frequency, % and mean and SD were calculated accordingly. Chi-square was applied and P value < 0.05 was considered statistically significant

RESULTS

Two hundred and two (202) medical students (66 males and 136 females) were examined. The prevalence of myopia came out to be 57.6% in medical students. Mean refractive error was -2.12D. 61% of females and 51.5% of males were myopic. First and second year students had greater percentage of myopia with 61.1% of the students being myopic. 50.4% of the myopics developed myopia 2 – 5 years back whereas 40.2 % developed it 6 – 10 years back and only 8.4% developed it one year back. Out of 117 myopic students, 71 (60.7%) had positive family history (myopia among first blood relations), 9 (7.7%) had myopia among relatives other than first blood relations, whereas 22 (18.8%) myopics did not show any family history. Statistically it showed strong significant relationship.

The mean reading hours per day of the myopics were 3.31 hours whereas students with no ocular disease studied for an average of 3.60 hours daily. Similarly the difference between daily time spent on writing activity by myopics and non-myopics was insignificant (p = 0.544) with myopics writing for a mean of 1.05 hours daily and non-myopics for a mean of 0.98 hours per day. The myopics watched television for an average of 2.24 hours daily and the non-myopics had a mean of 2.71 hours of watching television daily. Similarly, our study did not show any significant statistical relationship between working on computer, sleeping habits of students and amount of physical exercise done daily (p = 0.266, 0.968 and 0.305 respectively).

Table 1: *Frequency of myopic students according to No. of Diopters.*

No. of diopters (-D)	*Frequency*	*Percent*
0.5 – 1.5	53	26.2
1.75 – 3.00	33	16.3
3.25 – 4.5	16	7.9
> 5.00	15	7.4
Emmetropes	85	42.1
Total	202	100.0

Out of 117 myopics 18.8% did take vitamin A supplements whereas 81.2% did not take any Vitamin A supplements. Similarly, out of 117 myopics, 26.5% had less than 7 servings per week whereas 73.5% had 7 – 14 vitamin A servings per week. But these dietary factors did not show any significant relationship with myopia.

DISCUSSION

Our study was conducted amongst medical students who are relatively more exposed in performing near activities .Out of 202 students, 117 (57.9%) had myopia of different diopters. An earlier study of myopia in 128 Singapore medical students reported that the prevalence rate of myopia in Singapore medical students was 82%.[38] Another study of 345 medical students in Taiwan showed that more than 90% of Taiwanese medical students were myopic.[34] In contrast, similar studies on medical students in Norway and Denmark yielded relatively low prevalence rates of 50.3% and 50%, respectively.[29,35] However, the methodology, non-participation rates and refraction techniques differ and there are limitations in making comparisons. It is possible that differences in myopia prevalence rates in medical students across different countries may be attributable to ethnic variations and different genetic predispositions.

The range of myopia among all medical students in our study was from -0.5 to -6.0 D with

mean refractive error of -2.12 D. In a study carried out in Singaporean medical students, mean refractive error came out to be -3.75D in males and -4.76D in females 36.

Mean age of students was 20.34 years with standard deviation of ± 2.05 years; minimum 17 and maximum 25 years. Age group of 20 – 22 years had maximum number of students with myopia: 117 (57.9%) and showed statistically significant relationship (p = 0.00794). In a study conducted in medical students of Norway,[29] a clear relationship was detected between the current amount of myopia and the age of onset of myopia. As much as 43.3% of the myopic students wearing corrective lenses first received these at the age of about 20 years, indicating that such a large proportion of students developed myopia at the age of about 20 years.

Relationship with year of study was significant among first and second year medical students. Out of total 85 first and second year students, 52 students were myopic (61.1%). The percentage was statistically significant (p = 0.02) and it shows that students recently joining M.B.B.S have more frequency of myopia than the students who joined 4 – 5 years back.

An earlier study of 173 8 Greek high school students (aged 15 – 18 years) reported that the prevalence rate of myopia was higher in female students as compared to their male counterparts (p < 0.001).[35] This trend was also observed in another study in Finnish medical students.[36] In our present study, 61.0% of the females, and 51.5% of the males had myopia. Though the prevalence was higher in females but statistically it did not show any significant relationship (p = 0.17).

The number of boarders and day scholar students did not show any significant relationship to frequency of myopia (p = 0.15) as 62.6% boarders and 52.6% day scholars were myopic. Similarly, occu-

Table 2: *Myopia and its Determinants by statistical Analysis.*

Variables	*Number of students with myopia*	*Emmetropes*	*Total*	*P value*
Year of study				P = 0.0288
1st and 2nd year	52	33	85	
3rd and 4th year	50	37	87	
Final year	15	15	30	
Total	117	85	202	
Age of students (years)				P = 0.00794
17 – 19	47	17	64	
20 – 22	63	54	117	
> 22	17	4	21	
Total	117	75	202	
Gender of students				P = 0.017
Male	35	31	66	
Female	82	54	136	
Total	117	85	202	
Status of stud.				P = 0.15
Boarder	69	38	107	
D. scholar	48	47	95	
Family h/o Myopia				P = 0.0003
Yes	95	35	130	
No	22	50	72	
Total	117	85	202	
Reading hrs. per / day				P = 0.910
1 hr. and <	22	13	35	
2 – 8 hrs	89	65	154	
> 8 hrs.	06	07	13	
Total	117	85	202	
Writing hrs. per / day				P = 0.544
One hr. and <	74	52	126	
2 – 4 hrs.	40	32	72	
> 4 hrs.	03	01	04	
Total	117	85	202	

pation of father and mother was not related to myopia among their children studying in the medical college (p = 0.07 and 0.242 respectively).

Regarding socioeconomic set up of the families, it did not show any significant statistical relationship (p = 0.811) as around 58% students having myopia belonged to families having size of 5 – 8 members. Similarly, income per capita per month of the family was not related with myopia among medical students (p = 0.956).

50.4% of the myopics developed myopia 2 – 5 years back whereas 40.2% developed it 6 – 10 years back and only 8.4% developed it one year back. In a similar study carried out in Istanbul, Turkey, adult onset myopia group comprised 14.7% of all myopia cases.[30] It shows that development of myopia occurs mostly during early adulthood in school going age and with the passage of time, reporting of new myopia cases decreases. That is why myopia has been considered to be a problem with origins in childhood. The estimated prevalence in 6 – year – olds is 2% and in 15 – year – olds, 15%.[17] However, adult onset myopia is not an inferquent occurrence. Furthermore, myopic shifts in refraction can occur across the lifespan, although more common in the first two decades than in older persons.

Variables	*Number of students with myopia*	*Emmetropes*	*Total*	*P value*
T.V watching hrs. per / day				
1 hr. and <	53	31	84	P = 0.456
2 – 5 hrs.	56	45	101	
6 hrs. and >	08	09	17	
Working on comput. hrs/D				
1 hr. and <	75	56	131	P = 0.266
2 – 6 hrs.	36	28	64	
> 6 hrs.	06	01	07	
Physical exercise 30 min./day				
Regular	28	27	55	P = 0.968
Irregular	35	27	62	
No exercise	54	31	85	
Vit. A Supplementation				
Yes	22	12	34	P = 0.395
No	95	73	168	

As expected, 84.6% myopics reported the abnormality by themselves while 15.4% were reported by teachers and parents.

Out of 117 myopic students, 71 (60.7%) had positive family history (myopia among first blood relations), 9 (7.7%) had myopia among other than first blood relations, whereas 22 (18.8%) myopics did not show any family history. Statistically it showed strong significant relationship (p = 0.000003). Several lines of evidence point to a strong genetic role. First, racial differences in myopia prevalence between different countries and, in Singapore, between different racial groups, point towards a genetic predisposition to myopia.[16] In a recent study in Singapore, higher rates of myopia were seen in Chinese compared to Indian and Malay school children, despite controlling for education.[19] Second, a consistent association between a parental history of myopia and development of myopia has been documented.[20] This relationship remains after controlling for similar lifestyle habits in parents and children.[17] Third, data from twin studies show significantly greater concordance in myopia rates among monozygotic compared to dizygotic twins.[21] Finally, genetic studies have identified several loci for certain pathological variants of myopia22. So, the results of our study also suggest a strong familial predisposition of myopia.

The mean reading hours per day of the myopics were 3.31 hours whereas students with no ocular disease studied for an average of 3.60 hours daily. The difference was statistically insignificant (p = 0.910). Similarly the difference between daily time spent on writing by myopics and non-myopics was insignificant (p = 0.544) with myopics writing for a mean of 1.05 hours daily and non-myopics for a mean of 0.98 hours per day.

Study hrs., watching television, computer working and physical exercise did not show any statistical relationship with myopia. In other studies, high incidence and progression rates of myopia have been reported in individuals who spend long hours on near – work activity, such as carpet weavers, visual display terminal workers and microscopists.[24] Several environmental risk factors for myopia, including higher educational attainment, higher socio-

economic status and increased amount of near – work activities, are well – documented in children 25 and adult 26 populations. However, the exact mechanism of how these factors induce the development and progression of myopia remains controversial. Though the results of our study did not reveal any significant relationship between near work activity and myopia, it can be explained on the fact that basically these factors determine the age of onset of myopia. Most of the students studying in medical colleges have acquired myopia in their late childhood ages as mentioned above.

In our study around 8.4% students developed myopia after their admission in medical college (1 year back) whereas majority of the students developed it before their admission in medical college. The medical college is a surrogate factor for near work activity and it can lead to progression of myopia in medical students who have already developed the condition. But due to genetic differences our students did not show more frequency of high myopia. This can also be due to the fact that as age advances, myopic progression slows down and the refractive status of the individual gets stabilized. Out of 117 myopics 18.8% did take vitamin A supplements whereas 81.2% did not take any Vitamin A supplements. Similarly, of 117 myopics, 26.5% had less than 7 servings per week whereas 73.5% had 7 – 14 vitamin A servings per week. But these dietary factors did not show any significant relationship with myopia. In other studies dietary factors have also been suggested as possible risk factors for myopia 37. However, the exact mechanism of how these factors induce the development and progression of myopia remain controversial.

In *Conclusion* prevalence of myopia was high among AIMC students (57.6%). 1st and 2nd year students had greater percentage indicating that it is increasing in the younger age group. This indirectly depicts that excessive intelligence and school work which newer students have to undertake leads to early development of myopia. Besides, the significance of genetic predisposition was well appreciated in our study which had been well established by many other studies worldwide too. Amount of near work and nutritional status did not show any significant relationship with myopia. It may be due to stabilization of the refractive status of the majority of the students who developed the error many years back.

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