

# Refractive Errors among Collegiate Students

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## Abstract

The observed epidemiology of refractive errors seen over a generation, fuelled by environmental changes namely stress and time spent in education, wherein the student population group requires considerable attention. This studies prevalence rates of various refractive errors occurring among college students of North India and to comparatively evaluate with respect to education stream, gender, religion and type of diet, 1200 (400 medical, 400 engineering and 400 arts) students aged 17-22 years from different colleges were interviewed regarding their diet, religion, and education stream, personal and family history of any medical or ocular disease. Visual acuity of all the students was assessed by Snellen and Jaegers charts and refractive errors were measured by cycloplegic refraction. The prevalence rates and 95% confidence intervals (CI) for myopia, hyperopia and astigmatism were calculated. Results were analyzed by chi<sup>2</sup> test and P values of less than 0.05 were considered significant. It was found that the prevalence of refractive errors varies with gender and education stream, but not with religion and type of diet.

Myopia was most prevalent refractive error in college students, 37.6% students have myopia, 3.58% astigmatism and 0.33 % hyperopia. Also statistically significantly higher prevalence of myopia was found in medical students as compared to other education streams (Myopia was significantly higher in medical (71.25%) as compared to engineering (28.25%) & arts students (13.5%)). No significant difference of myopia prevalence was found with respect to gender, religion or type of diet. Astigmatic prevalence was not significantly different in medical and engineering students but both medical and engineering students have significantly higher astigmatic prevalence as compared to arts students. Astigmatism was also significantly higher in females as compared to males. Highest myopia prevalence in medical students justifies that deteriorating vision is an occupational hazard for medical students.

**Keywords:** Refractive Errors, Medical, Engineering, Arts, Gender, Education Stream

## 1. Introduction

Refractive errors constitute a sizeable proportion of any eye OPD (Out Patient Department) in India. The overall incidence has been reported to vary between 21% and 25% of patients attending eye OPD in India [1]. They are one of the most common causes of visual impairment around the world and the second leading cause of treatable blindness [2]. Compared to cataract, early onset of refractive error accounts for twice as many blind-persons. They were found to be responsible for a significant proportion of blindness and moderate visual impairment in the population of India [3, 4]. Refractive error is a remediable cause of visual impairment, with correction of significant refractive error being a priority of VISION 2020: The 'Right to Sight', the joint global initiative of the World Health Organization (WHO) and the International Agency for the Prevention of Blindness [5].

Several factors including genetic and environmental influences like near work, night lighting, and UV exposure are also believed to play a role in determining the refractive status of the eye, but the true underlying mechanisms involved remain unclear [6,7,8,9]. Over a generation epidemiology of refractive errors has been observed worldwide and it has been suggested that the modern epidemiology of myopia is being fuelled by stress, time spent in full time education and other environmental factors. One group which requires considerable attention is the student population. Knowledge of the prevalence of refractive errors in them and their correlation with gender, type of diet, religion and education stream would help plan effective refraction services.

## 2. Material

A systematic cross-sectional study was conducted in a North-Indian Medical, Engineering and Arts Colleges to assess the prevalence of refractive errors in student population. 1200 students (400 medical, 400engineering & 400arts students) were from Govt.

Medical College, Thapar Institute of Engineering and Technology and Multani Mal Modi College, Patiala. Students taken for the study were aged between 17-22 years, of either sex, belonging to Hindu or Sikh religion. By using interviewer-administered questionnaire information regarding diet, religion, and education stream was obtained. A standard examination procedure was used for each study subject. Detailed history about present and past ocular problems and treatment, history of any medical or surgical treatment, and family history were taken. A probe into family history was made in establishing the familial predisposition of inheritable ocular disorders like glaucoma, cataract and ptosis. Visual acuity was assessed for far and near vision with Snellen chart at room illumination, and near vision test types respectively. General physical examination along with local examination of eye was done. Anterior segment was examined with flashlight to detect cataract; congenital anomalies like anophthalmos, microphthalmos, large corneas; and evidence of previous eye surgery. Informed oral consent was obtained from each student after the nature of the study was explained to them individually. Students in whom any abnormality was detected on local examination of eye or students having any present or past history of any eye disease or history of trauma to eye or an insult such as a history of retinopathy, prematurity, neonatal problems, or genetic diseases and / or connective tissue disorders associated with refractive errors, e.g. Stickler or Marfan syndrome were excluded and new subjects were recruited. Examinations included best-corrected distant and near visual acuity testing using Snellen’s and Jaegers test type, retinoscopy and cycloplegic refraction using trial and error method.

We performed fogging to rule out accommodative spasm. For fogging, we placed +10 Dioptres (D) lens in a trial frame and then gradually reduced the strength of the lens while the subject continued to look at the eye chart. Streak retinoscopy was performed using a +1.5 D lens in the right eye frame and asking the subject to fixate at a 6-meter distant target in order to relax accommodation. The subjects with visual acuity of 6/6 and with retinoscopic readings that confirmed the absence of a refractive error were excluded from further refraction procedures. For other subjects short term cycloplegia was achieved with 1% tropicamide, one drop in each eye; repeated once in 5 minutes. Tropicamide was chosen as cycloplegic because it is a safe drug; Central Nervous system disturbances are rarely encountered and it has transient cycloplegic action with a duration of only 10 to 40 minutes so that students whole day is not affected by cycloplegia. Cycloplegic refraction was performed 25-30 minutes after instilling eye drops. The visual acuity, type of refractive error and correction were noted in subjects.

Myopia was defined as Spherical Equivalent (SE) of at least -0.5 Dioptres (D), hyperopia as SE of at least +0.5 D. Astigmatic correction was prescribed in the minus cylinder format and astigmatism was defined as a cylindrical error atleast  $\pm 0.50$  D cylindrical Equivalent (CE) in any axis. The prevalence rates and 95% confidence intervals (CI) for each refractive error were calculated. Proportions were compared using the chi-square test and P values of less than 0.05 were considered statistically significant.

### 3. Results

Of the 1200 subjects included in the study 698 (58.16%) were males and 502 (41.8 %) were females. There were 462 (38.5%) Sikh and 738 (61.5%) Hindu students. 644 (53.66%) were vegetarian and 566 (46.34%) non-vegetarian.

The prevalence rates and 95% CI of refractive errors in students were calculated. (Table I).

The overall prevalence rates of refractive errors were:

- Myopia 37.6% (95% CI =39.48, 35.72) (SE of at least -0.50D),
- Hyperopia 0.33% (95% CI =0.34, 0.31) (SE of at least +0.5D),
- Astigmatism 3.58% (95% CI =3.77, 3.39) (CE of at least  $\pm 0.05$ D).

**Table. 1** Prevalence of refractive errors with respect to gender, religion, type of diet and education stream

	N	Myopia % (95%CI)	Hyperopia % (95%CI)	Astigmatism % (95%CI)
<b>Total</b>	1200	452	4	43
<b>Gender</b>				
Male	698	35.39 (37.15, 34.63)	0.57(0.59, 0.55)	5.01(5.26, 4.76)
Female	502	40.84(42.88, 38.8)	Nil	1.59(1.66, 1.49)
<b>Religion</b>				
Sikh	462	35.71 (39.28, 33.92)	Nil	4.11(4.31, 3.91)
Hindu	738	38.89 (40.83, 36.95)	0.54(0.56, 0.52)	3.25(3.41, 3.08)

Type of diet				
Vegetarian	644	39.9(41.8, 37.9)	0.31(0.32, 0.29)	2.95(3.09,2.80)
Non vegetarian	556	35.06(36.81, 33.07)	0.36 (0.37, 0.34)	4.31(4.53, 4.09)
Education stream				
Medical	400	71.25(74.21, 67.68)	0.25(0.26, 0.23)	6.5(6.82, 6.17)
Engineering	400	28.25(29.66, 26.83)	Nil	3.75(3.93, 3.56)
Arts	400	13.5 (14.17, 12.82)	0.75(0.78, 0.71)	0.5(0.52, 0.47)

CI: confidence interval; D: dioptres; N: number; SE: spherical equivalence, CE: cylindrical equivalent

The prevalence rates of myopia in female students were observed to be no different from males ( $p>0.05$ ). No difference in myopia prevalence was found in relation to diet and religion ( $p<0.001$ ) as well. However, this difference was found to be significant in different education streams. Medical students have significantly higher myopia prevalence as compared to engineering & arts students ( $p<0.001$ ). Engineering students also had higher myopia prevalence as compared to arts ( $p<0.001$ ).

The overall prevalence rates of astigmatism were 3.58% (cylinder of at least 0.50D). The prevalence rate of astigmatism was significantly higher in males as compared to females ( $p<0.001$ ). There were no significant differences in the prevalence rates of astigmatism between different religions, type of diet and education stream.

The relationship between hyperopia and education stream, religion and diet was not examined, as there were just 0.33% hyperopic students in the study population.

#### 4. Discussion

Myopia is the most common refractive error found in students followed by astigmatism and hyperopia. Same pattern of distribution of refractive errors were observed in general adult Indian population which had 34.6% myopia prevalence, 37.6% astigmatism, 18.4% hyperopia [10].

This study reported no difference in myopia prevalence between females and males. The results are supported by other studies which found no significant difference in myopia in male and female engineering and Norwegian medical students [11, 12]. Even in adult population and in school children of India, myopia distribution was equal in both the sexes [10, 13]. In contrast to the results of the present study, another study reported myopia more common in males while assessing myopia prevalence in general population [14]. This could be because of the interference of other factors which effect the prevalence of myopia like maladjusted education study level.

Myopia prevalence varies strongly with the education stream. The prevalence is found very high in medical students as compared to other streams. Study conducted in Indian medical students in 1979 has shown myopia prevalence among medicos as 24% [15]. Study results have shown that the prevalence rate of myopia in Indian medical students has increased over the past two decades. However, there are limitations in comparing these two studies, as participation rates are different and criteria for entry into medical school may have changed. Similar to our results higher myopia prevalence has been recorded in medical students from other Asian countries. A study of 157 second year medical students in Singapore had reported prevalence rate of myopia in Singapore medical students was 89.8% while that observed in this study was 71.25 % [16].

The results obtained from the study in Taiwan in 1996, reported myopia in 92.8% medical students [17].

The myopia rates in medical students of Asia are higher as compared to those in Europe. A Danish study of 147 medical students (median age 26 years) in 2000 reported figures of 50% while the Norwegian study on 140 medical students (median age 24.9 years) in 1992 reported a prevalence rate of 50.3% [18]. Myopia rate in our study is less as compared to results from other Asian countries but higher than European studies

However, the methodology, non-participation rates and refraction techniques differ and there are limitations in making comparisons. Study on Danish students used refractive values based mainly on information given by the students [18].

It has been reported that the severity of myopia is associated with the level of educational attainment [19, 20]. A study in Israel also found a strong association of myopia with both intelligence and years of school attendance. The prevalence rate of myopia was found to be significantly higher in the more intelligent and better educated groups [21]. A study conducted among men drafted for military service in Denmark also revealed that factors associated with intelligence and education were seen to be important in trig-

gering the onset of myopia. Myopes in general achieve higher intelligence test scores and higher educational levels than non-myopes. The overall difference in intelligence test scores corresponded to approximately 7 IQ points [22]. Medical students are a select population with a high level of education as well as above average intelligence. This perhaps might explain the high prevalence rates of myopia among medical students as compared to student of other education streams.

The long and intensive study regimen of medical school involves extensive nearwork such as reading and writing [23, 24]. It has been suggested that the amount of near work could cause myopia as well as its progression in adulthood [25-28]. It is possible that medical school may be a surrogate factor for intensive near work activity. It has been hypothesized that an underlying genetic predisposition may alter eye growth [29, 30]. However, it is now generally agreed that both heredity and the environment have important roles to play [28, 31]. 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.

In the present study the myopia is significantly higher in medical (71.25%) as compared to engineering (28.25%) and arts (13.50%) students. The significantly variable prevalence of myopia with respect to education stream is supported by other studies where medical students have more (70.7%) myopia prevalence as compare to arts (36.5%) students [24] and engineering students have higher myopia prevalence as compared to other population [32].

The variability of refractive errors especially myopia with the education stream can be explained by the use abuse theory. The regimen of intensive study required of medical students and the high education demand in engineering students and play important role in deteriorating their vision. Higher rates of myopia among particular occupations have been frequently cited as evidence for an environmental impact on myopia. It has been found for example that prevalence rates for myopia are highest among groups of individuals who spend long hours on intensive near work [33]. Occupations thought to pose a risk for myopia include microscopy, carpet weaving, visual display terminal work, map and chart drawing, precision mechanics, textiles, law, teaching, and management [34]. The educational pressures & intensive studying in medical students has forced us to put it in the list of occupations badly affected myopia.

Hyperopia prevalence is found very less in our study. The prevalence of hyperopia was 1.3% in Singaporean medical students [16]. Low rates of hyperopia found in students could be because hyperopia declines with increasing years of education [35]. Higher rates of hyperopia were found in Norwegian engineering students which reported a higher figure of hyperopia of 30 % [32]. However, the participation rate (95%) in the Norwegian study differed from this study and it may be inappropriate to draw comparisons.

The prevalence of astigmatism in our study is 3.58% and astigmatic prevalence was found significantly higher in males than in females. Results are similar to study on polish students that found 4% of the students, aged from 6 to 18 suffer from astigmatism. No influence of the students' age on the prevalence of astigmatism was observed. It was found that astigmatism occurs more frequently among boys rather than girls [36]. In contrast to our results a study in students (15-18 years old) from Northern Greece reported prevalence of astigmatism was 10.2%, it has also reported that females ran a significantly higher risk of astigmatism than males [37]. On the other hand a study in Singapore school children reported equal prevalence rates of astigmatism in males and females [23]. The prevalence of astigmatism was found more in medical and engineering students as compared to arts students but medical and engineering students have no difference in astigmatic prevalence. The difference in prevalence of astigmatism and its relationship with gender reported by different studies can be explained by the fact that astigmatism is hereditary and varies widely between and within the racial groups [38]. We could not find any study comparing astigmatism with respect to education stream. There is needed to work more in this area.

No correlation of refractive errors is found with diet and religion. The difference of prevalence of refractive errors was neither found significant between Hindu and Sikh nor between vegetarian and non vegetarian students. One of the earlier studies on Indian college students compared refractive errors in relation to religion but in that study Sikh religion was not included [15]. No other study has been conducted till date to compare refractive errors between Hindu and Sikh students or to compare refractive errors in relation to type of diet.

## 5. Conclusion

This study has thrown some light on distribution of refractive errors on student population and has shown that education stream acts as an important factor in determining the type of refractive errors. Considering results of present study, results earlier study done in Indian medical students and other. Asian studies we can see that over two decades the prevalence of myopia has increase in Indian medical students and it is coming close to results obtained from other Asian countries. Highest prevalence of myopia in medical students as compared to engineering and arts students supports the role of environmental changes like stress and time spent in full time education in myopisation. It has also emphasized and justified the saying "Deteriorating vision –an occupational hazard for medical students". This study produces a small insight of ongoing problem of refractive errors in students. Much work is still needed to as-

sess on a larger scale to enable alterations of the environmental factors responsible for causing refractive errors for the betterment of generations.

## 6. References

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