

ORIGINAL ARTICLE

Myopia among Medical Students-A Cross Sectional Study in A South Indian Medical College

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Abstract: *Objective:* A systematic cross-sectional study conducted in a South-Indian Medical College to establish refractive errors as a plebeian problem in young medical students. *Background:* Increase in myopia prevalence rates posing a threat to the health and economy of the developing countries. There is ample evidence in the ophthalmic literature to support the classic view of association of myopia with the learned people. However, there are also suggestions in regard to the role of environmental, nutritional, hereditary and work associations for this dramatic increase in myopia. *Method:* In the present study, the medical students of NRI Medical College were studied for their refractive errors. In addition, their gender distributions, heights, weights, body mass indices were also studied in a batch-wise manner. Information about the refractive errors of eye of their parents are gathered through interviewing these medical students. *Results and Conclusion:* Our observations suggest that – (a) myopia is the predominant refractive errors among the medical students; (b) the numbers of myopic students in a batch of medical students are increasing year by year; (c) there is no apparent bias towards either gender and (d) majority of the parents of myopic medical students are also found to be myopic.

Keywords: Myopia, Medical students, BMI, Gender, Parental influence

Introduction

Myopia prevalence appears to be increasing among economically developed societies worldwide. There has been a dramatic increase in myopia prevalence rates over the past few decades in different parts of Asia [1]. The increase in rates has been remarkable in very young Asian children, too, suggesting that early lifestyle risk factors may have a large impact on early myopia development and the overall population prevalence rate of myopia [2]. 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 [3]. While myopia may be viewed as resulting from a combination of hereditary and environmental factors, the dramatic and sudden increases in myopia prevalence during the past century in certain societies argue strongly for a dominant environmental influence. The clinical literature dealing with the potential etiology for myopia is massive but remarkable for its paucity of clear insights [4]. Prominent among the hypothesized myopia risk factors is a role for close up work, such as reading and related visual tasks [5]. More advanced education is repeatedly associated with greater myopia prevalence, but it remains unclear if educational level is an independent risk factor or a surrogate for close up work or some other socioeconomic characteristics.

Based on studies with Broader Adult population Surveys Fledelius suggested that a significance share of myopic newcomers after teenage level [6]. Woo *et. al.* reported that the prevalence rate of myopia in Asian countries have reached epidemic proportions [7]. Woo *et al* postulated that medical students are a select population with a high level of education as well as above-average intelligence, which perhaps might explain the high prevalence of myopia among the medical students [7]. The long and intensive study regimen of medical curriculum involves extensive near work, such as, reading and writing [8]. It has been suggested that the amount of near work could cause myopia as well as its progression in adulthood [4, 9]. Possibility of medical curriculum as a surrogate factor for intensive near work activity has been suggested by Woo *et. al* [7]. In this process, the factors which are involved in the growth of eyes are also to be included. However, it is now generally agreed that both heredity and environment have important roles to play in the formation as well as its progression of refractive errors of eye [4].

Refractive errors are extremely common in the young academically active population. As for any nation, they are the future of the hardcore human resource; it has a huge economic impact. Almost all the countries are nowadays suffering from this new type of epidemic with specially affected Eastern Asian nations, as evidenced from the review of literatures. On the other hand, as these are the major cause of mild to moderate visual impairment in the young individuals, knowledge of the prevalence of refractive errors would be helpful in the planning of public health strategy. Thus, the study related to the refractive errors in the young population, especially those involved in the professional studies should be of prime concern. Though, recently some studies were carried out in Singapore and Taiwan, no specific study involving the medical students of India is available. As it is suggested from the review of literatures, refractive errors may be common in young medical students. To evaluate this hypothesis, the present study is aimed to have a systematic cross-sectional study of prevalence of refractive errors in students of medicine course of NRI Medical College, Guntur, Andhra Pradesh.

Material and Methods

The present study was carried on 549 MBBS students (out of which, 279 males and 270 females) of NRI Medical College. The study was conducted in four batches, admitted in the years from 2003 to 2006. Informed oral consent was obtained from each student after the nature of the study was explained to them individually. None of the students had any known ocular disease, 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. All students were examined for their height, weight, visual acuity and defects in color vision. Body mass index was calculated from the obtained height and weight. The refractive values were collected based on the information furnished by the students themselves or collected from their current spectacle prescription, wherever available. The family histories pertaining to refractive errors in their parents were also collected by individual interrogation of each student.

The anthropometric scale and weight machine were used to collect the data about height and weight of the individual student and represented in centimeters and kilograms, respectively.

The body mass index was calculated using the formula as follows

$$\text{Body Mass Index} = \frac{\text{Weight (Kg)}}{[\text{Height (m)}]^2}$$

The values, obtained thus are represented in terms of BMI score.

Snellen's chart was used to test the visual acuity for distant vision and Jaeger's charts were used to test the visual acuity for near vision. The test of possible defect of color vision was conducted with the help of Ishihara pseudo isochromatic color plates. Statistical calculations are carried out by student's 't'-test and the z score is used to calculate the level of significance.

Results

Batch of students	No. of students admitted			No. of students with Myopia			No. of students with other visual defect
	Male	Female	Total	Male	Female	Total	
2003-04	52	47	99	22	18	40	1 ^a
2004-05	75	75	150	27	34	61	1 ^b
2005-06	74	76	150	40	36	76	2 ^c
2006-07	74	76	150	48	57	105	-
Total	275	274	549	137	145	282	4

^a – One female student with anomalous trichromacy. ^b – One male student with inability to identify primary colors. ^c – Two male students confused with primary colors.

Table-1 is showing the overall information of the involved subjects (549 MBBS students from NRI Medical College, 2003-04 batch, 2004-05 batch, 2005-06 batch and 2006-07 batch). In the first batch of admission (2003-04 batch) there were 99 students admitted in the MBBS course, in the rest three batches of admission (2004-05 batch, 2005-06 batch and 2006-07 batch) there were 150 students in each year. Among all of these, two students (one female student from 2005-06 batch and one male student from 2006-07 batch) were physically challenged, however, without any ocular disorder (fitting in the exclusion criteria). Total four students (one female student from 2003-04 batch, one male student from 2004-05 batch and two male students from 2005-06 batch) were noted to be having defect in color vision (confused with primary color) as shown in table-1. There were total 286 students suffering from myopia (41 students in 2003-04 batch, 62 students in 2004-05 batch, 78 students in 2005-06 batch and 105 students in 2006-07 batch).

However, among these 4 students were found to be having some defects in color vision and thus excluded from the study related to myopic students. There is hardly any gender dominance in any of the four batches of medical students included in the study (Table-1). Table-1 is also depicting the prevalence of myopia in all the batches. It shows a trend towards an increase in the percentage (as well as the absolute number in each batch) of myopic students in every following year as 40%, 40.7%, 50.7% and 70% of total students. The numbers of both male and female students with their specific lens power were showed in Figure 1. As per the lens power (what the students are using currently), the students were divided into three groups of mild myopia (power ≤ 2 diopters), moderate myopia (power $>2-5$ diopters) and high myopia (power > 5 diopters). There distribution in each batch and with individual eye power for male (Figure 1A) and for female (Figure 1B) is presented.

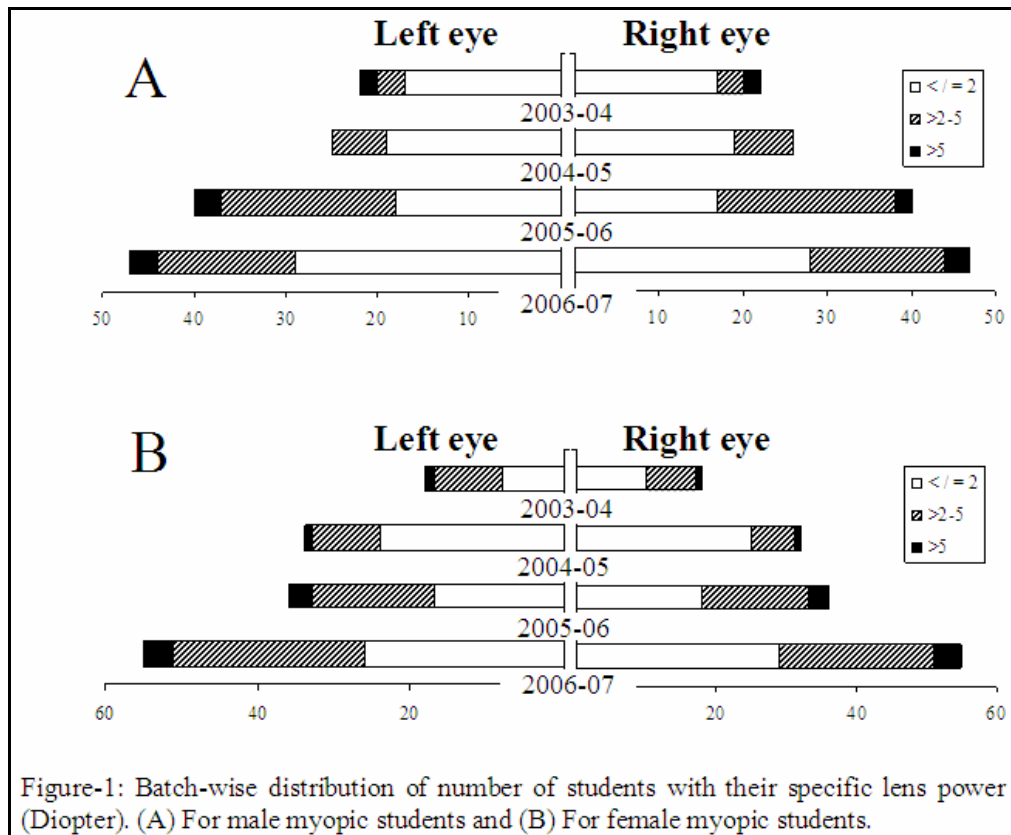


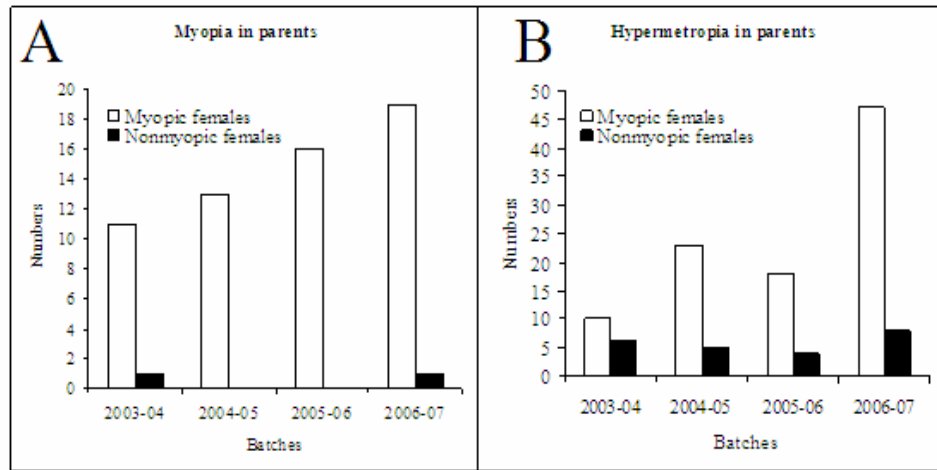
Figure-1: Batch-wise distribution of number of students with their specific lens power (Diopter). (A) For male myopic students and (B) For female myopic students.

The heights, weights and BMI scores of different batches of students were represented in table-2. Among the male students, there is no significant difference in heights, weights and BMI scores between the myopic and non-myopic students, whereas female myopic students show significantly lower heights and weights compared to non-myopic students in 2004-05 and 2005-06 batches. On the other hand, in 2006-07 batch of students, female myopics are significantly taller and heavier than the non-myopic counterparts.

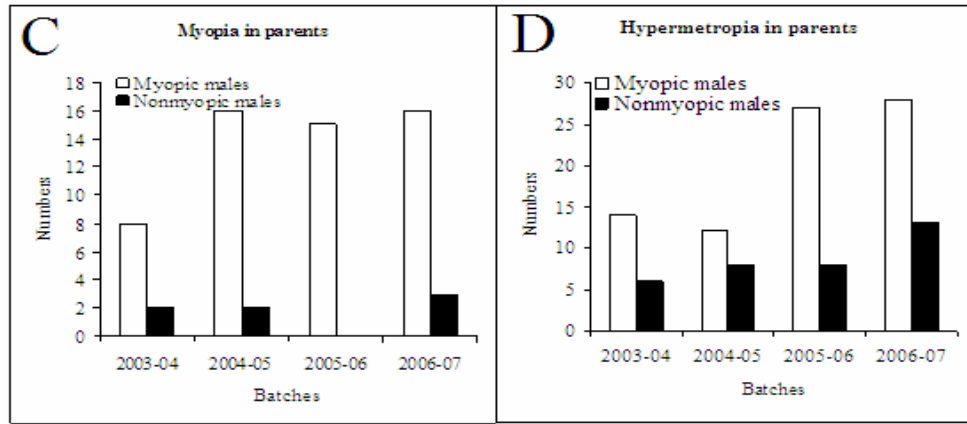
Table-2: Height, weight and BMI of the included students							
Batch of students		Height (cm)		Weight (Kg)		BMI (Score)	
		Non-myopic	Myopic	Non-myopic	Myopic	Non-myopic	Myopic
2003-04	Male	169.67 ± 1.29	168.73 ± 1.45	64.83 ± 2.04	63.32 ± 2.54	22.48 ± 0.48	22.18 ± 0.53
	Female	157.59 ± 1.42	152.67 ± 1.16*	56.86 ± 1.37	50.61 ± 1.55*	22.60 ± 0.39	21.82 ± 0.73
2004-05	Male	170.25 ± 0.69	168.48 ± 1.31	64.48 ± 1.11	62.33 ± 1.72	22.24 ± 0.28	21.72 ± 0.44
	Female	159.56 ± 1.18	157.41 ± 1.26	56.41 ± 1.48	56.06 ± 1.48	22.15 ± 0.47	22.34 ± 0.60
2005-06	Male	168.44 ± 1.43	166.86 ± 1.07	64.06 ± 1.52	60.64 ± 1.02	22.73 ± 0.64	21.79 ± 0.33
	Female	158.44 ± 0.88	155.19 ± 0.86*	55.03 ± 1.10	52.72 ± 1.04*	21.90 ± 0.38	22.04 ± 0.45
2006-07	Male	170.50 ± 1.39	170.81 ± 1.03	68.23 ± 2.38	65.79 ± 1.50	23.33 ± 0.60	22.47 ± 0.41
	Female	156.29 ± 1.99	160.86 ± 0.87*	52.76 ± 3.40	59.68 ± 1.51*	22.35 ± 0.89	23.03 ± 0.55

Data are mean ± SEM. * indicates p < 0.05 when compared with corresponding non-myopic group

Figure-2: Batch-wise comparison of refractive errors of eye in parents of myopic and nonmyopic students. (A) Myopia in parents of female students, (B) Hypermetropia in parents of female students, (C) Myopia in parents of male students and (D) Hypermetropia in parents of male students.



The comparisons of number of myopic parents in between myopic and nonmyopic female students are depicted in the figure 2A. The figure shows that there was an increase in the number of myopic parents in the myopic females of the every following batch whereas there is hardly any myopia in parents of nonmyopic females. Figure 2B shows that the number of hypermetropic parents. It has been observed that the numbers of hypermetropics are higher in parents of myopic female students than the parents of nonmyopic female students.



Likewise, in parents of male students the numbers of myopic parents were found to be higher in the myopics than the nonmyopics (Figure 2C). Similarly, the numbers of hypermetropic parents in myopic male students were also higher than the nonmyopic male students (Figure 2D) in every batch.

Table-3: Prevalence of refractive errors in parents of (A) myopic students and (B) nonmyopic students

A Parents of myopic students		Batches							
		2003-04		2004-05		2005-06		2006-07	
		M	F	M	F	M	F	M	F
No refractive errors in either of the parents		6	4	8	8	11	9	17	12
One of the parents is having refractive errors	Myo	1	3	2	2	3	9	7	10
	Hyp	9	4	7	14	12	11	11	12
Both the parents are having refractive errors	Myo	2	2	6	3	3	2	1	2
	Hyp	1	1	2	2	4	2	5	15
	Mix	3	4	2	5	7	3	7	5

B Parents of non-myopic students		Batches							
		2003-04		2004-05		2005-06		2006-07	
		M	F	M	F	M	F	M	F
No refractive errors in either of the parents		23	22	38	37	28	30	19	11
One of the parents is having refractive errors	Myo	1	1	2	0	1	0	1	1
	Hyp	6	6	8	3	5	5	3	2
Both the parents are having refractive errors	Myo	0	0	0	0	0	0	0	0
	Hyp	0	0	0	1	2	3	5	3
	Mix	0	0	0	0	0	0	0	0

Myo = Myopic, Hyp = Hypermetropic, Mix = One of the parents is myopic and other parent is hypermetropic, M = Male student, F = Female student.

Prevalence of refractive errors (myopia and hypermetropia) of myopic and nonmyopic students is presented in table-3.

Parents were subdivided into three groups (i) Both parents without any refractive error, (ii) One of the parents is having myopia or hypermetropia and (iii) Both the parents are having myopia or hypermetropia or one of the parent is having myopia and other parent is having hypermetropia.

Discussion

It is already an established fact that the correctable refractive errors of eye are creating a specific burden on the human resource as well as economy, worldwide. This acute eye problem is very much emphasized in some recent studies from Eastern Asian countries. India is also not exempted from this very problem. Since, most of the time young age group and especially those engaged in near work are found to be vulnerable to this crisis, the predicament need to be paid attention at all the stages of socio-academic-health-economic point of development. Thus the present study of refractive errors in medical students itself implies its own importance to be taken up.

The prevalence of ametropias in the literature is conflicting, mainly regarding myopia and hyperopia. According to Matsumura and Hirai, myopia is the most common ocular disorder in Japan, affecting, at some ages, 65.6% of individuals [10]. Some authors, in a sample of medical students in Singapore, discovered that 82% were myopic [8, 11]. In India, there are limited data available on the prevalence of refractive errors in the adult population. It is estimated that 49.3 million of those aged ≥ 15 years may have refractive errors [12] and undercorrected refractive error is the most common cause of reversible blindness in India. Kalikivayi *et al* [13] found that the prevalence of myopia was 8.6% among the school children in Southern India. However, a higher prevalence has been reported in North Indian children by Chandra *et. al.*[14]. In their study, Kalikivayi *et al* [13] observed significantly higher prevalence of myopia among children aged 10 years or greater compared to those aged less than 10 years. Thus they have suggested that myopia is progressive and/or that the onset of myopia may be delayed in some children [13]. However, till date, no population based data about the refractive errors in medical students is available. In this respect, this study is the first study concerning the refractive errors in the medical students.

During this study, among the four batches of medical students there is no significant gender variation (Table-1), thus the study groups provide an equal chance to include both male and female students in the study. The study also shows that (Table-1) the commonest refractive error, in that matter, the commonest visual defects also, among the medical students of NRI Medical College is the myopia. On the other hand, the interesting observation came out from the present study is that the percentage of myopics out of the total students taking admission to the medical curriculum of NRI Medical College is increasing every year (Table1). Following the trend of numbers of myopics year by year (Table-1), the numbers of male and female myopics are also increasing year after year. However, the percentages or absolute numbers of male and female medical students are not showing any consistent dominancy. In the 2003-04 batch and 2005-06, the numbers of male myopics were more than the female

myopics, whereas in the 2004-05 batch and 2006-07 batch, the numbers of male myopics were less than the female myopics. In a study by Goldschmidt [15], myopia was seen more frequently in girls than boys. Garner *et. al.* [16] reported that there was no difference in the prevalence of myopia between girls and boys. Similarly Kalikivayi *et al* [13] also did not find any difference between the male and female children. However, more recently Mavracanas *et al* [17] reported that the prevalence rate of myopia was higher in female students as compared to their male counterparts among the Greek high school students. Therefore, from the present study, no comment can be made about the gender bias of myopia prevalence. However, it demands an absolute standing about the gender variation; for which conclusive study with more number of subjects is required.

It has been noted that height and obesity have been linked to several eye conditions [18-19]. Higher intraocular pressure and cataract were found to be more common in taller individuals [20]. Cataract occurs either in underweight or overweight individuals, whereas elevated intraocular pressure is associated with obesity [18-19]. Therefore, eyeball length or myopia may be influenced by height or BMI. In previous studies, no relationship between anthropometric measurements and myopia was detected in Israeli military recruits, whereas myopic Finnish males were taller than their nonmyopic counterparts [21-22]. In a recent study by Wong *et al* [23] in Singapore Chinese adults, taller persons were found to have eyes with longer eyeballs, deeper anterior chambers, thinner lenses, and flatter corneas, although no increase in myopia. In their study, ocular measurements did not vary with weight or body mass index. Because myopia most commonly starts in young children and the period of critical body and eye growth occurs in early childhood, the effects of dynamic changes in body growth on the emmetropization process would be best studied in young growing children [17]. As it is indicated that no definite relationship is available between the refractive errors of eye and body measurement, in the present study also it was observed that only female myopic students showing some significant differences in height and weight in comparison to their nonmyopic counterpart (Table-2). However, these differences were also not consistent in all the batches. On the other hand, the body mass index is not showing any significant difference between the myopics and nonmyopics, even in female students. Controlling for age, gender, parental myopia, reading, school, and weight showed that taller Singapore Chinese children had eyes with longer axial lengths, deeper vitreous chambers, flatter corneas, and refractions that tended toward myopia [20]. From the present study, though no conclusive comment on relationship between body mass index and refractive error can be made, it is observed that male myopic medical students studying in NRI Medical college are having lower (statistically insignificant) body mass index than the nonmyopic male counterpart (Table-2). In the contrary, female myopics of last three batches are showing higher BMI in comparison to nonmyopic female medical students (Table-2). In a multivariate analysis Saw *et al* [20] also observed that eyes in children who were heavier or who had a higher BMI tended to have refractions that were more hyperopic, and eyes in heavier children had shorter vitreous chambers. Thus the gender as well as body measurements may have some contribution in respect to refractive errors.

Though, the impacts are not statistically proven, it cannot be undermined either. In a study of school children of rural and urban Gujarat, Bhatt *et. al.* [24] observed that myopia risk was associated with female gender and having father with a higher level of schooling. In the present study also, to have an idea about the hereditary contribution on the prevalence of myopia among the medical students of NRI Medical College, the information regarding the refractive errors of the parents were gathered. The collected information do indicate the weightage of hereditary influence on myopia among the students (Figure 2 and Table-3), however, it is either due to direct genetic predisposition or through just habitual influence, cannot be concluded by the present study. The present study on the medical student of NRI Medical College in regard to the refractive errors of eye revealed that – (a) Myopia is the predominant refractive errors among the medical students studying in this college. In this regard, the importance of rigorous academic hard work in the previous years to qualify the admission test related to medical study need to be studied to find out whether this is one of the underlying causes of getting myopia in the young age. (b) The numbers of myopic students in a batch of medical students are increasing year by year. However, the concluding remark about the two possibilities - myopics are getting admitted into the medical curriculum or students aspiring for admission in medical curriculum are becoming myopics cannot be made. It needs further follow up study with younger age group. (c) Among the group of medical students studied, the prevalence of myopia shows no apparent bias towards either gender. (d) Majority of the parents of myopic medical students are also found to be myopic. However, this not necessarily prove the hereditary influence regarding myopia, as both parents and offspring are may be of high academic profile or like minded individuals with privileged choice for near work.

Therefore, from the present study the importance of young age refractive errors in the medical students *per se* high academic professionals is very much highlighted, however, before any conclusion is drawn, it demands some further study. In spite of some shortcomings inherent in the present study, it can be concluded that the myopia is predominant among the medical students and it is going to be an economical threat for the nation.

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