

# Refractive Errors among Medical Students – A Cross-sectional Study

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## Abstract

**Objective:** The objective of the study was to determine the prevalence of refractive errors among the medical students of Nishtar Medical University Multan and to learn any impact of their daily routine on the incidence of the disease.

**Materials and Methods:** A cross-sectional study of 200 medical students of Nishtar Medical University (98 males and 102 females) was carried out. Forty students each from all five academic years of MBBS were selected using a simple random sampling technique. The chosen study population was explained the study's objectives and a written consent form was obtained from each student. The medical screening record of visual acuity was taken from the participants. Some additional ophthalmological examinations were also carried out by a senior consultant of the university's ophthalmological department to confirm the refractive error status. A questionnaire was also structured, containing information about their daily routines, habits, and personal information to assess some risk factors' possible association with refractive errors. The data were recorded on a data sheet for every individual, and the statistical analysis was performed using SPSS v.2.0 and Microsoft Excel.

**Results:** Out of 200 medical students, 119 (59.5%) had some or the other form of refractive error. The class-wise prevalence of refractive errors in successive years of MBBS from 1<sup>st</sup> to 5<sup>th</sup> year was 29 (72.5%), 21 (52.5%), 25 (62.5%), 25 (62.5%), and 19 (47.5%). Among those with refractive errors, 55 (46.2%) were male and 64 (53.7%) were female. In comparison, 109 (91.6%), 5 (4.2%), and 5 (4.2%) were myopes, hyperopes, and simple astigmatic, respectively. The applied tests of significance, that is, Chi-squared tests and Fischer's exact tests with a two-sided P value of <0.05%, were used. The studied variables in the study showed that gender, parental history of refractive errors, increased use of electronic gadgets, daily involvement in sports, frequent use of dietary supplements, use of appropriate light for studying, and regular practice of eye exercises were statistically significant in the prevalence of refractive errors among the medical students.

**Conclusion:** There is a high prevalence of refractive errors among Nishtar Medical University medical students, and myopia is the most prevalent refractive error. Several factors are studied in this study, which has a significant association with disease incidence.

**Keywords:** Astigmatism, Hypermetropia, Medical students, Myopia, Refractive errors

## INTRODUCTION

Refractive error is defined as an error in focusing light on the retina, causing a decreased visual acuity.<sup>[1]</sup> The three most common types of refractive errors are as follows:

- Myopia (Nearsightedness) – causing difficulty to focus far objects
- Hypermetropia (Farsightedness) – causing difficulty to focus near objects.

Astigmatism – this is distorted vision resulting from an irregularly curved cornea.<sup>[2]</sup>

Refractive errors are estimated to be the second most common cause of blindness worldwide in 2010<sup>[3]</sup> and one of the most familiar reasons for patients to visit an ophthalmologist. Academically active professionals, like medical students, are the primary sufferers of visual

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impedance.<sup>[4]</sup> It may be because they contact technology the most in their everyday activities, spend long hours reading and doing near work, not finding enough time for sports and physical activities, and acute academic stress to pass and compete.<sup>[5,6]</sup> Poor vision in students negatively influences their future life as it affects their productive performance in education and affects their professional competence and performance in the long-term.<sup>[7]</sup>

Unfortunately, there is a scarcity of studies addressing refractive error prevalence in Pakistan; however, a survey conducted on Singapore's medical students showed a prevalence rate of 82% for refractive errors.<sup>[8]</sup> Another study showed a prevalence of 54% for refractive errors among the medical students of India.<sup>[9]</sup> Therefore, medical students of Nishtar Medical University Multan were selected to determine the prevalence of various refractive errors and find an impact of their daily routine over the disease progression to get a record for this region.

## MATERIALS AND METHODS

### Study Design and Settings

It is a cross-sectional study conducted from March to May 2020 at Nishtar Medical University, Multan. Ethical issues were addressed according to the institutional review board.

The university has a medical screening policy for admitting students, where every student is screened for various medical illnesses, refractive error problems, and vaccination statuses. It has its medical board, including a highly specialized ophthalmologist that takes the best-corrected visual acuity using a Snellen chart, automated refractometer, doing some blood work, and followed by a medical interview. For our study, we took the medical screening record of visual acuity from the participating students. Some additional ophthalmological examinations were also carried out by a senior consultant of the university's ophthalmological department.

Among all 5 years of MBBS, 40 students from each class were selected, making 200 students, based on simple random sampling. The students of both sexes aged from 18 to 25 years. The chosen study population was explained the study's objectives, and a written consent form that stated the purpose, methods, risks, benefits, and the assurance of the confidentiality of the data was obtained from each student. The participation rate was 100%. The study was conducted over 2 months.

A questionnaire was structured to assess the possible association of some risk factors with refractive errors. It was adopted from different studies.<sup>[10,11]</sup> Some sections

of the questionnaire were customized to fit the study population and the differences in the living environment that may impact quantifying outdoor and indoor activities. Previous studies have widely used the questionnaire-based method to quantify near-work and outdoor activities.<sup>[12,13]</sup> All questionnaires were filled by the study participants. The questions covered necessary information like demographic data, including name, age, gender, class, corrected refractive measurements, year of diagnosis, personal history of wearing spectacles or contact lenses, and parental refractive error status. The data regarding the average number of hours spent per day on near-work activities were collected from questions based on studying, using mobile phones, computer, and television. The data regarding the time spent on outdoor activities were collected from questions about involvement in sports and other outdoor hobbies. The participants were also asked about the use of any dietary supplement, appropriate light for studying, the practice of any eye exercise, eyewashes before going to bed, and also about their everyday nutritional habits.

### Procedure and Data Analysis

The questionnaire-based data were collected, organized, summarized, analyzed, and later presented using Microsoft Excel and SPSS v.20. Chi-squared tests and Fisher's exact tests were used to test the association among categorical and continuous variables, respectively. For the analysis, a two-sided  $P < 0.05$  was considered statistically significant.

## RESULTS

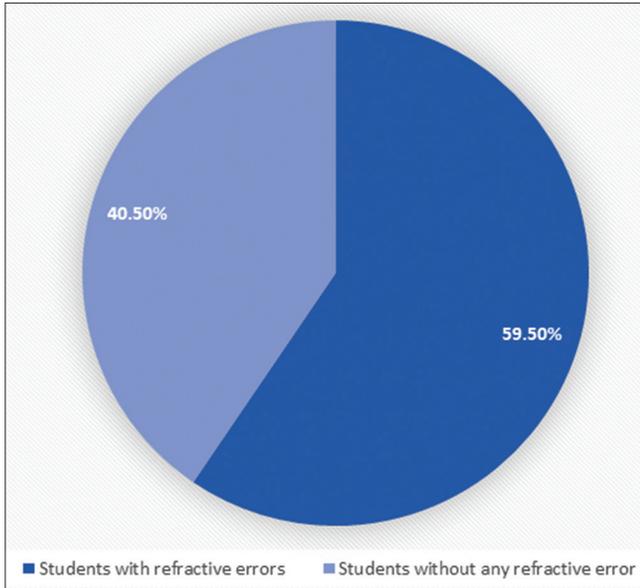
The study comprises 200 medical students from the classes 1<sup>st</sup> to 5<sup>th</sup> year of MBBS, 40 students from each class with zero non-participation rate and ages ranged from 18 to 25 years. One hundred nineteen (59.5%) of 200 subjects had some or the other form of refractive error [Figure 1]; with 29 (72.5%), 21 (52.5%), 25 (62.5%), 25 (62.5%), and 19 (47.5%) students having refractive errors in successive years of MBBS from 1<sup>st</sup> to 5<sup>th</sup> year. Among those with refractive errors, 55 (46.2%) were male and 64 (53.7%) female [Figure 2]. In comparison, 109 (91.6%), 5 (4.2%), and 5 (4.2%) were myopes, hyperopes, and simple astigmatic, respectively. The overall mean age of respondents having refractive errors was  $20.7 \pm 1.65$  years. On the contrary, 81 (40.5%) students had no refractive error [Figure 1].

The prevalence of refractive errors among different age groups of the studied population is shown in Table 1. The results show the maximum prevalence in the age group of 18–19 years.

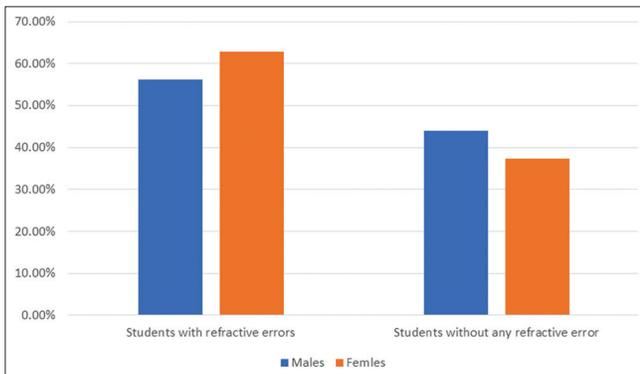
The applied tests of significance showed that from the studied variables in the study such as gender, parental

**Table 1: Prevalence of refractive errors in different age groups**

Age groups	Students with refractive errors	Students without any refractive error	Total	Percentage of students with refractive errors
18–19	29	14	43	67.44
20–21	55	32	87	63.21
22–23	29	29	58	50
24–25	06	06	12	50



**Figure 1: Total distribution of refractive errors among students**



**Figure 2: Gender-wise distribution of refractive errors among students**

history of refractive errors, increased use of electronic gadgets, involvement in sports, frequent use of dietary supplements, use of appropriate light for studying, and regular practice of eye exercises, were statistically significant in the prevalence of refractive errors among the medical students [Table 2].

Gender-wise response to the questionnaire was recorded. After comparing the values of different variables between males and females having refractive errors, it was found that females have more prevalence of refractive errors

than males and females have early diagnosis, more frequent change in prescription, more intense studying hours, fewer sports involvement, and more positive parental history and less habit of dietary supplement intake than males [Table 3].

Class-wise response to the questionnaire was also recorded. After comparing different variables, it was found that 1<sup>st</sup>-year students have more prevalence of refractive errors while other variables are found not to be comparable [Table 4].

## DISCUSSION

This study has several important findings. Among the medical students aged from 18 to 25 years, the prevalence of refractive errors was 59.5%, following the results of similar studies conducted in India, showing a prevalence of 54% and 55%.<sup>[5,9]</sup> The majority of participants in our study were affected by myopia (91.6%) followed by hyperopia (4.2%) and astigmatism (4.2%). Such high prevalence of myopia in young medical students of Pakistan is supported by the studies on medical students of India (77.7%), Singapore (82%),<sup>[9]</sup> and Malaysia,<sup>[14]</sup> where myopia was also found to be higher as compared with other errors of refraction. However, such prevalence of myopia was quite high when compared to other countries. It was estimated to be 32.9%, 13%, 19.7%, and 34.2% in Turkish, Norwegian, Jordanian, and European students, respectively, aged 20–24.<sup>[15–18]</sup> The high reported prevalence of myopia observed in South-Asian students as compared to the East-Asian and Western students could be explained by the ethnic variations, different genetic predisposition and environmental factors; like the medical students of South-Asia spend less time outdoors as they are subjected to a more rigorous examination system.<sup>[13,19,20]</sup>

Regarding the prevalence among male and female participants, a significant difference was observed in this study. Similar results were seen in a survey of medical students of Saudi Arabia and Turkey.<sup>[16]</sup>

The presence of refractive parents' errors was a significant contributing factor in the prevalence of visual error defects in students under study, using

**Table 2: Comparison of variables between students with refractive errors and students without any refractive error**

Questions	Students having refractive errors n=119 (100%)	Students without any refractive error n=81 (100%)
Hours for studying		
Moderate	67 (56.30)	53 (65.43)
Intense	52 (43.70)	28 (34.57)
Hours for resting		
Moderate	46 (38.66)	37 (45.68)
Intense	73 (61.34)	44 (54.32)
Hours for using electronic gadgets		
Moderate	41 (34.45)	40 (49.38)
Intense	78 (65.55)	41 (50.62)
Involvement in sports		
Yes	21 (17.65)	36 (44.44)
No	98 (82.35)	45 (55.56)
Last professional grade		
Good	3 (2.52)	5 (6.17)
Average	116 (97.48)	76 (93.83)
Presence of refractive error in any parent		
Yes	90 (75.63)	40 (49.38)
No	29 (24.37)	41 (50.62)
Intake of dietary supplements		
Yes	24 (20.17)	28 (34.57)
No	95 (79.83)	53 (65.43)
Attitude toward review for visual assessment		
Every 6 months assessment	11 (9.24)	0 (0)
Every year assessment	20 (16.81)	4 (4.94)
When there are visual symptoms	88 (73.95)	77 (95.06)
Use of appropriate light for studying		
Yes	102 (85.71)	77 (95.06)
No	17 (14.29)	4 (4.94)
Practice of eye exercises		
Yes	6 (5.04)	19 (23.46)
No	113 (94.96)	62 (76.54)
Habit of eye wash at night		
Yes	39 (32.77)	34 (41.98)
No	80 (67.23)	47 (58.02)

Moderate: 1–4 h, Intense: More than 4 h, Good: Above 70%, Average: 60–70%

statistical significance tests. This result is also in agreement with similar studies done.<sup>[16,21]</sup> Parental refractive error status was sometimes interpreted as evidence for a genetic role; however, as there is growing evidence for the greater influence of environmental factors, it remains difficult to explain the complex interaction between environmental and genetic factors in the prevalence of refractive error. It is generally agreed now that both heredity and environment have important roles to play.<sup>[22,23]</sup>

The long and extensive study regimen of a medical school involves extensive near-work such as reading and writing.<sup>[8]</sup> Suggested that an increased amount of near-work could cause an early defective vision and its progression in adulthood.<sup>[22]</sup> The possible association between near-work activity and the prevalence of refractive error can be explained on the basis that increasing the amount of near-work done can consequently increase

accommodation, which in turn could potentially cause defective vision, particularly myopia.<sup>[24]</sup> However, evidence from experimental animal studies has shown that accommodation is not an influencing factor.<sup>[25-28]</sup> Multiple studies have demonstrated an association of near-work with the prevalence of refractive errors. For instance, a longer axial length was substituted for myopia, and it showed association with a long time indoors.<sup>[29]</sup> Another study implied that for each additional 1 h of writing/reading or computer work, myopia's odds increased by 24% and 16%, respectively.<sup>[15]</sup> Our study also found a significant association between the prevalence of refractive errors and the amount of near-work performed. Since there is no universal definition for near-work, and hence quantification of near-work may vary, and so might the results. A questionnaire-based survey for quantifying near-work has been used in this study. However, it is prone to have recall bias in terms of recalling time spent on various near-work activities

**Table 3: Gender-wise response to questionnaire by students having refractive errors**

Questions	Male n=55(100%)	Female n=64 (100%)
Type of refraction error		
Myopia	52 (94.55)	57 (89.06)
Hypermetropia	1 (1.82)	4 (6.25)
Astigmatism	2 (3.64)	3 (4.69)
Time of diagnosis		
Before entering medical college	44 (80)	56 (87.50)
After entering medical college	11 (20)	8 (12.50)
No. of times the change in prescription after entering medical college		
None	24 (43.64)	34 (53.13)
Once	17 (30.91)	18 (28.13)
Twice	10 (18.18)	6 (9.38)
Thrice or more	4 (7.27)	6 (9.38)
Attitude toward the use of visual aids		
Class lectures only	9 (16.36)	28 (43.75)
Book reading only	4 (7.27)	2 (3.13)
Driving only	2 (3.64)	0 (0)
Using electronic gadgets only	0 (0)	4 (6.25)
Every time	40 (72.73)	30 (46.88)
Hours for studying		
Moderate	31 (56.36)	36 (56.25)
Intense	24 (43.64)	28 (43.75)
Hours for resting		
Moderate	21 (38.18)	25 (39.06)
Intense	34 (61.82)	39 (60.94)
Hours for using electronic gadgets		
Moderate	16 (29.09)	25 (39.06)
Intense	39 (70.91)	39 (60.94)
Involvement in sports		
Yes	18 (32.73)	3 (4.69)
No	37 (67.27)	61 (95.31)
Last professional grade		
Good	1 (1.82)	2 (3.13)
Average	54 (98.18)	62 (96.87)
Presence of refractive error in any parent		
Yes	39 (70.91)	51 (79.69)
No	16 (29.09)	13 (20.31)
Intake of dietary supplements		
Yes	12 (21.82)	12 (18.75)
No	43 (78.18)	52 (81.25)
Attitude toward review for visual assessment		
Every 6 months assessment	7 (12.73)	4 (6.25)
Every year assessment	12 (21.82)	8 (12.50)
When there are visual symptoms	36 (65.45)	52 (81.25)
Use of appropriate light for studying		
Yes	47 (85.45)	55 (85.94)
No	8 (14.55)	9 (14.06)
Practice of eye exercises		
Yes	1 (1.82)	5 (7.81)
No	54 (98.18)	59 (92.19)
Habit of eye wash at night		
Yes	15 (27.27)	24 (37.50)
No	40 (72.73)	40 (62.50)

Moderate: 1-4 h, Intense: More than 4 h, Good: Above 70%, Average: 60-70%

bedsides its possible inability to detect individual differences.

The protective role of daily outdoor sports from developing refractive errors has also been studied in various studies. Some did not find an association and some found only a weak association. Our study signifies that students involved in daily sports activities and spent less time indoors had

a low prevalence of refractive error. A similar association was reported in other studies too.<sup>[11,12,15]</sup>

It was also found that the students who regularly took dietary supplements, studied under appropriate light, and practiced regular eye exercises had less chance of developing refractive errors. However, this association is not supported by adequate evidence from studies.

**Table 4: Class-wise response to questionnaire**

Questions	Class (1 <sup>st</sup> year) n=40 (100%)	Class (2 <sup>nd</sup> year) n=40 (100%)	Class (3 <sup>rd</sup> year) n=40 (100%)	Class (4 <sup>th</sup> year) n=40 (100%)	Class (5 <sup>th</sup> year) n=40 (100%)
Type of refraction error					
Myopia	28 (70)	18 (45)	22 (55)	24 (60)	17 (42.5)
Hypermetropia	1 (2.5)	2 (5)	1 (2.5)	1 (2.5)	0 (0)
Astigmatism	0 (0)	1 (2.5)	2 (5)	0 (0)	2 (5)
Time of diagnosis					
Before entering medical college	26 (65)	19 (47.5)	20 (50)	21 (52.5)	14 (35)
After entering medical college	3 (7.5)	2 (5)	5 (12.5)	4 (10)	5 (12.5)
No. of times the change in prescription after entering medical college					
None	23 (57.5)	5 (12.5)	13 (32.5)	10 (25)	7 (17.5)
Once	1 (2.5)	12 (30)	5 (12.5)	10 (25)	7 (17.5)
Twice	5 (12.5)	3 (7.5)	2 (5)	3 (7.5)	3 (7.5)
Thrice or more	0 (0)	1 (2.5)	5 (12.5)	2 (5)	2 (5)
Attitude toward the use of visual aids					
Class lectures only	9 (22.5)	6 (15)	8 (20)	9 (22.5)	5 (12.5)
Book reading only	2 (5)	1 (2.5)	0 (0)	1 (2.5)	2 (5)
Driving only	1 (2.5)	0 (0)	0 (0)	1 (2.5)	0 (0)
Using electronic gadgets only	0 (0)	1 (2.5)	3 (7.5)	0 (0)	0 (0)
Every time	17 (42.5)	13 (32.5)	14 (35)	14 (35)	12 (30)
Hours for studying					
Moderate	17 (42.5)	10 (25)	13 (32.5)	15 (37.5)	12 (30)
Intense	12 (30)	11 (27.5)	12 (30)	10 (25)	7 (17.5)
Hours for resting					
Moderate	10 (25)	8 (20)	9 (22.5)	13 (32.5)	6 (15)
Intense	19 (47.5)	13 (32.5)	16 (40)	12 (30)	13 (32.5)
Hours for using electronic gadgets					
Moderate	10 (25)	6 (15)	9 (22.5)	9 (22.5)	7 (17.5)
Intense	19 (47.5)	15 (37.5)	16 (40)	16 (40)	12 (30)
Involvement in sports					
Yes	6 (15)	1 (2.5)	3 (7.5)	7 (17.5)	4 (10)
No	23 (57.5)	20 (50)	22 (55)	18 (45)	15 (37.5)
Last professional grade					
Good	2 (5)	1 (2.5)	0 (0)	0 (0)	0 (0)
Average	27 (67.5)	20 (50)	25 (62.5)	25 (62.5)	19 (47.5)
Presence of refractive error in any parent					
Yes	17 (42.5)	18 (45)	18 (45)	21 (52.5)	16 (40)
No	12 (30)	3 (7.5)	7 (17.5)	4 (10)	3 (7.5)
Intake of dietary supplements					
Yes	7 (17.5)	3 (7.5)	0 (0)	6 (15)	8 (20)
No	22 (55)	18 (45)	25 (62.5)	19 (47.5)	11 (27.5)
Attitude toward a review for visual assessment					
Every 6 months assessment	2 (5)	2 (5)	2 (5)	3 (7.5)	2 (5)
Every year assessment	3 (7.5)	1 (2.5)	4 (10)	4 (10)	8 (20)
When there are visual symptoms	24 (60)	18 (45)	19 (47.5)	18 (45)	9 (22.5)
Use of appropriate light for studying					
Yes	24 (60)	20 (50)	20 (50)	23 (57.5)	15 (37.5)
No	5 (12.5)	1 (2.5)	5 (12.5)	2 (5)	4 (10)
Practice of eye exercises					
Yes	1 (2.5)	0 (0)	0 (0)	4 (10)	1 (2.5)
No	28 (70)	21 (52.5)	25 (62.5)	21 (52.5)	18 (45)
Habit of eye wash at night					
Yes	11 (27.5)	6 (15)	4 (10)	11 (27.5)	7 (17.5)
No	18 (45)	15 (37.5)	21 (52.5)	14 (35)	12 (30)

Moderate: 1–4 h, Intense: More than 4 h, Good: Above 70%, Average: 60–70%

## CONCLUSION

It is concluded that there is a high prevalence of refractive errors among the medical students of Nishtar Medical University Multan, and myopia is found to be the most prevalent refractive error. Several factors

such as parental history of refractive errors, increased use of electronic gadgets, involvement in daily sports, frequent use of dietary supplements, use of appropriate light for studying, and regular practice of eye exercises, which have a significant association with the disease incidence.

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