

A Study on Prevalence and Risk Factors of Refractive Errors among Undergraduate Medical Students in a Tertiary Care Hospital of West Bengal

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Abstract:

Background: Refractive error among the young students is becoming a major problem worldwide. Uncorrected refractive error can have huge social, psychological, economic, and developmental implications. The study aimed to estimate prevalence of diagnosed refractive errors among the undergraduate medical students of Burdwan Medical College, Purba Bardhaman district and risk factors associated with it.

Methods: A cross-sectional study was conducted among the undergraduate medical students of Burdwan Medical College of Purba Bardhaman district, West Bengal, during period from April 2022 to May 2022. A calculated sample of 294 students were selected by complete enumeration and interviewed with a predesigned, pretested questionnaire.

Results: Out of 294 study participants 170 (57.8%) were suffering from Refractive errors. As per categorization of refractive error, 66.5% had simple myopia, 28.8% had myopia with astigmatism, 3.5% had simple hypermetropia and 1.2% had hypermetropia with astigmatism. Among the 162 Myopic subjects most 111 (68.5%) had Low (0 to -3) degree of Myopia in Right eye and 110 (67.9%) had the same in the left eye. 42 (26%) and 41 (25.4%) had Moderate degree of Myopia in right and left eye respectively. 8 (4.9%) and 10 (6.1%) had High degree of Myopia in right and left eye respectively. 0.6% of the participants did not have any power in either right eye or left eye. No statically significant difference of physical activity on a daily basis (for more than 5 times per week) and presence of Myopia was found.

Conclusion: Prevalence of Refractive errors among the under graduate medical students was 57.8% in eastern India.

Keywords: Astigmatism, Myopia, Hypermetropia, Refractive Error.

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Introduction

Eyes are the 'Windows of the Soul'. The World Health Organization and the International Agency for the Prevention of Blindness announced this while launching the global project 'VISION 2020' to reduce preventable blindness.[1,2] A refractive error is a frequent vision problem. It occurs when the eye's ability to focus images from the outer world is impaired.

Refractive errors induce blurry vision, which can sometimes be severe enough to cause visual impairment.[3] Visual impedance caused by uncorrected refractive errors is extremely common in young adults and is the second most common cause of treatable visual hindrance.[4] The following are the four most prevalent refractive errors:

Myopia (near-sightedness): This is the inability to view distant objects clearly. It is a refractive error wherein the image forms in front of retina.

Hypermetropia (farsightedness): This is the inability to see clearly close objects. The refractive error wherein the image is formed behind the retina is known as hypermetropia/ hyperopia.

Astigmatism: This is a condition in which the clear covering of the eyeball, the cornea, is irregularly bent, resulting in impaired vision. The type of refractive error wherein the refraction of light varies in different meridians of the eye and the rays of light entering the eye cannot converge to a point focus but form focal lines is known as astigmatism.

Presbyopia: This is a condition that causes difficulty reading or seeing at a distance. It is

linked to ageing and affects almost everyone. Although refractive faults cannot be prevented, they can be detected and treated with corrective glasses, contact lenses, or refractive surgery. They do not obstruct the whole development of good visual function if addressed early and by eye-care professionals. Correction takes several forms depending on the flaw, the person's age, and the requirements of the profession or activity performed. [5]

Refractive errors are becoming a major problem in many countries around the world. Myopia is becoming more common, particularly in Asian countries where pestilence levels have reached epidemic proportions [6]. According to the WHO, 153 million people worldwide have vision impairment due to untreated refractive problems. They can be a burden on a country's economy, particularly in developing countries like India. [6]

The prevalence has increased in rural India from 4.6% in 1980-2008 to 6.8% in 2009-2019, compared to a change from 7.9%-8.9% in urban India during the same period. Myopia has become a major public health issue around the world, with estimates that up to half of the world's population will be myopic by 2050. [8]

Uncorrected myopia can have huge social, psychological, economic, and developmental implications. In addition, due to the degenerative changes in the retina and the optic disc, the irreversible vision-threatening sequel seems inevitable. [9] Apart from Myopia, Hypermetropia, astigmatism and Presbyopia are also common among Indians. A larger population appears to be unaware of these problems, which leads to a progressive visual inadequacy. This is especially true for young adults who are studying in their schools, colleges, and universities. [10,11] A number of factors, relevant to our study, affect occurrence and prevalence of myopia in a person are: nutrition, exposure to electronic devices, lifestyle, health habits, whether room is well lit etc. [12,13,14] Many studies have found a strong link between intellect and the severity of myopia, as well as the number of years spent in school. [15,16,17] Since the advent of the ongoing COVID era, where e-learning has virtually matched, or even taken over book reading in a way, the prevalence of refractive errors among students has seen a significant rise. [18,19] Studies on refractive errors have primarily focused on school going children in different parts of India. [20,21] In the limited number of studies that were performed on medical students, a high prevalence rate of refractive errors were found, with majority being inadequately aware of it. [22] Fewer studies on the subject have been conducted in West Bengal. [23] Hence, we decided to conduct an observational study on the prevalence of diagnosed refractive

errors in medical undergraduate students of Burdwan Medical College, using medical students of West Bengal as our target population, developed specific aims and objectives, and arrived at certain meaningful conclusions.

Aims and Objectives

General Objective: To determine the socio-demographic profile and the prevalence of diagnosed refractive errors and associated risk factors among the undergraduate medical students of Burdwan Medical College.

Specific Objectives

1. To find out the socio-demographic profile of undergraduate medical students of Burdwan Medical College.
2. To find out the prevalence of refractive errors among the study subjects.
3. To determine the risk factors associated with the refractive errors among the study subjects.

Materials and Methods

Type of study, Study design, Area and Duration:

It was a descriptive observational study with cross-sectional design. The study was performed in Burdwan Medical College, Purba Bardhaman, West Bengal, India over a period of one month from April to May 2022.

Sampling Frame: All undergraduate medical students of the following batches (aged between 18 to 33 years) of Burdwan Medical College were taken as sampling frame:

1st professional MBBS, 2nd professional MBBS, 3rd professional MBBS part I, 3rd professional MBBS part II

Inclusion Criteria: We included all the willing participants who have given consent in our study.

Exclusion Criteria: The subjects who did not respond in spite of giving reminder at least for three times within the fixed period and the aberrant responses were excluded from our study.

Sample Size and Sampling Technique: Complete enumeration was done for the study. A total of 294 students who gave valid responses were taken as sample size.

Data collection, Tools, Technique: Data was collected physically for about duration of one week by using a pre-designed, pre-tested, structured questionnaire which was applied for the purpose of data collection. The form was composed on the basis of several parameters like: Socio-demographic parameters of the respondents, type and severity of refractive errors, some risk factors like average book reading time, study time and sleep duration, lighting condition of the room, nutritional status and BMI of the students, physical

activity etc. It was circulated among the undergraduate medical students for a fixed period of 29th April to 4th May for filling it up, after taking consent from the subject.

Operational definition: Myopia has been categorised into three degrees: low, moderate, and high. Low myopia is defined as less than -3 diopters, moderate myopia ranges from -3 to -6 diopters, and high myopia is greater than -6 diopters. Similarly, hypermetropia has been classified into three degrees. Low hypermetropia is less than +2 diopters, moderate hypermetropia falls between +2.25 to +5 diopters, and high hypermetropia is greater than +5 diopters.

Technique of data analysis: The collected data was checked for completeness and consistency. Data was analyzed using statistical package for social sciences (SPSS) version 23. Descriptive statistics were used and results were expressed in frequencies and percentages.

Ethical Issues: Risks and benefits were analyzed before the study. Confidentiality and anonymity were strictly kept for each subject during the study. Informed consent was obtained from every participant, explaining the purpose of the study, procedures, risks, benefits and the assurance of confidentiality of the results. Right to withdraw from the study was given to all.

Results:

Background characteristics of study participants: A total of 294 study participants were included in the study. Study participants were aged between 18 to 33 years with the mean age being 20.5 years. Half of the study participants (56.6%) belonged to 18-20 years age group, 60.5% were males and 80.2% were Hindu. 84.5% were from nuclear families, 57.5% were from urban areas, 52.8% were from upper class and 5.8% were from lower class. 48% of the respondents were residing in hostel, 55.8% of the respondents were from 1st professional MBBS. 42.2% were without any refractive error and 57.8% of them had different types of refractive errors.

Categorization of Refractive Errors among study subjects: Out of 294 participants, 170 (57.8%) were found to have Refractive errors. As per categorization of refractive error, 66.5% had simple myopia, 28.8% had myopia with astigmatism, 3.5% had simple hypermetropia and 1.2% had hypermetropia with astigmatism.

Prevalence of different types of Refractive error in different years of study: Out of 294 participants, 164 were from 1st Professional MBBS and among them: 85 (51.8%) had various types of refractive errors. Similarly, 112 were from 2nd Professional MBBS and among them 70 (62.5%) had refractive errors. 12 were from 3rd Professional

MBBS Part 1 and among them 10 (83.4%) had refractive errors. 6 students were from 3rd Professional MBBS Part 2 and among them 5 (83.3%) had refractive errors. Among the students having different kinds of refractive errors (170), 57 (33.5%) were from 1st Professional MBBS diagnosed with simple Myopia. Similarly 51 (30%) students having simple myopia were from 2nd Professional MBBS and 5 (2.9%) students having the same were from 3rd Professional MBBS Part 1. 4 (2.3%) students from 3rd Professional MBBS Part 2 were found to have Myopia with Astigmatism.[Table No. 1]

Degree of Refractive errors among the study subjects: Among the 162 Myopic subjects, most-111 (68.5%) had Low (0 to -3) degree of Myopia in Right eye and 110 (67.9%) had the same in the left eye. 42 (26%) and 41 (25.4%) had Moderate degree of Myopia in right and left eye respectively. 8 (4.9%) and 10 (6.1%) had High degree of Myopia in right and left eye respectively. 0.6 of the participants did not have any power in either right eye or left eye. [Figure No. 1] In the same way among the 8 Hypermetropic subjects, most 6 (75%) had Low (0 to +2) degree of Hypermetropia in Right eye and 7 (87.5%) had the same in the left eye. 1 (12.5%) had Moderate degree of Hypermetropia in right and another 1 (12.5%) had the same in left eye respectively. 12.5% of the participants did not have any power in right eye or left eye.

Risk factors associated with Refractive Errors-

Association of average book reading time with refractive error: Some association of average book reading and average study time were found. Among 113 simple myopic students, 86 (76.1%) had average book reading time of 2-6 hours, and similarly 13 (66%) of the simple hypermetropic students had the average book reading time between 4-6 hours. [Figure No. 2]

Association of average screen time with refractive error: Similarly 69% of the simple Myopic students had average screen time between 2-6 hours and 83.3% of the simple hypermetropic students had the same for 2-6 hours. [TABLE NO. 2]

Association of daily physical activity with refractive error: It was found that among 162 myopic students, most (74.1%) were not involved with any kind of physical activity on a daily basis (for more than 5 times per week). Similarly among 8 hypermetropic students most (62.5%) did not perform any physical activity.

In this study, it was found that there is no statically significant difference of physical activity on a daily basis (for more than 5 times per week) and

presence of Myopia at 95% level of significance (p=0.468) [TABLE NO. 3]

Table 1: Showing distribution of study subjects according to prevalence of different types of Refractive error in different years of study

Year of study	Simple Myopia [No. (%)]	Myopia with Astigmatism [No. (%)]	Simple Hypermetropia [No. (%)]	Hypermetropia with Astigmatism [No. (%)]
1 st Professional MBBS	57 (33.5)	22 (12.9)	5 (2.9)	1 (0.7)
2 nd Professional MBBS	51 (30)	19 (11.1)	Nil (0)	Nil (0)
3 rd Professional MBBS Part 1	5 (2.9)	4 (2.3)	1 (0.7)	Nil (0)
3 rd Professional MBBS Part 2	Nil (0)	4 (2.3)	Nil (0)	1 (0.7)
Total	170 (100)	170 (100)	170 (100)	170 (100)

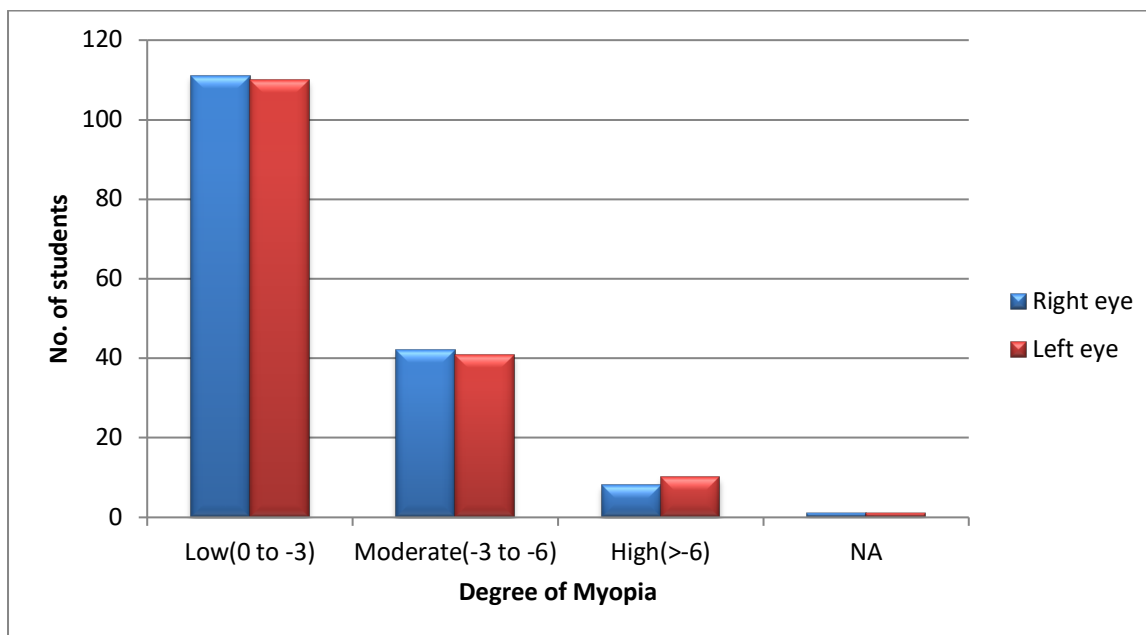


Figure 1: Compound bar diagram showing the distribution of study subjects according to Degree of myopia

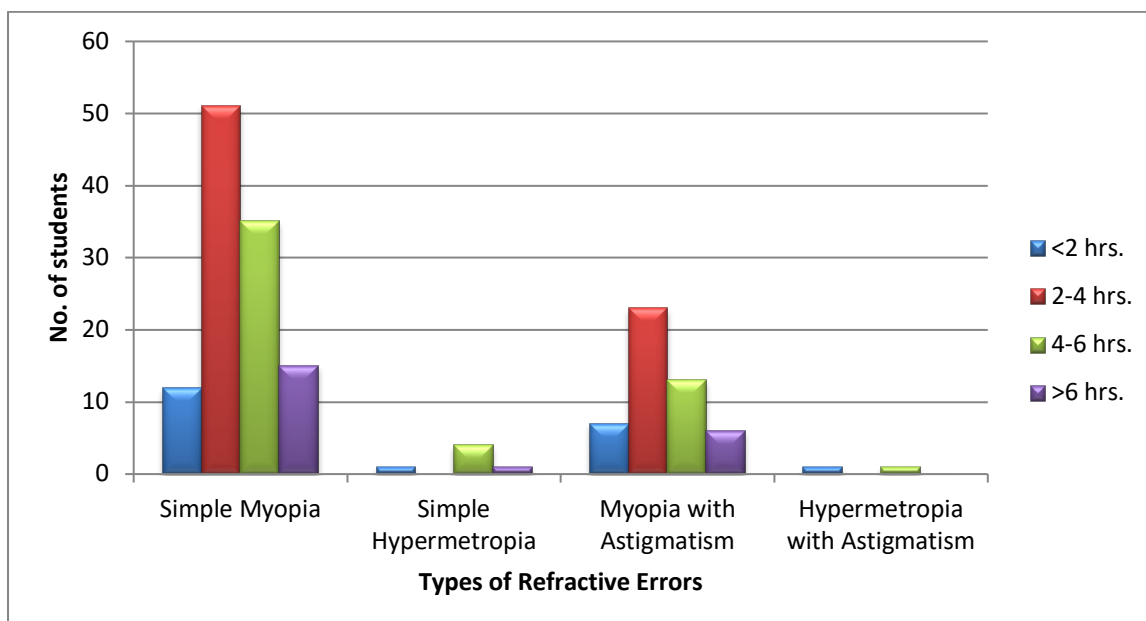


Figure 2: Compound bar diagram showing distribution of study subjects according to average book reading time per day

Table 2: showing distribution of study subjects according to Average Screen Time per day(n=170)

Average Screen Time per Day (in hrs.)	Myopia No. (%)	Myopia with Astigmatism No. (%)	Hypermetropia No. (%)	Hypermetropia with Astigmatism No. (%)
<2	11 (9.7)	8 (16.3)	-	-
2-4	39 (34.5)	17 (34.7)	2 (33.3)	-
4-6	39 (34.5)	14 (28.6)	3 (50)	1 (50)
>6	24 (21.3)	10 (20.4)	1 (16.7)	1 (50)
Total	113 (100)	49 (100)	6 (100)	2 (100)

Table 3: showing distribution of study subjects according to the regular physical activity (n=170)

Working out regularly for more than 5 times per week	Types of Refractive error		Chi Square, DF	P Value
	Myopia No. (%)	Hypermetropia No. (%)		
Yes	42(25.9)	3(37.5)	0.427,1	0.468
No	120(74.1)	5(62.5)		
Total	162(100)	8(100)		
Grandtotal	170			

Discussion

The current study was an observational study with cross-sectional design, which was carried out among the undergraduate MBBS students of Burdwan Medical College. A total of 294 students were chosen as study sample. The study was compared with many previous studies conducted in different regions of India and also in abroad. In the current study it was found that the prevalence of Refractive Error is 57.8% and Myopia being the most common (95.3%). 63.7% of students having Refractive Error are from 1st Professional MBBS, which is comparable with studies done by Dey AK et al in their article: Prevalence of Refractive Errors in Medical Students published in International Journal of Health and Research (IJHSR) [24] and also another study conducted by Ismail I. A. et al in their Prevalence of Refractive Errors and its Associated Risk Factors among Medical Students of Jazan University, Saudi Arabia: A Cross-sectional Study published in Middle East African Journal of Ophthalmology(MEAJO) [25].

This finding is comparable with the studies on medical students in Pakistan(58%) [26], Copenhagen (50.3%) [27]. The present study correlates with the findings of Refractive Errors in Central (55%) [28] and Western (56%) [29] Indian study but lower than Southern India (70%) [30].

The higher rate of Refractive Errors in Medical students are probably due to high level of educational achievement, above average intelligence, long and exhaustive study schedule, prolonged near work and the increasing e-learning methods nowadays specially in the COVID era. Medical students are a group of young adults who spend prolonged periods on reading and close work. With their rigorous study schedule of an average 5.5 years, they have been reported to be at risk for Myopia.

Conclusion

In this study the prevalence of Refractive errors among the under graduate medical students was 57.8%. Long reading hours and screen time, lack of physical activity and high BMI were found as significant risk factors. Majority of the parents of the medical students with Refractive Errors were found to have the same condition.

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References

1. Khanna RC, Marmamula S, Rao GN. International vision care: issues and approaches. Annual Review of Vision Science. 2017 Sep 15; 3:53-68.
2. Gilbert C, Foster A. Childhood blindness in the context of VISION 2020: the right to sight. Bulletin of the World Health Organization. 2001; 79:227-32.
3. Who.int. 2013. Blindness and vision impairment: Refractive errors. [online] Available at: <<https://www.who.int/news-room/questions-and-answers/item/blindness-and-vision-impairment-refractive-errors>> [Accessed 26 April 2022].
4. Alam H, Siddiqui MI, Jafri SI, Khan AS, Ahmed SI, Jafar M. Prevalence of refractive error in school children of Karachi. JPMA. The Journal of the Pakistan Medical Association. 20
5. Who.int. 2013. Blindness and vision impairment: Refractive errors. [online] Available at: <<https://www.who.int/news-room/questions-and-answers/item/blindness-and-vision-impairment-refractive-errors>> [Accessed 26 April 2022].

6. Al-Rashidi SH, Albahouth AA, Althwini WA, et al. Prevalence Refractive Errors among Medical Students of Qassim University, Saudi Arabia: Cross-Sectional Descriptive Study. *Open Access Maced J Med Sci*. 2018;6(5):940-943. Published 2018 May 19. doi:10.3889/oamjms.2018.197
7. Agarwal D, Saxena R, Gupta V, Mani K, Dhiman R, Bhardawaj A, Vashist P. Prevalence of myopia in Indian school children: Meta-analysis of last four decades. *PloS one*. 2020 Oct 19;15(10):e0240750.
8. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, Wong TY, Naduvilath TJ, Resnikoff S. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. *Ophthalmology*. 2016 May 1;123(5):1036-42.
9. Congdon N, Burnett A, Frick K. The impact of uncorrected myopia on individuals and society. *Community eye health*. 2019;32(105):7.
10. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *British Journal of Ophthalmology*. 2012 May 1;96(5):614-8.
11. Paudel P, Ramson P, Naduvilath T, Wilson D, Phuong HT, Ho SM, Giap NV. Prevalence of vision impairment and refractive error in school children in B a R ia–V ung T au province, Vietnam. *Clinical & experimental ophthalmology*. 2014 Apr;42(3):217-26.
12. Harb EN, Wildsoet CF. Nutritional Factors and Myopia: An Analysis of National Health and Nutrition Examination Survey Data. *Optometry and Vision Science*. 2021 May 1;98(5):458-68.
13. Lanca C, Saw SM. The association between digital screen time and myopia: A systematic review. *Ophthalmic and Physiological Optics*. 2020 Mar;40(2):216-29.
14. Chen CJ, Cohen BH, Diamond EL. Genetic and environmental effects on the development of myopia in Chinese twin children. *Ophthalmic paediatrics and genetics*. 1985 Jan 1;6(1-2):113-9.
15. Dandona R, Dandona L, Srinivas M, Sahare P, Narsaiah S, Munoz SR, Pokharel GP, Ellwein LB. Refractive error in children in a rural population in India. *Investigative ophthalmology & visual science*. 2002 Mar 1;43(3):615-22.
16. Goh PP, Abqariyah Y, Pokharel GP, Ellwein LB. Refractive error and visual impairment in school-age children in Gombak District, Malaysia. *Ophthalmology*. 2005 Apr 1;112(4):678-85.
17. Ghaderi S, Hashemi H, Jafarzadehpur E, Yekta A, Ostadimoghaddam H, Mirzajani A, Khabazkhoob M. The prevalence and causes of visual impairment in seven-year-old children. *Clinical and Experimental Optometry*. 2018 May 1;101(3):380-5.
18. Wong CW, Tsai A, Jonas JB, Ohno-Matsui K, Chen J, Ang M, Ting DS. Digital screen time during the COVID-19 pandemic: risk for a further myopia boom? *American journal of ophthalmology*. 2021 Mar 1; 223:333-7.
19. Chang P, Zhang B, Lin L, Chen R, Chen S, Zhao Y, Qu J. Comparison of myopic progression before, during, and after COVID-19 lockdown. *Ophthalmology*. 2021 Nov 1;128(11):1655-7.
20. Pavithra MB, Maheshwaran R, Rani Sujatha MA. A Study on the prevalence of refractive errors among School Children of 7-15 years age group in the field practice areas of a medical college in Bangalore. *Int J Med Sci Public Health* 2013; 2: 641-645.
21. Murthy GVS, Gupta SK, Ellwein LB, Munoz SR, Pokharel GP, Sanga L et al. Refractive Error in Children in an Urban Population in New Delhi. *Invest Ophthalmol Vis sci*. 2002;43: 623-631
22. Rajdeep P, Patel R. A study of refractive errors on students at Baroda Medical College. *IJRRMS* 2013;3: 18-19.
23. Dey AK, Chaudhuri SK, Jana S, Ganguly P, Ghorai S, Sarkar A. Prevalence of refractive errors in medical students. *Int J Health Sci Res*. 2014;4(8):98-102.
24. Dey AK et al. Prevalence of Refractive Errors in Medical Students *IJHSR* 2014; 2249-9571
25. Ismail I Abuallut et al. Prevalence of Refractive Errors and its Associated Risk Factors among Medical Students of Jazan University, Saudi Arabia: A Cross-sectional Study *MEA-JO* 2021 Jan;27(4):210-217.
26. Chaudhury R Ali H, Sheikh NH. Frequency and underlying factors of myopia among medical students. *Biomedca*2011;27: 154-160
27. Fledelius HC. Myopia profile in Copenhagen medical students 1996-98. Refractive stability over a century is suggested. *Acta Ophthalmol Scand*. 2000; 78:501-505
28. Wakode Ns, Wakode SL, KsheerisagarDD. Risk Factors for Myopia in Inner Mongolia medical students in China. *Open Journal of Recent Trends in Science and Technology*. 2013; 8:9-11
29. Katharotia RG, Dave AG, Dabhoiwala ST, Patel ND, Rao PV, Oommen ER. Prevalence and progression of refractive errors among medical students, *Indian Journal of Physiology and Pharmacology*. 2012; 56:284-287.
30. Chalasani S, Jampala VK, Nayak P. Myopia among Medical Students-A Cross Sectional Study in A South Indian Medical College. *Al Ameen Journal of Medical Sciences*. 2012;5: 233-242.