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Frequency of Refractive Errors in the Students of Khawaja Fareed University of Engineering and Information Technology, Rahim Yar Khan Punjab Pakistan

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Abstract

The purpose of this study was to find out the frequency of refractive errors in the students of Khawaja Fareed University of Engineering & Information Technology (KFUEIT), Rahim Yar Khan. A Cross-sectional university-based study was carried out from March 1, 2023, to May 19, 2023, at KFUEIT. All enrolled students from various disciplines at KFUEIT were included, except those who were not KFUEIT students or had undergone ocular surgery, or had preexisting other eye diseases, systemic diseases, or syndromes. Out of a total of 623 students representing various disciplines who participated in the study, 603 met the predefined inclusion criteria. Visual acuity testing, non-cycloplegic objective refraction, and subjective verification were performed to evaluate refractive error measurements. Data analysis was carried out using SPSS version 21, employing descriptive statistics, frequency calculations, and cross-tabulations. According to the results of the study, 179 students out of the 603, which is approximately 29.7%, had refractive errors. Myopia emerged as the most prevalent refractive error, affecting 25.2% of students, followed by astigmatism (3.0%) and hyperopia (1.5%). Gender analysis demonstrated a slightly higher prevalence of myopia among male students compared to females. Moderate myopia was the most prevalent severity level observed. Male students predominantly exhibited compound myopic astigmatism, while simple myopic astigmatism was more prevalent in females. Conclusion: Our study at KFUEIT found that 29.7% of the 603 students had refractive errors. These findings can guide interventions and policies for a visually healthy environment at KFUEIT.

Keywords Myopis, Hyperopia, Astigmatism

1. Introduction

The development of human vision is a dynamic process. Age-related variations in a person's refractive status are a significant aspect of the visual development process. Because the optical system affects how the eyes grow and how their ability to focus is developed, refractive status is a factor in determining normal ocular function. Consequently, every condition that alters refractive status also affects vision (1, 2). When the retina is focused by parallel light rays coming from infinity with the eye's accommodation at rest, this is known as emmetropia (3). A condition known as a refractive error occurs when the eye's optical structures are failed to concentrate parallel light beams onto the retina (4).

The three distinct types of refractive errors are astigmatism, hypermetropia as well as myopia (5). The myopic eye concentrates images in front of the retina, which causes blurry vision in the distance (6). In many countries, it is the highly frequent cause of refractive defects in both adolescents as well as young people (7), and its occurrence has been increasing quickly over the

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past few decades (8). Hyperopia is a common refractive error where the eye is too short or lacks proper convergence, causing images to focus behind the retina instead of on it. (9). Astigmatism causes light rays to focus at multiple points in the eye, resulting in blurry vision at both near and far distances (10), which accounts for about thirteen percent of the refractive defects (errors) (11).

The findings of The Vision Loss Expert Group study reveal that the distance effective refractive errors coverage in the substantial-income splendid region was 79.1% in 2021, while it was 62.1% in the Middle East and North Africa, 49.5% in Central and Eastern Europe, 40.0% in Oceania, Southeast Asia as well as East Asia, 34.5% in the Caribbean and Latin America, nine percent in South Asia, alongside 5.7% in the continent of sub-Saharan Africa (12).

The frequency of refractive error in an educational institute can have significant implications for the academic performance and overall well-being of the students. As optometrists we take steps to control refractive error, so we have done research on the frequency of refractive error and brought out results insight of administration so that the university take a step for screening and managing the refractive error so that it should not become a barrier for academic performance.

2. Methodology

Population study: This cross-sectional study was conducted at Khawaja Fareed University of Engineering & Information Technology (KFUEIT), Rahim Yar Khan, Pakistan, from March 1, 2023, to May 19, 2023. The Ethics Committee of the Institute of Health Sciences at Khawaja Fareed University of Engineering & Information Technology, Rahim Yar Khan, granted ethical permission for this cross-sectional research study. The purposes of the research project were clearly described to the study members, and everyone involved in this research gave written informed consent. Furthermore, assurances of data confidentiality were obtained from each student, and no financial or other forms of compensation were offered to the participants.

Inclusion and Exclusion Criteria: All students of KFUEIT, RYK are eligible to participate in the study, even those who use corrective spectacles or contact lenses. However, individuals with pre-existing eye diseases such as cataracts, glaucoma, keratoconus, or those with systemic diseases, syndromes, and a history of ocular surgeries (e.g., refractive surgeries, cataract surgery) were excluded from participation.

Data Sources and Participants: This is a population-based cross-sectional research investigation which employed a multi-phase sampling technique to ensure maximum participation from students across various disciplines at KFUEIT. The university campus was divided into strata based on departments, and participants were randomly selected from each stratum. A total of 603 students from both undergraduate and graduate degree programs representing diverse fields such as engineering, computing, health sciences, economics, agriculture, chemistry, physics, and law, participated in this study.

Definitions: The determination of the spherical equivalent (SE) involved the summation of the spherical value with half the power of the cylinder value. Myopia was characterised as having an equivalent of sphere in either eye of at least -0.50 diopters (D). Following this, myopic individuals were divided into three categories according to their refraction (spherical equivalent): mild myopia (within -0.50 and -1.50 D of SE), moderate myopia (while Spherical Equivalent within -1.75 and -6.00 D), as well as severe myopia (with Spherical Equivalent (SE) which is equal to or greater than -6.25 D). Spherical equivalent values greater than +0.25 D were considered to be hyperopia, whereas values between -0.25 D and +0.25 D were considered to be emmetropia. Astigmatism was identified when the cylinder value reached or exceeded -0.50 D, with the possibility of it manifesting as simple, compound, or mixed astigmatism. Simple myopic astigmatism was characterized by a Plano sphere and a cylinder value greater than -0.25 D, while simple hyperopic astigmatism exhibited a Plano sphere and a cylinder value exceeding +0.25 D. Compound myopic astigmatism was defined by a sphere value of ≥ -0.25 D and a cylinder value of ≥ -0.25 D, whereas compound hyperopia astigmatism was characterized by a sphere value of ≥ +0.25 D and a cylinder value of ≥ +0.25 D. Mixed astigmatism was denoted by a positive sphere value (> +0.25 D) and a negative cylinder value (> -0.25 D), or vice versa.

Examination and Screening Protocol: Our study adopted a thorough examination and screening methodology to determine the subjects' visual acuity and refractive error of vision. A Snellen chart, an internationally recognized instrument to determine visual acuity, was being used, and it had been set six meters away to ensure standardized assessment environments.

The testing processes were carried out monocularly, starting with each individual's right eye (OD) and proceeding to the left eye (OS), while keeping the non-tested eye covered to prevent potential interference. This sequential examination of the eyes allowed for a comprehensive assessment of each eye's visual capabilities. To determine the refractive error, we followed a standard refraction process, which involved non-cycloplegic, objective refraction (specifically using retinoscope), followed by subjective verification. This technique ensures that the measurements are taken without the use of eye drops to temporarily relax the eye muscles, offering a more real-world assessment of the participants' vision.The refractive error assessments included measurements in spherical power, cylindrical power, and cylindrical axis formats, providing a detailed profile of each participant's eye condition. These readings were precisely recorded on paper sheets, ensuring accuracy and consistency in the data collection process.

Data Analysis: Using SPSS version 21, data was updated, coded, inputted, and analysed by employing Descriptive statistics (Frequency etc.). The data was visually represented through the utilization of tables, graphs, and charts. The gender and kind of refractive error have been calculated as frequencies and percentages. Cross-tabulations for gender and refractive error type were carried out.

3. Results

A total of 603 students took part in this study. The age of the participants ranged from 19 years to 28 years, with the majority falling between 21 to 24 years old. Among the participants, there were 249 female students and 354 male students. Out of the total student population, 179 students were found to have refractive errors.

In this study, the most common eyesight issue we found was nearsightedness (myopia), affecting 152 students, which makes up 25.2% of the group. The second most common issue was astigmatism, seen in 18 students (3.0% of the total). Hyperopia, or farsightedness, came in third, with 9 students (1.5%). Interestingly, myopia was more common among males (26.84%) than females (22.89%) (Table 1).

3.1 Myopia and Hyperopia

When examining the severity of myopia, it was observed that moderate myopia (n=88; 58.2%) was more prevalent than mild myopia (n=59; 38.8%), followed by severe myopia (n=5; 0.8%) (Table 2). Regarding hyperopia, a total of 9 cases were detected, with 5 cases in females and 4 cases in males. Among male students (n=4) with hyper

Table 1: Frequency of types of refractive errors n students

Refractive Errors	Frequency	Percent
Emmetropia	424	70.3
Myopia	152	25.2
Hypermetropia	9	1.5
Astigmatism	18	3.0
Total	603	100.0

-opia, 3 had mild hyperopia and 1 had moderate hyperopia. Among female students (n=5) with hyperopia, 2 had mild hyperopia and 3 had hyperopia. No cases of severe hyperopia were found among the participants, whether male or female (Table 2).

3.2 Astigmatism

In terms of astigmatism, a total of 18 cases were observed, with 12 cases in males and 6 cases in females (Table 3). Among the 6 astigmatic female students, 3 had simple myopic astigmatism, 2 had compound myopic astigmatism, and 1 had compound hyperopic astigmatism. Among the male students (n=12) with astigmatism, 10 had compound myopic astigmatism, 1 had compound hyperopic astigmatism, and only 1 had simple myopic astigmatism. No cases of mixed astigmatism were found among the participants, whether male or female (Table 2) Types of Refractive Errors on the basis of gender of the students are shown below (Table 3).

4. Discussion

The findings of this study provide valuable insights into the prevalence and distribution of refractive errors among university students in Rahim Yar Khan, Pakistan. A deeper interpretation of the results reveals the significant impact of refractive errors on student well-being and academic performance. Addressing these visual health issues is crucial for ensuring a conducive learning environment and enhancing students' quality of life.

A total of 603 students from various academic disciplines took part in this research study, and their refractive errors were examined by following a standardized protocol. Myopia and astigmatism were the two refractive mistakes (errors) that were detected to be most frequently present in our study. We observed that myopia is more prevalent among male students compared to female students. Likewise, it was observed that astigmatism was

more common among male students than in female students.

Table 2: Degree of refractive errors and their distribution in male and female

Refractive Errors	Severity Levels	Male	Female	Total
Myopia	Mild Myopia (-0.50 and -1.50)	32	27	59
	Moderate Myopia (-1.75 and -6.00 D)	60	28	88
	severe Myopia (≥-6.25 D)	3	2	5
Hyperopia	Mild Hyperopia (+0.50 and +1.50 D)	3	2	5
	Moderate Hyperopia (+1.75 and +6.00 D)	1	3	4
	Severe Hyperopia (≥+6.25 D)	0	0	0
Astigmatism	simple myopic astigmatism (≥ -0.25 DC)	1	3	4
	compound myopic astigmatism [(≥ -0.25 DS) + (≥ -0.25 DC)]	10	2	12
	simple Hyperopic astigmatism (≥ +0.25 DC)	0	0	0
	compound hyperopic astigmatism [(≥ +0.25 DS) + (≥ +0.25 DC)]	1	1	2
	mixed astigmatism [(≥ -0.25 DS) + (≥ +0.25 DC)] or [(≥ +0.25 DS) + (≥ -0.25 DC)]	0	0	0
Total (n)		111	68	179

Table 3: Frequency of refractive errors on the basis of gender

	Gender of the Students		Total
	Male	Female	
Emmetropia	243	181	424
Myopia	95	57	152
Hypermetropia	4	5	9
Astigmatism	12	6	18
Total	354	249	603

Refractive error in vision is the second most prevalent cause of loss of vision after cataracts, as reported by both the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) (13). Refractive error (RE) ranks high among the most widespread vision problems affecting both adolescents and children (13). Refractive error (RE) is among the most widespread vision issues (problems) in adolescents as well as children (14). Most drug-induced refractive errors that have been observed are discussed in relation to transient myopia or other unexpected vision issues in the human eyes. (15). Early start and advancement of myopia increase the likelihood of acquiring high myopia significantly, particularly in Asian populations where myopia advances more quickly. Although the exact causes of the beginning and progression of myopia are not fully known, it is acknowledged that a variety of hereditary and environmental variables are involved (16). When the effects of myopia were examined in terms of how they influence everyday life, it became clear that impairment of vision is linked with a significant decrease in everyday activities, exceedingly difficult tasks involving sight, and a reduced level of social engagement. This may have a negative impact on education, older people's functional abilities, employment prospects, child development, and mental health (17).

The findings of our research study investigation revealed that refractive errors were present in 29.7% of the participants, with myopia being the most prevalent condition (25.2%). The outcomes correlate with earlier studies which demonstrate myopia affects university students globally with considerable prevalence. Astigmatism (3.0%) and hyperopia (1.5%) were among the other refractive errors identified among the individuals investigated. In this study, the frequency of refractive errors (RE) in Saudi citizens residing in Arar City, the northern frontier's regional seat, was examined. According to the research study, 45.8% of the participants had RE; the most prevalent imperfections were astigmatism (9.5%), hyperopia (11.9%), and myopia (24.4%) (18). The purpose of the study conducted in Israel was to identify the prevalence of refractive errors among Arab and Jewish first-year college students. The study's results showed that myopia was highly prevalent, with a prevalence figure of 66.3% (19).

The study further looked at the degree of myopia. The prevalence of moderate myopia (58.2%) was found to be higher than that of mild myopia (38.8%) and severe myopia (0.8%). According to these results, a significant percentage of myopic students had moderate refractive error. It is essential to keep in mind that people with moderate to severe myopia should take into account the course of their myopia and its possible effects on their visual health as well as their academic achievement. A comprehensive research project was carried out to determine the frequency of myopia in a significant population of adult rhesus macaques in Yunnan Province, in southwest China. It was also found in the survey that 62.47% (Myopic) of these macaques had vision problems (20). In a research conducted from February to September 2016, 63.8% of participants at the Foundation University Medical College (FUMC) in Islamabad had myopia. The findings of the research suggest that of the 90 myopic students; 27.7% were men and 36.2% were women (21).

Astigmatism impacted 3.0% of the individuals, with males having a slightly higher incidence than females. In both sexes, compound myopic astigmatism was the most common type of astigmatism. There were no cases of mixed astigmatism among the study's participants. A study conducted from September 2013 to September 2018 at the Rawal Institute of Health Sciences, Islamabad, aimed to identify the types, prevalence, and trends of refractive errors among patients from remote areas seeking vision therapy in the outpatient department. The most prevalent refractive defect in the study sample, as indicated by the information gathered, was compound myopic astigmatism (26.9%), subsequently followed by simple myopia (23.4%), presbyopia (20.6%), and mixed astigmatism (11%). Furthermore, 3.6% of participants

only had presbyopia and simple myopia, whereas 8.3% of those examined had both presbyopia and mixed astigmatism. The prevalence of compound myopic astigmatism was significantly greater in younger age groups (19.9% vs. 46.4%) compared with those who were older. In comparison to men, women were slightly more likely to have simple myopia (23.8% vs. 22.9%), mixed astigmatism (12.4% vs. 8.9%), and presbyopia (21.3% vs. 19.5%) (22). The prevalence of refractive errors has been investigated through screening of patients who visited the ophthalmology departments of three tertiary care hospitals: The Children's Hospital & the Institute of Child Health Multan, Nishtar Hospital, Multan, and THQ Hospital Kabirwala. The research findings revealed that astigmatism (74.5%) and myopia (46.75%) were the most common refractive issues. Conversely, hypermetropia was more prevalent across gender in the 4–10 age group (36.8%) and the 41 age group (38.7%) (23).

The results of this research investigation play an important part to the understand occurrence of refractive errors among university students in Rahim Yar Khan, Pakistan. In terms of astigmatism, it affected 3.0% of the participants, with males being somewhat more likely than females to have it. The most prevalent kind of astigmatism in both sexes was compound myopic astigmatism. In the research population size, there were no cases of mixed astigmatism. The results of this research investigation play an important part to the understand prevalence of refractive defects (errors) among university students in Rahim Yar Khan, Pakistan. Reduced educational and job possibilities as a result of uncorrected refractive problems (myopia, hyperopia, and astigmatism) have an effect on both the individual and the community. Conservative approximations indicate that the annual global economic cost to society, resulting from lost productivity, is estimated to be $269 billion. Therefore, uncorrected refractive error is an issue of public health which impacts humanities; uncorrected astigmatism and hyperopia are linked to worse educational achievement (13). The two main factors contributing to vision impairment globally are untreated refractive defects and cataracts. Uncorrected refractive defects, identified as the primary cause, contribute to 86.1 million cases marked by moderate to severe vision impairment. Some cataract occurrences are also categorized as refractive errors, and a subset of these cases retains residual refractive errors after surgery. These residual cases require refractive corrections but may not be associated with significant vision impairment (24). According to estimates, Uncorrected Refractive Error is responsible for a US$202 billion annual loss of worldwide GDP as a result of distance Visual Impairments. URE constitutes a significant risk to public health, and preventive measures are required to be taken in order to control the problem because a high URE burden is connected with poorer socioeconomic status (25).

Educational institutions have a significant role in promoting visual health in students. Universities can help students manage refractive problems by adopting routine vision screening programs and making corrective methods like glasses or contact lenses accessible. To promote a visually healthy atmosphere in educational institutions, it is also necessary to advocate for routine eye exams and raise awareness about the significance of eye health.

The number of participants in the research was comparatively small despite efforts to obtain a representative sample, which could affect the generalizability of the results to other university populations. Selection bias may also have been introduced due to the exclusion of participants with pre-existing eye diseases or systemic conditions. In the future, studies with bigger numbers of participants and different demographic information about respondents is suggested to address these restrictions while providing greater insight into the prevalence of refractive errors across students attending universities.

5. Conclusion

In summary, this population-based research study from Pakistan's Khawaja Fareed University of Engineering & Information Technology provides insight into the distribution and prevalence of refractive errors in undergraduates and graduates. The research study included 603 students from various fields of study, and the data analysis showed that 29.7% of them had refractive defects. Myopia has been found to be the most prevalent refractive error, immediately followed by astigmatism and then hypermetropia.

Conflict of interest The authors declared that they have no competing or conflict of interest

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