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Original article

Visual status among undergraduate students: Findings from an emerging university in Saudi Arabia

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ABSTRACT

Background: Refractive error is an important preventable cause of visual impairment and blindness worldwide. In adult life, reduced vision can potentially affect the academic performance, choice of occupation and socio-economic status. This study aimed to assess the prevalence of refractive errors and related visual impairment among undergraduate male students in Prince Sattam bin Abdulaziz University in Al-Kharj, Saudi Arabia.

Methods: A descriptive cross-sectional study was employed in the current work. After obtaining an informed consent; each eligible student was asked to fill a self-constructed survey and have screened in the college premises for visual acuity and refractive error. Candidates detected with defective vision have been referred for further examination at well-equipped ophthalmology clinic in the University Hospital.

Results: A total of 420 undergraduate students, with age ranged from 18 to 30 years, have participated in the current study. About 25.0% of the participants have used spectacles at the time of examination. Positive family history of spectacles use was found in 71.4%. Our study showed that visual acuity in the better eye was low in 34.76% of the participants. Seventy-eight students (18.6%) of the total participants reported defective vision and have fulfilled refractometric examination. Of the examined students 83.3% were found to have refractive errors. Astigmatism, 52.6%, was the most frequently encountered refractive error among the participants; followed by myopia, 26.9%; and hypermetropia 2.6%.

Conclusion: The current study confirms that refractive error is an important preventable cause of visual impairment. Significant portion of the examined participants were found to have refractive errors recommending further work to improve visual status in undergraduate students.

1. Background

Refractive errors are among the most common causes of visual impairment and represent the second leading cause of treatable blindness in different age, gender and ethnic groups. Globally it has been reported that 216.6 million people were visually impaired in 2015, further uncorrected refractive error as the leading cause, followed by cataract, age-related-macular degeneration, glaucoma, diabetic retinopathy and others. Uncorrected refractive error and cataract together, contributed to 55% of blindness and 78% of vision impairment in adults aged 50 years and older (Resnikoff et al.,

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Table 1
Ocular history of the participants.

Question	Answer	Frequency	Percentage
Present history of ocular disease	Yes	147	35.0%
	No	273	65.0%
Past history of ocular disease	Yes	55	13.1%
	No	365	86.9%
Use of spectacles	Yes	105	25.0%
	No	315	75.0%
History of refractive surgery	Yes	14	3.3%
	No	406	96.7%
Family history of spectacles use	Yes	300	71.4%
	No	120	28.6%
Practice of electronic games or social media applications	Yes	420	100%
	No	0	0.0%
Duration of mobile practicing	2 hrs or less	24	5.7%
	3–5 hrs	98	23.3%
	more than 5 hrs	298	71.0%
Present history of chronic diseases	Yes	53	12.6%
	No	367	87.4%
Past history of chronic diseases	Yes	29	6.9%
	No	391	93.1%
Family history of systemic disease	Yes	285	67.9%
	No	135	32.1%

Table 2
Examination Findings.

	Results	Frequency	Percentage
Visual acuity right eye	Normal	274	65.2%
	Mild decrease	98	23.3%
	Moderate/Severe decrease	48	11.4%
	Total	420	100%
Visual acuity left eye	Normal	257	61.2%
	Mild decrease	118	28.1%
	Moderate/Severe decrease	45	10.7%
	Total	420	100%
Visual acuity with pinhole vision right eye	Normal	72	48.6%
	Mild decrease	67	45.3%
	Moderate/Severe decrease	9	6.1%
	Total	148	100%
Visual acuity with pinhole vision left eye	Normal	82	49.7%
	Mild decrease	75	45.5%
	Moderate/Severe decrease	8	4.8%
	Total	165	100%
Type of RE_ RtE	Emmetropic	13	16.7%
	Myopic	21	26.9%
	Hypermetropia	2	2.6%
	Anisometropia	1	1.3%
	Astigmatism	41	52.6%
	Total	78	100%
Type of RE_LtE	Emmetropic	13	16.7%
	Myopic	22	28.2%
	Hypermetropia	2	2.6%
	Anisometropia	1	1.3%
	Astigmatism	39	50.0%
	Amblyopia	1	1.3%
	Total	78	100%

Notes. RE: refractive error; RtE: right eye; LtE: left eye.

2008; Flaxman et al., 2017). Visual acuity is a complex phenomenon that is affected by optical factors (e.g. state of the image-forming mechanisms of the eye), and retinal factors (e.g. state of the cones). Also, visual acuity is affected by stimulus factors such as illumination, brightness of the stimulus, contrast between the stimulus & the background, and duration of exposure to the stimulus. The refractive errors and its consequences have been recognized as a public health problem in many countries as well as the World health organization (WHO). The WHO has launched a campaign for managing refractive errors by the year 2020 and placed it as the fifth position for its urgency (Barrett et al., 2010; Bamashmus and Al-Akily, 2010; Maul et al., 2000).

There are several worldwide studies that have reported about refractive errors with a significantly wide range (9.4–83.1%) of prevalence. The variations in prevalence may be related to ethnicity, inheritance, age, gender, education level, and socio-economic status of the studied populations (Midelfart et al., 2002; Naiglin et al., 2002; Yared et al., 2012; Aldebasi, 2014; Alruwaili et al., 2018; Hashemi et al., 2018; Alsaif et al., 2019). In most eastern Mediterranean region countries including Saudi Arabia visual impairment and blindness remain a growing health challenge (Al-Ghamdi, 2019). Population-based studies conducted in northern Saudi Arabia had reported that 13.9% (Al-Shaaln et al., 2011) and 23.5% (Parrey and Alswelmi, 2017) of the adult participants had visual impairments. Another population study conducted in Riyadh has observed that correctable visual impairment was highly prevalent, and was observed in 17.8% of the adolescents (Alsaqr et al., 2018).

Visual impairment influences different aspects of life; it is usually associated with difficulties in physical function, emotional distress, and low socialization (Al-Shaaln et al., 2011). Students constitute a particularly vulnerable group, because uncorrected refractive error may have a dramatic impact on learning capability and educational potential (Negrel et al., 2000). Limited studies have been published regarding the prevalence of refractive errors among undergraduate students in Saudi Arabia (Aldebasi, 2014; Alsaif et al., 2019; Al-Wadaani et al., 2013). The current study aims to assess the prevalence of refractive errors and visual impairment among undergraduate male students in Prince Sattam bin Abdulaziz University in Al-Kharj, Saudi Arabia.

2. Methods

The ethical committee in College of Medicine, Prince Sattam Bin Abdulaziz University approved the current study protocol. The research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki (World Medical Association, 2013). Written consent forms duly signed from the participants has been required as a prerequisite for inclusion. Assents from selected faculties were also obtained. The results of examination were sent to the participants for further management.

2.1. Study design

The current work is a descriptive cross-sectional study. It was conducted using a special validated & standardized proforma to collect personal and socio-demographic data including name, age, history of present and past ocular/systemic problems and usage of spectacles by students; and family history of ocular problems and using of spectacles.

2.2. Sample size and sampling technique

In order to create a high degree of representation of the study population, and based on the objectives of the study, the sample size was calculated by Open Epi version 3 (OpenEpi, 2016). The following considerations were employed for sample size calculation: The total recorded study population for the academic year

Table 3
Relationship between visual acuity left eye and questionnaire variables.

Question	Visual acuity left eye						Chi-Square Value	P-Value
	Answer		Normal	Mild decrease	Moderate/ Severe decrease	Total		
Age	18-25 Yrs	F	250	113	44	407	1.75	0.781
		P	59.5%	26.9%	10.5%	96.9%		
	26-30Yrs	F	6	5	1	12		
		P	1.4%	1.2%	0.2%	2.9%		
	Above 30Yrs	F	1	0	0	1		
		P	0.2%	0.0%	0.0%	0.2%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
Marital status	single	F	248	117	45	410	3.86	0.159
		P	59.0%	27.9%	10.7%	97.6%		
	married	F	9	1	0	10		
		P	2.1%	0.2%	0.0%	2.4%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
College	business administration	F	99	34	13	146	27.31*	0.002
		P	23.6%	8.1%	3.1%	34.8%		
	applied med sciences	F	49	25	10	84		
		P	11.7%	6.0%	2.4%	20.0%		
	college of sciences and humanities	F	17	9	12	38		
		P	4.0%	2.1%	2.9%	9.0%		
	Engineering	F	35	20	6	61		
		P	8.3%	4.8%	1.4%	14.5%		
	Pharmacy	F	29	11	1	41		
		P	6.9%	2.6%	0.2%	9.8%		
	Computer Sciences	F	28	19	3	50		
		P	6.7%	4.5%	0.7%	11.9%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
Present history of ocular disease	Yes	F	34	71	42	147	153.71*	<0.001
		P	8.1%	16.9%	10.0%	35.0%		
	No	F	223	47	3	273		
		P	53.1%	11.2%	0.7%	65.0%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
Past history of ocular disease	Yes	F	18	22	15	55	27.77*	<0.001
		P	4.3%	5.2%	3.6%	13.1%		
	No	F	239	96	30	365		
		P	56.9%	22.9%	7.1%	86.9%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
Use of spectacles	Yes	F	11	54	40	105	183.94*	<0.001
		P	2.6%	12.9%	9.5%	25.0%		
	No	F	246	64	5	315		
		P	58.6%	15.2%	1.2%	75.0%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		

Notes. F: Frequency; P: Percentage; (*) There is a statistically significant relationship at (0.05) or less.

2015/2016 was 8183 male students (Prince Sattam bin Abdulaziz University). The sample size was calculated keeping confidence interval (CI) at 95%. Accordingly, the sample size is calculated to be 367 participants. For correction of any possible data loss the total sample would be 400.

The current study was conducted at Al-Kharj, Saudi Arabia. Eligible participants include male students in PSAU. A multi-stage sampling method has been applied. In particular, samples of different university colleges have been selected through cluster sampling technique then samples of participants were selected using simple random sampling. A written approval to participate in the study was obtained from each selected student.

2.3. Materials /instruments

After obtaining an informed consent; each eligible student was asked to fill a self-constructed survey. The survey used was based on a review of the published literature. The following information have been collected: personal and socio-demographic data including name, age, history of present and past ocular problems and use of spectacles and family history of ocular problems and use of spectacles.

Well-trained researchers and assistants screened each participant in the college premises for refractive error. A standard ophthalmic screening examination was conducted for each study subject. The examination included an assessment of visual acuity by Snellen's chart at 6-meter distance in a well-illuminated room, assessment of improvement in visual acuity by pinhole test (in those with decreased vision).

Candidates detected with defective vision have been referred for further examination at well-equipped ophthalmology clinic in the University Hospital. The specialist ophthalmologist in ophthalmology clinic did further examination and evaluation by auto refractometer followed by the acceptance of spectacle power. Retinoscopy with/without cycloplegic dilatation was done in required cases.

Table 4
Relationship between visual acuity left eye and questionnaire variables

	Visual acuity left eye						Chi-Square Value	P-Value
Question	Answer		Normal	Mild decrease	Moderate/ Severe decrease	Total		
History of refractive surgery	Yes	F	8	5	1	14	0.510	0.775
		P	1.9%	1.2%	0.2%	3.3%		
	No	F	249	113	44	406		
		P	59.3%	26.9%	10.5%	96.7%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100		
Family history of spectacles use	Yes	F	170	94	36	300	9.05*	0.011
		P	40.5%	22.4%	8.6%	71.4%		
	No	F	87	24	9	120		
		P	20.7%	5.7%	2.1%	28.6%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
Duration of mobile practicing	2 hrs or less	F	17	7	0	24	8.13*	0.047
		P	4.0%	1.7%	0.0%	5.7%		
	3–5 hrs	F	54	27	17	98		
		P	12.9%	6.4%	4.0%	23.3%		
	more than 5 hrs	F	186	84	28	298		
		P	44.3%	20.0%	6.7%	71.0%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
Present history of chronic diseases	Yes	F	32	16	5	53	0.19	0.908
		P	7.6%	3.8%	1.2%	12.6%		
	No	F	225	102	40	367		
		P	53.6%	24.3%	9.5%	87.4%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
Past history of chronic diseases	Yes	F	19	9	1	29	1.73	0.422
		P	4.5%	2.1%	0.2%	6.9%		
	No	F	238	109	44	391		
		P	56.7%	26.0%	10.5%	93.1%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		
Family history of systemic disease	Yes	F	169	81	35	285	2.58	0.275
		P	40.2%	19.3%	8.3%	67.9%		
	No	F	88	37	10	135		
		P	21.0%	8.8%	2.4%	32.1%		
	Total	F	257	118	45	420		
		P	61.2%	28.1%	10.7%	100%		

Notes. F: Frequency; P: Percentage; (*) There is a statistically significant relationship at (0.05) or less

Refractive error is defined as an error of ± 0.50D or more for myopia and hyperopia and a cylindrical error of ≥ 0.50 D (WHO, 2007; Niroula and Saha, 2009).

2.4. Data analysis

The data were analyzed using SPSS (version 21 USA). Prevalence of visual impairment (visual acuity of 6/12 or worse) was calculated for uncorrected visual acuity and best measured visual acuity (Yingyong, 2010; Marmamula et al., 2009). The percentage, frequency, means and relative mean for data variables was calculated. Chi square test and trend analysis was used to study the association of refractive errors with age and socioeconomic status of students. ANOVA analysis of variance has been used to find harmony between age groups, and the statistical significance of differences.

3. Results

The current study included a total number of 420 male students. Their age ranged from 18 to 30 years. One hundred forty-six (34.8%) of the participants were from College of Business Administration, 84 (20.0%) from Applied Medical Sciences, 61 (14.5%) from College of Engineering, 50 (11.9%) from College of Computer Sciences, 41 (9.8%) from College of Pharmacy, and 38 (9.0%) from College of Sciences and Humanities. Most of the participants, 410 (97.6%) were single.

Regarding ocular history of the participants, positive present history of ocular disease was reported by 147 (35.0%) of the responders; while past history of ocular disease and history of refractive surgery were reported by 55 (13.1%) and 14 (3.3%) of the responders respectively. Ocular disorders (acute/ chronic) reported in the present or past history of the subjects included: allergic diseases (spring catarrh), corneal ectasia, corneal scars/ opacity, dry eyes, developmental cataracts, uveitis and retinal disease. Also in the current study, 105 (25.0%) of the participants used spectacles; while positive family history of spectacles use was found in 300 (71.4%) of them. All of the participants reported that they practiced electronic games or social media applications; with 298 (71.0%) of them used to practice more than 5 h/day (Table 1).

Visual acuity of left eye was found to be low (Visual Acuity ≤ 6/12) in 163 (38.8%) of the participants; whereas in right eye, visual impairment was noted in 146 (34.76%) of them (Table 2). Our results showed that the visual acuity was significantly related to the history of ocular disease, personal and family history of spectacles use, and duration of mobile practicing (Tables 3 and 4). Of the total 78 (18.6%) of the participants who have fulfilled refractometry, 65 (83.3%) of them were found to have refractive errors in the right eye. Astigmatism, 41 (52.6%), was most frequently encountered refractive error among the participants;

Table 5
Relationship between refractive errors right eye and questionnaire variables.

Question	Answer		Diagnosis RtE			Chi-Square Value	P-Value
			Normal	RE	Total		
Age	18–25 Yrs	F	11	65	76	10.26*	0.001
		P	14.1%	83.3%	97.4%		
	26-30Yrs	F	2	0	2		
		P	2.6%	0.0%	2.6%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Marital status	single	F	12	65	77	5.07*	0.024
		P	15.4%	83.3%	98.7%		
	married	F	1	0	1		
		P	1.3%	0.0%	1.3%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
College	business administration	F	5	22	27	1.70	0.889
		P	6.4%	28.2%	34.6%		
	applied med sciences	F	3	12	15		
		P	3.8%	15.4%	19.2%		
	college of sciences and humanities	F	1	3	4		
		P	1.3%	3.8%	5.1%		
	Engineering	F	1	13	14		
		P	1.3%	16.7%	17.9%		
	Pharmacy	F	2	7	9		
		P	2.6%	9.0%	11.5%		
	Computer Sciences	F	1	8	9		
		P	1.3%	10.3%	11.5%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Present history of ocular disease	Yes	F	3	47	50	11.41*	0.001
		P	3.8%	60.3%	64.1%		
	No	F	10	18	28		
		P	12.8%	23.1%	35.9%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Past history of ocular disease	Yes	F	4	11	15	1.34	0.248
		P	5.1%	14.1%	19.2%		
	No	F	9	54	63		
		P	11.5%	69.2%	80.8%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Use of spectacles	Yes	F	2	40	42	9.29*	0.002
		P	2.6%	51.3%	53.8%		
	No	F	11	25	36		
		P	14.1%	32.1%	46.2%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		

Notes. F: Frequency; P: Percentage; (*) There is a statistically significant relationship at (0.05) or less.

followed by myopia, 21 (26.9%); and hypermetropia 2 (2.6%) (Table 2).

Almost all of the participants with refractive errors were in the age group 18–25-year-old, with statistically significant relation ($p = 0.001$). Moreover, our results showed that the refractive errors were significantly related to single marital status, positive present history of ocular disease, personal and family history of spectacle use, duration of mobile practicing, and past history of chronic diseases (Tables 5 and 6).

4. Discussion

Refractive error is an important preventable cause of visual impairment and blindness worldwide. Several studies and WHO reports showed that refractive errors are the first cause of visual impairment and the second cause of visual loss worldwide (Hashemi et al., 2018). The current study reports the prevalence of refractive errors in undergraduate male students showing astigmatism as the most frequently encountered refractive error among the participants; followed by myopia, and hypermetropia. Impaired vision can potentially affect adult academic performance, choice of occupation and socio-economic status (McCarty and Taylor, 2000). It has been estimated that global economic loss due to lost productivity caused by uncorrected refractive error was around $269 billion (Smith et al., 2009) and due to uncorrected presbyopia was US$11.023 billion (Frick et al., 2015). The prevalence of refractive errors is changing over time according to gender, age, and geographic areas (Yingyong, 2010).

The present work included a total number of 420 university adult male students. Positive present history of ocular disease was reported by approximately one/third of the responders; while past history of ocular disease and history of refractive surgery were reported by 13.1% and 3.3% of the responders respectively. Furthermore, quarter of the participants used spectacles at the time of examination; but about 30% of those with refractive errors did not use the spectacles. Similarly, it has been also reported that around half of the participants did not use any kind of management for refractive errors (Alruwaili et al., 2018). Positive family history of spectacles use was found in more than two/third of

Table 6
Relationship between refractive errors left eye and questionnaire variables.

Question	Answer		Diagnosis LtE			Chi-Square Value	P-Value
			Normal	RE	Total		
History of refractive surgery	Yes	F	0	1	1	0.203	0.653
		P	0.0%	1.3%	1.3%		
	No	F	13	64	77		
		P	16.7%	82.1%	98.7%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Family history of spectacles use	Yes	F	8	54	62	4.08*	0.049
		P	10.3%	69.2%	79.5%		
	No	F	5	11	16		
		P	6.4%	14.1%	20.5%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Duration of mobile practicing	2 hrs or less	F	3	2	5	7.22*	0.027
		P	3.8%	2.6%	6.4%		
	3- 5 hrs	F	3	19	22		
		P	3.8%	24.4%	28.2%		
	more than 5 hrs	F	7	44	51		
		P	9.0%	56.4%	65.4%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Present history of chronic diseases	Yes	F	0	6	6	1.30	0.254
		P	0.0%	7.7%	7.7%		
	No	F	13	59	72		
		P	16.7%	75.6%	92.3%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Past history of chronic diseases	Yes	F	2	2	4	4.37*	0.046
		P	2.6%	2.6%	5.1%		
	No	F	11	63	74		
		P	14.1%	80.8%	94.9%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		
Family history of systemic disease	Yes	F	9	44	53	0.012	0.914
		P	11.5%	56.4%	67.9%		
	No	F	4	21	25		
		P	5.1%	26.9%	32.1%		
	Total	F	13	65	78		
		P	16.7%	83.3%	100%		

Notes. F: Frequency; P: Percentage; (*) There is a statistically significant relationship at (0.05) or less.

the participants indicating a role of genetic factors in development of refractive errors as previously reported (Hashemi et al., 2018; Flitcroft, 2014). However, our study shows lack of awareness regarding correction of refractive errors among the participants. Uncorrected vision remains one of the largest public health crisis and challenges despite the simple and cost-effective preventing solutions (Holden et al., 2014; Kassalow, 2019). Awareness of both health professional and the population is crucial for facing uncorrected vision and its consequences.

All of the participants reported that they practiced electronic games or social media applications; with a significant portion of them used to practice more than 5 h per day (Table 1). This increase the daily time spent in near-work activities that in turn is one the common risk factors of development of refractive errors (Alruwaili et al., 2018; Flitcroft, 2014). The current study showed that visual acuity in the better eye was low (Visual Acuity $\leq$ 6/12) in 34.76% of the participants. The latter finding is higher than that reported by other studies conducted in Saudi Arabia (23.5%) (Parrey and Alswelmi, 2017) and (17.8%) (Alsaqr et al., 2018), or in India, 16.63% (Malhotra et al., 2020) of the adult population. Finding of the present study is closer to that reported by a study conducted in Pakistan which reported low visual acuity in 27% of the adult participants (Dineen et al., 2007). The variations may be due to differences in Visual Acuity cut-point, sample size, the study populations regarding genetic, ethnic, cultural and occupational differences as well as lifestyle and environmental factors.

Of the total 78 (18.6%) of the participants who have fulfilled refractometry, 83.3% of them were found to have refractive errors in the right eye. This finding confirms that refractive error is a real eye health problem in the population. Our finding is in consistence to that was shown by Alruwaili and co-workers (83.1%) among Saudi Medical students in Aljouf University; and Albatanony and co-workers (72.2%) among Saudi Medical and Pharmacy students in Qassim University; as well as another Nigerian study, (79.5%) (Alruwaili et al., 2018, Albatanony, 2016; Megbelayin et al., 2014). But our finding is higher than that was reported among Saudi adults in Arar city (45.8%) (Parrey and Elmorsy, 2019). An Indian study reported a refractive error prevalence of 60.81% among dental students (Agrawal et al., 2014). It has been well noted that refractive errors in general are directly proportional to the level of the education and intelligence of the study populations, as well as the extent of near-work activities (Alruwaili et al., 2018; Flitcroft, 2014). It has been reported that myopia is associated with near-work activities (Huang et al., 2015). Some studies have concluded that near-work causes astigmatism due to incyclotorsion (Hashemi et al., 2018). In our study, astigmatism, 52.6%, was the most frequently encountered refractive error among the participants; followed by myopia, 26.9%; and hypermetropia 2.6%

(Table 2). These findings are in consistence with that was reported by Hashemi and co-workers (Hashemi et al., 2018). But they are in contrast to other studies that report myopia as the dominant refractive error ranging from quarter to half of examined participants (Alsaif et al., 2019; Parrey and Elmorsy, 2019; Al-Rashidi et al., 2018). Limitations of our study include the low response rate for fulfilling the refractometry, and the specific study population of the university students. Also, the lack of female student participation makes it difficult to be generalized.

5. Conclusion

The current study confirms that refractive error is an important preventable cause of visual impairment and blindness. Astigmatism was the most frequently encountered refractive error among the participants; followed by myopia, and hypermetropia. We recommend periodical screening of undergraduate students of both genders as well as preschool and schoolchildren for refractive errors. Future works and health-measures are recommended to be implemented for improving the visual status in schoolchildren as well as undergraduate students. Further studies should classify reflective errors in both sphere and cylinder forms into high risk groups and low risk groups.

Declarations

Ethics approval and consent to participate

The ethical committee in College of Medicine, Prince Sattam Bin Abdulaziz University approved the current study. An informed consent was taken from the study participants, after explanations about the aim of the study to each of them.

Consent for publication

Not applicable.

Availability of data and materials

Data are available upon request from the author.

Funding

Not applicable.

Authors' contributions

This work was performed in collaboration between all authors. They designed the study, collected and processed the responses, created the manuscript, and approved the final version of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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