Original Research Article



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Saudi Medical Journal of Students (SMJS)

Official Journal of Faculty of Medicine University of Tabuk ISSN: 1658-8274 (Print version); 1658-8282 (Electronic version)

PREVALENCE OF VISUAL DEFECTS RELATED TO DIGITAL DEVICE USAGE OF EDUCATIONAL PURPOSE AMONG UNIVERSITY OF TABUK STUDENTS, SAUDI ARABIA, 2020

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ABSTRACT

Background: Eye-related problems are common among digital device users as a result of the increased dependence on the internet, e-books, and others. Since a few studies concerning this topic had been conducted in this area, this study aimed to determine the prevalence of visual defects related to digital device usage due to educational purposes among University of Tabuk Students in Saudi Arabia, 2020

Material and method: A cross-sectional descriptive study. It was conducted at Tabuk city among 468 students of the University of Tabuk. Study data were obtained by a semi-structured questionnaire distributed to the students of the University of Tabuk. Later on, the data was interpreted by The Statistical Package for the Social Sciences (SPSS, version 23, IBM, Chicago, USA).

Results: Out of 468 respondents, 68.2% were females, and over half of the participants (54.7%) were students of medicine. Most of them (39.5%) have used digital devices for learning for less than a year. Eye symptoms were reported by 71.2% of participants. Moreover, the most reported symptom was eye pain (65.4%), following that is eye redness (40.8%). Furthermore, vision was affected in 56.2% of participants.

Conclusion: The Survey for eye disorders associated with electronic studying among University of Tabuk students revealed higher symptom rates compared with many similar studies. Digital studying has many benefits, but it markedly affects the eye health of students.

To Cite This Article: Alhawiti MM, Alzhrani LD, Aljohani AA, Alhawiti RM, Alatwi GE, Asiri RT, Albalawi RS, Alatawi Z. Prevalence of Visual Defects Related to Digital Device Usage of Educational Purpose Among University of Tabuk Students, Saudi Arabia, 2020. Saudi Med J Students. 2021 Jul 1;2(2): 13-23

INTRODUCTION

The visual field is the portion of the subject's surroundings that can be seen at any time. A visual field defect is a loss of part of the usual field of vision, so it does not include severe visual impairment of either one eye or both [1].

Mobile technologies are playing an increasingly important role in college student's academic life. Devices such as smartphones, tablets, and e-book readers connect users to the world instantly, heightening access to information and enabling interactivity with others. Applications that run on these devices let users not only consume but also discover and produce content [2].

Vision and eye-related problems are common among digital device users. Individuals who spend long periods looking at any type of digital device display have intense accommodation and extraocular muscle strains and often exhibit blurred vision [3].

One of the commonest visual problems related to the digital device is Computer Vision Syndrome which can cause: dryness, tearing, gritty, redness, burning sensation, and blurring of vision.

Modification in the ergonomics of the working environment, patient education, and proper eye care are important strategies in preventing computer vision syndrome [4].

A study conducted by the National Institute of Occupational Safety and Health (NIOSH) in Malaysia indicated 70.6% of workers who used computers in their workplace complain of eyestrain [4].

The study aims to estimate how eye-relatedcomplains are common among University of Tabuk students in Saudi Arabia, using digital devices for educational purposes, compared to students using the traditional way of education like papers, Attempting to find a relationship between eye complaints and using digital devices for a long time.

SUBJECTS & METHODS

It is a cross-sectional descriptive study. The study was conducted at Tabuk city, more specifically in the University of Tabuk. This city is the capital city of the Tabuk region, located in northwestern Saudi Arabia. This study required one month to be completed and included all students of the University of Tabuk during 2020, both males and females, with the exception of postgraduate students. Study data were obtained by sending a semistructured questionnaire to all students of the University of Tabuk. Later on, the data were inserted into an Excel sheet. Sample variables were age, major, academic level, number of hours spent on studying using electronic devices per day, and visual defects.

Statistical analysis:

The Statistical Package for the Social Sciences (SPSS, version 23, IBM, Chicago, USA). We performed descriptive statistics and analytic statistics. We employed the Chi-Square test (χ 2) for the association and the differences between the two categorical variables. P values were considered significant if equal to or less than 0.05.

Ethical approval for research conduction

Ethical approval was obtained from the committee of research ethics- university of Tabuk. Persons' data was used for the purpose of the study only, and the data was kept secure.

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RESULTS

Table (1) shows the socio-demographic characteristics of the participants. Our study included 468 students, of which 68.2% were females and over a half (61.1%) aged 21-23 years. Over half of our participants (54.7%) were students of medicine and other health sciences, followed by natural sciences (23.7%), engineering (8.8%), and other fields. The period of E-studying varied among participants as 39.5% have used digital devices for learning for less than a year, while 17.9% have used them for one years, 19.2% for two years, 12.0% for three years, and 11.3% for more than three years.

Table (2) shows that the usage of electronic devices for educational purposes during course weeks varied among participants as 34.6% reported daily use of 5-8 hours, 29.5% reported daily use of 3-4 hours, and only 5.8% reported daily use of +13 hours. Eye symptoms were reported by 71.2% of all participants, and they include eye pain which was reported by 65.4%, and eye redness which was reported by 40.8%. Vision was affected in 56.2% of participants, and the severity of the affection was major in 14.1%, average in 47.1%, and minor in 38.8%.

Table (3) shows that 42.1% of participants have not had their eyes examined for more than two years, and 70.9% have performed optometry. One-fourth (25.0%) of students had a visual acuity equal to 6/6, while 75% had varying results. Astigmatism has been reported in 16.0% of participants. A family history of eye disorders has been reported by 78.2% of participants, and 51.5% think that digital books could be replaced with printed books.

Table (4) shows the relationship between age groups, sex, the field of study, educational level, hours spent on electronic devices for studying and other purposes, eye pain and redness, and vision changes due to Estudying. Significant association of vision affection is present with sex (P=0.002), the field of study (P=0.017), eye pain during Estudying (P=0.000), eye redness during Estudying (P=0.000), and average daily use of digital devices for other purposes (P=0.000).

 Table (5) shows the relationship between age

 groups, sex, the field of study, educational level, eye redness, and vision changes with daily use of digital devices for studies. The duration of daily use of digital devices for studying is significantly associated with age (P=0.000). Younger ages (19-20 years) used digital devices least for studying, while 21.2% older students (+24 years) for over 13 hours. The field of the study was found to be a significant factor related to an increased average daily digital learning hours (P=0.000). The period of E-studying is also associated with average daily hours spent on E-studying (P=0.000).

Table (6) shows the relationship between age groups, sex, the field of study, educational level, hours spent on electronic devices for studying, and other purposes change in vision with symptoms of eye pain and redness. Eye redness and pain have been significantly associated with sex among respondents (P=0.000). Males were more likely to experience eye redness or pain as they have been reported by 41.6% and 22.9% for males and females, respectively. They have also been significantly associated with average daily use of electronic devices for other

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Parameter	Frequency	Percent
Age		
• 19 – 20 years	130	27.8%
• 21 – 23 years	286	61.1%
• $24 < years$	52	11.1%
Mean±S.D.	$21.4{\pm}1.5$	
Gender		
• Male	149	31.8%
• Female	319	68.2%
Field of study		
 Medicine and 	256	54 7%
health sciences	230	54.770
• Engineering	41	8.8%
 Natural 	111	23.7%
Sciences		
• Others	60	12.8%
Year of study		
• First and second	126	26.9%
year		
• Third and fourth	221	47.2%
year		
• Fifth and sixth	121	25.9%
year		2012/0
Period of E-studying		
• Less than a year	185	39.5%
• One year	84	17.9%
 Two years 	90	19.2%
• Three years	56	12.0%
• More than three years	53	11.3%

Table	1:	Socio-d	lemogr	aphic	data	of	the
partici	ipar	nts, KSA	A, 2020	(N=46	68)		

purposes (P=0.030) and Change in the vision (P=0.000).

DISCUSSION

The study included 468 students, of which 61.1% were aged 21-23 years, and 68.2% were females. Over half, 54.7% of participants were students of medicine and health sciences. The study aimed to discuss the following outcomes: the prevalence of

Table 2: Usage of electronic devices forstudying among Tabuk Universitystudents, KSA, 2020 (N=468).

Parameter		Frequency	Percent
Average daily use of el		electronic devices	s for studying
•	1-2 hours	83	17.7%
•	3 - 4 hours	138	29.5%
•	5-8 hours	162	34.6%
•	9-12 hours	58	12.4%
•	13 < hours	27	5.8%
Ave	rage daily use of	f electronic devi	ces for other
purp	oses		
•	1-2 hours	63	13.5%
٠	3 - 4 hours	105	22.4%
•	5-8 hours	151	32.3%
•	9-12 hours	108	23.1%
٠	13 < hours	41	8.8%
E-st	udying affected vi	ision	
٠	Yes	263	56.2%
٠	No	205	43.8%
If ye	es, severity of affe	ection (N=263)	
٠	Minor	102	38.8%
٠	Average	124	47.1%
٠	Major	37	14.1%
Eye	pain during E-stu	dying	
٠	Yes	306	65.4%
٠	No	162	34.6%
Eye	redness after E-st	udying	
٠	Yes	191	40.8%
٠	No	277	59.2%

visual defects among Tabuk University students, and its association with digital device usage for educational purpose, whether most students now depend on digital devices or printed books for studying, estimation of the relationship between visual impairment and use of digital devices for a long time for any purpose.

Usage of electronic devices for educational purposes during course weeks varied among

Table	3:	History	of	eye	diseases	of	Tabuk
Univer	rsity	y student	ts, I	XSA	, 2020 (N=	=46	8).

Parameter	Frequency	Percent
Last eye examination		
• Less than six months	105	22.4%
• Six months – 1 year	93	19.9%
• 1 − 2 years	73	15.6%
• More than two years	197	42.1%
Performing optometry		
• Yes	332	70.9%
• No	136	29.1%
Optometry result (N=332)		
• 1/6	8	2.4%
• 2/6	16	4.8%
• 3/6	46	13.9%
• 4/6	84	25.3%
• 5/6	95	28.6%
• 6/6	83	25.0%
Family history of eye disor	rders	
• Yes	366	78.2%
• No	102	21.8%
Do you think you could	replace e-stud	ying with
printed books?		
• Yes	241	51.5%
• No	227	48.5%
Diagnosis with other eye d	lisorders	
• Yes	106	22.6%
• No	362	77.4%
Diagnosis (N=106)		
• Dry eye	4	3.8%
 Astigmatism 	75	70.8%
• Others	27	25.4%

participants as 34.6% reported daily use of 5-8 hours, 29.5% reported daily use of 3-4 hours, and only 5.8% reported daily use of +13 hours. The duration of daily use of digital devices for studying is significantly associated with age (P=0.000). Younger ages (19-20 years) used digital devices least for studying, while 21.2% older students (+24 years) for over 13 hours. An Indian study conducted by Ichhpujani *et al.* reported that the use of electronic devices among high school students was less as only 14.2% and 3.3% used digital devices for reading for 4-6 hours, and +6 hours, respectively [5]. Similarly, the Ichhpujani *et al.* study found a significant association between the time spent on digital devices by students with age (P<0.001). The younger students are, the more likely they spend less time studying on digital devices.

Over half of our participants (54.7%) were students of medicine and other health sciences, followed by natural sciences (23.7%), engineering (8.8%), and other fields. The field of the study was found to be a significant factor related to an increased average daily digital learning hours (P=0.000). Students of medicine and health sciences (7.8%) studied for longer durations per day (+13 hours) than engineering (4.9%), natural sciences (4.5%), and others (0.0%). On the other hand, nearly half of students of other fields (43.3%) reported an average daily use of only 1-2 hours, while only 7.4% of medicine and health sciences students studied for this duration. Moreover, the field of study was found to be significantly associated with reported E-study-related vision changes (P=0.017). Over a half (62.9%) of students of medicine and health sciences reported changes, whereas Estudying affected the vision of only 20.0%, 7.3%, and 9.8% of natural sciences, engineering, and other fields students. A cross-sectional study conducted among medical students in Dominica found that 49.5% of all participants presented with one or more eye defects [6]. In contrast, a study conducted on university students in Saudi

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		Vision aff	ected by E-		
Param	eter	stuc	lying	P-value	
		Yes	No		
	19 – 20 years	23.4%	31.2%		
Age groups	21 – 23 years	64.9%	58.2%	0.177	
	24 < years	11.7%	10.6%		
~	Male	39.5%	25.9%	0.000	
Sex	Female	60.5%	74.1%	0.002	
	Medicine and health sciences	62.9%	48.3%		
	Engineering	7.3%	9.9%	0.017	
Field of study	Natural Sciences	20.0%	26.6%		
	Others	9.8%	15.2%		
	First and second year	22.4%	30.4%		
Educational level	Third and fourth year	47.3%	47.1%	0.066	
	Fifth and sixth year	30.2%	22.4%		
Eye pain during E-studying	Yes	53.2%	74.9%	0.000	
	No	46.8%	25.1%	0.000	
	Yes	30.7%	48.7%		
Eye redness during E-studying	No	69.3%	51.3%	0.000	
Average daily use of electronic	1-2 hours	16.6%	18.6%		
devices for studying	3-4 hours	32.7%	27.0%		
	5-8 hours	33.2%	35.7%	0.187	
	9 – 12 hours	14.1%	11.0%		
	13 < hours	3.4%	7.6%		
Average daily use of electronic	1-2 hours	10.7%	15.6%		
devices for other purposes	3-4 hours	15.6%	27.8%		
	5-8 hours	41.5%	25.1%	0.000	
	9 – 12 hours	26.8%	20.2%		
	13 < hours	5.4%	11.4%		
*The Chi-square statistic is significant at	the 0.05 level				
Arabia found that business	students eye sympto	om, which	was more	prevalent	

Table 4: Correlation between age groups, sex, the field of study, year of study, hours spent on electronic devices for studying and other purposes, eye pain and redness and vision changes due to E-studying, KSA, 2020 (N=468).

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among medical students [7].

The period of E-studying varied among participants as 39.5% have used digital

experienced more eye symptoms prevalence

than medical students, except for the burning

D	· · · · · · · · · · · · · · · · · · ·	Daily use of digital devices for studies					T-4-1	D
Par	ameter	1-2	3-4	5-8	9-12	+13	Total	P-value*
	19 - 20 years	29.2%	22.3%	37.7%	9.2%	1.5%	100%	
Age groups	21 - 23 years	14.7%	33.9%	32.5%	14.0%	4.9%	100%	0.000
	24 < years	5.8%	23.1%	38.5%	11.5%	21.2%	100%	
Sex	Male	14.1%	32.9%	37.6%	11.4%	4.0%	100%	0.250
	Female	19.4%	27.9%	33.2%	12.9%	6.6%	100%	0.359
	Medicine and health sciences	7.4%	30.1%	38.3%	16.4%	7.8%	100%	
Field of	Engineering	26.8%	31.7%	31.7%	4.9%	4.9%	100%	0.000
study	Natural Sciences	24.3%	27.9%	32.4%	10.8%	4.5%	100%	
	Others	43.3%	28.3%	25.0%	3.3%	0.0%	100%	
	First and second year	22.2%	24.6%	38.1%	9.5%	5.6%	100%	
Educationa 1 level	Third and fourth year	17.2%	30.8%	33.9%	14.5%	3.6%	100%	0.171
	Fifth and sixth year	14.0%	32.2%	32.2%	11.6%	9.9%	100%	
E-studying	Yes	18.6%	27.0%	35.7%	11.0%	7.6%	100%	
affected vision	No	16.6%	32.7%	33.2%	14.1%	3.4%	100%	0.187
Eye	Yes	12.0%	26.7%	40.8%	14.7%	5.8%	100%	
redness during E- studying	No	21.7%	31.4%	30.3%	10.8%	5.8%	100%	0.020
	Less than a year	30.3%	2.7%	30.3%	30.3%	6.5%	100%	
	One year	13.1%	13.1%	23.8%	31.0%	19.0%	100%	
Period of	Two years	7.8%	5.6%	26.7%	40.0%	20.0%	100%	0.000
L-studying	Three years	7.1%	5.4%	33.9%	35.7%	17.9%	100%	
	More than three years	9.4%	5.7%	35.8%	45.3%	3.8%	100%	

Table 5: Correlation between age groups, sex, the field of study, year of study, eye redness and vision changes with daily use of digital devices for studies, KSA, 2020 (N=468).

*The Chi-square statistic is significant at the 0.05 level.

devices for learning for less than a year, while 17.9% have used them for one year, 19.2% for two years, 12.0% for three years, and 11.3% for more than three years. The period of E-studying is associated with average daily hours spent on E-studying (P=0.000). Students who have used digital devices for learning for more years were more likely to

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Table 6: Correlation between age groups, sex, the field of study, year of study, hours spent on electronic devices for studying and other purposes change in vision with symptoms of eye pain and redness, KSA, 2020 (N=468).

	Denometer	Eye redr	Eye redness or pain		
	rarameter		No		
	19 – 20 years	26.2%	73.8%		
Age groups	21 – 23 years	28.7%	71.3%	0.375	
	24 < years	36.5%	63.5%		
C.	Male	41.6%	58.4%	0.000	
Sex	Female	22.9%	77.1%	0.000	
	Medicine and health sciences	30.9%	69.1%		
	Engineering	36.6%	63.4%	0.150	
Field of study	Natural Sciences	20.7%	79.3%		
	Others	30.0%	70.0%		
	First and second year	23.0%	77.0%		
Educational level	Third and fourth year	29.9%	70.1%	0.197	
	Fifth and sixth year	33.1%	66.9%		
Change in the vision	Yes	19.8%	80.2%	0.000	
	No	40.5%	59.5%	0.000	
	1-2 hours	31.3%	68.7%		
	3-4 hours	25.4%	74.6%		
Daily use of digital	5-8 hours	34.0%	66.0%	0.202	
devices for studies	9 – 12 hours	25.9%	74.1%		
	13 < hours	14.8%	85.2%		
Daily use of digital	1-2 hours			0.020	
devices for other purposes		14.3%	85.7%	0.030	
	3-4 hours	31.4%	68.6%		
	5-8 hours	33.8%	66.2%		
	9 – 12 hours	31.5%	68.5%		
	13 < hours	19.5%	80.5%		

*The Chi-square statistic is significant at the 0.05 level.

spend more hours daily. Of all, 45.3% of students whose E-studying period is over three years have a daily E-studying average of 9-12 hours, while only 30.3% of those with

less than a year period had the same daily average.

Eye symptoms were reported by 71.2% of all participants, and they include eye pain which was reported by 65.4%, and eye redness

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which was reported by 40.8%. These findings are high compared to many similar studies. A study conducted in Saudi Arabia found the prevalence of pain to be 14% and redness to be 15.1% [8]. The study of Iqbal et al. was conducted among students of Sohag University, Egypt, and found the prevalence of eye redness to be 15% only, and eye strain was reported among 16% of students [9]. Another study conducted in Malaysia on 795 university students found that 16.4% reported eye strain [10].

Eye redness and pain have been significantly associated with sex among respondents (P=0.000). Males were more likely to experience eye redness or pain as they have been reported by 41.6% and 22.9% for males and females, respectively. They have also been significantly associated with average daily use of electronic devices for other purposes (P=0.030) and change in the vision (P=0.000).

Vision was affected in 56.2% of participants, and the severity of the affection was major in 14.1%, average in 47.1%, and minor in 38.8%. Vision affection was associated with sex (P=0.002) as more females (60.5%) reported vision affection than males (39.5%). The field of the study was also a predictor for vision affection (P=0.017). Medical students and students of health sciences were more likely to report vision affection than other majors. This could be attributed to the increased demand for studying and referral of digital resources in medical students [11]. A study conducted in Singapore on medical students reported that the prevalence of myopia among medical students was 89.8% and hyperopia was prevalent among 1.3% [12]. Further factors associated with vision

affection were average daily hours spent on digital devices for all purposes (P=0.000), eye pain during E-studying (P=0.000), and eye redness during E-studying (P=0.000).

Students of a public university in Ghana had a refractive error prevalence of only 12.75% [13]. Astigmatism has been reported in 16.0% of participants. This is more than the findings of Abudawood *et al.*, who found astigmatism prevalence among university students of 11.7% [8]. In another study conducted in Northern Greece, students' age 15-18 years found the prevalence of astigmatism to be 10.2% [14].

The reason why students study on digital devices for longer durations is possibly that they are unaware of the negative outcomes on eye health. The carelessness of eye health can also lead to prolonged digital use and more eye morbidities as 42.1% of participants have not had their eyes examined for more than two years.

Various protective measurements can be taken to prohibit further visual affection related to digital device usage. The 20/20/20 rule is commonly indicated as advice by eve care physicians to their patients who experience prolonged exposure to near-point devices [15]. The rule statement is; every 20 minutes, take 20 seconds break and focus your sight on something at least 20 feet away [16]. Experiencing symptoms such as eve pain, redness, or dry eye requires extending the time to complete tasks and presuppose short, frequent breaks, which in turn can reinforce work adequacy, efficiently compensating for time spent away from the screen [17, 18].

CONCLUSION

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Survey for eye disorders associated with electronic studying among Tabuk university students revealed higher symptom rates than many similar studies. Digital studying has many benefits, but it markedly affects the eye health of students.

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