Astigmatism Among Female University Students: Prevalence, Association With Socio-Economic Factors And Time Duration Of Using Electronic Devices

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Abstract: *Astigmatism is a type of refractive error in which the eye does not focus light evenly on the retina. This results in distorted or blurred vision at all distances The aim of this cross-sectional study was to measure the prevalence of astigmatism among the female university students who rely heavily on electronic devices. Also, to find the association between this eye defect and the socio-economic factors and the time duration of using electronic devices. The sample consisted of female students, studying in university, in Jeddah city, who responded to self-administrated questionnaires. It was found that the prevalence of astigmatism was 14.69 %, and there was no statistical significant association with both the socio-economic factors and time duration of using electronic devices.However, the risk of astigmatism is more among Saudi students, and among those who use e-devices more than 8 hours per day.*

Keywords: Astigmatism, electronic devices,Jeddah city, female university students.

I.   Introduction

1.1 Rationale and importance

Astigmatism is a type of refractive error in which the eye does not concentrate light evenly on the retina. This leads to distorted or blurred vision at all distances. More symptoms include headaches, eyestrain and trouble driving at night.[1] If Astigmatism occurs early in life it can cause amblyopia.[2]] In 2005 a Polish study revealed that "with-the-rule astigmatism" may lead to the onset of myopia.[3]

Diagnosis is simply by an eye exam,[1] however the cause is not clear,[4] may be partly related to genetic factors.[5] Astigmatism is caused by combination of external (corneal surface) and internal (posterior corneal surface, human lens, fluids, retina, and eye-brain interface) optical attributes.Sometimes the external optics may have the greater influence, in other times the internal optics may prevail. The axes and magnitudes of external and internal astigmatism do not necessarily concur, but it is the combination of the two that determines the overall optics of the eye, which typically expressed by a person's refraction. Measuring the contribution of the external astigmatism done by the use of techniques likekeratometry and corneal topography.[6][7]

The prevalence of Astigmatism In Europe and Asia is between 30 and 60% of adults.[5] However, all ages can be affected.[1] Some research has suggested a link between astigmatism and higher prevalence of migraine headaches.[8]According to an American study the prevalence among the ages of five and 17 was nearly 28.4% (three in 10 children),[9] while a Brazilian study found that 34% of the students in one city had astigmatism.[10] In Bangladesh it was found that nearly 1 in 3 (32.4%) of those over the age of 30 had astigmatism.[11]Other studies found that the prevalence of astigmatism increases with age.[12]Furthermore, in different studies, age, gender, genetics, and even environmental factors had shown to affect astigmatism. [13]

1.2 Objectives

The aim of the study was to:
1- Measure the prevalence of astigmatism among female university students
2- Examine association between astigmatism and socio-economic factors
3- Examine association between astigmatism and the duration of using electronic devices.

II.   Methods

The study was a cross-sectional type. The target population was female university students in Jeddah city, in 2017. The sample size was 150 female university students, and self-administrated questionnaire was the tool of collecting data, which was tested previously in a pilot study of 21 female university students, then

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revised.7 students refused to participate, which consisted 4.89% , and that was an acceptable percent of non-participating .Excel sheet was used for data entry, making tables, and calculating simple calculations. While chi square analysis was performed via chi-square test calculator on the web site www.socscistatistics.com.

III. Results

3.1 Prevalence
It was found that the prevalence of diagnosed astigmatism was 14.69 % of the study sample.

3.2 Socio-economic
3.2.1 Age
More than half of the sample (55.9%) were 25 years old or less, while those who weremore than 30 years old consisted 21% of the sample. Among the astigmatic students 52.38% aged 25 years old or less, and 9.52% of the astigmatic participants over 30. While 56.56% of non-astigmatic students were 25 years old or less, and 20.49 % of the non-astigmatic participantsbetween 26 and 30 years old. The association between astigmatism and age was not statistically significant at $p < 0.05$ (The chi-square statistic is 4.0013, and calculated p-value is 0.135248.)

3.2.2 Nationality
55.9% of the sample were non- Saudi nationality. It was found that Astigmatism among Saudi and non-Saudi students were 52.38% and 47.62% respectively.

Table1: Distribution of Astigmatism by nationality, among female university students, in Jeddah city,in 2017

Nationality	Astigmatism	Not Astigmatism	Total
Saudi	11	52	63
Non Saudi	10	70	80
Total	21	122	143

Prevalence ratio = (11/63) / (10/80) = 1.3968, which means that the risk among Saudi students is 1.4 than non-Saudi.

3.2.3 Marital status
31% of the sample were married while 5% were divorced. Among astigmatic students 76.19% were not married (two of them were divorced while others were single). On the other hand, 67.21% of non-astigmatic students were not married (five of them were divorced). There was no statistical significant association between astigmatism and marital status at $p < 0.05$ (The chi-square statistic is 0.6695, and calculated p-value is 0.413213).

3.2.4 Year of study
70.6% of the study participants were at the third year or less. Among astigmatic students 66.67% were at third year or less, while 71.31% of non-astigmatic students were at level 6 or less. At $p < 0.05$, there was no statistical significant association between astigmatism and year of university study (The chi-square statistic is 0.1863, and the calculated p-value is 0.66599).

3.2.5 Monthly income
The question of monthly income of the family was a sensitive issue for some of the participants.

Table2: Astigmatism by monthly income, among female university students, in Jeddah city 2017

Monthly income	Astigmatism	Not Astigmatism	Total
Less than 5000 SAR	12	52	64
5000-10000 SAR	8	49	57
More than 10000 SAR	1	21	22
Total	21	122	143

As shown in the table 44.76 % of the sample hadmonthly income less than 5000 SAR, whereas 15.38 % of the sample had more than 10000 SAR per month.By comparison, 57.14% of astigmatic versus 42.62% of non-astigmatic students had less than 5000 SAR for monthly income; while 4.76% of astigmatic versus 17.21% of non-astigmatic students had more than 10000 SAR per month. By statistical analysis, it was found that the chi-square statistic was 2.6686, and the p-value was 0.263338. This mean that at $p < 0.05$ there is no statistical significant association between astigmatism and monthly income.

3.2.6Employment
27.27% of the sample were workers, while 11.89% were previously workers. Among astigmatic students 19.05% were workers versus 28.69 % of non-stigmatic students were workers. On other hand, 23.81% of astigmatic students were previously workers versus 9.84% of non-astigmatic were previously workers. However, these differences were not statistically significant at p < 0.05 (the chi-square statistic is 3.6085, and the calculated p-value is 0.164597).

3.2.7Electronic devices usage
As shown in table 3, 57% of the sample used two electronic devices or more (computer, mobile, laptop,tablet,..) for studying, while 43% used one e-device only . Students with astigmatism and those without astigmatism who usedtwo devices or more were 52% and 58%respectively. However, at p < 0.05there was no statistical significant difference between one e-device or more for studying, (the chi-square statistic is 0.2477 and calculated p-value is .618675).

Table 3: Number of devices used for study, , among female university students, in Jeddah city 2017

Number of devices	Astigmatism	Not Astigmatism	Total
One device	10	51	61
Two or more devices	11	71	82
Total	21	122	143

With respect to duration of using e-devices per day, there was close percentage of 4 hours or less (27.27%) and more than 8 hours (26.57%) durations among the sample.

Table4: Distribution of Astigmatism by the average of hours of using e-devices, , among female university students, in Jeddah city 2017

The average	Astigmatism		Not Astigmatism		Total	
	f	%	f	%	f	%
less than 4	5	23.81	34	27.87	39	27.27
4.1-6 hours	2	9.52	35	28.69	37	25.87
6.1-8 hours	8	38.10	21	17.21	29	20.28
more than 8 hours	6	28.57	32	26.23	38	26.57
Total	21	100.00	122	100.00	143	100.00

It wasfound that the lowest percent (20.28 %) of the sample used the e-devices between 6.1-8 hours per day. This percent was consistent with students without astigmatism, but discordant with those who had astigmatism. The highest percent of using the e-learning devices was 38.10% among astigmatic students. Statistically, there was no significant difference between astigmatic and non-astigmatic students at p < .05(the chi-square statistic is 6.5408, and the calculated p-value is 0.088066).
When the duration categorized into less than 8 hours, and 8 hours or more, the prevalence ratio was 0.90476. This mean that the risk of astigmatism is more when duration of using e-devices more than 8 hours per day.

IV.   Discussion
The prevalence of Astigmatism in this study is lower than prevalence reported among old people in Myanmar (30%)and in Indonesia (77%). [13] This could be because 56% of the sample were 25 years old or less.In Europe and Asia the prevalence among adults was between 30 and 60% .[5]
The effect of gender, level of education, and geographic location was controlled in this study since all participants were female university students in Jeddah city. A Japanese study consisted of 100 people, aged 23-83 years old, found there was no gender-related difference, but aging influences changes in types of astigmatism differently in men and women may be due to decreases in levels of sex hormones.[14]In India, Out of total 930 adolescents(12-18 years) attending the eye clinic from Jan 2007- Jan 2009 for any eye ailment, 35.23% presented astigmatism.[15] however, a Saudi study found that the magnitude and incidence of corneal astigmatism was dependent on both race and gender. The average corneal astigmatism for Saudi Arabian boys (-0.70D) and girls (-0.70D) were similar. This value was lower than that reported for Asian girls. The difference could be partly related to the shape and texture of the eyelids of Asian eyes. [16] Another study found the prevalence of uncorrected refractive errors, particularlyastigmatism, was high among children aged 3-10years in Medinah, with significant age differences.[17] Among preschoolers (3-5 years old), (17%) had astigmatism. There was a trend of an increasing percentage of astigmatism among older children, and American Indian

children had lower risk of astigmatism. [18]Furthermore, A population-based study in Tehran, revealed that age, education and ametropia were the main predictors of astigmatism. [19]

Regarding the effect of time duration of using electronic devices, An American optometric association declared that many individuals experience eye discomfort and vision problems when viewing computer, tablet, e-reader and cell phone for extended periods. The level of discomfort appears to increase with the amount of digital screen use. Uncorrected vision problems like farsightedness and astigmatism, inadequate eye focusing or eye coordination abilities, and aging changes of the eyes, such as presbyopia, can all contribute to the development of visual symptoms when using a computer or digital screen device. In Malaysia, National Institute of Occupational Safety and Health (NIOSH) conducted a study, and found that 70.6% of them complain of eyestrain. [20] In Jeddah sample it was found that the risk of astigmatism was more when duration of using e-devices was more than 8 hours per day.

V. Conclusion

Based on the results, it was found that the prevalence of astigmatism was 14.69 %, and there was no statistical significant association with both the socio-economic factors and time duration of using electronic devices. However, the risk of astigmatism is more among Saudi students, and among those who use e-devices more than 8 hours per day.

Acknowledgments

Conflicts Of Interest

The author declares no conflict of interest.

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