Prevalence of myopia and its association with electronic devices among university students in Riyadh, Saudi Arabia

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ABSTRACT

Background: Myopia is the most common refractive error worldwide and is a growing global burden. Although myopia is a well-recognized problem, it has not been extensively studied in Saudi Arabia. This study aimed to determine the prevalence of myopia and assess the association between e-reading and myopia.

Methodology: This cross-sectional study included data collected from 571 male medical students in Riyadh between February 2019 and May 2019. The participants were categorized into three groups using stratified random cluster sampling: 187, 194, and 190 students from the fifth, third, and first years, respectively. The prevalence of myopia was self-reported through a questionnaire that also included details regarding the pattern of electronic device use. Statistical analyses were performed using Statistical Package for the Social Sciences to determine the prevalence with 95% confidence level.

Results: Among the 291 medical students who responded, 117 (40%) had myopia (95% confidence interval = 33.4%-48.0%), of whom 70% were diagnosed before attending the university. When comparing between myopic and non-myopic students with respect to electronic device usage, no significant difference was found (p = 0.28). However, a significant difference was found between the groups in terms of laptop utilization compared to other types of electronic devices, such as smartphones and tablets (p = 0.03).

Conclusions: The prevalence of myopia among university medical students was 40%. A significant difference was found between myopic and non-myopic students regarding laptop use compared with other types of electronic devices.

Keywords: Electronic devices, myopia, prevalence, students, university.

Introduction

Myopia, the most common refractive error, is a growing public health issue worldwide. In 2000, a meta-analysis of 2.1 million participants showed that myopia was estimated to affect 22.9% of the world population, with the highest prevalence among individuals aged between 10 and 39 years. In 2010, the prevalence of myopia increased to 1.950 million (28.3%) [1]. The rise in the prevalence of myopia has a vital effect on education and socialization among affected individuals. A study conducted in Saudi Arabia on medical students examined 454 participants from two universities, namely University of Hail located in Northern Kingdom of Saudi Arabia (KSA) and Prince Sattam University in the Capital Riyadh, and reported that 243 (56%) participants had myopia [2]. Moreover, a recent study conducted in 2019 in Imam Abdulrahman Bin Faisal University, eastern region of KSA, among students who were studying health-related majors revealed that among 162 male students, 69 (43%) had myopia [3]. Additionally, two cross-sectional studies...
Association with electronic devices among university students

Conducted at Inner Mongolia Medical University, China, in 2011 and 2013, among 1,015 students in both years showed prevalence rates of 70.5% and 69.2% respectively [4]. A study in Nanjing, China, among 1,200 participants concluded that the prevalence of myopia was 87% among university students [5].

Myopia is abundantly found among the student population, which increases their risk of social blindness, retinal detachment, glaucoma, and myopic retinopathy [6,7]. With the rising prevalence of myopia, many studies have been conducted to determine possible risk factors. Family history is greatly associated with juvenile myopia [8,9]. Environmental factors such as less outdoor activities, near work, and higher education level have been shown in some studies to contribute to myopia development [8-13]. In addition, the noticeable shift among medical students to study from tablets, smartphones, and computers may be associated with myopia development or progression [14,15].

Most risk factors, such as lesser outdoor activities, more near work, and higher level of education have been extensively studied and are strongly associated with myopia. The possibility of an association between the use of display screen devices, such as computers, tablets, and smartphones, and myopia has not been extensively studied. Because of the increased use of these devices among medical students and the rising prevalence of myopia, this association should be studied to raise awareness among medical students and to bring attention to this possibly unrecognized problem. Thus, this study aimed to determine the prevalence of myopia and investigate the possible association between the development of myopia and e-reading from devices such as smart phones, tablets, and computers among male medical students in Riyadh, Saudi Arabia.

Methodology

Settings

This study only included male medical students. The sample size was 571 students, and questionnaires were distributed to all participants on the assumption that the response rate would be 50%.

Study population

The study population included all 571 male medical students from the fifth (187), third (194), and first (190) years. Students with diabetes mellitus, glaucoma, or any type of ocular injury were excluded. This study was approved by the appropriate review board. Written informed consent was obtained from the participants and was approved by the review board.

Questionnaire survey

Data were collected between February 2019 and May 2019 using a self-developed questionnaire. A pilot study was conducted among 76 medical students from two different groups, the second- and fourth-year students, to assess the validity and reliability of the questionnaire; all of them were not included in this study. All questionnaires were completed by the study participants independently.

Basic information such as demographic data, cumulative grade point average, period of diagnosis (before or during university program), method of correction, family history of myopia, hours spent studying per week, time spent on electronic devices performing activities other than studying per week in study settings, and study method utilized was obtained via the questionnaire.

Statistical analyses

The data collected were analyzed using the Statistical Package for the Social Sciences software (version 22.0, IBM Corp., Armonk, NY). Statistical analyses were performed to determine the prevalence of myopia (with 95% confidence interval [CI]) among male medical students in Riyadh. Categorical variables (batch and myopia status) are presented as frequencies and percentages. Numerical variables such as age are presented as the standard deviation and mean. A Chi-square test was performed to identify the association between studying using electronic devices and myopia among medical students. The association was to be considered significant if $p$-values were <0.05.

Results

Among 571 distributed questionnaires, 291 participants responded (response rate, 51%); all the participants were males, and the mean age was 22 (± 2.5) years (Table 1). Among the 291 students, 117 had myopia (40%), and they were from the fifth (44), third (41), and first (32) years (95% CI: 33.4-48.0) (Figure 1). There was no significant difference between myopic and non-myopic students in terms of age. The prevalence of myopia was three times more likely to use laptops (odds ratio = 3.31) (Figure 2). There were no significant differences between myopic and non-myopic students concerning any of the collected variables except with regard to the use of a laptop, which showed a significant difference between both groups ($p = 0.03$); students with myopia were three times more likely to use laptops (odds ratio = 3.31) (Figure 3). When comparing myopic and non-myopic students in terms of hours spent studying on weekdays, greater percentages of myopic students, 18% and 13%, studied for 5-6 and >6 hours respectively, while greater percentages of non-myopic students, 33% and 44%, studied for 1-2 and 3-4 hours, respectively ($p = 0.42$) (Figure 4). There was a 2% variation in all categories when comparing myopic and non-myopic students in terms of hours spent studying during weekends ($p = 0.95$). When asked about the time spent on electronic devices to perform activities other than studying during weekdays, a greater proportion (58%) of myopic students spent >4 hours compared with non-myopic students (53%). In contrast, a greater percentage of non-myopic students (47%) used electronic devices...
Association with electronic devices among university students

Table 1. Prevalence of myopia among medical students in Riyadh.

<table>
<thead>
<tr>
<th></th>
<th>Myopic</th>
<th>Non-myopic</th>
<th>Total number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>First year</td>
<td>44</td>
<td>42.3</td>
<td>60</td>
</tr>
<tr>
<td>Third year</td>
<td>41</td>
<td>43.2</td>
<td>54</td>
</tr>
<tr>
<td>Fifth year</td>
<td>32</td>
<td>34.8</td>
<td>60</td>
</tr>
<tr>
<td>All</td>
<td>117</td>
<td>40.2</td>
<td>174</td>
</tr>
</tbody>
</table>

Figure 1. Association between myopia and commonly utilized tools for studying.

Figure 2. Association between myopia and type of electronic devices commonly used for studying.

for ≤4 hours to perform activities other than studying compared with myopic students (42%) \((p = 0.40)\). On weekends, most students in both groups (myopic and non-myopic students) used electronic devices for >4 hours, sharing an equal percentage of 67% \((p = 0.84)\).

Among 117 students diagnosed with myopia, a high number of students (70%) were diagnosed before their university program started, compared with 30% of those diagnosed later. Family history of myopia was present in 82% of students diagnosed with myopia (Table 2).

The most common method of correction was eyeglasses (87%), while 2% of students used corrective lenses and 4% used both; 6% of students reported not using any method of correction.
Association with electronic devices among university students

![Graph showing hours spent studying on weekdays](image1.png)

**Figure 3. Hours spent studying on weekdays.**

![Graph showing hours spent studying on weekends](image2.png)

**Figure 4. Hours spent studying on weekends.**

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>Before university</td>
<td>82</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>After university</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>Family history</td>
<td>Present</td>
<td>96</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Absent</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>Method of correction</td>
<td>Eyeglasses</td>
<td>102</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Corrective lenses</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Not corrected</td>
<td>7</td>
<td>6</td>
</tr>
</tbody>
</table>

**Table 2. Variables obtained from medical students with myopia in Riyadh.**

**Discussion**

This study had several important findings. First, the prevalence of myopia among medical students was 40%. Second, there was no association between studying using electronic devices and myopia except for the use of a laptop, which was significantly higher among myopic students. Similar results were demonstrated in a study conducted among Spanish university graduates, which showed that the use of computers was associated with...
the progression of myopia [15]. In addition, a prospective cohort study conducted in Netherlands found that computer use at 3 years of age was associated with the development of myopia at school age [16].

The prevalence of myopia in this study was much closer to that in a similar study conducted in the region; the prevalence of myopia was estimated to be 42.5% among male college students [3]. However, the prevalence in our study was much higher than in a similar cross-sectional study among medical students in Turkey, which concluded the prevalence to be 33% [10]. However, the prevalence in our study was found to be less when compared with a study among university students in Nanjing, China, which reported a prevalence of 86.8% [5]. In addition, two cross-sectional studies conducted at Inner Mongolia Medical University, China in 2011 and 2013, reported prevalence rates of 70.5% and 69.2%, respectively [4]. The difference between the results found in Saudi Arabia and these studies can be attributed to the variation among populations in different geographical regions and genetic and lifestyle differences. When comparing myopic and non-myopic students regarding the utilization of electronic devices for studying, they both shared an equal percentage [89% (p = 0.28)]. Similar results were demonstrated in the Nanjing study that reported no significant difference between myopic and non-myopic students concerning the use of electronic devices [5]. A family history of myopia was present in 82% of students diagnosed with myopia, which was in agreement with previous studies, concluding that family history was a significant factor for myopia development [3,10,17]. Studies have suggested that myopia is associated with genetic factors. However, we cannot disregard the effects of habits and lifestyle. The most common method of correcting myopia was eyeglasses (87%), which corresponded with a study conducted in Saudi Arabia, while 2% used corrective lenses and 4% used both; 6% of the participants reported not using any method of correction [2].

Conclusion

There was no association between studying using electronic devices and myopia. Although the prevalence in Riyadh was not as high as that reported in other countries, myopia still affected a significant number of the population, and further associated factors need to be investigated to educate the population and decrease the burden of this condition.

Recommendations

Although a validated questionnaire was used, which was the main method adopted by many studies, and the specificity and sensitivity of self-reported diagnosis of myopia were approximately 0.74 and 0.76, respectively, an expert objective measurement could have supported the study with more exact data and quantified the degree of myopia in the study participants [18]. Longitudinal cohort studies should be conducted to further investigate the association between the use of electronic devices and myopia.


