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The Effect of Online Learning on Myopia Progression

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ABSTRACT

During the pandemic COVID-19, online learning is an alternative solution because it can be used anywhere and at any time. Long-term use of digital devices causes a variety of eye problems, the most common of which is refractive error. Medical students are at high risk of experiencing myopia because they do a lot of long and intensive reading and other close-up activities. This study analyzes the effect of online learning on the refraction status of students at the Faculty of Medicine, University of Semarang. This research uses observational analytics with a cross-sectional method, conducted from December 2022 to January 2023. The sample was students from the Faculty of Medicine, Muhammadiyah University of Semarang, class of 2019, 2020 and 2021 used a simple random sampling method. There were 41 students had emmetropic status before the pandemic, and 41 students had myopic status. Refractive status before and after online learning was analyzed using the Mann-Whitney test. The refraction status of respondents after online learning who had myopic refractive status increase in negative spherical diopters were 23 people (56.1%) while The refraction status of respondents after online learning who who had emetropi status increase of negative spherical diopters were 2 people (4.9%). Analysis results show the p value of 0.001 (<0.05) indicating that there was a significant difference in negative spherical diopters between the myopic and emmetropic groups, before and after online learning. To sum up, online learning affects refractive status, by increasing myopia.

Keywords: *Myopi, Refractive Status, Online Learning, Screen Time*

1. INTRODUCTION

Comorbidity between diabetic mellitus (DM) and tuberculosis (TB) poses a danger to the treatment and prevention of TB disease globally. Ten million new instances of active tuberculosis (TB) infection are reported each year, and TB is believed to be the cause of almost 1.2 million fatalities globally. Clinicians have seen a connection between TB and diabetic mellitus (DM) for many years [1].

According to studies, DM can treble the risk of having TB and that each can raise the incidence of the other [2]. Studies have linked uncontrolled diabetes (plasma HbA1C level > 7.0%) to subpar TB treatment results or possibly treatment failure. Indonesia has a significant TB and DM burden. A WHO report from 2020 said that Indonesia was responsible for the second-highest percentage (8.5%) of global TB incidence [3]. Given Indonesia's vast population and prevalence of DM, over 6% of adults in the country between

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the ages of 20 and 79 have the disease [4]. In Indonesia, individuals with pulmonary TB had an age-standardized prevalence of diabetes mellitus of 11.3%, according to a recent study [5]. Over 13% of DM patients in Indonesia between 2013 and 2016 were found to have ever had TB or to have been given a TB diagnosis, according to another study [2].

One-third of the world's population may be infected with Mycobacterium tuberculosis, although not everyone who is infected goes on to develop active TB because the germ is typically destroyed by the immune system. However, the bacteria can remain latent in certain people. With risk factors like advanced age, diabetes, and other immunosuppressive medications, they may subsequently become active and cause disease. So, after adjusting for confounding variables, uncontrolled diabetes mellitus and five additional risk factors were discovered to have an impact on the failure of TB treatment. More than five times as many respondents were at risk of not responding to treatment if their diabetes was uncontrolled and their HbA1c level was less than 7% after two months of treatment [6].

An increased risk of recurrence was found to be significantly correlated with uncontrolled DM (HbA1c), according to a systematic study. Similar results from a different multicenter research were obtained in South Korea. As a result, it's critical to carefully evaluate the clinical circumstances and blood glucose levels of TB patients with DM while they're undergoing treatment. A larger risk of worsening TB treatment outcomes was seen in respondents under the age of 45.7 Studies carried out in Indonesia have found a similar outcome. Similar to this, poor financial circumstances were also linked to treatment failure. A study carried out in Kuala Lumpur, Malaysia, however, found no appreciable differences in the economic circumstances of the two groups. Although the majority of research conducted outside of the Middle East did not find a connection between DM and conversion at the end of two months, we took into account a longer observation period of six months.6 This study aims to identify the relationship between glycemic control and the length of treatment in patients with tuberculosis and diabetes mellitus.

2. METHOD

This research has received ethical approval from the Health and Research Ethics Commission (KEPK) of the Faculty of Medicine, Muhammadiyah University, Semarang, issued with letter number No. 119/ EC/ KEPK-FK/ UNIMUS/ 2022. This research uses observational analytics with a cross-sectional method. This research was conducted from December 2022 to January 2023 using the zoom meeting application and also face-to-face meetings to find out the respondent's refraction history. The research sample was students from the Faculty of Medicine, Muhammadiyah University of Semarang, class of 2019, 2020 and 2021. The sample used a simple random sampling method which was carried out by selecting samples that met the inclusion criteria of 82 student samples. where 41 students had normal refractive status before the pandemic, and 41 students had myopic refractive error status. Refractive status before and after online learning was analyzed using a non-

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parametric test using the Mann-Whitney test. Increased myopia is a change or increase in the respondent's negative spherical diopters. The initial refraction status baseline is based on the refraction status questionnaire question data before the start of online learning (2019) while the final refraction status is the refraction status in December 2022. The questionnaire was carried out using google form and distributed to students of class 2019, 2020 and 2021.

3. RESULTS

Table 1. Characteristics of Refraction Status Respondents Before and After Online Learning

Characteristics	N	Percentage (%)
Gender		
Male	19	23,2%
Female	63	78,8%
Refraction status before online learning		
Myopi	41	50%
Emetropi	41	50%
Refraction status after online learning		
Myopi		
Increased myopia	23	56,1%
No change	18	43,9%
Emetropi		
Increased myopia	2	4,9%
No change	39	95,1%

Based on the data in table 1, the results showed that there were 63 female respondents (78.8%) more than 19 male respondents (23.2%). The refractive status of respondents before online learning who had myopic refractive error status and emetrop status each was 41 people (50%). The refraction status of respondents after online learning who had myopic refractive error status experienced an increase in negative spherical diopters were 23 people (56.1%) while those whose refractive status remained the same were 18 people (43.9%). The refraction status of respondents after online learning who who had emetropi status experienced an increase of negative spherical diopters were 2 people (4.9%) while those whose refractive status remained normal were 39 people (95.1%).

The data that had been collected was tested for normality first using the Kolmogorov-Smirnov test, obtaining a p value of 0.000, indicating that the data was not normally distributed, so a non-parametric test was used using the Mann-Whitney test. The results of the comparative test between refraction status before and after online learning can be seen in table 2.

Table 2. Differences in refraction status before and after online learning between the myopic and emmetropic groups

Variable	Myopia		Emetrop		
	before online learning **(mean ± SD)**	after online learning	before online learning	after online learning	***p-value***

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		(mean± SD)	(mean± SD)	(mean± SD)	
Negative spherical diopters	1.76±1.58	2.20±1.74	0.00±0.00	0.05±0.31	0.001*

Based on table 2, a p value of 0.001 (<0.05) was obtained, indicating that there was a significant difference in negative spherical diopters between the myopic and emmetropic groups, before and after online learning.

4. DISCUSSION

This study analyses the effect of online learning on the refraction status of students at the Faculty of Medicine, University of Semarang. The 2019 COVID pandemic has encouraged students in particular to carry out the learning process online so that the level of computer use is higher every day. The respondents of this study consisted of 2 groups, where the first group were those who did not wear glasses before the pandemic, and the second group were respondents who had used glasses since before the pandemic. This research shows that online learning can cause a decrease in vision as indicated by the majority of respondents who wear glasses experiencing an increase in myopia, and 2 respondents who previously did not wear glasses experienced myopia after online learning.

The new coronavirus disease of 2019 (COVID-19) had a worldwide impact, this disease was affecting almost everyone's lives. It has caused many health issues to spiral out of control, one of them is myopia. Evidence suggests that myopia is impacted by environmental and lifestyle factors, with the importance of continuous usage of nearby digital screens being highlighted. [11] Studies also found that subjects with pre-pandemic myopia are more likely to report symptomatic myopia progression during the COVID-19 pandemic than those who did not self-identify as having myopia prior to the pandemic. Subjects who already had myopia prior to the COVID-19 pandemic appear to have a higher rate of myopia development. It is stated that higher myopia progression was significantly correlated with more digital screen time for online learning.[11]

Based on all of the studies that mention a relationship between digital screen use and the progression of myopia. All of these statements make sense with the explanation of a study conducted on mice, where they explained that blue light emitted from computer screens. for example, has dangerous effects on the retinal pigment epithelium so that it can lead to retinal pigment epithelial dysfunction, that might result in axial elongation and the progression of pathological myopia.[12], [13] It can even cause the outer blood-retinal barrier among the neuroretina and the choroid to become destabilized, resulting in crucial delays in retinal development signals. Indeed, it has been established that using near vision eyes causes the ciliary muscle to tighten, the refractive power of the retina will rise, the axis of the eye to lengthen, and myopic vision diseases may occur.[11], [14]

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Exposure time to digital screens as well as digital devices used for online studies can also have an effect on the development of myopic vision in adolescents. According to our investigation, most students mainly use mobile phones and computers for online learning. Over the past few years, mobile phones and tablet PCs have become popular among the younger generation (one in three children aged 1-6 years use a mobile phone for 1-2 hours per day). During the COVID-19 pandemic, home and school confinement results in more online learning to maintain the normal process of academic assignments.[15]

We found that myopia progression during the study-at- home period was higher than the highest myopia progression during the period before COVID-19 in other studies. The changes in visual acuity and axial elongation were not statistically significant; we believe this might be related to the small degree and short follow-up time. [16] There have been several studies regarding the prevalence of myopia after the COVID-19 pandemic. A cross-sectional study about school-age students in Shandong, China showed that comparing with 4 years before, the prevalence of myopia increased by 1.2–3 times after the COVID-19 pandemic, and it increased more among 6 to 8 year-olds. In a study conducted in Hong Kong, the annual incidence of myopia was 29.68% in the COVID-19 cohort compared with 11.63% in the pre-COVID-19 cohort. [17]

5. CONCLUSION

There was a significant difference between refraction status before and after online learning. Where respondents who before online learning had myopia refractive errors experienced more visual impairment than respondents who before the pandemic did not have refractive errors.

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