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RELATIONSHIP BETWEEN NEAR WORK ACTIVITIES AND THE DEGREE OF MYOPIA IN ADOLESCENTS AT RSD DR. SOEBANDI JEMBER

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ABSTRACT

Myopia is a visual impairment characterized by difficulty seeing distant objects due to light focusing in front of the retina. The global prevalence of myopia continues to increase and is expected to reach 49.8% by 2050. One of the main risk factors for myopia is near work activities, such as reading, using gadgets, and working with computers for a long time. This study aims to evaluate the relationship between near work activities and the degree of myopia in adolescents at Dr. Soebandi Jember Hospital. This study used a descriptive analytic correlational method with a cross-sectional approach. The study sample consisted of adolescents with myopia who were selected using total sampling technique. Data were collected through a near work activity questionnaire and patient medical records, then analyzed using the Kendall Tau test. The results showed a significant relationship between near work activities and the degree of myopia (p value = 0.020; correlation coefficient = 0.264). In addition, there was a significant relationship between the length of time reading books (p = 0.025), smartphone/tablet use (p = 0.005), laptop/computer use (p = 0.036), and watching television (p = 0.042) with the degree of myopia in adolescents. The conclusion of this study is that there is a significant relationship between near work activities and the degree of myopia in adolescents at RSD dr. Soebandi Jember.

Keywords: *Myopia; Near Work; Degree of Myopia; Adolescents*

Background

Myopia is a visual disorder where individuals experience difficulty seeing distant objects clearly. It is categorized as a serious non-communicable disease, with incidence rates rising annually across the globe. People with myopia can still see objects at a close distance clearly. This condition occurs when incoming light focuses in front of the retina, resulting in blurred vision for distant objects (National Eye Institute, 2023). Near work activities, such as reading or prolonged use of computers, force the eyes to continuously accommodate, which can lead to axial elongation of the eyeball and, consequently, blurred distance vision (Saminan, 2013).

According to WHO data in 2020, approximately 2.6 billion people of all ages were estimated to have myopia, with 312 million of them under the age of 19 in 2015 (WHO, 2019). Projections estimate that by 2050, 49.8% of the global population will be affected by myopia, with high myopia prevalence reaching 9.8% (Holden et al., 2016). In Indonesia, the prevalence of refractive errors is about 25% of the population, affecting an estimated 55 million people. Around 10% of the 66 million school-aged children in Indonesia are affected by refractive errors (RG FK UNS, 2020). A study by Oneta et al. (2023) of 384 students found that 64.58% had mild myopia, 27.87% moderate, and 7.55% severe. A preliminary study at RSD dr. Soebandi Jember reported 50 cases of adolescent myopia in 2023.

Students from elementary to high school levels are constantly exposed to near work activities for both learning and recreational purposes (Efendi, 2021). Near work is a well-established risk factor for the development of myopia, while outdoor activity is considered a strong protective factor. In the millennial era, outdoor physical activity is increasingly rare, while near work has become a daily norm (Gunardi et al., 2020). Delayed accommodation during near work has been linked to the onset and progression of myopia. It has been shown that significant accommodative lag is present before the onset of myopia and that emmetropic children who develop myopia demonstrate greater accommodative lag than those who remain emmetropic. This lag causes hyperopic defocus, which contributes to axial elongation of the eyeball and myopia progression (Gammoh, 2018). These facts and phenomena have inspired the researchers to study the relationship between near work and the degree of myopia in adolescents at RSD dr. Soebandi Jember.

Methods

This study employed a descriptive-analytic correlational design with a cross-sectional approach to examine the relationship between near work and the degree of myopia in adolescents. The study population consisted of adolescent patients with myopia attending the Ophthalmology Clinic at RSD dr. Soebandi Jember, selected using a total sampling technique. The study was conducted using medical record data from RSD dr. Soebandi Jember. The data collection period spanned from December 2024 to January 2025. Data were collected from two sources: secondary data from medical records and primary data from a near work activity questionnaire. Univariate analysis was used to describe frequency distributions, while bivariate analysis using Kendall's Tau-b and Tau-c tests was conducted to assess the relationships between variables. This research adhered to ethical principles, including obtaining informed consent, maintaining data confidentiality, and providing benefits such as increasing participants' awareness of the impact of near work on myopia.

Results

Tabel 1. Characteristics of Adolescents with Myopia

Respondent Characteristics	Median	Min.	Max.	Frequency	Percentage
Age (years)	14	10	18		
Gender					
				15	45,5
Male				18	54,5
Female					
Degree of Myopia					
				15	45,5
				10	30,3
Mild				8	24,2
Moderate					
Severe					
Parental History of Myopia					
				19	57,6
				14	42,4
Yes					
No					
Outdoor Activity Duration					
				3	9,1
				19	57,6
Often (12–16 hrs/week)				11	33,3
				0	0,00
Sometimes (7–11 hrs)					
Rarely (2–6 hrs)					
Never (≤1 hr)					

Table 1 shows that the median age of adolescents with myopia at RSD dr. Soebandi Jember was 14 years. Myopia was more prevalent among females (54.5%) than males (45.5%). Of the respondents, 45.5% had mild myopia, 30.3% moderate, and 24.2% severe. A parental history of myopia was reported by 57.6% of the participants. Regarding outdoor activities, the majority of respondents engaged in outdoor activities for 7–11 hours per week (57.6%), followed by 2–6 hours (33.3%), and 12–16 hours (9.1%).

Tabel 2. Relationship Between Near Work and Degree of Myopia

Variable	**r**	***p-value***
Near Work Degree of Myopia	0,264	0,020

Table 2 shows a p-value of 0.020, which is less than the significance level α = 0.05. This indicates a statistically significant relationship between near work and the degree of myopia in adolescents. The positive correlation coefficient (r = 0.264) suggests that increased near work activity is associated with a higher degree of myopia, although the relationship is weak.

Tabel 3. Relationship Between Duration of Book Reading and Degree of Myopia

Indicator	***p-value***
Reading Duration Degree of Myopia	0,025

Table 3 The p-value of 0.025 indicates a significant relationship between the duration of reading books and the degree of myopia in adolescents.

Tabel 4. Relationship Between Duration of Smartphone/Tablet Use and Degree of Myopia

Indicator	***p-value***
Smartphone/Tablet Duration Degree of Myopia	0,005

Table 4 a p-value of 0.005 shows a statistically significant relationship between smartphone/tablet use and the degree of myopia.

Tabel 5. Relationship Between Duration of Laptop/Computer Use and Degree of Myopia

Indicator
Laptop/Computer Duration
Degree of Myopia

Table 5 the p-value of 0.036 indicates a significant relationship between the duration of laptop/computer use and the degree of myopia.

Tabel 6. Relationship Between TV Watching Duration and Degree of Myopia

Indicator	***p-value***
TV Watching Duration Degree of Myopia	0,042

Table 6 The p-value of 0.042 shows a significant association between

the duration of watching television and the degree of myopia in adolescents.

Discussion

The study involved 33 adolescent respondents aged between 10 and 18 years. According to Muryantisa et al. (2024), the highest incidence of myopia cases at Bali Mandara Eye Hospital in 2022 was in the adolescent group, totaling 55 patients (41.4%). In terms of gender, the majority of respondents were female (54.5%) compared to males (45.5%). Supit & Winly (2021) found that females have a 1.21 times higher risk of developing myopia than males. This may be attributed to females spending less time outdoors and engaging in more near work activities. Limited exposure to sunlight, which plays a role in ocular accommodation and light refraction on the retina, can increase the risk of developing myopia. Sufficient sunlight helps train the eyes in focusing light properly (Lestari, 2020). This study found that the highest proportion of participants had mild myopia (45.5%), followed by moderate (30.3%), and severe (24.2%). These findings align with Muryantisa et al. (2024), who reported that mild myopia was the most common type (54.9%) at Bali Mandara Eye Hospital. In terms of heredity, 57.6% of respondents reported a parental history of myopia. According to the Indonesian Ministry of Health's Non-Communicable Disease Prevention Directorate (P2PTM Kemenkes, 2024), genetic factors are among the primary causes of myopia, influencing the structure of the eyeball. Children are three times more likely to develop myopia if one parent is affected, and six times more likely if both parents are. However, genetic predisposition alone is insufficient—environmental factors also play a significant role in the development of myopia (Supit & Winly, 2021).

Respondents reported spending 7–11 hours per week (57.6%) on outdoor activities, 2–6 hours (33.3%), and 12–16 hours (9.1%). Outdoor activities have a strong protective effect against myopia, even among children with a genetic predisposition (Jiang et al., 2021). High-intensity light outdoors may affect axial eye growth and trigger dopamine release, which helps inhibit eye elongation. Sunlight exposure also stimulates the synthesis of vitamin D, which may help regulate scleral growth and ciliary muscle tone—factors crucial to retinal image clarity (Zhang & Deng, 2020).

The Kendall's Tau-c test revealed a p-value of 0.020 ($p < 0.05$), indicating a statistically significant relationship between near work and the degree of myopia. These results are consistent with research by Sukamto et al. (2019), which reported a significant correlation ($p = 0.006$) between near work activities and myopia. Longer school hours, homework, and shifts in leisure activities—particularly among adolescents who favor screen-based entertainment over outdoor play—contribute to this trend (Philipp et al., 2022). The positive correlation ($r = 0.264$) implies that greater near work is

associated with more severe myopia, although the strength of the correlation is weak, suggesting that other factors such as heredity and outdoor exposure also influence myopia progression.

Kendall's Tau-b analysis showed a p-value of 0.025, indicating a significant correlation between book reading duration and myopia severity. This supports findings by Chhabra et al. (2022), who found a significant positive correlation between myopia prevalence and reading time. Additionally, reading posture and lighting are important. Jiang et al. (2022) noted that maintaining a distance of more than 33 cm from the book may help prevent and control myopia, and Liang et al. (2024) emphasized that upright posture could be an effective behavioral intervention. Chhabra et al. (2022) also found that reading in dim light significantly increases the risk of myopia ($p = 0.0006$). Parents should ensure children study in well-lit environments to reduce the prevalence of myopia.

The test results showed a significant association between smartphone/tablet use and myopia severity ($p = 0.005$). This aligns with Wea et al. (2018), who found that over half of respondents using smartphones for more than four hours daily had myopia. Mobile devices differ from traditional reading materials in wavelength, size, contrast, resolution, and spectral composition. They also emit high-energy blue light, which can damage retinal cells and disrupt circadian rhythms, leading to changes in genes like MMPs and TGF-β involved in scleral remodeling and eye elongation (Li et al., 2021; Chakraborty et al., 2018). Parents should limit screen time, encourage outdoor activities, and use anti-blue light filters or glasses to mitigate risks. Moreover, prolonged use of smartphones can reduce blinking frequency, contributing to dry eyes and ocular fatigue (Choi et al., 2018). Chronic eye strain may cause accommodative spasms that promote myopia development (McBrien & Millodot, 1986).

The duration of laptop/computer use was also significantly correlated with myopia ($p = 0.036$), as supported by Ariaty et al. (2019) and Enthoven et al. (2020). Children using digital screens extensively are more likely to develop myopia. High visual demands on digital devices can exacerbate Computer Vision Syndrome (CVS), manifesting in symptoms like dry or strained eyes (American Optometric Association, 2024). Kurmasela et al. (2013) found that most students began experiencing CVS symptoms after 2–3 hours of laptop use. The 20-20-20 rule (taking a 20-second break to view something 20 feet away every 20 minutes) is recommended to reduce CVS and maintain eye health (P2PTM Kemenkes, 2024).

Lastly, TV watching duration also showed a significant association with myopia ($p = 0.042$), consistent with findings by Nurjanah (2018). Prolonged screen exposure reduces blink rates, leading to dry, irritated eyes. Blue light from screens reduces contrast and causes fatigue. Sitting too close to

the TV (less than five times the screen width) forces excessive accommodation, potentially leading to lens and muscle changes that contribute to myopia (Saminan, 2013). Healthy screen habits—such as maintaining viewing distance, limiting screen time, and increasing outdoor activities—are essential to protect eye health.

Conclusion

This study concludes that there is a significant relationship between near work activities and the degree of myopia in adolescents at RSD dr. Soebandi Jember. The Kendall's Tau analysis showed a positive correlation, indicating that increased near work is associated with a higher degree of myopia. In addition, specific activities—including the duration of book reading, smartphone/tablet use, laptop/computer use, and television watching—were also found to be significantly correlated with the severity of myopia. These findings suggest that changes in visual behavior, particularly among school-aged children, contribute to the rising prevalence of myopia. Preventive efforts are needed, such as managing screen time, promoting healthy reading habits, and conducting regular eye examinations, to reduce the risk and progression of myopia in adolescents

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