

RELATIONSHIP BETWEEN DURATION OF OUTDOOR ACTIVITIES AND THE INCIDENCE OF MYOPIA IN CHILDREN IN ELEMENTARY SCHOOL

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ABSTRACT

Myopia in school-aged children is now a global health problem that has increased drastically due to shifts in modern lifestyles. Children currently spend more time indoors for close-range activities and using gadgets, thus reducing the duration of outdoor physical activity which actually has a protective effect from exposure to natural light. The purpose of this study was to analyze the relationship between outdoor physical activity and the incidence of myopia. This type of research is a quantitative descriptive with a cross-sectional approach. The population in this study was all elementary school students. Sampling was carried out using a purposive sampling technique of 67 people. Data collection used questionnaires and observations. Data analysis used the chi-square test. The results showed that most respondents had a moderate duration of outdoor activity, namely 44 respondents (63.8%). Most respondents did not experience myopia, namely 53 respondents (76.8%). Correlation analysis showed a significant relationship between the duration of outdoor activity and the incidence of myopia in elementary school children ($p = 0.001$). Respondents with a low duration of outdoor activity had a higher proportion of myopia than respondents with a moderate or high duration of outdoor activity. Based on the research results, it can be concluded that there is a relationship between outdoor physical activity and the incidence of myopia, low duration of outdoor activity has a higher proportion of myopia incidence.

Keywords: Outdoor Physical Activity, Incidence Of Myopia.

INTRODUCTION

Myopia, or nearsightedness, is a refractive disorder characterized by the eye's inability to focus distant objects precisely on the retina, resulting in blurry vision (Khoiro & Rasyid, 2025). This condition occurs due to axial elongation of the eyeball or an increase in the refractive power of the eye's optical system that is disproportionate to the length of the eyeball. In recent decades, myopia has become a significant global public health problem, particularly in school-age children.

The prevalence of myopia has increased drastically in various countries, both developed and developing, along with changes in modern lifestyles. If left uncontrolled, myopia can progress to high myopia, which carries the risk of causing serious complications such as retinal detachment and macular degeneration. Therefore, myopia not only impacts the quality of vision but also has long-term implications for eye health (Rafii et al., 2025). The World Health Organization (WHO) estimates that 153 million people worldwide have uncorrected refractive errors, 12.7% of whom are children (Thalia, 2022). Approximately 90% of children typically experience refractive errors, especially in cases of myopia (Saiyang et al., 2021).

Myopia, or nearsightedness, is a prominent visual impairment and a leading cause of visual impairment worldwide. The prevalence of myopia is highest in East Asia, particularly in China, Japan, and Korea, at around 85-90%, followed by Singapore, at around 50%. In Southeast Asia, myopia affects approximately 20% of elementary school children and 80% of adults. Meanwhile, the prevalence of myopia in Indonesia is approximately 10-12% in children and 25% in adults (Nuralam et al., 2023). Myopia can be caused by several factors, both internal and external.

The increasing incidence of myopia in school-age children is significantly influenced by changes in daily activity patterns, particularly increased near-field activity and prolonged use of digital devices. Children today tend to spend more time indoors studying, playing with gadgets, and watching digital screens than engaging in physical activity outdoors. This leads to increased exposure to near-field activities, which can trigger persistent accommodative stress on the eyes. Furthermore, exposure to digital screens is also associated with decreased blink frequency and eye fatigue, which can worsen children's visual impairment. Recent research shows that using digital devices for more than 4 hours per day significantly increases the risk of myopia in school-age children (Hendra Yuda & Rachman Irwanto, 2023).

Various previous studies have examined factors associated with the incidence of myopia. Research by Maulana et al. (2025) showed a significant relationship between outdoor activities and the incidence of myopia (Maulana et al., 2025). Similar results were also found by (Susanti, 2022), who stated that outdoor activities were associated with the incidence of myopia, in addition to close-up activities. Furthermore, research (Wu, 2018) showed that exposure to outdoor light has a protective effect against the onset of myopia in children.

Previous research has not yielded consistent results. Research by Khoiro and Rasyid (2025) found that physical activity, including outdoor activities, was not significantly associated with the incidence of myopia, while the distance between gadget use and the frequency of use did have a significant relationship (Khoiro & Rasyid, 2025). This suggests differences in research findings, likely influenced by respondent characteristics, research methods, and the variables used.

Previous research has been conducted in adolescents and young adults, such as college students, and in clinical or university settings. Research specifically examining the relationship between outdoor physical activity and myopia in elementary school students is limited, particularly in Indonesia. Given the research gap and the limited research population within elementary school children, this study is crucial to determine the relationship between outdoor physical activity and myopia in elementary school students. The results are expected to serve as a basis for early myopia prevention efforts through increased outdoor activity.

The increase in myopia in elementary school-aged children is thought to be related to lifestyle changes, such as increased near-vision activities (reading, gadget use) and decreased outdoor physical activity. Outdoor activities are known to provide exposure to natural light, which may play a role in inhibiting the development of myopia.

Several studies have shown that children who engage in more outdoor activities have a lower risk of developing myopia compared to children who spend more time indoors. However, the relationship between outdoor physical activity and the incidence of myopia requires further investigation, particularly in elementary school students in Indonesia. Based on this, this study examines the relationship between outdoor physical activity and the incidence of myopia in elementary school students.

The general objective of this study is to determine the relationship between the duration of outdoor activities and the incidence of myopia in elementary school children. The specific objectives of this study are: 1) Identifying the duration of outdoor activities, 2) Assessing the incidence of myopia through children's refraction examinations, 3) Analyzing the relationship between outdoor physical activity and the incidence of myopia. Theoretically, this study is expected to add scientific references in the field of optometry regarding the risk factors for myopia in elementary school-aged children and become a basis for further research. Practically, this study is expected to provide understanding for schools

and parents regarding the importance of outdoor activities and healthy gadget use, become a consideration for eye health workers in developing myopia prevention education programs, and become initial data for educational institutions and health services in implementing eye health screening in elementary school students.

Myopia is a condition in which light entering the eye is focused in front of the retina, resulting in blurred distance vision. Myopia can occur because the eyeball is longer than normal or the cornea/lens' refractive power is too strong. Myopia (nearsightedness) is a refractive disorder in which the image falls in front of the retina, causing distant objects to appear blurry. This condition occurs due to the eyeball being too long or the lens' refractive power being too strong (Khalid, 2019) . Myopia, or nearsightedness, is a refractive disorder caused by parallel rays entering the eye not being focused in front of the retina. In myopia, near objects will appear clear, but distant objects will appear blurry (Efendi, 2019) .

Myopia can be divided into axial myopia and refractive myopia.

1) Axial Myopia

Axial myopia is a type of nearsightedness caused by an increase in the elongation of the eyeball (axial length) of 1 mm, correlating with a myopia shift of 3 diopters, while children have a longer axial length than adults, children who are prone to myopia have a length large axial size at birth, which replaces the process of emmetropation, resulting in rapid progression to myopia in children (Widiantoro, 2025) .

2) Refractive Myopia

Refractive myopia is a type of nearsightedness caused by changes in the structure or position of the eye's image-forming structures, such as increased corneal curvature, a higher corneal power, and increased optical power of the lens. Refractive myopia is less common than axial myopia. Refractive myopia occurs when the eye cannot focus light properly on the retina due to changes in the eye's refractive elements (Dinari, 2022) .

Myopia in children can be influenced by several factors, including:

1) Genetic factors (heredity)

Genetic factors are one of the main causes of myopia. If one or both parents have a history of nearsightedness, the risk of their children experiencing the same condition increases significantly (Sari et al., 2026) . This suggests that genetic factors play a role in shaping the structure of the eyeball, thereby increasing the likelihood of developing myopia (Ministry of Health of the Republic of Indonesia, 2024) . Children with myopic parents are at higher risk because certain genes influence eye growth.

2) Environmental Factors and Habits

a) Near work activities

Near-field activities such as reading, writing, and using gadgets at close range for long periods can increase the risk of myopia (Tulangow et al., 2025) . This occurs because the eye continues to accommodate (adjust focus), so that the ciliary muscle works continuously. If continued, this condition can cause eye fatigue and contribute to the elongation of the eyeball which causes myopia. For example (reading too close, playing gadgets for hours, and writing or working at a less than ideal eye distance). These activities continuously increase eye accommodation, which can trigger the growth of the eye's axial length.

b) Lack of outdoor activities

Lack of outdoor activity is also a risk factor for myopia. Exposure to natural light while outdoors helps inhibit the growth of the eyeball's length. Children who rarely spend time outdoors tend to have a higher risk of developing myopia than

those who frequently play outside. Exposure to natural sunlight stimulates dopamine production in the retina, which inhibits eyeball elongation. Children who rarely spend time outdoors are at a higher risk of developing myopia.

3) Excessive use of gadgets

Excessive gadget use, both in terms of duration and viewing distance, can increase the risk of myopia. Prolonged gadget use causes the eyes to continuously focus on close objects without rest. Furthermore, the habit of using gadgets at too close a distance (<30 cm) puts a strain on the eyes. This combination of prolonged use and close viewing distance can accelerate the development of refractive errors, particularly myopia. Studying in dim light increases the work of the accommodative muscles, thereby increasing the risk of myopia.

4) Age Factor

Myopia generally appears at the age of 6-14 years (the period of eye growth) and usually stabilizes in the 20s.

5) Systemic Factors or Diseases

Some causes of systemic factors or diseases include diabetes mellitus (changes in the lens refractive index), keratoconus (a prominent corneal disorder), and certain genetic syndromes.

Outdoor physical activity is any form of physical activity carried out outdoors, such as playing, exercising, and other activities involving exposure to sunlight. Exposure to natural light is believed to stimulate the release of dopamine in the retina, which plays a role in inhibiting eyeball elongation (Maulana et al., 2025). Outdoor activities include playing, exercising, and recreational activities carried out outside the home or school. Exposure to natural light plays a crucial role in the development of a child's visual system, particularly in controlling eyeball growth. Outdoor light intensity can reach over 10,000 lux, much higher than indoor lighting, which is generally less than 500 lux. This difference has significant biological effects on the visual system (Wu, 2018).

Outdoor physical activities for elementary school children can include a variety of activities involving physical movement and conducted in an open environment with exposure to natural light. These activities include:

1) Play activities

Such as playing ball, cycling, jumping rope, or traditional games played outdoors.

2) Sports activities

Includes structured and unstructured sports activities such as soccer, running, or outdoor gymnastics.

3) Recreational activities

Leisure activities such as walks, picnics, or family activities outside the home.

4) School activities outside the classroom

Such activities include school sports, ceremonies, or outdoor learning activities. These activities provide greater exposure to natural light than indoor activities, potentially providing a protective effect against the development of myopia.

5) Recommended Duration of Outdoor Activities

The duration of outdoor activity is an important factor in preventing myopia in children. Several studies have shown that the more time spent outdoors, the lower the risk of developing myopia. (Maulana, 2025).

METHOD

approach To obtain an objective picture of a phenomenon by measuring variables that can be analyzed statistically. Descriptive research aims to describe the characteristics of a

population or phenomenon systematically and factually without manipulating the variables being studied (Sugiyono, 2020) .

This research was conducted at MIN 1 Bantul in July 2026 .

The variables in this study include independent and dependent variables . The independent variable is the duration of outdoor physical activity. The dependent variable is the occurrence of myopia.

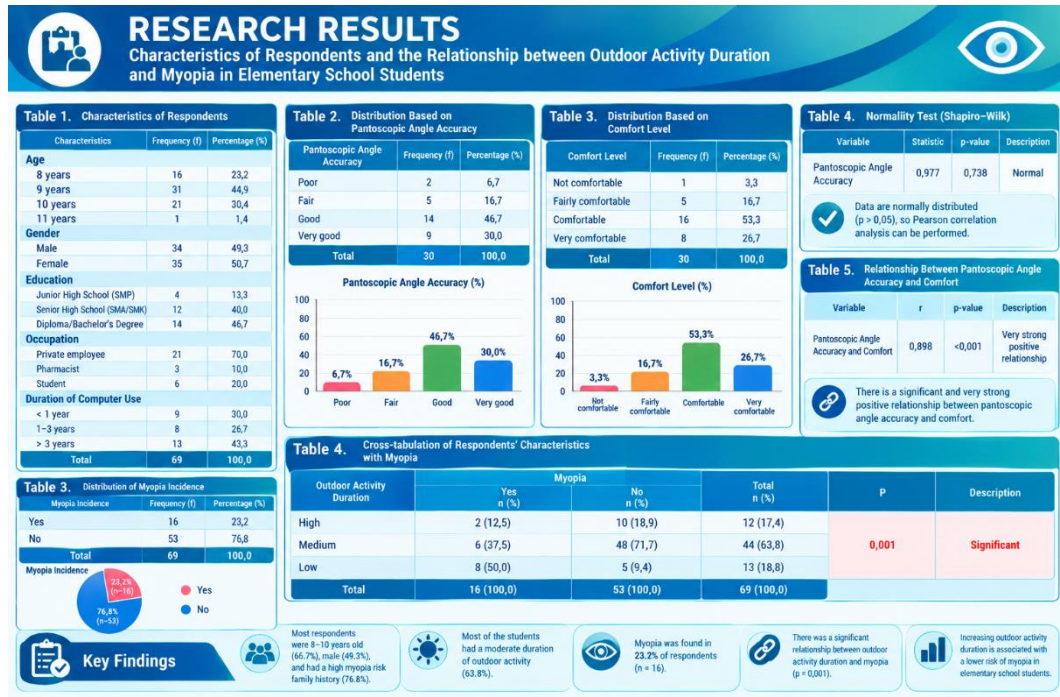
The population is the entire research subject, possessing specific characteristics consistent with the research objectives. In this study, the population was all elementary school students. The sample is a portion of the population used as research subjects. The sampling technique used in this study was purposive sampling, which is a technique for determining the sample based on specific criteria established by the researcher.

The operational definition of this study consists of two variables, namely the duration of outdoor physical activity and myopia. The duration of outdoor physical activity is defined as the time students spend doing physical activities outdoors with exposure to natural light, which is measured using a checklist with an ordinal scale and categorized into low (less than 1 hour/day), moderate (1–2 hours/day), and high (more than 2 hours/day). Meanwhile, myopia is defined as a distance vision disorder characterized by the shadow falling in front of the retina, which is measured using a Snellen chart or a visual acuity examination with a nominal scale and categorized into myopia and non-myopia.

The instrument used was a questionnaire or observation sheet. Data analysis included univariate and bivariate analysis. Univariate analysis aims to describe each research variable through frequency distribution tables and percentages so that it can provide an overview of the duration of outdoor physical activity and the incidence of myopia in respondents (Sugiyono, 2019; Setiawan & Saryono, 2021). Bivariate analysis was conducted to determine the relationship between the duration of outdoor physical activity as an independent variable and the incidence of myopia as a dependent variable using the Chi-Square (χ^2) test with a 95% confidence level ($\alpha = 0.05$). If the p-value ≤ 0.05 then H_0 is rejected and H_a is accepted, meaning there is a relationship. Whereas if $p > 0.05$ then H_0 is accepted and H_a is rejected, meaning there is no relationship.

RESULTS AND DISCUSSION

Based on the chart of a total of 69 respondents, the majority were 9 years old (31 respondents (44.9%)), followed by 10 years old (21 respondents (30.4%)), 8 years old (16 respondents (23.2%)), and 11 years old (1.4%). Based on gender, there were 35 female respondents (50.7%) and 34 male respondents (49.3%). Based on class level, most respondents came from class III (48 people (69.6%)), while respondents from class II were 21 people (30.4%). Meanwhile, based on the history of parental myopia, the majority of respondents did not have a history of parental myopia, namely 53 respondents (76.8%), while those who had a history of parental myopia were 16 respondents (23.2%).



The study results show that the duration of outdoor activities among elementary school children is still dominated by the moderate category, followed by the low and high categories. This finding suggests that most children are not spending optimal time engaged in outdoor activities. However, outdoor activities play a crucial role in maintaining eye health, particularly in preventing myopia. Exposure to natural light during outdoor activities can stimulate the release of dopamine in the retina, which functions to inhibit axial elongation of the eyeball, the primary cause of myopia.

In theory, outdoor activity is a protective factor against the development of myopia. Exposure to sunlight with a higher intensity than indoor light can stimulate the release of the neurotransmitter dopamine in the retina (Ba & Li, 2024). Dopamine functions to inhibit axial elongation of the eyeball, which is the main mechanism of myopia. In addition, when outdoors, the eyes focus more often on distant objects, thereby reducing the burden of eye accommodation due to continuous close viewing activities (Budi & Mukhtar, 2026). Therefore, children who have a longer duration of outdoor activity tend to have a lower risk of myopia than children who spend more time indoors.

The results of this study align with those of Maulana et al. (2025), which showed a significant association between the intensity of outdoor activity and the incidence of myopia ($p = 0.001$). The study stated that individuals with higher outdoor activity levels had a lower risk of myopia compared to those who performed more indoor activities. Similarly, Susanti's (2022) study found that outdoor activity was significantly associated with the incidence of myopia ($p = 0.001$). Although previous studies were conducted in different populations and locations, the results confirm that increased outdoor activity is a protective factor against myopia.

Refraction examination results indicate that some elementary school children have myopia. This condition indicates that refractive disorders have been present since school age and have the potential to affect children's learning abilities and quality of life if not promptly addressed. Myopia in children is influenced by various factors, both genetic and environmental, such as excessive near-sightedness, prolonged use of gadgets, and lack of outdoor activity (Murni Marlina Simarmata et al., 2023).

According to refractive theory, myopia is a refractive disorder in which parallel light rays entering the eye are focused in front of the retina due to an excessive axial length of the eyeball or excessive refractive power of the cornea or lens (Dinari, 2022). As a result, distant objects

appear blurry, while nearby objects can still be seen clearly. Myopia is influenced by the interaction between genetic and environmental factors. The most commonly reported environmental factors include high near-sightedness, prolonged use of gadgets, lack of outdoor activity, and the habit of reading at too close a distance. A refractive examination is the standard method for determining the status of refractive disorders so that it can be determined whether a child has myopia or not (Nurpatonah et al., 2024).

The results of this study support the research of Singh and Choudhary (2023), who reported that prolonged use of electronic devices is associated with the progression of myopia in children and adolescents. Furthermore, research by Enthoven et al. (2020) also showed that computer use, reading duration, and reading distance are associated with an increased risk of myopia in children. Both studies suggest that changes in modern lifestyles, which are dominated by near-vision activities, are one of the factors increasing the incidence of myopia in school-age children.

Based on the chart, respondents who experienced myopia were mostly with low duration of outdoor activities, namely 8 respondents (50.0%). Meanwhile, respondents who did not experience myopia were mostly with moderate duration of outdoor activities, there were 38 respondents (71.7%). The results of the Pearson Chi-Square test showed a significant value of 0.001, so H_0 was rejected and H_1 was accepted. This indicates that there is a significant relationship between the duration of outdoor activities and the incidence of myopia in elementary school children. Children with a lower duration of outdoor activities tend to have a higher incidence of myopia than children with a moderate or high duration of outdoor activities.

The analysis showed a significant association between outdoor activity and the incidence of myopia in elementary school children. Children with less outdoor activity tended to have a higher risk of developing myopia than those with more frequent outdoor activity. These results support the theory that sunlight exposure helps inhibit axial eye growth by increasing the release of retinal dopamine, thereby reducing the risk of myopia.

These findings align with research by Maulana et al. (2025) and Susanti (2022), which both found a significant association between outdoor activity and the incidence of myopia. Although the subjects of the previous studies were university students and respondents in optics, while this study was conducted on elementary school students, the results consistently demonstrate that outdoor activity is a protective factor against myopia.

On the other hand, research by Khoiro and Rasyid (2025) showed that gadget use, particularly distance spent using gadgets, was associated with the incidence of myopia, while physical activity showed no significant association. This difference is likely influenced by the characteristics of the respondents, who were college students with different activity patterns than elementary school children. This study emphasized outdoor activity as a protective factor, rather than physical activity in general.

Overall, the results of this study strengthen the evidence that increasing the duration of outdoor activity is a simple and effective strategy for reducing the risk of myopia in school-age children. Therefore, parents and schools should encourage children to engage in regular outdoor activities, along with limiting gadget use and excessive near-vision activities, as an effort to prevent myopia from an early age.

CONCLUSION

Based on the results of the study on the relationship between the duration of outdoor activities and the incidence of myopia in elementary school children, it can be concluded that the majority of respondents had a moderate duration of outdoor activities, namely 44 respondents (63.8%), and the majority did not have myopia, namely 53 respondents (76.8%). The results showed a significant relationship between the duration of outdoor activities and the incidence of myopia ($p = 0.001$), with the incidence of myopia being higher in respondents who had a low duration of outdoor activities. Schools are expected to increase opportunities for students to engage in outdoor activities through sports, games, and learning outside the

classroom. Parents are advised to encourage children to engage in outdoor activities regularly, limit the use of gadgets and close-up activities, and have regular eye examinations. Health workers are expected to increase education regarding the prevention and early detection of myopia, while future researchers are advised to use a larger sample and consider other factors such as genetics, close-up activities, gadget use, and intensity of light exposure.

BIBLIOGRAPHY

- Ba, M., & Li, Z. (2024). The impact of lifestyle factors on myopia development: Insights and recommendations. *AJO International* , 1 (1), 100010. <https://doi.org/10.1016/j.ajoint.2024.100010>
- Budi, FO, & Mukhtar, D. (2026). The Relationship between Reading Habits Using Gadgets in a Lying Position and Refractive Eye Disorders (Myopia) in Class VIII Students at SMPN 119, Cempaka Baru Subdistrict, Central Jakarta: Examination Using a Snellen Chart and Its Review from an Islamic Perspective. *Journal of Health Sciences Research* , 5 (1), 392–403.
- Dinari, NA (2022). Myopia: Etiology and Therapy. *Mirror of the World of Medicine* , 49 (10), 556. <https://doi.org/10.55175/cdk.v49i10.2069>
- Efendi, Z. (2019). Factors Involving Near-Distance Work Activities in the Incidence of Myopia in School-Age Children .
- Hendra Yuda & Rachman Irwanto. (2023). The Effect of Gadget Usage Duration on the Incidence of Refractive Disorders in Students at Ma Chung University, Malang. *SCIENTIFIC JOURNAL OF PUBLIC HEALTH AND SOCIAL SCIENCE* , 1 (4), 19–30. <https://doi.org/10.59024/jikas.v1i4.981>
- Ministry of Health of the Republic of Indonesia. (2024). Indonesian Health Profile 2024. Ministry of Health of the Republic of Indonesia.
- Khalid, N. (2019). The Influence of Gadget Use on the Incidence of Myopia in Students of SMP Negeri 12 Makassar. *Diagnosis Scientific Journal of Health* , 14 (3), 325–330.
- Khoiro, IF, & Rasyid, M. (2025). Correlation of BMI, Gadget Use and Physical Activity with the Incidence of Myopia in Medical Students of Tarumanagara University. *PREPOTIF: Journal of Public Health* , 9 (2).
- Maulana, YR, Rahmawati, A., & Istadi, Y. (2025). The Relationship Between the Intensity of Outdoor Activity Time and the Incidence of Myopia. *Journal of Medical Sciences and Health*, 12 (6). <http://ejournalmalahayati.ac.id/index.php/kesehatan>
- Murni Marlina Simarmata, Asiyah, S., Efendi, Z., & Maryani, F. (2023). Analysis of Risk Factors for Booming Myopia in Students at MTSn 2 Jatiasih, Bekasi City. *Journal of Optical Eyes* , 4 (2), 12–22. <https://doi.org/10.54363/jmo.v4i2.146>
- Nuralam, I., Djunaedi, HE, Sidiq, VA, & Laras, DS (2023). Risk Factors for Myopia Refractive Disorders in Students of Al-Ulfah Islamic Senior High School, Garut Regency in 2023 .
- Nurpatonah, C., Purwanto, T., Husna, HN, Milataka, I., Yulianti, AM, Agnesti, AD, Hajj, MAH, & Assalam, AK (2024). EYE EXAMINATION AS A SCREENING MEASURE FOR REFRACTION DISORDERS IN STUDENTS OF SMKN 1 CIJULANG .
- Rafii, MN, Himayani, R., Iyos, RN, & Utama, WT (2025). Literature Review: Risk Factors Associated with the Incidence of Myopia. *Journal of Multidisciplinary Studies* , 2 (2), 65–69. <https://doi.org/10.35912/jasmi.v2i2.4262>
- Saiyang, B., Rares, LM, & Supit, WP (2021). Refractive Eye Disorders in Children. *Medical Scope Journal* , 2 (2). <https://doi.org/10.35790/msj.v2i2.32115>
- Sari, EN, Nofita, R., Sartika, A., & Elizabeth, B. (2026). Risk Factors for Myopia in Children Aged 7–11 Years at JTEC Harapan Bunda Hospital, East Jakarta. *Journal of Medical and Health Sciences* , 13 (3), 691–700. <https://doi.org/10.33024/jikk.v13i3.25199>
- Sugiyono. (2020). Quantitative, Qualitative, and R&D Research Methods. Bandung: Alfabeta.
- Susanti. (2022). The Relationship Between Close-up Activities and Outdoor Activities with the Incidence of Myopia at Optik Dia Baturaja. *Applied Health Journal* , 9 (1).
- Thalia. (2022). Incidence of Uncorrected Refractive Errors in Children. *Masada Health Journal* , XVI (2), 415–416.

- Tulangow, DS, Lastriyanti, L., & Sapeni, MA-AR (2025). Length of Gadget Use as a Trigger for Increasing Degrees of Myopia. Journal of Health Research “SUARA FORIKES” (Journal of Health Research “Forikes Voice”) , 16 (1). <https://doi.org/10.33846/sf16106>
- Widiantoro, PD (2025). Overview of Myopia in Pediatric Patients at the Eye Clinic of Dr. M Salamun Hospital, Bandung in 2024 [Scientific Paper]. Dharma Husada College of Health Sciences, Bandung.
- Woo. (2018). Myopia prevention and outdoor light intensity in children . 76 (100801).