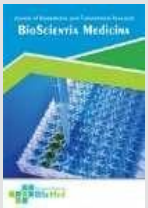
Bioscientia Medicina: Journal Of Biomedicine & Translational Research

eISSN (Online): 2598-0580



Bioscientia Medicina: Journal of Biomedicine & Translational Research

Journal Homepage: www.bioscmed.com

Myopia Progression in Children: A Comparative Analysis of Pre-Pandemic and Pandemic Periods

Harsya Luthfi Anshari[1]*, Kemala Sayuti[1]

[1]Department of Ophthalmology, Faculty of Medicine, Universitas Andalas, Padang, Indonesia

ARTICLE INFO

Keywords:
Children
COVID-19
Myopia progression
Pandemic
Screen time

***Corresponding author:**
Harsya Luthfi Anshari

E-mail address:
Harsya.luthfi@gmail.com

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/bsm.v9i1.1175

A B S T R A C T

Background: The COVID-19 pandemic brought about significant changes in children's lifestyles, including increased screen time and reduced outdoor activities due to school closures and lockdowns. These changes raised concerns about potential myopia progression in children. **Methods:** This study compared the spherical equivalent (SE) measurements of children aged 8-17 years from two time visits: one before the pandemic (September 2019 - February 2020) and one during the pandemic (March 2020 - February 2022). Data on family history of myopia, screen time, and outdoor activities were also collected. Paired t-tests were used to analyze the differences in SE between the two visits. **Results:** A total of 11 children participated in the study. The mean change in SE was -1.55 D, indicating a significant increase in myopia during the pandemic (p = 0.046). The average daily screen time was 201 minutes, while outdoor activity time was 42 minutes. **Conclusion:** The findings suggest a potential corelation between increased screen time, reduced outdoor activities, and myopia progression in children during the pandemic. It is crucial to encourage healthy visual habits, including limiting screen time and promoting outdoor activities, to mitigate the impact of the pandemic on children's vision.

1. Introduction

Myopia, or nearsightedness, is a prevalent refractive error characterized by the inability to focus on distant objects clearly. It is a growing global health concern, with the prevalence of myopia projected to affect nearly 50% of the world's population by 2050. The development of myopia is influenced by a complex interplay of genetic and environmental factors. While genetic predisposition plays a role, environmental factors, particularly those related to near work and outdoor activities, have been identified as significant contributors to myopia progression.[1-3] The COVID-19 pandemic and the subsequent lockdowns and school closures led to unprecedented changes in children's lifestyles. Online learning became the norm, leading to increased screen time and reduced opportunities for outdoor activities. These changes raised concerns among ophthalmologists and public health experts about the potential impact on children's vision and myopia progression.[4-6]

Several studies have investigated the relationship between screen time and myopia. While the evidence is not entirely conclusive, some studies suggest that prolonged near work, including screen time, may contribute to myopia development. On the other hand, outdoor activities have been consistently shown to have a protective effect against myopia progression. The higher levels of light intensity and the longer viewing distances experienced outdoors are thought to play a role in this protective effect.[7-10] This study aims to investigate the impact of the COVID-19 pandemic on myopia progression in children by comparing their spherical equivalent (SE) measurements before and during the pandemic. We also examine the association between myopia progression, screen time, outdoor activities, and family history of myopia.

2. Methods

This retrospective cohort study was conducted at the Regina Eye Center, a specialized eye hospital. The study included children aged 8-17 years who had undergone eye examinations at the center between September 2019 and February 2022. This timeframe allowed for a comparison of pre-pandemic and pandemic data, with the onset of the pandemic designated as March 2020. The study population consisted of pediatric patients diagnosed with myopia. To be eligible for inclusion in the study, children had to meet the following criteria; Age: Between 8 and 17 years old at the time of their first eye examination. This age range was chosen to focus on school-aged children, who are considered to be at higher risk for myopia progression; Myopia Diagnosis: A spherical equivalent (SE) of -0.50 diopters (D) or less in at least one eye, as recorded in the hospital medical records. This criterion ensured that all participants had a confirmed diagnosis of myopia; Examination Frequency: At least two eye examinations recorded in the hospital's electronic medical record system. The first examination had to occur between September 2019 and February 2020 (pre-pandemic period), and the second examination between March 2020 and February 2022 (pandemic period). This criterion allowed for the assessment of changes in SE over time. Patients with incomplete medical records or missing data on SE measurements, screen time, or outdoor activities were excluded from the study to ensure data quality and reliability.

Data collection was performed by trained research personnel who were blinded to the study's objectives. This blinding was implemented to minimize potential bias in data collection and interpretation. The following data were collected for each participant; Demographics: Age, gender, and family history of myopia. Family history of myopia was defined as having at least one parent or sibling with myopia; Ophthalmological Examination: SE measurements from the two visits. SE is a measure of the refractive error of the eye, expressed in diopters. Negative SE values indicate myopia, with higher negative values representing greater degrees of myopia; Lifestyle Factors: Daily screen time and outdoor activity time. Screen time was assessed through a structured questionnaire that asked about the average number of hours spent each day using digital devices, including smartphones, tablets, computers, and televisions. Outdoor activity time was assessed through a similar questionnaire that asked about the average number of hours spent each day outdoors, engaging in activities such as sports, playing, or walking.

All ophthalmological examinations were conducted by licensed optometrists or ophthalmologists at the Regina Eye Center. The examinations followed standardized procedures to ensure consistency and accuracy of measurements; Cycloplegic Refraction: Cycloplegic refraction was performed to obtain accurate SE measurements. Cycloplegic eye drops were administered to temporarily paralyze the ciliary muscle, which controls the eye's focusing mechanism. This paralysis prevents accommodation, ensuring that the measurements reflect the true refractive error of the eye; Visual Acuity Measurement: Visual acuity was measured using a standard Snellen chart. Visual acuity is a measure of the eye's ability to see details at a distance. It is expressed as a fraction, with the numerator representing the testing distance and the denominator representing the distance at which a person with normal vision can read the same line on the chart; Other Ocular Assessments: Other routine eye assessments, such as slit-lamp examination and fundus examination, were also performed to rule out any other ocular conditions that could affect visual acuity or myopia progression.

Data analysis was performed using statistical software (SPSS version 26). Descriptive statistics were used to summarize the characteristics of the study population, including mean, standard deviation, and frequency distributions. The primary outcome measure was the change in SE between the two visits. Myopia progression was categorized based on the degree of SE change; Slow progression: SE change > -0.5 D; Medium progression: -1.0 D < SE change ≤ -0.5 D; Fast progression: SE change ≤ -1.0 D. Paired t-tests were used to compare SE measurements between the two visits. Paired t-tests are appropriate for comparing the means of two related groups, in this case, the same group of children at two different time points. A p-value < 0.05 was considered statistically significant. This study was approved by the Institutional Review Board of the Regina Eye Center. Informed consent was obtained from the parents or legal guardians of all participants before enrollment in the study. All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

3. Results

Table 1 presents the characteristics of the 11 children who participated in the study on myopia progression during the COVID-19 pandemic. The mean age of the participants was 12.4 years, with a standard deviation of 2.8 years. The median age was 12 years, with a range of 8 to 17 years. 5 participants (45.5%) were male. 6 participants (54.5%) were female. 6 participants (54.5%) had a family history of myopia. 5 participants (45.5%) did not have a family history of myopia. The mean screen time was 201 minutes per day, with a standard deviation of 87 minutes. The median screen time was 202 minutes per day, with a range of 15 to 360 minutes. The mean outdoor activity time was 42 minutes per day, with a standard deviation of 15 minutes. The median outdoor activity time was 42 minutes per day, with a range of 10 to 60 minutes. The mean initial SE was -2.34 diopters, with a standard deviation of 1.23 diopters. The median initial SE was -2.50 diopters, with a range of -0.50 to -4.00 diopters. The mean final SE was -3.89 diopters, with a standard deviation of 1.98 diopters. The median final SE was -4.00 diopters, with a range of -1.00 to -7.00 diopters. The mean SE change was -1.55 diopters, with a standard deviation of 0.93 diopters. The median SE change was -1.50 diopters, with a range of -0.50 to -3.00 diopters.

Table 1. Participants characteristics.

Characteristic	Category	Frequency (n)	Percentage (%)
Age (years)			
Mean ± SD	12.4 ± 2.8	-	-
Median (Range)	12 (8-17)	-	-
Gender			
	Male	5	45.5
	Female	6	54.5
Family history of myopia			
	Yes	6	54.5
	No	5	45.5
Screen time (minutes/day)			
Mean ± SD	201 ± 87	-	-
Median (Range)	202 (15-360)	-	-
Outdoor activity (minutes/day)			
Mean ± SD	42 ± 15	-	-
Median (Range)	42 (10-60)	-	-
Initial SE (D)			
Mean ± SD	-2.34 ± 1.23	-	-
Median (Range)	-2.50 (-0.50 to -4.00)	-	-
Final SE (D)			
Mean ± SD	-3.89 ± 1.98	-	-
Median (Range)	-4.00 (-1.00 to -7.00)	-	-
SE change (D)			
Mean ± SD	-1.55 ± 0.93	-	-
Median (Range)	-1.50 (-0.50 to -3.00)	-	-

SD = Standard Deviation; SE = Spherical Equivalent; D = Diopters.

Table 2 shows how the 11 children in the study were categorized based on their myopia progression during the study period. The average SE before the pandemic was -2.34 diopters. This worsened to -3.89 diopters during the pandemic. This change was statistically significant (p=0.046), meaning it's likely not due to random chance. 8 children (72.7%) showed slow progression, with their SE changing between -0.50 and -0.25 diopters. No children fell into medium progression. 3 children (27.3%) showed fast progression, with their SE changing by -1.00 diopters or more.

Table 2. The prevalence of DR and its subtypes.

Variable	**Before pandemic**	**Post pandemic**	**p-value**
Spherical equivalent (D)	-2.34 ± 1.23	-3.89 ± 1.98	0.046
Myopia progression	**SE Change (D)**	**Frequency (n)**	**Percentage (%)**
Slow (> -0.5 D)	-0.50 to -0.25	8	72.7
Medium (-1.0 D < SE ≤ -0.5 D)	-0.75 to -0.50	0	0
Fast (≤ -1.0 D)	≤ -1.00	3	27.3
Total	11	100	-

4. Discussion

Myopia, or nearsightedness, is a prevalent refractive error that affects millions of children worldwide. It is a growing global health concern, with the prevalence of myopia projected to affect nearly 50% of the world's population by 2050. Myopia is a condition where the eye is unable to focus on distant objects clearly. This occurs when the eyeball is slightly elongated or the cornea is too curved, causing light to focus in front of the retina instead of directly on it. As a result, distant objects appear blurred while near vision remains clear. Myopia can lead to various complications, including retinal detachment, glaucoma, and cataracts, if left uncorrected or if high myopia develops. The prevalence of myopia has been steadily increasing in recent decades, particularly in East Asia, where it has reached epidemic proportions. While the exact reasons for this increase remain unclear, several factors are believed to contribute, including genetic predisposition, environmental factors, and lifestyle changes. To understand myopia, it's helpful to visualize how the eye normally functions. In a normal eye, the cornea and the lens work together to bend (refract) incoming light rays so that they focus precisely on the retina, the light-sensitive tissue lining the back of the eye. The retina then converts these light signals into electrical impulses that are sent to the brain via the optic nerve, where they are interpreted as images. In a myopic eye, the eyeball's shape (axial length) or the cornea's curvature disrupts this precise focusing. Because the light focuses before it reaches the retina, the images of distant objects become blurred. Myopia is a global health concern, and its prevalence has been steadily increasing in recent decades. This rise is particularly alarming in East Asia, where rates have reached epidemic proportions. Studies suggest that in some East Asian countries, such as Singapore, South Korea, and Taiwan, the prevalence of myopia among young adults is as high as 80-90%. While myopia is a global issue, its prevalence varies across different regions and populations. Factors such as ethnicity, genetic predisposition, and environmental influences play a significant role in the development and progression of myopia. A family history of myopia is a significant risk factor. Children with one or both parents who have myopia are more likely to develop the condition themselves. Prolonged near work activities, such as reading, writing, and using computers or smartphones, have been strongly linked to myopia development. The close focusing involved in these activities may contribute to changes in the eye's shape and refractive power. Spending less time outdoors has also been identified as a risk factor for myopia. Exposure to natural light and engaging in activities with longer viewing distances are thought to have a protective effect against myopia development. The shift towards urban living, with its associated indoor lifestyles and reduced outdoor time, is believed to be a contributing factor to the rising prevalence of myopia. Some studies suggest that dietary factors, such as a lack of certain nutrients, may play a role in myopia development. Factors in early childhood, such as premature birth and low birth weight, have also been associated with an increased risk of myopia. Difficulty seeing the board or reading printed materials can hinder a child's learning and academic progress. Children with uncorrected myopia may feel self-conscious or embarrassed about their vision problems, leading to social isolation and decreased self-esteem. Myopia can limit a child's participation in sports and other physical activities, potentially leading to a less active lifestyle and associated health issues. High myopia, a more severe form of the condition, increases the risk of developing serious eye conditions later in life. The separation of the retina from the back of the eye, which can lead to vision loss if not treated promptly. A group of eye diseases that damage the optic nerve, often leading to peripheral vision loss and, if left untreated, blindness. Clouding of the eye's lens, causing blurred vision and eventually blindness if not surgically removed. Damage to the macula, the central part of the retina responsible for sharp, central vision, leading to vision loss in the center of the visual field. Early detection and management of myopia are crucial to prevent its progression and reduce the risk of developing serious eye health complications later in life. Regular and comprehensive eye examinations are essential for early detection and management of myopia. Children should have their eyes examined by an eye care professional at least once a year, or more frequently if they have a family history of myopia or show signs of vision problems. Eyeglasses are the most common method for correcting myopia. They provide clear vision by bending light rays to focus correctly on the retina. Contact lenses are another option for correcting myopia. They sit directly on the eye's surface and provide a wider field of clear vision compared to eyeglasses. Low-dose atropine eye drops have been found to effectively slow myopia progression. Atropine works by temporarily paralyzing the ciliary muscle, which controls the eye's focusing mechanism. Multifocal contact lenses have multiple focal points, providing clear vision at various distances. They are thought to slow myopia progression by reducing peripheral hyperopic defocus, a condition that may contribute to eyeball elongation. Orthokeratology involves wearing specially designed rigid gas permeable contact lenses overnight to reshape the cornea. This temporary reshaping corrects myopia during the day, reducing the need for eyeglasses or daytime contact lenses. It is also thought to slow myopia progression. Encouraging children to spend more time outdoors is one of the most effective ways to prevent myopia progression. Aim for at least two hours of outdoor time per day, engaging in activities such as playing sports, walking, or simply relaxing in natural light. While near work activities are essential for learning and development, it's important to encourage children to take breaks from these activities every 20 minutes to reduce eye strain and allow their eyes to refocus on distant objects. Ensure that children have adequate lighting when engaging in near work activities to reduce eye strain. A balanced diet rich in fruits, vegetables, and omega-3 fatty acids may support eye health and potentially reduce the risk of myopia progression. Parents, educators, and healthcare providers play a crucial role in addressing myopia in children. Teach children about the importance of eye health and encourage them to adopt healthy visual habits. Emphasize the importance of regular eye examinations and ensure that children receive comprehensive eye care. Promote outdoor activities and limit screen time to help prevent myopia progression. Create supportive environments for children with myopia, ensuring that they have the necessary resources and accommodations to succeed academically and socially.[11,12]

Myopia, also known as nearsightedness, is a complex refractive error that results in blurred distance vision. While it's a common condition easily corrected with glasses or contact lenses, understanding its underlying causes is crucial for effective prevention and management, especially in children. Myopia arises from a mismatch between the eye's optical power and its length. In a normal eye, light rays focus precisely on the retina for clear vision. In myopia, the light focuses in front of the retina, making distant objects appear blurry. This can be due to an elongated eyeball (axial myopia) or excessive curvature of the cornea (refractive myopia). The development and progression of myopia are influenced by a complex interplay of genetic and environmental factors. While genetics provides the blueprint, environmental factors can significantly modify how this blueprint is expressed. Myopia, or nearsightedness, is a common vision condition where distant objects appear blurred while near vision remains clear. This refractive error occurs when the eyeball is slightly elongated or the cornea is too curved, causing light to focus in front of the retina instead of directly on it. While environmental factors play a significant role in myopia development, genetics also contribute significantly. A strong family history of myopia is a well-established risk factor. Children with one or both myopic parents have a significantly higher risk of developing myopia themselves. This suggests that certain genes make individuals more susceptible to developing the condition. Studies have shown that the risk of myopia increases with the number of myopic parents. Children with two myopic parents have a higher risk than those with only one myopic parent. The risk is also higher if the myopia in the parents is severe. This familial link suggests a strong genetic component in myopia development. Research has identified numerous genes associated with myopia. Genes that regulate the growth and development of the eyeball, particularly its axial length. Genes that influence the refractive power of the cornea and lens. Genes involved in the transmission of visual signals from the retina to the brain. Genes that regulate the structure and function of the sclera, the white outer layer of the eye. It's important to understand that myopia is a complex trait, and its genetic influence is not straightforward. Multiple genes interact with each other and with environmental factors to contribute to myopia development. Different genes can interact with each other to increase or decrease the risk of myopia. Genes can influence how susceptible a person is to environmental risk factors for myopia, such as near work and lack of outdoor time. Environmental factors can influence gene expression, affecting how genes related to eye growth and development are turned on or off. Understanding the genetic basis of myopia can have important implications for its management and prevention. Identifying individuals with a high genetic risk can help prioritize early intervention and monitoring. Genetic information may help guide the selection of the most effective myopia control strategies for individual patients. In the future, gene therapy may hold promise for preventing or correcting myopia by targeting specific genes involved in its development. While genetics provides a foundation for susceptibility, environmental factors play a critical role in triggering and accelerating myopia progression. These factors interact with genetic predispositions to shape the development and severity of myopia, particularly in children and adolescents. Prolonged near work activities, such as reading, writing, and using digital devices, have been consistently linked to myopia development. The close focusing involved in these activities may contribute to changes in the eye's shape and refractive power. Sustained near work requires constant accommodation, where the eye's lens changes shape to focus on close objects. This prolonged effort can lead to eye strain and fatigue, potentially contributing to myopia progression. The ciliary muscle, responsible for changing the lens shape, is under constant tension during near work. This sustained contraction may lead to changes in the eye's structure, promoting axial elongation and myopia development. Near work can also create a condition called peripheral hyperopic defocus, where the light rays from peripheral objects focus behind the retina. This may stimulate eye growth and contribute to myopia. The eye constantly receives signals from both the central and peripheral retina. In peripheral hyperopic defocus, the blurred peripheral image may send signals to the eye to elongate, leading to myopia. Spending less time outdoors has been identified as a significant risk factor for myopia. Exposure to natural light and engaging in activities with longer viewing distances are thought to have a protective effect against myopia development. Bright outdoor light is believed to stimulate the release of dopamine in the retina, a neurotransmitter that inhibits eye growth and myopia progression. Dopamine plays a crucial role in regulating eye growth and development. Higher levels of dopamine, triggered by bright outdoor light, may suppress axial elongation and reduce the risk of myopia. The visual environment outdoors, with its greater variety of distances and visual stimuli, may also play a role in regulating eye growth and preventing myopia. The dynamic visual environment outdoors, with constantly changing focal distances, may help to train the eye's focusing mechanism and promote healthy eye growth. Higher levels of education have been associated with an increased risk of myopia, possibly due to the increased near work demands associated with academic pursuits. The more years spent in education, the higher the exposure to near work activities like reading and writing. This prolonged near work may contribute to myopia development. Living in urban environments has been linked to a higher prevalence of myopia, likely due to a combination of factors, including increased near work, reduced outdoor time, and limited exposure to natural light. Urban environments often provide fewer opportunities for outdoor activities and exposure to natural light. The combination of increased near work and reduced outdoor time may contribute to higher myopia rates in urban areas. Some studies suggest that dietary factors, such as a lack of certain nutrients, may play a role in myopia development. However, more research is needed to confirm these findings. A balanced diet rich in fruits, vegetables, and omega-3 fatty acids is essential for overall health, including eye health. While specific dietary links to myopia are still under investigation, a healthy diet may play a supportive role in preventing myopia progression. It's important to recognize that these environmental factors do not act in isolation. They interact with each other and with genetic predispositions to influence myopia development. For example, a child with a family history of myopia who spends long hours engaged in near work and limited time outdoors may be at a particularly high risk of developing myopia. Understanding the role of environmental factors in myopia progression has important implications for its prevention and management. Encouraging healthy visual habits, such as increasing outdoor time, taking breaks from near work, and ensuring proper lighting, can help mitigate the impact of environmental risk factors. Public health initiatives aimed at promoting outdoor activities and reducing excessive near work, especially in children, may help curb the rising prevalence of myopia. Identifying children at high risk due to environmental factors allows for early intervention to slow myopia progression. It arises from a mismatch between the eye's optical power and its length, causing light to focus in front of the retina instead of directly on it. While often easily corrected with glasses or contact lenses, understanding the underlying causes of myopia is crucial for effective prevention and management, especially in children. It's important to emphasize that myopia development is not solely determined by genetics or environment but rather by a complex interplay between the two. Genetic factors may make some individuals more susceptible to the effects of environmental factors. For example, children with a strong family history of myopia may be more likely to develop myopia if they also engage in excessive near work or spend limited time outdoors. Genes related to eye growth, refractive development, retinal signaling, and scleral remodeling can influence an individual's baseline risk for myopia. Some people may have a genetic makeup that makes them more sensitive to environmental triggers. Environmental factors, such as near work, lack of outdoor time, and other lifestyle factors, can interact with genetic predispositions to trigger and accelerate myopia progression. Consider two children, one with a strong family history of myopia and one without. Both children engage in similar amounts of near work and outdoor activities. The child with the genetic predisposition may be more likely to develop myopia due to their inherited susceptibility. Environmental factors can also influence gene expression, affecting how genes related to eye growth and development are turned on or off. This highlights the dynamic relationship between genes and environment in shaping myopia development. Epigenetics refers to changes in gene expression that do not involve alterations to the underlying DNA sequence. Environmental factors can trigger epigenetic modifications, such as DNA methylation and histone modification, which can affect how genes are expressed. Epigenetic changes can influence the expression of genes involved in eye growth and development, potentially increasing or decreasing the risk of myopia. Studies have shown that exposure to sunlight can alter the epigenetic regulation of genes involved in eye growth in animal models. This suggests that environmental factors like sunlight exposure can directly influence gene expression and myopia development.[13,14]

The COVID-19 pandemic brought about significant changes in children's lifestyles, primarily due to the implementation of lockdowns and school closures. These changes disrupted the daily routines and activities of children, leading to increased screen time and reduced opportunities for outdoor activities. With the shift to online learning and social interactions, children's screen time increased significantly. This prolonged exposure to digital devices raised concerns about its potential impact on their vision and myopia progression. Schools adopted online learning platforms to continue education during lockdowns. Children spent hours each day attending virtual classes, completing assignments, and engaging in online activities. Social distancing measures limited in-person interactions, leading children to rely on digital devices for communication and entertainment. Video calls, social media, and online games became primary means of staying connected with friends and family. Restrictions on outdoor activities led children to spend more time indoors, further increasing their engagement with digital devices. Streaming services, video games, and social media platforms became major sources of entertainment and leisure activities. Lockdowns and restrictions on public gatherings limited children's opportunities for outdoor activities. Parks, playgrounds, and recreational facilities were closed or had limited access, reducing children's exposure to natural light and open spaces. The decrease in outdoor activities led to a more sedentary lifestyle for many children. This lack of physical activity raised concerns about overall health and well-being, including potential impacts on eye health. Reduced exposure to natural sunlight can disrupt the circadian rhythm, affecting sleep patterns and potentially influencing eye growth and development. The combination of increased screen time and reduced outdoor activities raised concerns about the potential impact on children's vision and myopia progression. Prolonged near work, including screen time, has been associated with myopia development in numerous studies. The close focus involved in these activities may contribute to changes in the eye's shape and refractive power. Outdoor activities have been shown to have a protective effect against myopia, possibly due to the higher levels of light intensity and longer viewing distances experienced outdoors. The reduction in outdoor time during the pandemic may have diminished this protective effect. Several studies have reported an increase in myopia progression in children during the pandemic. The increased screen time associated with online learning and the reduced time spent outdoors are believed to be the main contributing factors. Studies have shown that children experienced a faster rate of myopia progression during the pandemic compared to pre-pandemic periods. This suggests that the pandemic-related lifestyle changes may have accelerated myopia development. Some studies have also reported a higher prevalence of myopia among children during the pandemic. This indicates that more children developed myopia during this period, possibly due to the altered lifestyle factors. The impact of the COVID-19 pandemic on children's vision highlights the need for public health interventions to promote healthy visual habits and mitigate the effects of lifestyle changes. Parents, educators, and healthcare providers should educate children about the importance of eye health and encourage them to adopt healthy visual habits. Public health initiatives should promote outdoor activities and encourage children to spend more time outdoors, even during periods of restricted movement. Strategies for managing screen time and promoting healthy digital habits should be implemented to reduce the potential negative impacts on children's vision.[15,16]

Screen time refers to the amount of time spent using digital devices, such as smartphones, tablets, computers, and televisions. The use of digital devices has become ubiquitous in modern society, and children are spending an increasing amount of time engaged in screen-based activities. This trend has raised concerns about the potential impact of screen time on children's vision, particularly the development and progression of myopia. The proliferation of digital devices and the increasing availability of online content have led to a dramatic rise in screen time among children. This trend has been further accelerated by the COVID-19 pandemic, with the shift to online learning and social interactions. Children use digital devices for various entertainment purposes, including watching videos, playing games, and using social media. Digital devices are increasingly used for educational purposes, both in the classroom and at home. Online learning platforms, educational apps, and e-books are becoming common tools for learning. Children use digital devices to communicate with friends and family through social media, video calls, and messaging apps. While the evidence linking screen time to myopia is not entirely conclusive, several studies suggest that prolonged screen time may contribute to myopia development. The close viewing distance and the lack of accommodative relaxation during screen time may contribute to axial elongation of the eye, leading to myopia progression. When using digital devices, children often hold them close to their faces, resulting in a shorter viewing distance than when reading a book or looking at distant objects. This close viewing distance may place excessive strain on the eye's focusing mechanism, potentially contributing to myopia development. Accommodation is the process by which the eye's lens changes shape to focus on objects at different distances. During near work, including screen time, the ciliary muscle contracts to change the lens shape for near focus. Prolonged near work may lead to a lack of accommodative relaxation, where the ciliary muscle remains tense even when not actively focusing on near objects. This sustained tension may contribute to axial elongation and myopia progression. Digital devices emit blue light, a high-energy visible light that can penetrate the eye and reach the retina. While the evidence is still emerging, some studies suggest that excessive blue light exposure may contribute to myopia development by disrupting retinal signaling and affecting eye growth. Several studies have investigated the relationship between screen time and myopia in children. While some studies have shown a direct correlation between increased screen time and myopia development, others have found no significant association. Studies that have found a positive correlation between screen time and myopia suggest that children who spend more time on digital devices are more likely to develop myopia or experience faster myopia progression. Other studies have found no significant association between screen time and myopia, indicating that other factors, such as genetics, outdoor time, and near work activities other than screen time, may play a more significant role. The relationship between screen time and myopia is complex and likely influenced by various factors, including the type of screen time activity, the duration of exposure, the viewing distance, and individual susceptibility. Different screen time activities may have different impacts on myopia development. For example, reading an e-book on a tablet may have a different effect than playing a fast-paced video game. The total amount of screen time may be a crucial factor, with longer durations potentially increasing the risk of myopia. The distance between the eyes and the screen may also play a role, with closer viewing distances potentially increasing the risk. Genetic predisposition and other individual factors may influence how susceptible a child is to the potential effects of screen time on myopia development. While the evidence linking screen time to myopia is not entirely conclusive, it is prudent to take precautions to manage screen time and promote healthy visual habits in children. Encourage children to limit their screen time and engage in other activities, such as playing outdoors, reading books, and spending time with family and friends. Encourage children to take frequent breaks from screen time to rest their eyes and allow their focusing mechanism to relax. The 20-20-20 rule is a helpful guideline every 20 minutes, look at something 20 feet away for 20 seconds. Encourage children to maintain a proper viewing distance when using digital devices. The ideal distance is typically around arm's length. Consider using blue light filters on digital devices to reduce blue light exposure. Regular eye exams are essential for early detection and management of myopia.[17,18]

Myopia, or nearsightedness, is a common vision condition that affects millions of children worldwide. It is characterized by the inability to focus on distant objects clearly due to an elongated eyeball or an overly curved cornea. While several factors contribute to myopia development, including genetics and near work, outdoor activities have been consistently shown to have a protective effect against myopia progression. Studies have shown that children who spend more time outdoors have a lower risk of developing myopia and slower myopia progression compared to those who spend less time outdoors. This protective effect has been observed across different populations and age groups, suggesting that outdoor activities play a crucial role in maintaining healthy vision. Children who spend more time outdoors are less likely to develop myopia in the first place. This suggests that outdoor activities may help prevent the onset of myopia, especially in children who are genetically predisposed to the condition. In children who already have myopia, spending more time outdoors can slow down the progression of the condition. This can help prevent high myopia, a more severe form of myopia that increases the risk of developing serious eye conditions later in life. The exact mechanism by which outdoor activities protect against myopia is not fully understood, but several theories have been proposed. One theory suggests that exposure to bright outdoor light stimulates the release of dopamine in the retina, which inhibits axial elongation of the eye. Dopamine is a neurotransmitter that plays a crucial role in regulating eye growth and development. Higher levels of dopamine, triggered by bright outdoor light, may suppress axial elongation and reduce the risk of myopia. Another theory proposes that the longer viewing distances experienced outdoors reduce the accommodative demand on the eye, preventing excessive accommodation and axial elongation. When looking at distant objects, the eye's focusing mechanism relaxes, reducing the strain on the ciliary muscle and potentially preventing axial elongation. The spectral composition of outdoor light, which is richer in short-wavelength blue light, may also play a role in myopia protection. Blue light has been shown to stimulate the release of dopamine in the retina and may also influence the growth and development of the eye. Exposure to sunlight also triggers the production of vitamin D in the body. Vitamin D plays a role in calcium absorption and bone health, which may indirectly influence eye growth and development. A variety of outdoor activities can provide the benefits of sunlight exposure and longer viewing distances. Unstructured play in parks, playgrounds, or backyards allows children to engage in a variety of activities, including running, jumping, and climbing, while also being exposed to natural light. Organized sports, such as soccer, basketball, and baseball, provide opportunities for physical activity and longer viewing distances. Nature walks and hikes expose children to natural light and varying terrain, promoting both physical activity and visual stimulation. Taking lessons or activities outdoors, such as reading under a tree or having a picnic lunch, can provide the benefits of outdoor exposure while also engaging in learning activities. Parents and educators can play a crucial role in promoting outdoor activities and encouraging children to spend more time outdoors. Make outdoor time a regular part of the day, even if it's just for a short period. Aim for at least two hours of outdoor time per day, especially for children who are at risk of developing myopia. Encourage children to limit their screen time and engage in other activities, such as playing outdoors, reading books, and spending time with family and friends. Incorporate outdoor activities into learning experiences whenever possible. Set a good example by spending time outdoors yourself and engaging in outdoor activities with your children.[19,20]

5. Conclusion

This study investigated the impact of the COVID-19 pandemic on myopia progression in children. The findings revealed a statistically significant increase in myopia during the pandemic period, likely attributable to increased screen time and decreased outdoor activities. These results underscore the importance of promoting healthy visual habits in children, particularly during periods of increased screen time and limited outdoor opportunities. Further research with larger sample sizes and prospective designs is needed to confirm these findings and explore the long-term impact of the pandemic on children's vision. Public health interventions are necessary to educate children, parents, and educators about the importance of eye health and encourage the adoption of healthy visual habits.

6. References

1. Kaya P, Uzel MM. Development and progression of myopia in children during the COVID-19 pandemic in urban area in Turkey. Int Ophthalmol. 2023; 43(10): 3823–9.
2. Usmani E, Callisto S, Chan WO, Taranath D. Real-world outcomes of low-dose atropine therapy on myopia progression in an Australian cohort during the COVID-19 pandemic. Clin Experiment Ophthalmol. 2023; 51(8): 775–80.
3. Elbakry A, Sidky MK, El Shiwy H, Hassanien A. Myopia progression in Egyptian Urban children under the influence of online learning during the COVID-19 pandemic. Egypt J Ophthalmol, (Mansoura Ophthalmic Center). 2023; 3(1): 32–40.
4. Cui L, Zhou H, Lou X, Chen T, Guo Y, Li J, et al. Effects of behaviors and surrounding environment on myopia before and during the COVID-19 pandemic: a longitudinal analysis of children and adolescents in China. Z Gesundh Wiss. 2023; 32(7): 1–13.
5. Kassem A. Myopia progression in children and adolescents: impact of COVID-19 pandemic and current and future control strategies. Acta Biomed. 2023; 94(2): e2023002.
6. Huang S, Shen F, Zhou F, Gong Q, Liu K, Feng W, et al. Myopia in elementary school students in Eastern China during the COVID-19 pandemic. Front Public Health. 2023; 11: 1167379.
7. Zhou X, Liu T, Wu A, Cheng B, Chen M, Wang K. Prevalence of myopia among senior students in Fenghua, Eastern China, before and during the COVID-19 pandemic. Front Public Health. 2023; 11: 1180800.
8. Guo C, Li Y, Luo L, Lin J, Qiu K, Zhang M. Progression and incidence of myopia among schoolchildren in the post-COVID-19 pandemic period: a prospective cohort study in Shantou, China. BMJ Open. 2023; 13(8): e074548.
9. Laan D, Tan ETC, Huis In Het Veld PI, Jellema HM, Jenniskens K. Myopia progression in children during home confinement in the COVID-19 pandemic: a systematic review and meta-analysis. J Optom. 2024; 17(1): 100493.

10. Lac A. Drinking to cope with the COVID-19 pandemic mediates pathways from COVID-19 anxiety to alcohol use and alcohol myopia consequences. J Dual Diagn. 2024; 20(4): 327–39.
11. Au Eong JTW, Chen KS, Teo BHK, Lee SSY, Au Eong K-G. Impact of the coronavirus disease 2019 pandemic on the progression, prevalence, and incidence of myopia: a systematic review. Taiwan J Ophthalmol. 2024; 14(2): 159–71.
12. Au Eong JTW, Tsai JHJ, Crosby NJ, Au Eong K-G. Childhood myopia and the coronavirus disease 2019 pandemic: lessons for future pandemics. Taiwan J Ophthalmol. 2024; 14(2): 284–5.
13. Mackey DA. Getting a clearer picture of myopia after the COVID-19 pandemic. Taiwan J Ophthalmol. 2024; 14(2): 141–2.
14. Lau J, Koh W-L, Ng JS, Lee D, Peh CH, Lam J, et al. How can we better evaluate paediatric progression of myopia and associated risk factors? Lessons from the COVID-19 pandemic: a systematic review. Acta Ophthalmol. 2024; 102(3): e257–71.
15. Li T, Wei R, Du B, Wu Q, Yan J, Meng X, et al. Prevalence of myopia among children and adolescents aged 6-16 during COVID-19 pandemic: a large-scale cross-sectional study in Tianjin, China. Br J Ophthalmol. 2024; 108(6): 879–83.
16. Li F, Li Y, Liu Z, Xu C, Li H, Sun Y, et al. Influence of eye-related behavior on myopia among junior middle school students under the background of double reduction during the COVID-19 pandemic. BMC Public Health. 2024; 24(1): 1531.
17. He T, Yin L, Zheng Q, He B, Xu Z, Hu T, et al. Survey on pattern of myopia in school children in Hangzhou after the COVID-19 pandemic: a school-based vision screening study. BMC Public Health. 2024; 24(1): 1850.
18. He T, Yin L, Zheng Q, He B, Xu Z, Hu T, et al. Correction: Survey on pattern of myopia in school children in Hangzhou after the COVID-19 pandemic: a school-based vision screening study. BMC Public Health. 2024; 24(1): 2346.
19. Mu J, Zhong H, Jiang M, Yang W. Epidemiological characteristics of myopia among school-age children before, during, and after the COVID-19 pandemic: a cohort study in Shenzhen, China. Front Med (Lausanne). 2024; 11: 1368219.
20. Yotsukura E, Torii H, Mori K, Ogawa M, Hanyuda A, Negishi K, et al. Slowing of greater axial length elongation stemming from the Coronavirus disease 2019 pandemic with increasing time outdoors: the Tokyo myopia study. Ophthalmol Sci. 2024; 4(5): 100491.