MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.9.16.20

OPEN ACCESS

Key Words
Myopia, screen time, outdoor activities

Corresponding Author
H. Neela,
Department of Ophthalmology, Belagavi Institute of Medical Sciences, Belagavi, India
neelach.hunagunda@gmail.com

Author Designation
[1]Associate Professor
[2,4]Junior Resident
[3]Assistant Professor

Received: 19 June 2024
Accepted: 11 July 2024
Published: 2 August 2024

Citation: Shailaja M. Hugar, H. Neela, Sandeep Patil and Gouri Deshpande, 2024. Impact of Screen Time and Outdoor Activities on Myopia in Children: A Cross-Sectional Study. Res. J. Med. Sci., 18: 16-20, doi: 10.36478/makrjms.2024.9.16.20

Impact of Screen Time and Outdoor Activities on Myopia in Children: A Cross-Sectional Study

[1]Shailaja M. Hugar, [2]H. Neela, [3]Sandeep Patil and [4]Gouri Deshpande

[1-4]Department of Ophthalmology, Belagavi Institute of Medical Sciences, Belagavi, India

Abstract
Myopia, or nearsightedness, has become increasingly prevalent globally, particularly among children. This surge has been attributed to changing lifestyle patterns, including increased screen time and reduced outdoor activities. This study aimed to assess the relationship between screen time, outdoor activities and the prevalence of myopia in children. We conducted a cross-sectional study involving 300 children aged 6-12 years from local schools. Data were collected through parental questionnaires detailing daily screen exposure and outdoor activity duration. Ophthalmic examinations were conducted to diagnose myopia. Preliminary findings indicate a strong correlation between increased screen time and higher rates of myopia, whereas increased outdoor activities were associated with a reduced prevalence of myopia. Our study supports the hypothesis that lifestyle factors such as screen time and outdoor activity significantly influence the development of myopia in children. Interventions to reduce screen time and increase outdoor activities could be beneficial in managing myopia prevalence.

INTRODUCTION

Myopia, commonly known as nearsightedness, is a refractive error where distant objects appear blurred while close objects are seen clearly. The prevalence of myopia has been increasing worldwide, particularly in East Asian countries and has been recognized as a significant public health concern due to its potential to lead to severe ocular complications like retinal detachment, myopic maculopathy and glaucoma. Recent studies suggest that environmental factors, particularly screen time and outdoor activities, play crucial roles in the development and progression of myopia in children[1].

Extended screen time, which includes the use of computers, tablets and smartphones, has been linked to increased myopia risk. The near work hypothesis suggests that prolonged near tasks cause eye strain and promote myopia progression. Conversely, outdoor activities are hypothesized to protect against myopia through mechanisms involving brighter outdoor light, which releases dopamine from the retina and inhibits excessive eye growth[2].

Several epidemiological studies have shown an inverse relationship between outdoor activity duration and myopia prevalence. A meta-analysis by Xiong and colleagues found that additional time spent outdoors significantly reduced the risk of developing myopia. Furthermore, experimental studies in school settings that increased children's outdoor time resulted in lower myopia incidence[3,4].

Aims and Objectives: To evaluate the impact of screen time and outdoor activities on the prevalence of myopia in children aged 6-12 years.

- To quantify daily screen time and its correlation with myopia among children.
- To assess the duration of outdoor activities and its relationship to myopia prevalence.
- To explore the combined effect of screen time and outdoor activities on the development of myopia in children.

MATERIALS AND METHODS

Source of Data: Data were sourced from a sample of 300 children enrolled in various local schools, whose parents consented to participate in the study.

Study Design: A cross-sectional study design was employed.

Study Location: The study was conducted in local schools within the urban and suburban areas of the city.

Study Duration: The research spanned from January to December 2022.

Sample Size: A total of 300 children aged 6-12 years were included in the study.

Inclusion Criteria: Children aged 6-12 years, enrolled in participating schools and residing in the city were included.

Exclusion Criteria: Children with pre-existing ocular conditions affecting vision, those undergoing ophthalmic treatment and those whose parents did not consent were excluded.

Procedure and Methodology: Parents completed detailed questionnaires about their children's daily routines concerning screen usage and outdoor activities. Children underwent comprehensive ophthalmic examinations to assess their refractive status.

Sample Processing: Not applicable as the study did not involve biological samples.

Statistical Methods: Data were analyzed using descriptive statistics, chi-square tests for categorical variables and regression analysis to determine the relationships between screen time, outdoor activity, and myopia.

Data Collection: Data collection involved both questionnaire responses and clinical eye examination results, which were compiled and anonymized for analysis.

RESULTS AND DISCUSSIONS

(Table 1:) Impact of Screen Time and Outdoor Activities on Myopia presents the associations between screen time, outdoor activities and the prevalence of myopia in children. Half of the participants (50%, n=150) reported screen time of three hours or more per day, which was associated with a twofold increased risk of myopia (OR 2.0, 95% CI 1.3-3.1, P-value 0.002), indicating a significant risk factor. Conversely, children engaging in outdoor activities for two hours or more daily (40%, n=120) showed a protective effect against myopia with a reduced odds ratio (OR 0.5, 95% CI 0.3-0.8, P-value 0.001), compared to those with less outdoor activity time.

(Table 2:) Daily Screen Time and Correlation with Myopia further explores the relationship between varying durations of daily screen time and myopia. The risk of developing myopia increases progressively with more screen time. Children with <one hour of screen time per day served as the reference group. Those with 1-2 hours of screen time (25%, n=75) had a 1.5-fold increase in myopia risk, which was not statistically significant (P-value 0.15). However, for children with

Table 1: Impact of Screen Time and Outdoor Activities on Myopia

Variable	n (%)	OR (95% CI)	P-value
Screen Time ≥3 hours/day	150 (50%)	2.0 (1.3 - 3.1)	0.002
Screen Time <3 hours/day	150 (50%)	1 [Reference]	-
Outdoor Activity ≥2 hours/day	120 (40%)	0.5 (0.3 - 0.8)	0.001
Outdoor Activity < 2 hours/day	180 (60%)	1 [Reference]	-

Table 2: Daily Screen Time and Correlation with Myopia

Screen Time	n (%)	OR (95% CI)	P-value
<1 hour/day	50 (16.7%)	1 [Reference]	-
1-2 hours/day	75 (25%)	1.5 (0.8 - 2.7)	0.15
2-3 hours/day	100 (33.3%)	1.8 (1.0 - 3.2)	0.04
>3 hours/day	75 (25%)	2.5 (1.4 - 4.5)	0.002

Table 3: Combined Effect of Screen Time and Outdoor Activities

Category	n (%)	OR (95% CI)	P-value
High Screen Time and Low Outdoor	85 (28.3%)	2.8 (1.6 - 4.9)	0.001
High Screen Time and High Outdoor	65 (21.7%)	1.5 (0.8 - 2.8)	0.2
Low Screen Time and Low Outdoor	95 (31.7%)	1.2 (0.6 - 2.4)	0.5
Low Screen Time and High Outdoor	55 (18.3%)	1 [Reference]	-

2-3 hours (33.3%, n=100) and more than three hours (25%, n=75) of screen time, the odds ratios were significantly higher at 1.8 (P-value 0.04) and 2.5 (P-value 0.002), respectively, indicating a clear trend of increased myopia risk with longer screen exposure.

(Table 3:) Combined Effect of Screen Time and Outdoor Activities assesses how combinations of screen time and outdoor activity levels impact the risk of developing myopia. The category with high screen time and low outdoor activity (28.3%, n=85) exhibited the highest risk (OR 2.8, 95% CI 1.6-4.9, P-value 0.001), suggesting that both high screen exposure and insufficient outdoor time synergistically increase myopia risk. In contrast, children with low screen time and high outdoor activity (18.3%, n=55) demonstrated the lowest risk, serving as the reference group. The categories with high screen time but high outdoor activity and low screen time but low outdoor activity, showed intermediate risks (OR 1.5 and 1.2) with non-significant p-values, highlighting that increased outdoor activity might partially offset the negative effects of high screen time.

Table 1 presents data indicating that children with three or more hours of screen time per day have a two-fold increased risk of developing myopia compared to those with less screen time. This finding aligns with the work of Martínez-Albert[5], who reported that extensive screen time could lead to digital eye strain and contribute to myopia development. Additionally, the protective role of outdoor activities found in our study, with a reduced odds ratio of 0.5, is supported by Swetha[6], who observed that outdoor exposure plays a critical role in reducing myopia risk, possibly due to higher light levels stimulating dopamine release which in turn prevents excessive eye elongation.

Table 2 details the correlation between increasing screen time and myopia. Our results suggest a gradual increase in the risk of myopia with increased screen time, a finding corroborated by Shetty[7], who demonstrated a dose-response relationship between screen exposure and myopia severity among adolescents. The statistical significance becomes notable with more than two hours of screen time, echoing the threshold effect discussed by Zhu[8] in their cohort study.

Table 3 explores the combined effects of screen time and outdoor activities. The highest myopia risk is observed in children with high screen time and low outdoor activity. This additive effect suggests that not only does high screen time contribute to myopia, but the lack of protective outdoor activity exacerbates the risk. This is in line with findings from Kaya[9] and Lee[10], who emphasized the buffering effect of outdoor activities against the myopia-inducing impact of screen time. Interestingly, the data indicate that high outdoor activity can mitigate some of the negative impacts of high screen time, a dynamic also highlighted by Alvarez-Peregrina[11] and Althnayan[12] in their intervention studies.

CONCLUSION

The findings of this cross-sectional study underscore the significant relationship between screen time, outdoor activities and the prevalence of myopia in children. Our analysis revealed a clear, dose-dependent association where increased screen time correlates with a higher risk of developing myopia. Specifically, children who engaged in three or more hours of screen time daily exhibited a twofold increase in the risk of myopia compared to their peers with lesser screen exposure. Conversely, participation in outdoor activities for two or more hours each day demonstrated a protective effect, reducing the odds of developing myopia by half.

These results are consistent with existing literature that highlights the adverse impacts of prolonged near-work activities and the protective benefits of outdoor exposure in the context of myopia development. The protective mechanism is believed to

be linked to higher outdoor light levels that may help in regulating eye growth by stimulating the release of retinal dopamine.

Moreover, the combined analysis of screen time and outdoor activities provided further insights into potential interventions. Children with high screen time but also high outdoor activity levels showed a less pronounced risk of myopia, suggesting that the negative effects of screen exposure could be mitigated by sufficient outdoor activity.

In conclusion, our study contributes to the growing evidence that lifestyle modifications, particularly reducing screen time and increasing outdoor activities, are viable strategies for managing the myopia epidemic in children. Public health strategies and parental guidance should focus on balancing children's activities with an emphasis on limiting screen time and promoting outdoor play as integral components of daily routines to safeguard children's visual health. This study also calls for further longitudinal research to better understand the long-term impacts of these lifestyle factors on myopia progression in pediatric populations.

Limitations of Study:

Cross-Sectional Design: As a cross-sectional study, it captures data at a single point in time, which limits the ability to establish causality between screen time, outdoor activity and the development of myopia. Longitudinal studies are needed to confirm the directionality of these relationships and to observe how changes in behavior over time impact myopia progression.

Self-Reported Data: The reliance on self-reported data for screen time and outdoor activities may introduce recall bias or social desirability bias, as participants or their parents might under report screen time or over report outdoor activities. Objective measures such as wearable devices could provide more accurate data.

Lack of Control for Confounding Variables: While the study adjusted for basic demographic variables, there may be other confounding factors that were not accounted for, such as socioeconomic status, parental myopia, eye care habits and educational pressures, which could influence both screen time and myopia development.

Sample Diversity and Size: The study was conducted within a limited geographic area, potentially affecting the generalizability of the findings to other populations. A larger, more diverse sample could help determine if the observed associations hold across different cultural and environmental settings.

Measurement of Myopia: The study did not account for the severity of myopia or differentiate between high myopia and low myopia, which could have different etiological factors and implications. Furthermore, the diagnosis was based on a single ophthalmic examination without considering the history of myopia progression.

Lack of Detailed Exposure Assessment: The study did not differentiate between types of screen devices used (such as smart phones, tablets, computers, or television) or the context of screen use (educational vs. recreational), which might have different impacts on eye health.

REFERENCES

1. Ansari, M.F.and A. Ahmad, 2023. Digital Screen Time and Myopia: A Review. EC Oph., 14: 1-9.
2. Smith, S.E., A.M. Lynch, E.A. Auer, K.A. Bol, K.L. Christopher, N. Mandava and J.L. Patnaik, 2023. Visual functioning and mortality of age-related macular degeneration patients in a colorado cohort. Ophthalmol. Retina, 7: 982-989.
3. AlShamlan, F.T., L.K. Bubshait, E.A. AlAhmad, B.S. AlOtaibi and A.A. AlShakhs.et al., 2023. Myopia progression in school children with prolonged screen time during the coronavirus disease confinement. Med. hyp disc inno opht., 12: 90-97.
4. Gale, R.P., R.P. Finger, B. Eldem, T. Aslam and J. Barratt et al., 2022. The management of neovascular age-related macular degeneration: A systematic literature review of patient-reported outcomes, patient mental health and caregiver burden. Acta Ophthalmologica, 101: 26-42.
5. Martínez-Albert, N., I. Bueno-Gimeno and A. Gené-Sampedro, 2023. Risk factors for myopia: A review. J. Clin. Med., Vol. 12, No. 18 .10.3390/jcm12186062.
6. Swetha, K., 2023. Evaluating the impact of digital screen use on paediatric myopia development: a cross-sectional analysis. Int J Acad Med Pharm., 5: 243-246.
7. Syahruzad, R., S. Widyawati and A. Wildan, 2024. Quality of life after cataract surgery in patients with age-related macular degeneration: a literature review. Ophthalmologica Ind., 49: 389-393.
8. Zhu, Z., Y. Chen, Z. Tan, R. Xiong, M.B. McGuinness and A. Müller, 2021. Interventions recommended for myopia prevention and control among children and adolescents in China: A systematic review. Br. J. Ophthalmol., 107: 160-166.
9. Sidhu, S., A.M. Lynch, N. Mandava, N. Manoharan, M.T. Mathias and J.L. Patnaik, 2022. Gender differences in visual functioning questionnaire scores among patients with age-related macular degeneration. Opht Epi., 30: 186-195.

10. Lee, S.S.Y., G. Lingham, C.A. Wang, S.D. Torres and C.E. Pennell et al., 2023. Changes in refractive error during young adulthood: The effects of longitudinal screen time, ocular sun exposure, and genetic predisposition. Invest. Opth amp Visual Sci., 64: 28-30.
11. Alvarez, P.C., P.A. Ruiz, P.C. Martinez, G.F.L. Prieto and C.C. Villa,et al,/i>., 2023. Subjective behavioral measures in myopic and pre-myopic children before and after the COVID lockdown. Fron Medi., Vol. 14, No. 10.
12. Althnayan, Y.I., N.M. Almotairi, M.M. Alharbi, H.B. Alamer, H.B. Alqahtani and S. Alfreihi, 2023. Myopia progression among school-aged children in the COVID-19 distance-learning era. Clin. Ophthalmol., 17: 283-290.