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Original Article

To study the relation between screen time and reading with myopia, pre-myopia, and ocular biometric and anthropometric measures in 6-7-year-old school children in Jharkhand.

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Abstract

Objective:

To study the relation between screentime and reading with Myopia, pre-myopia, and ocular biometric and anthropometric measures in 6-7 years school-going children visiting a tertiary eye care centre of Jharkhand.

Method:

It was a hospital-based cross-sectional study.52 school children visiting the OPD between Nov'23-June'24 were included in the study. Cycloplegic autorefraction, ocular biometry, height, and weight were recorded, along with other details of the children, by the parents in a questionnaire format. Myopia & pre-myopia risk assessment was performed.

Result:

Daily screen time was 26.92% < 1 hr, 46.15% 1-2hrs, 17.30% 2-4 hrs, and 9.61% > 4 hrs.

Conclusion:

It revealed>2hrs/day on screens was associated with a more spherical power, increased refractive astigmatism, higher axial length, heavier weight, and higher BMI. It also revealed that daily screentime>2h was associated with myopia and pre-myopia. Frequent reading/writing was associated with screentime (less than 2h/day)

***Keywords**: Myopia; Pre-myopia; Screen time; Reading habits; Axial length; Childhood myopia; Ocular biometry; Body mass index.*
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Introduction

The prevalence of myopia is projected to reach 50% by the year 2050, with 10% exhibiting pathological myopia.1 In Asia, the incidence of nearsightedness has increased fourfold in the last twenty years.2Myopia is associated with visual impairment (VI) in middle age and later in life, so it's important to start treatment early and avoid myopia in children since they are at risk for developing the condition at a young age.3The last ten years have seen a dramatic shift in the ways people work, learn, and interact socially due to the pervasiveness and proliferation of digital media.4 Because of the proliferation of digital media, the previous decade has seen a sea change in the context of learning, work, and social contact.5The worldwide adoption of screen-based interaction was hastened more recently by pandemic control measures, including lockdowns.6The American Academy of Pediatrics advises against screen media use for children under 18 months, except for video chatting. For those aged 18 to 24 months, only high-quality content watched together with a caregiver is recommended. Screen time should be limited for children aged 2 to 5 years, with a strong focus on parental involvement. For children 6 years and older, the AAP suggests creating a personalized Family Media Plan instead of enforcing a strict daily screen time limit. Meanwhile, the World Health Organization recommends no sedentary screen time for children under 2 years and no more than one hour per day for children aged 2 to 4 years.7-9In this study, children aged 6–7 who visited a tertiary eye care center in Jharkhand had their screen time, reading/writing time, and related refractive, ocular biometric, and anthropometric variables measured.

Aim

To study the relation between screen time and reading with Myopia, pre-myopia, and ocular biometric and anthropometric measures in 6-7 years school-going children visiting a tertiary eye care centre of Jharkhand.

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Objective

1. To understand the relation between screen time and ocular biometric measures in 6-7 years school-going children visiting a tertiary eye care centre in Jharkhand
2. To understand the relation between screen time and BMI (Body Mass Index) in 6-7 years school-going children visiting a tertiary eye care centre in Jharkhand

Materials and methods:

Study design

This study was a hospital-based cross-sectional study.

Study setting

This project was carried out at the Regional Institute of Ophthalmology (RIO), Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand, India, which is a tertiary care teaching institution with a huge referral base across the urban and rural locations in the state and its neighbouring states. The institute offers a wide range of ophthalmic care, which includes outpatient services, inpatient care, paediatric ophthalmology, refraction, cataract surgery, vitreoretinal services, glaucoma, ocular imaging, and ocular biometry services. Eligible children seen at the Paediatric Ophthalmology and General Ophthalmology Outpatient Department (OPD) during the study were screened and enrolled in the study in a random manner.

Study duration

The study was conducted over 6 months between November 2023 and June 2024

Sample size

The sample size was determined using the convenience sampling method. All eligible children aged 6–7 years who fulfilled the inclusion criteria and whose parents/guardians provided written informed consent during the study period were consecutively enrolled. A total of 52 participants were included in the final analysis.

Sample size determination

Because it was an exploratory cross-sectional study that was conducted in a hospital, consecutive convenience sampling was used. The Regional Institute of Ophthalmology recruited all eligible children (between 6 and 7 years) presenting to the institute during the period of study and using the eligibility criteria. To report, the sample size can be defined with the help of the finite cross-sectional formula:

For reporting purposes, the sample size may be described using the finite cross-sectional formula:

where

- Z = 1.96 (95% confidence interval)
- P = expected prevalence
- d = allowable error

But due to the exploratory nature of the study, a short study period, and the availability of qualified children, all successive eligible children (n= 52) were added to the final analysis.

Study population

52 school children who visited the OPD between November 2023 and June 2024, of the age group between 6 and 7 years, were included in the study.

Inclusion criteria

- Children who were 6-7 years of age
- The parents(of those children) who gave consent for the study

Exclusion criteria

- Children who have conglomerate anomalies in their vision.
- Children with previous ocular surgery or ocular trauma.
- Children with systemic diseases affecting eye development.
- Children who have developmental impairment that does not allow accurate ophthalmic testing.
- Parents who do not want to give informed consent or children who do not want to give assent

Method for Sample Collection

The Participants' parents/legal guardians completed a standardised eye health and lifestyle questionnaire reporting inter alia, eye and vision problems. Completed questionnaires were returned to the first author after completion. Parents/guardians reported their child's daily screentime (including computers, video game players, iPads, smartphones and television) as follows: "<1 h, '1–2 h', '2–4 h' or 'over 4 h'. Reading/writing time was reported as follows: 'all/most leisure time reading/writing', 'frequently reading/writing', 'occasionally reading/writing' or 'seldom/never reading/writing'. Parents' history of myopia related to the child's birth parent was self-reported by the parent/legal guardian.

Cycloplegic autorefraction, ocular biometry, height, and weight were recorded. The study used parent/legal guardian-reported measures as a proxy for daily screentime and reading/writing time.

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Examination

- Children with written informed consent from parents/legal guardians and child assent were examined.
- The examination involved cycloplegic autorefraction performed at least 30 min post-instillation of anaesthetic and cycloplegic eye drops.
- The power of the children (spherical and astigmatic component) was used in subsequent analysis.
- The Zeiss IOLMaster 500 was used to measure the axial length (AL).
- Participant height (in cm) was measured using a measuring tape.
- Weight (in kg) was measured using digital scales. (Participants removed their shoes for both height and weight measurements.)

Statistical methodology

Data were analyzed using software STATA Version 18.
P values less than 0.05 will be considered statistically significant.

Dependent variables

The primary analyses used continuous dependent variables: Axial Length, spherical power, height, weight, BMI, and corneal astigmatism. Near visual tasks were quantified using two measures: i) time spent on screens daily; ii)time spent reading/writing.

Bias

Several precautions were taken to reduce bias. The selection bias was minimized by sampling all participants who were eligible consecutively. Cycloplegic autorefraction and ocular biometry were performed using standardized protocols by trained ophthalmologists to minimise measurement bias. A structured questionnaire involving standardized instructions was used to minimize information bias in the process of responding to the questionnaire by parents. Analytical bias was once again reduced by double-checking data entry and predefined statistical analysis procedures.

Ethical approval

The study was conducted with the institutional ethics committee (IEC), Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand. Ethical approval was obtained before the start of the study. The research was performed based on the principles of the Declaration of Helsinki. Parents or legal guardians provided written informed consent, and the children who participated were provided with assent whenever possible.

Results

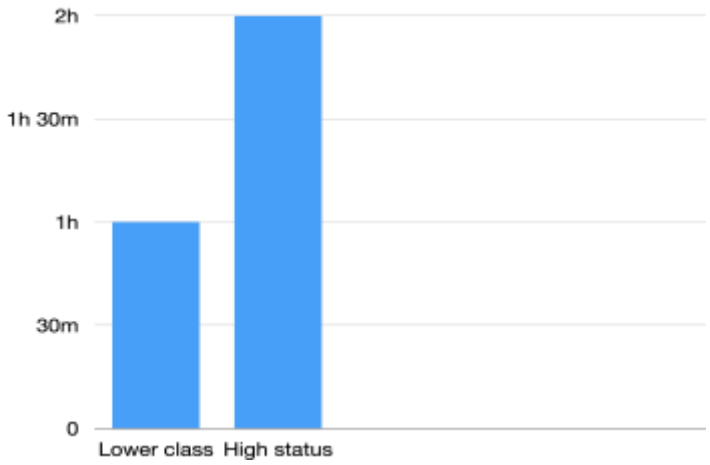

Figure1-Relation between socioeconomic status screentime

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Parents/legal guardians reported their child's daily screentime as follows:

Daily screentime	percentage of population under study
<1hr	26.92%
1-2hrs	46.15%
2-4hrs	17.30%
>4hrs	9.61%

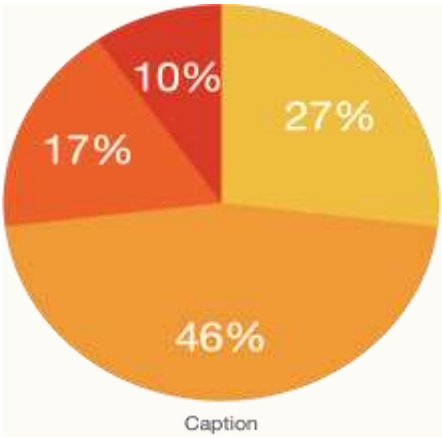
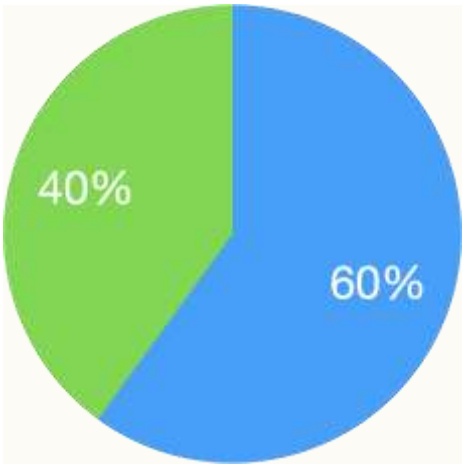


Figure 2 - Relationship between child's daily screentime and percent population



Blue colour – urban population
Green colour-rural population

Figure 3-Relation between the population which is urban and the population that is rural, under our study

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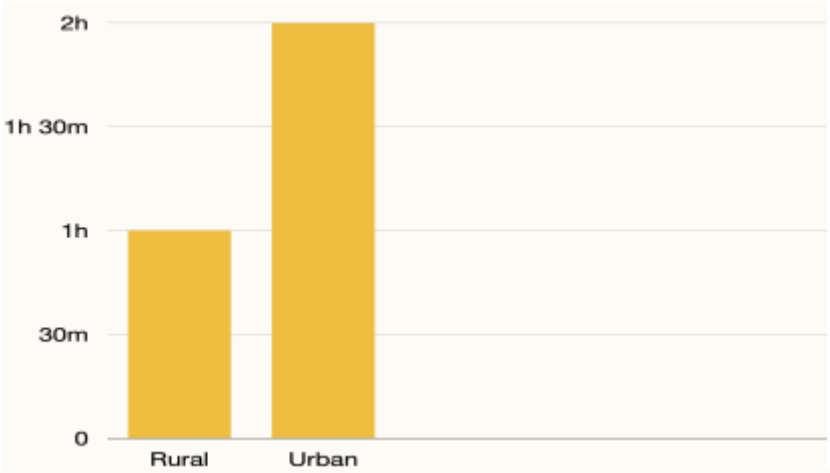

Figure 4- Relation between mean screentime and rural- urban population

Table 1 Refractive Characteristics of the Participants (n = 52)

Variable	Value
Mean spherical power	−1.50 D
Mean refractive astigmatism	0.58 D
Myopia	3.7%
Pre-myopia	32.4%
Clinical emmetropia	33.2%
Hyperopia	30.6%

Table 2 Reading/Writing Habits of Participants

Reading habit	Frequency (%)
All/most leisure time	2.7
Frequently	39.1
Occasionally	47.7
Seldom/Never	9.8

Refractive and corneal astigmatism

Participants on screens >2 h/day had 0.12D more astigmatism than those on screens ≤2 h/day

Overweight/obesity

Screentime >2 h/day was associated with overweight/obesity.

Discussion

This study examined parent/legal guardian-reported near-vision tasks (screentime and reading) and their relationship with refractive error, ocular biometric and anthropometric parameters in 6- to 7-year-olds. Increased screentime was associated with a more myopic power, higher Axial Length, higher with-the-rule refractive astigmatism, and higher BMI. The relationship between overweight/obesity, increased screentime, and myopia, pre-myopia, is of concern. Children on screens over 2 hours daily were almost four times more likely to be overweight/obese, aligning with the literature where two or more hours per day on screens in childhood is strongly associated with overweight and obesity.10Furthermore, high myopia has been associated with overweight/obesity in children.11 Obesity-associated insulin resistance may promote axial elongation.12Myopia and astigmatism frequently coexist, and as demonstrated here, both were significantly associated with increased screentime. The relationship between screentime and increased levels of WTR refractive astigmatism found here is in line with Tong et al.,13 who found that playing video games and using computers was associated with Cartesian (J0) WTR astigmatism severity in Singaporean 7- to 9-year-olds. More recent studies demonstrated that increased screentime and time spent engaged in online gaming were associated with a longer AL and myopic SER in 18-year-olds.14 Furthermore, children already myopic at 6–7 years of age are more likely to become highly myopic in adulthood

without intervention.15 The association between near-vision activities such as reading and writing are long known to be associated with myopia;16,17 however as evidenced here, reading is becoming eclipsed by near-visual tasks involving screens and portable devices,18 which is concerning as time spent reading is associated with increased functional connectivity in the reading-related brain, and screentime is associated with reduced functional connectivity.18Of further concern, the ubiquitous use of screens may increase sedentary activity and decrease outdoor activity. As social media platforms are designed to be addictive,19the potential acceleration of myopia progression and increased BMI in young children is concerning. Hence, public health interventions designed to limit screen time are needed. Study strengths include the size, randomly selected population, questionnaire completion rate, standardised cycloplegic refraction and ocular biometry. The findings are cross-sectional, and so risk factors have the potential to be associated with myopia, premyopia, obesity, etc., thus limiting conclusions regarding the directionality of associations. Furthermore, screen time reported by parents may be skewed toward more socially acceptable answers and less extreme reports.20 Also, because the gadgets were portable, some parents or legal guardians would have found it challenging to report screen time usage.21 However, since the participants were 6–7 years of age, individual ownership of screen devices is unlikely, and parents were more likely to facilitate access to devices, thereby limiting the impact of potential inaccuracy. Thus, longitudinal evaluations, including objectively measured screen time and near visual task analysis, are required to explore the relationships better.

Conclusion

Increased screentime was associated with higher Axial length, greater with-the-rule astigmatism, higher BMI, increased odds for myopia, pre-myopia and being overweight/obese, and was inversely related to reading/writing time. Myopia and pre-myopia were associated with near visual tasks. One in five participants aged 6–7 years exceeded the World Health Organization-recommended daily screentime (<2 h/day), which rose to one in three among socioeconomically disadvantaged participants. The present study identified target populations for initiatives designed to decrease screen-related sedentary behaviour. This is essential while managing myopia.

Limitations

The research has several limitations. First, the cross-sectional design of the research, using a hospital as the study sample, restricts causal inferences regarding the development of myopia with the use of screen time. Second, the sample size is relatively small, and this might decrease statistical power. Third, screen time and reading habits were parent-reported, which implies the potential for recall and reporting bias. Lastly, the actual duration of outdoor activity and socioeconomic confounding variables were not measured objectively, and this could have played a role in the associations observed.

Recommendations

- Screen time leisure activities must be no more than two hours daily in line with WHO and the American Academy of Pediatrics.
- Schools are to promote frequent outdoor activities and equal reading habits.
- There should be periodic vision screening programmes at school to enable early identification of pre-myopia and myopia.
- Parents should be counselled on healthy use of digital devices that are used by children.
- Future multicentre longitudinal studies with greater sample size will need to assess the long-term impact of screen exposure upon ocular development.

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List of abbreviations

AL Axial Length
BMI Body Mass Index
IEC Institutional Ethics Committee
OPD Outpatient Department
RIMS Rajendra Institute of Medical Sciences
RIO Regional Institute of Ophthalmology
SER Spherical Equivalent Refraction
STATA Statistical Software for Data Analysis
WTR With-The-Rule
WHO World Health Organization

Availability of data

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Author contributions

Dr.Vatsala Kunwar: Conceptualization, study design, participant recruitment, data collection, data interpretation, manuscript drafting, and corresponding author.

Dr Rahul Prasad: Clinical examination, ophthalmic measurements, data validation, literature review, and manuscript revision.
Dr. Ashish Bharti: Statistical analysis, interpretation of results, critical revision of the manuscript, and supervision of data analysis.
Dr.Lalhmingmawii C: Literature review, data management, manuscript editing, proofreading, and final approval of the manuscript.

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These revisions comprehensively address the reviewer's comments while maintaining the manuscript in a format suitable for submission to an ophthalmology journal.

Conflict of interest

There were no conflicts of interest.

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