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THE RELATIONSHIP OF SCREEN-TIME DURATION WITH HEALTH-RELATED FITNESS IN ADOLESCENTS

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Introduction

Adolescents today spend an average of **3–4 hours daily** on screen-based activities, far exceeding the **recommended limit of 2 hours per day** by the World Health Organization (WHO).(Dubey et al., 2018) This trend has escalated with the rise of smartphones, online education, and digital entertainment platforms, drastically transforming adolescent lifestyles. Screen-time, defined as the total time spent on devices like smartphones, computers, televisions, and tablets, has seen a dramatic increase over recent years. While technology has enabled advancements in communication and education, excessive screen-time poses a critical challenge to health-related fitness, which encompasses physical, mental, and emotional well-being.(Panjeti-Madan & Ranganathan, 2023) Health-related fitness is a multidimensional construct, including components such as cardiovascular endurance, muscular strength, flexibility, and body composition, which are essential for overall well-being and quality of life.(Britton et al., 2020) Adolescence, a critical period of growth and development, requires balanced physical activity for optimal health. However, sedentary behaviours associated with prolonged screen-time often lead to adverse health outcomes, such as obesity, musculoskeletal issues, and mental health disorders like anxiety and depression.(Kumar et al., 2015) Consequently, understanding the relationship between screen-time duration and health-related fitness is vital to developing evidence-based interventions aimed at promoting healthier lifestyles in adolescents.

The increasing prevalence of sedentary behaviours among adolescents is a growing public health concern. A study utilizing data from the World Health Organization Global School-based Student Health Survey across 23 African countries reported a prevalence rate of 30% among adolescents aged 12–17 years.(Abonie & Ackah, 2024) Studies highlight that prolonged screen-time is associated with negative impacts on physical activity levels, dietary habits, and overall health, contributing to long-term risks of chronic diseases such as cardiovascular disorders, diabetes, and

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obesity. Despite global awareness campaigns emphasizing physical activity and reduced sedentary time, screen-time among adolescents continues to rise, particularly with the ubiquity of smartphones and other digital devices.(E et al., 2023)

India, with its large adolescent population, faces unique challenges in addressing this issue. Recent studies indicate that Indian adolescents spend an average of 4 to 5 hours per day on screens, engaging in activities such as gaming, video chatting, online streaming, and social media.(Kumari & Choudhary, 2024) This duration significantly exceeds the World Health Organization's recommendation of limiting recreational screen time to no more than 2 hours per day for adolescents. A study conducted in Mumbai found that approximately 85% of adolescents had a screen time of more than 2 hours per day.(Raju, 2024) These findings underscore the pressing need to evaluate the extent to which screen-time influences health-related fitness parameters and to identify specific risk factors associated with these behaviours among Indian adolescents.

This study aims to fill the gap by exploring the relationship between screen-time duration and health-related fitness in adolescents, providing critical insights to inform policymakers, educators, and healthcare professionals. Understanding this relationship is essential to design effective interventions and awareness programs that can mitigate the negative effects of excessive screen-time, fostering healthier habits and improving the overall quality of life for adolescents.

METHODOLOGY

Research Design: A cross-sectional, quantitative research design was adopted for the study.

Study Setting and Participants: The study was conducted in different schools of Mahendragarh, Haryana.

Sampling: In this study, a random sampling technique was employed to select 500 adolescents, comprising 186 males and 314 females, aged between 14 and 16 years.

Data Collection:

Data was collected using a socio-demographic questionnaire to record age, gender, residence, educational status, and screen-time habits, with daily screen-time tracked over seven days to calculate weekly averages. Health-related fitness assessments, including body composition,

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cardiorespiratory endurance, flexibility, and muscular endurance, were conducted following standardized protocols. Cognitive skills were evaluated through problem-solving, verbal intelligence, and perception tasks in a distraction-free setting.

Data Analysis: The collected data are analyzed using appropriate statistical methods. The Shapiro-Wilk test was applied to check the normality of the data. Descriptive statistics were calculated, with mean and standard deviation (SD) used for continuous variables and proportions for categorical variables. The level of significance was set at 0.05 for all statistical tests.

RESULT

Table 1: Distribution of socio - demographic variables of samples. (N=500)

Sr. No.	Variable		Statistic	
1.	Age in years		Mean ± SD	14.72 ± 0.823
			Median (IQR)	14.0 (14.0 – 15.0)
			Range	14.0 – 16.0
2.	Studying class		Mean ± SD	9.75 ± 1.093
			Median (IQR)	9.0 (9.0 – 11.0)
			Range	9.0 – 11.0
3.	Gender	Male	Frequency	186
			Percentage	37.2%
		Female	Frequency	314
			Percentage	62.8%

The table 1 study population comprised participants with an average age of 14.72 years (SD ± 0.823), indicating low variability, and a median age of 14 years with an interquartile range (IQR) of 14.0 to 15.0, while the age range was 14 to 16 years. The average studying class was 9.75 (SD ± 1.093), with a median of 9 and an IQR of 9.0 to 11.0, spanning a class range from 9 to 11. Regarding gender distribution, 37.2% (186) of the participants were male, and 62.8% (314) were female, indicating a higher proportion of females in the study.

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Table 2: Descriptive statistics of Body Composition across different levels of Screen Time (N=500)

Descriptive statistics (Values of body composition)	Screen time		
	0-60 min	60-180 min	180 min & more
Mean ± SD	69.88 ± 28.93	63.67 ± 27.78	76.87 ± 20.49
Median (IQR)	75.0 (50-90)	75.0 (50-90)	75.0 (75-95)
Range (Min-Max)	10 – 95	10 – 95	10 – 95
Skewness	-1.054	-0.632	-1.414
Kurtosis	-0.266	-0.851	1.703

Table 2 represents the descriptive statistics of body composition across screen time levels among 500 participants. For 0–60 minutes of screen time, the mean body composition was **69.88 ± 28.93** (median: 75.0, IQR: 50–90, range: 10–95), with skewness of **-1.054** and kurtosis **-0.266**. For 60–180 minutes, the mean was **63.67 ± 27.78** (median: 75.0, IQR: 50–90, range: 10–95), skewness **-0.632**, and kurtosis **-0.851**. For 180 minutes or more, the mean was **76.87 ± 20.49** (median: 75.0, IQR: 75–95, range: 10–95), with skewness **-1.414** and kurtosis **1.703**.

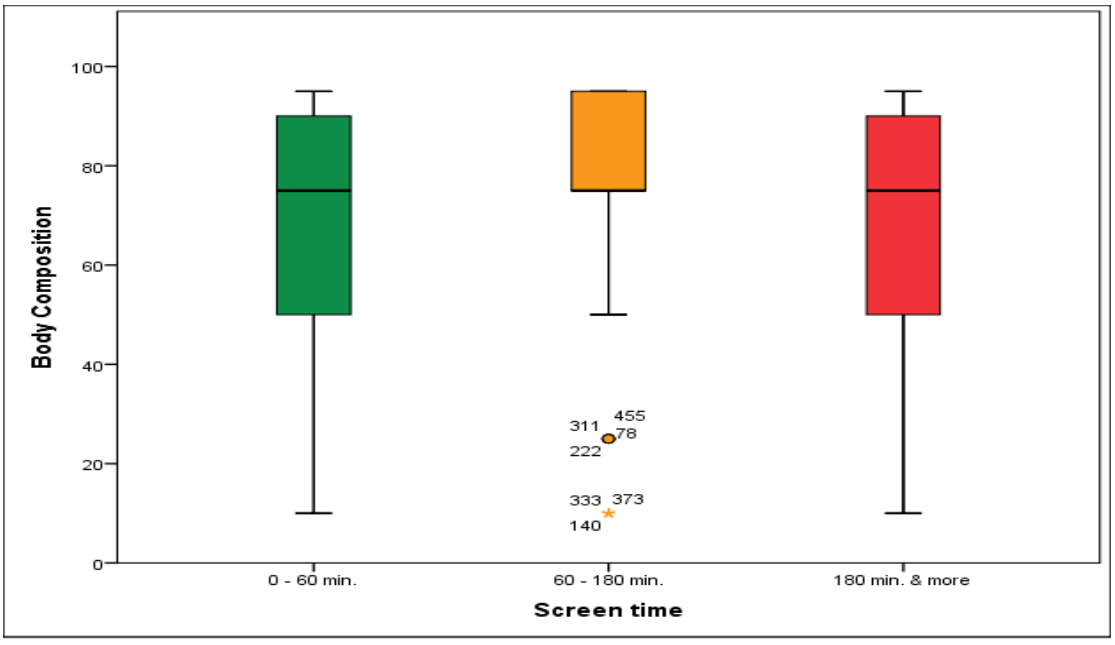

Figure 1: Box and whisker showing body composition among different screen time

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Table 3: Normality test of body composition (N=500)

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	P value	Statistic	df	P value
Body Composition	0.264	500	0.001	0.825	500	0.001

Table 3 presents the normality test results for body composition among 500 participants using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The Kolmogorov-Smirnov test yielded a statistic of **0.264** and a p-value of **0.001**, while the Shapiro-Wilk test produced a statistic of **0.825** and a p-value of **0.001**. Since the p-values in both tests were below the significance level of **0.05**, the results indicate that the body composition values significantly deviate from normality, confirming a non-normal distribution.

Table 4: Kruskal-Wallis Test showing differences in Body Composition across different levels of Screen Time (n=500)

	Screen time	N	Mean Rank	Kruskal-Wallis Test value	P value*
Body Composition	0 - 60 min.	222	219.67	21.268	0.001
	60 - 180 min.	158	286.23		
	180 min. & more	120	260.49		
	Total	500			

* = p value significant at 0.05 level of significance

Table 4 presented the results of the Kruskal-Wallis test, assessing differences in body composition across three screen time groups within a sample of 500 participants. The mean rank for the 0-60 minutes group (n=222) was 219.67, for the 60-180 minutes group (n=158) it was 286.23, and for the 180 minutes or more group (n=120) it was 260.49. The Kruskal-Wallis test value was 21.268

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with a p-value of 0.001, indicating a statistically significant difference in body composition across the different screen time groups at the 0.05 level of significance.

DISCUSSION

The study demonstrated significant associations between screen time and body composition, with increased screen time correlating with higher BMI and fat mass. This relationship, supported by the Kruskal-Wallis test ($p = 0.001$), underscores the detrimental impact of sedentary behaviour on adolescents' health.

Our findings align with evidence from **Wu et al. (2023)** and **Barnett et al. (2010)**, which highlight that increased screen time is associated with higher BMI and fat mass. In particular, Wu et al. emphasize the link between screen time and increased abdominal fat indices, mirroring our observation of unfavourable body composition metrics in adolescents with higher screen time.(Wu et al., 2023; Barnett et al., 2010)

Similarly, the association between prolonged screen time and unfavourable fat distribution, particularly visceral fat, as reported **Oei et al. (2023)**, corroborates our study's findings of higher body composition values in the high screen time group.(Oei et al., 2023) The consistency across these studies reinforces the robustness of the evidence linking screen time to increased adiposity.

Contrastingly, **Lehnhard et al. (2023)** explored the mitigating effects of physical activity on body composition and reported that adolescents with higher cardiorespiratory fitness experienced reduced waist circumference, even with significant screen exposure. This finding suggests a buffering role of physical activity, which aligns with our observations of potential lifestyle factors that can moderate the impact of screen time.(Lehnhard et al., 2023)

A major strength of this study is the robust sample size (N=500), providing strong statistical power to detect associations across screen time groups. The use of the Kruskal-Wallis test further ensured accurate comparisons in the presence of non-normal data. However, the cross-sectional design limits causal inference, and reliance on self-reported screen time introduces the potential for recall bias. Additionally, the study does not account for confounding variables such as dietary habits, socioeconomic status, or genetic predispositions, which might influence body composition.

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This study reaffirms the hypothesis that increased screen time negatively affects body composition in adolescents, with higher screen time linked to elevated BMI and fat mass. Conversely, physical activity serves as a mitigating factor, underscoring the importance of promoting active lifestyles.

Future research should focus on longitudinal studies to establish causality and delve deeper into the interactions between screen time, physical activity, and other lifestyle factors. Tailored interventions considering individual metabolic and behavioural responses could provide more effective strategies to combat the adverse effects of sedentary behaviours.

CONCLUSION

This study highlights the significant relationship between screen time and body composition among adolescents. Descriptive statistics revealed variations in body composition metrics across different levels of screen time, with the highest mean body composition observed in the group with more than 180 minutes of screen exposure. The normality tests confirmed a non-normal distribution of body composition data, justifying the use of non-parametric analysis. The Kruskal-Wallis test further established statistically significant differences in body composition across the three screen time categories ($p = 0.001$). These findings underscore the impact of increased screen time on adverse body composition outcomes, emphasizing the importance of addressing screen time as a modifiable factor in promoting healthier lifestyles among adolescents.

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