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The Impact of Screen Time on Breathing Patterns and Respiratory Health in College Students

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Abstract

With increasing digitalization, prolonged screen time has become a prevalent lifestyle factor among college students. While excessive screen use is linked to postural dysfunction, its impact on breathing patterns remains underexplored. This study investigated the relationship between screen time and respiratory function in college students. A cross-sectional study was conducted on 80 students (mean age: 21.4 ± 2.3 years), categorized into low (≤4 hours/day) and high (>4 hours/day) screen time groups. Respiratory assessments included chest expansion, spirometry (FVC, FEV_1), respiratory rate, and breath-holding time. Forward head posture (FHP) was also evaluated. Pearson's correlation and multiple regression analysis examined associations between screen time and respiratory outcomes. Students with high screen time exhibited significantly reduced chest expansion ($p < 0.001$), lower FVC and FEV_1 ($p < 0.01$), increased respiratory rate ($p < 0.001$), and shorter breath-holding time ($p = 0.002$). Screen time negatively correlated with chest expansion ($r = -0.48$, $p < 0.001$) and positively with respiratory rate ($r = 0.52$, $p < 0.001$). Regression analysis indicated screen time and FHP as significant predictors of reduced lung function ($R^2 = 0.41$, $p < 0.001$). These findings suggest prolonged screen exposure alters breathing patterns and impairs respiratory function in college students. Postural correction, breathing exercises, and screen-time management strategies may help mitigate these effects. Future studies should explore long-term implications and interventions to preserve respiratory health in the digital era.

Keywords: Screen time, Breathing patterns, Respiratory function.

1. INTRODUCTION

The increasing reliance on digital devices has led to a significant rise in screen time among college students, raising concerns about its potential effects on physical health. While previous studies have extensively explored the impact of prolonged screen exposure on posture, vision, and cognitive function, its influence on respiratory health remains largely underexplored. Breathing patterns play a crucial role in maintaining respiratory efficiency, influencing oxygen exchange, lung function, and overall well-being (Ragnarsdóttir M & Kristinsdóttir EK 2006) . However, altered breathing mechanics, often associated with poor posture and sedentary behavior, can lead to respiratory inefficiencies and dysfunction.

Prolonged screen time is often associated with a forward head posture, rounded shoulders, and thoracic kyphosis, all of which contribute to restricted diaphragmatic movement and shallow breathing patterns (Bhat C. et. al 2024). Studies suggest that forward head posture reduces ribcage mobility and alters

respiratory mechanics, leading to increased reliance on upper chest breathing rather than diaphragmatic breathing. Such breathing inefficiencies have been linked to decreased lung capacity, increased respiratory rate, and reduced oxygenation, all of which can impact both physical and cognitive performance (Han J. 2016).

Despite the growing concern over screen time and its potential health implications, limited research has investigated its direct relationship with respiratory function. This study aims to assess the impact of screen time on breathing patterns and respiratory health among college students. Specifically, we examine the association between screen time and respiratory parameters, including chest expansion, respiratory rate, breath-holding capacity, and lung function, to determine whether excessive screen exposure contributes to altered breathing mechanics.

2. Methodology

This cross-sectional study was conducted among college students aged 18–25 years. Participants were recruited through convenience sampling from a university setting. After obtaining informed consent, they were categorized into three groups based on their self-reported daily screen time:

- **Low screen time:** ≤ 3 hours/day (n = 27)
- **Moderate screen time:** 4–6 hours/day (n = 26)
- **High screen time:** ≥ 7 hours/day (n = 27)

Inclusion Criteria

- College students aged 18–25 years
- No history of respiratory, cardiovascular, or neurological disorders
- Non-smokers
- No recent history of acute illness affecting respiration

Exclusion Criteria

- Diagnosed respiratory conditions (e.g., asthma, COPD)
- Structural spinal deformities affecting posture
- Engagement in professional-level athletic training
- Current participation in respiratory therapy or breathing exercises

Outcome Measures

To assess the impact of screen time on respiratory function, the following parameters were evaluated:

1. **Chest Expansion:** Measured at the xiphoid level using a flexible measuring tape. The difference in chest circumference between full expiration and full inspiration was recorded in centimeters.
2. **Respiratory Rate (RR):** Counted manually over one minute in a resting state.
3. **Breath Holding Time (BHT):** Assessed as the duration (in seconds) that a participant could hold their breath after a deep inhalation.
4. **Spirometry Measures:** Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second (FEV_1) were recorded using a calibrated spirometer to evaluate pulmonary function.

Participants were asked to complete a demographic questionnaire, including information on their daily screen time, physical activity levels, and health history. They were then guided through the breathing

assessments in a quiet room to minimize distractions. All measurements were taken at the same time of day to control for circadian variations in lung function.

Statistical Analysis

Data analysis was performed using SPSS (v.26). Descriptive statistics were used to summarize demographic data and respiratory parameters. One-way ANOVA was conducted to compare respiratory parameters among the three screen-time groups. Pearson's correlation analysis was used to examine relationships between screen time and respiratory function. Multiple regression analysis was performed to determine whether screen time significantly predicted respiratory outcomes. A significance level of **$p < 0.05$** was considered statistically significant.

3. Results

Demographic and Clinical Characteristics

A total of 80 participants (mean age: 21.3 ± 2.1 years, 40 males and 40 females) were included in the study. The mean daily screen time was 5.8 ± 2.6 hours, with 27 participants categorized as low screen time users (≤3 hours/day), 26 as moderate screen time users (4-6 hours/day), and 27 as high screen time users (≥7 hours/day). The baseline characteristics of participants are presented in Table 1.

Table 1. Demographic and Clinical Characteristics of Participants

Variable	Low Screen Time (n=27)	Moderate Screen Time (n=26)	High Screen Time (n=27)	p-value
Age (years)	21.1 ± 2.3	21.4 ± 1.9	21.5 ± 2.1	0.732
Gender (M/F)	13/14	12/14	15/12	0.822
Screen Time (hrs/day)	2.5 ± 0.6	5.1 ± 0.8	8.7 ± 1.2	<0.001**
Physical Activity (hrs/week)	3.2 ± 1.1	2.5 ± 0.9	1.4 ± 0.7	0.004**

(*p < 0.05 is statistically significant, *$p < 0.001$ highly significant*)

Effect of Screen Time on Breathing Parameters

One-way ANOVA analysis revealed a significant difference in chest expansion, respiratory rate, breath-holding time (BHT), and spirometry measures (FVC and FEV_1) across the three screen-time groups. Higher screen time was associated with reduced chest expansion, increased respiratory rate, and decreased lung function parameters. Post-hoc comparisons (Bonferroni correction) showed that high screen time users had significantly poorer respiratory function compared to both low and moderate screen time users ($p < 0.05$).

Table 2. Comparison of Respiratory Parameters Among Screen Time Groups

Variable	Low Screen Time	Moderate Screen Time	High Screen Time	p-value
Chest Expansion (cm)	4.2 ± 0.6	3.5 ± 0.7	2.8 ± 0.5	<0.001**
Respiratory Rate (breaths/min)	14.1 ± 1.9	16.5 ± 2.2	18.9 ± 2.4	<0.001**
Breath Holding Time (sec)	46.2 ± 6.3	38.9 ± 5.8	30.7 ± 5.1	<0.001**

FVC (L)	3.8 ± 0.5	3.2 ± 0.4	2.7 ± 0.5	<0.001**
FEV_1 (L)	3.1 ± 0.4	2.6 ± 0.3	2.1 ± 0.4	<0.001**

(*p < 0.05 is statistically significant, *p < 0.001 highly significant)

Correlation Between Screen Time and Respiratory Parameters

Pearson's correlation analysis revealed a significant negative correlation between screen time and chest expansion ($r = -0.62$, $p < 0.001$), as well as breath-holding time ($r = -0.58$, $p < 0.001$), indicating that higher screen exposure was associated with reduced thoracic mobility and lower breath-holding capacity. Conversely, a significant positive correlation was found between screen time and respiratory rate ($r = 0.55$, $p < 0.001$), suggesting that increased screen time led to rapid, shallow breathing.

Table 3. Correlation Between Screen Time and Respiratory Measures

Variable Comparison	Pearson's r	p-value
Screen Time vs. Chest Expansion	-0.62	<0.001**
Screen Time vs. Respiratory Rate	0.55	<0.001**
Screen Time vs. Breath Holding Time	-0.58	<0.001**
Screen Time vs. FVC	-0.48	0.002**
Screen Time vs. FEV_1	-0.45	0.004**

(*p < 0.05 is statistically significant, *p < 0.001 highly significant)

Predictors of Respiratory Dysfunction in College Students

A multiple regression analysis was conducted to assess whether screen time, physical activity, and posture were significant predictors of respiratory dysfunction. The model was statistically significant ($F(3,76) = 18.52$, $p < 0.001$, $R^2 = 0.41$), indicating that these factors explained 41% of the variance in respiratory health.

- Screen time ($\beta = -0.47$, $p < 0.001$) emerged as the strongest predictor, suggesting that prolonged screen exposure had the most significant impact on breathing function.
- Physical activity ($\beta = 0.32$, $p = 0.002$) had a protective effect, with higher activity levels being associated with better respiratory function.
- Forward head posture ($\beta = -0.29$, $p = 0.004$) was also a significant predictor, indicating that postural changes linked to screen use contributed to respiratory dysfunction.

Table 4. Multiple Regression Analysis for Predicting Respiratory Dysfunction

Predictor Variable	Standardized β	p-value
Screen Time (hrs/day)	-0.47	<0.001**
Physical Activity (hrs/week)	0.32	0.002**
Forward Head Posture	-0.29	0.004**

(*p < 0.05 is statistically significant, *p < 0.001 highly significant)

4. Discussion

The present study examined the impact of screen time on respiratory function among college students and found that prolonged screen exposure was significantly associated with altered breathing patterns and reduced pulmonary function. The findings align with existing literature suggesting that excessive

screen use contributes to sedentary behavior, poor posture, and subsequent respiratory impairment.

Effect of Screen Time on Breathing Patterns

The results demonstrated that students with higher screen time exhibited significantly increased respiratory rates and reduced breath-holding capacity. This suggests a shift toward shallow, rapid breathing, which may be attributed to prolonged static postures, reduced diaphragmatic activity, and increased sympathetic nervous system activation (Shah I.K et al. 2023). Similar findings have been reported in studies linking screen use with stress-induced breathing alterations, particularly in individuals engaged in prolonged digital device usage for academic or recreational purposes (Jung S.I el. Al. 2016).

Impact on Thoracic Mobility and Lung Function

A key finding of this study was the significant reduction in chest expansion and spirometry parameters (FVC and FEV_1) among high screen time users. This suggests that prolonged screen exposure may contribute to restrictive breathing patterns, likely due to the adoption of a slouched posture, which limits rib cage mobility and diaphragmatic excursion (Feldman G. et. al. 2023). Previous research has shown that forward head posture and thoracic kyphosis—common postural deviations associated with screen use—negatively impact pulmonary function by reducing vital capacity and lung compliance.

Posture-Related Mechanisms

One plausible explanation for the observed respiratory changes is the biomechanical impact of prolonged sitting and forward head posture. When individuals maintain a slouched or forward-flexed position, there is a decrease in diaphragmatic efficiency and an increase in accessory muscle recruitment, leading to an inefficient breathing pattern. The significant correlation between screen time and reduced chest expansion in this study supports this hypothesis, indicating that prolonged exposure to digital screens may indirectly contribute to respiratory dysfunction through postural adaptations (Kunal K, Arora S 2022).

Role of Physical Activity in Respiratory Health

The regression analysis indicated that physical activity was a significant protective factor against screen time-induced respiratory impairments. Participants who engaged in regular physical activity exhibited better lung function and greater chest expansion compared to those with sedentary lifestyles. This finding reinforces the importance of exercise in maintaining optimal respiratory function, particularly in individuals with high screen exposure. Aerobic exercise has been shown to improve lung capacity, enhance diaphragmatic strength, and counteract the effects of prolonged sedentary behavior (Cheng YJ et. al. 2023).

Potential Physiological and Psychological Influences

Beyond biomechanical factors, the influence of physiological and psychological stress related to screen use cannot be ignored. Prolonged screen time, particularly in academic settings, has been linked to mental fatigue, anxiety, and autonomic dysregulation, which can contribute to dysfunctional breathing patterns. Increased sympathetic nervous system activity during prolonged screen exposure may lead to heightened respiratory rates and reduced breath-holding time, as observed in this study (Oswald TK et. al. 2020). These findings highlight the potential interplay between screen-related cognitive stress and respiratory function.

While this study provides valuable insights into the relationship between screen time and respiratory function, certain limitations must be acknowledged. First, the reliance on self-reported screen time data may introduce recall bias, as participants might overestimate or underestimate their actual screen usage.

Future studies should consider objective tracking methods, such as screen-time monitoring applications, to enhance accuracy. Second, the cross-sectional design of this study limits the ability to establish causality between prolonged screen exposure and respiratory function impairments. Longitudinal studies are needed to assess the long-term effects of screen use on breathing patterns and lung function. Finally, although physical activity and posture were considered, other potential confounding factors, such as body mass index (BMI), stress levels, and sleep patterns, were not accounted for in this study. These variables may have influenced respiratory outcomes and should be incorporated into future research to provide a more comprehensive understanding of the interplay between digital habits and respiratory health. Future research should explore intervention strategies, such as structured breathing exercises and postural correction programs, to assess their effectiveness in counteracting screen-related respiratory impairments. Additionally, studies examining the impact of different types of screen-based activities (e.g., academic vs. recreational screen use) on respiratory function may provide further insights.

5. Conclusion

This study highlights a significant association between prolonged screen time and impaired respiratory function in college students. The findings emphasize the need for awareness regarding the respiratory implications of excessive screen exposure and suggest that postural correction, regular physical activity, and breathing exercises may serve as effective strategies to mitigate these effects. Given the increasing digitalization of education and work environments, further research is warranted to develop targeted interventions aimed at preserving respiratory health in screen users.

References:

1. Bhat C, Saji R, KB RB. Effect of screentime in college students during the COVID-19 online classes on their neck posture and postural control: an observational study. International Journal of Research in Medical Sciences. 2024 Mar;12(3):813.
2. Cheng YJ, Macera CA, Addy CL, Sy FS, Wieland D, Blair SN. Effects of physical activity on exercise tests and respiratory function. British journal of sports medicine. 2003 Dec 1;37(6):521-8.
3. Feldman G, Westine M, Edelman A, Higgs M. A Mindful Alternative to Screen Time: The Short-Term Effects of a Breath-Focused Mindfulness Exercise vs. Unstructured Smartphone Screen Time on Heart Rate Variability and Relaxation. Journal of Social and Clinical Psychology. 2023 Dec;42(6):581-607.
4. Han J, Park S, Kim Y, Choi Y, Lyu H. Effects of forward head posture on forced vital capacity and respiratory muscles activity. Journal of physical therapy science. 2016;28(1):128-31.
5. Jung SI, Lee NK, Kang KW, Kim K, Lee DY. The effect of smartphone usage time on posture and respiratory function. Journal of physical therapy science. 2016;28(1):186-9.
6. Kunal K, Arora S. The Impact of Postural Defect on Respiratory Impairment in Collegiate Students: A Narrative Review. International journal of health sciences.;6(S4):8375-84.
7. Oswald TK, Rumbold AR, Kedzior SG, Moore VM. Psychological impacts of “screen time” and “green time” for children and adolescents: A systematic scoping review. PloS one. 2020 Sep 4;15(9):e0237725.
8. Ragnarsdóttir M, Kristinsdóttir EK. Breathing movements and breathing patterns among healthy men and women 20–69 years of agereference values. Respiration. 2006 Feb 1;73(1):48-54.
9. Shah IK, Kumar A, Rajasekar S, Pathak AA, Suvarna N, Gopal K, Muthukrishnan R. Association

between Smartphone Addiction and Breathing Pattern in Sedentary Young College-Going Students–A Cross-Sectional Study. Nigerian Journal of Clinical Practice. 2023 Nov 1;26(11):1637-41.