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Original article

Additive Effect of High Sugar Intake and Prolonged Screen Exposure on Cognitive Performance in Young Adults

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Abstract
This study examined the combined effects of sugar intake and screen exposure on concentration and fatigue among medical students. A cross-sectional survey of 133 participants assessed dietary habits, daily screen use, and cognitive outcomes. Analysis revealed that students with daily sugar consumption had the highest percentage of low concentration (45.1%), whereas those who rarely or never consumed sugar demonstrated the strongest concentration outcomes (55.6% high concentration). The association between sugar intake frequency and concentration levels was statistically significant ($\chi^2 = 12.15$, df = 4, p = 0.016). Similarly, prolonged screen exposure (>7 hours/day) was linked to elevated moderate (n = 28) and low concentration (n = 17) levels, together with reduced fatigue resistance (n = 11). In contrast, students limiting screen use to less than two hours per day exhibited the lowest incidence of low concentration (n = 3) and greater resilience to fatigue. Combined analysis suggested an additive effect, with high sugar intake and prolonged screen exposure jointly predicting poorer concentration and higher fatigue complaints, although this association was not statistically significant ($\chi^2 = 19.43$, df = 16, p = 0.247). These findings highlight the importance of reducing free sugar intake and moderating screen time to preserve cognitive performance and support long-term brain health in student populations.
Keywords: *Sugar Intake, Screen Time, Concentration, Mental Fatigue, Medical Students.*

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Introduction

Cognitive performance in students is increasingly recognized as being influenced by modifiable lifestyle behaviors, particularly dietary sugar intake and screen exposure. Excessive consumption of free and added sugars has been linked to neuroinflammation, impaired hippocampal function, and reduced efficiency in memory and learning processes. Evidence from both experimental and human studies suggests that frequent high-sugar consumption negatively affects attention and working memory, with younger populations appearing especially vulnerable to these effects (1,2).

Parallel to dietary influences, prolonged screen time has emerged as another critical factor affecting cognition. Excessive use of digital devices has been associated with attentional dysregulation, executive function difficulties, and poorer academic achievement, with mechanisms thought to involve disrupted sleep, overstimulation of reward pathways, and reduced sustained attentional control (3,4).

Previous studies have highlighted that these two behaviors often co-occur in student populations, compounding their effects on concentration and fatigue. For example, high dietary sugar intake has been shown to impair learning and memory efficiency, while screen exposure further weakens attention networks and executive control, leading to poorer cognitive outcomes (5). Longitudinal evidence also suggests that lifestyle factors such as diet quality and screen use interact to influence academic achievement and cognitive resilience (6). Neuroimaging studies provide further support, showing that high sugar intake and prolonged screen exposure are associated with reduced cortical thickness in regions essential for memory and executive control (7).

The World Health Organization has emphasized reducing free sugar intake to improve energy stability and cognitive clarity (8), while emerging biomarker research suggests that these daily habits may influence long-term brain health and risk for neurodegenerative conditions such as Alzheimer's disease (9). The present study, therefore, investigates the relationship between sugar intake frequency and concentration levels, evaluates the impact of screen exposure duration on concentration and mental fatigue, and explores the combined effects of these lifestyle factors on cognitive outcomes.

Methods

Data Collection

Data were collected in December 2025 through an online questionnaire created using Google Forms. The participants were students from the Faculty of Medicine at Al-Maaref International University, with a total of 133 individuals voluntarily providing information on demographics, sugar intake habits, screen-time behaviors, sleep patterns, and self-reported cognitive assessments.

Study Selection

The study employed a convenience sampling method, targeting students who voluntarily chose to complete the survey. Inclusion criteria required participants to be aged 16 years or older, currently enrolled in either secondary or university-level education, and to have completed all required items in the questionnaire. Responses that were incomplete or submitted by non-students were excluded from the analysis.

Data Extraction

Responses were exported to SPSS software for statistical processing. Sugar intake was classified into three groups: daily consumption, a few times per week, and rarely or never. Screen-time behavior was divided into four categories: less than two hours, two to four hours, five to seven hours, and more than seven hours per day. Concentration levels were assessed using a five-point focus scale, which was subsequently grouped into high, moderate, and low categories. Mental fatigue was evaluated based on self-reported experiences of tiredness after screen use and daily fatigue, and responses were categorized as yes, no, or sometimes.

To explore the relationships between lifestyle habits and cognitive outcomes, three analytic tables were produced. The first examined the association between sugar intake and both concentration and fatigue, the second focused on screen-time patterns in relation to concentration and fatigue, and the third combined sugar intake and screen-time patterns to assess their joint influence on concentration levels.

Statistical Analysis

The data were cleaned and analyzed descriptively using SPSS. Frequencies and percentages were calculated to summarize participant characteristics and lifestyle behaviors. Cross-tabulations were performed to examine the distribution of concentration levels across categories of sugar intake and screen exposure. Chi-square tests were applied to assess the statistical significance of observed associations, with p-values reported in the results tables, and a threshold of $p < 0.05$ considered statistically significant.

Ethical Considerations

This study was conducted in accordance with ethical research standards. Participation was entirely voluntary, and all respondents provided informed consent prior to completing the questionnaire. The purpose of the study, the confidentiality of responses, and the right to withdraw at any time were clearly explained to participants. No identifying personal information was collected, and data were analyzed anonymously to ensure privacy and integrity. Approval

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for the study was obtained from the Faculty of Medicine at Al-Maaref International University, and the research adhered to institutional and international guidelines for human subject's research.

Results

The distribution of concentration levels across different sugar intake frequencies among the study population of 133 students revealed clear patterns. Students who reported daily sugar consumption showed the highest proportion of low concentration (45.1%). In contrast, those consuming sugar a few times per week demonstrated a more balanced distribution, with moderate concentration being most common (40%) and a lower incidence of low concentration (23.6%). Students who rarely or never consumed sugar exhibited the highest proportion of high concentration (55.6%) and the lowest proportion of low concentration (14.8%). Statistical analysis confirmed that these differences were significant (χ^2 test, p = 0.016) (Table 1).

Table 1. Distribution of Concentration Levels by Sugar Intake Frequency among 133 Medical Students

Sugar Consumption	High Concentration	Moderate Concentration	Low Concentration	Total (n)	p-value
Daily	13	15	23	51	**0.016**
A few times a week	20	22	13	55	
Rarely/Never	15	8	4	27	

Screen exposure showed a similar influence on concentration and fatigue outcomes. Students with the highest screen exposure (>7 hours/day) demonstrated the greatest proportions of moderate (n = 28) and low concentration (n = 17), together with reduced fatigue resistance (n = 11). Screen use of 5–7 hours/day was also associated with elevated moderate concentration scores (n = 26). In contrast, students who used screens for less than 2 hours/day exhibited the lowest incidence of low concentration (n = 3) and showed greater resilience to mental fatigue. Although these patterns suggest a negative impact of prolonged screen use on cognitive performance, statistical analysis using the chi-square test did not yield a significant association across screen exposure categories (χ^2 = 161.92, df = 8, p > 0.05), likely due to sparse data in some subgroups (Figure 1).

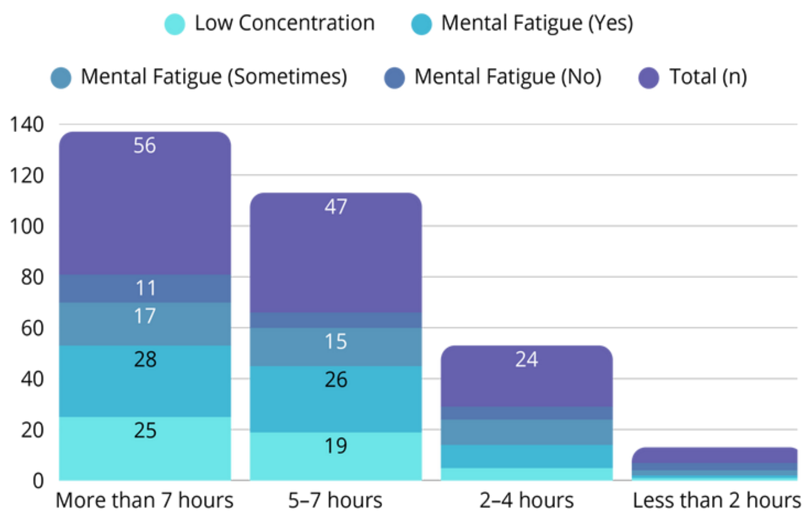

Figure 1. Distribution of Concentration and Fatigue Levels by Screen Time Exposure among Medical Students (n = 133)

The combined analysis of sugar intake and screen exposure further highlighted the compounded effects of these lifestyle habits. Students with high sugar intake and prolonged screen exposure (>5-7 hours/day) exhibited the highest counts of moderate (n=14) and low concentration (n=18). Conversely, those with low sugar intake and minimal screen time (<2 hours/day) showed the highest proportion of high concentration (n=3) and no cases of low concentration, suggesting a protective effect. Moderate screen use (2–4 hours/day) combined with reduced sugar intake was associated with relatively balanced concentration outcomes, while excessive screen time consistently correlated with diminished concentration regardless of sugar intake level. Statistical testing, however, indicated that the overall association across the combined categories was not statistically significant (χ^2 test, p = 0.247) (Table 2).

Table 2. Combined Effects of Sugar Intake and Screen Time on Concentration Levels Among Medical Students (n = 133)

Sugar Intake / Screen Time	High Concentration	Moderate Concentration	Low Concentration	P value
Daily / More than 5–7 hours	13	14	18	0.247
Daily / 2–4 hours	1	1	2	
Daily / Less than 2 hours	0	1	0	
A Few Times a Week / More than 5–7 hours	11	15	13	
A Few Times a Week / 2–4 hours	6	7	2	
A Few Times a Week / Less than 2 hours	0	1	0	
Rarely/Never / More than 5–7 hours	6	9	3	
Rarely/Never / 2–4 hours	4	1	0	
Rarely/Never / Less than 2 hours	3	1	0	

Discussion

The present study highlights the compounded influence of sugar intake and screen exposure on concentration and fatigue among medical students. The finding that daily sugar consumption was associated with the highest proportion of low concentration is consistent with evidence that diets high in free sugars impair hippocampal-dependent memory and reduce synaptic plasticity (10). Kanoski and Davidson (2011) demonstrated that Western-style diets rich in sugar and fat disrupt hippocampal function, leading to cognitive impairment (10). More recent biomarker studies confirm that elevated glucose levels correlate with reduced hippocampal microstructure and poorer memory outcomes (11). These mechanisms provide a biological explanation for the observed decline in concentration among students with frequent sugar intake.

Screen exposure showed a parallel negative effect, with students reporting more than seven hours per day of screen use exhibiting the highest rates of moderate and low concentration, alongside reduced fatigue resistance. This aligns with neuroimaging evidence that prolonged screen exposure is associated with reduced cortical thickness in regions essential for executive control and attention (12). Horowitz-Kraus and Hutton (2018) found that increased screen-based media exposure was linked to weaker brain connectivity in children, while time spent reading strengthened networks associated with attention and comprehension (12). Such findings support the interpretation that excessive screen use may weaken attentional networks, contributing to the patterns observed in this study.

The combined analysis revealed an additive effect, with students who both consumed sugar daily and engaged in prolonged screen exposure showing the greatest number of low concentration cases and fatigue complaints. This dual impact reflects the interconnectedness of lifestyle behaviors. Visier-Alfonso et al. (2023) reported that screen time mediates the relationship between diet quality and academic achievement, suggesting that poor dietary habits and excessive screen use may jointly undermine cognitive resilience (13). Sleep disruption associated with screen overuse may further exacerbate the negative effects of poor diet, compounding risks for attentional instability and fatigue (14).

These findings have important implications for long-term brain health. Emerging evidence suggests that lifestyle factors such as diet and screen exposure may influence early biomarkers of neurodegenerative disease. Livingston et al. (2020)

emphasized that modifiable risk factors—including diet quality and cognitive engagement—play a critical role in dementia prevention (15). The observation that healthier behaviors, such as reduced sugar intake and limited screen time, were associated with improved concentration and fatigue resilience in this study supports the growing consensus that daily habits can shape cognitive trajectories across the lifespan.

Conclusion

This study provides evidence that high sugar intake and prolonged screen exposure exert a compounded negative effect on concentration and fatigue resilience among medical students. Conversely, healthier lifestyle behaviors—such as reduced sugar consumption and controlled screen use—are associated with improved cognitive outcomes. These findings align with recent neurological and public health literature and reinforce international recommendations to reduce free sugar intake and moderate screen use to preserve cognitive clarity and long-term brain health.

Conflict of interest. Nil

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