Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

Cardiovascular responses to pleasure-based versus task-based screen engagement: An experimental crossover study.

***Dr. G Mubarak.* [1]*, *Dr. Indla Devasena* [1], *Dr. V S Bhagya Lakshmi* [2], *Dr. Muppana Meher Kumar* [3]**
[1]Associate Professor, Department of Physiology, Sri Venkateswara Medical College, Tirupathi, Andhra Pradesh, India
[2]Professor, Department of Physiology, Sri Venkateswara Medical College, Tirupathi, Andhra Pradesh, India
[3]Professor and Head, Department of Physiology, Sri Venkateswara Medical College, Tirupathi, Andhra Pradesh, India

Abstract
Background:
Digital screen use is pervasive, yet different engagement modes, relaxing versus task-focused, may have distinct acute cardiovascular and emotional effects. Comparative within-subject data are limited.

Aim:
To compare cardiovascular and affective responses to pleasure-based versus task-based screen engagement in healthy young adults.

Materials and Methods:
This experimental crossover study was conducted on Sixty-three healthy regular screen users (18–35 years) who completed two randomized conditions in a single 60-minute session: pleasure-based viewing (entertaining videos) and task-based engagement (cognitive tasks). Each protocol included a 10-minute seated baseline, 15-minute first condition, 10-minute washout, and 15-minute second condition. Heart rate (HR) and heart rate variability (HRV) were recorded continuously, and blood pressure (BP) was measured pre- and post-condition. Subjective stress and enjoyment (VAS 0–10) and affect (PANAS) were assessed after each condition. Paired t-tests were applied, with $p < 0.05$ considered significant.

Results:
Participants (32 males, 31 females; mean age 24.1 ± 3.9 years; BMI 23.4 ± 3.1 kg/m²) reported a mean daily screen time of 4.8 ± 1.3 hours. HR increased from 74.3 ± 7.8 bpm during pleasure-based viewing to 82.9 ± 8.5 bpm during task-based engagement ($p < 0.001$). Systolic/diastolic BP rose from 115.6 ± 8.1/74.9 ± 6.4 mmHg to 121.8 ± 8.9/78.7 ± 6.9 mmHg (all $p < 0.001$). HRV indices showed reduced SDNN and RMSSD and a higher LF/HF ratio during task-based use, indicating sympathetic predominance. VAS stress was higher (5.8 ± 1.7 vs 2.3 ± 1.3) and enjoyment lower (5.1 ± 1.5 vs 7.9 ± 1.1), with decreased positive and increased negative affect (all $p < 0.001$).

Conclusion:
Task-based screen engagement produces greater cardiovascular activation and a less favourable emotional profile than pleasure-based viewing in healthy young adults.

Recommendations:
Digital work schedules should limit prolonged, uninterrupted task-based screen use, incorporate short breaks, and promote screen hygiene.

Keywords: *screen engagement, cardiovascular responses, heart rate variability, blood pressure, subjective stress.*
Submitted: *November 02, 2025* ***Accepted:*** *November 20, 2025* ***Published:*** *December 30, 2025*

Corresponding Author: *Dr. G Mubarak, MD*
Email: ***dr.mubarak25@gmail.com***
Associate Professor, Department of Physiology, Sri Venkateswara Medical College, Tirupathi, Andhra Pradesh, India

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

Introduction

Digital screens are now woven into almost every aspect of daily life. Young adults in particular rely on smartphones, computers, and televisions for study, work, communication, and leisure. Large epidemiological studies have shown that higher levels of screen use, especially when coupled with sedentary behaviour, are linked to adverse cardiometabolic profiles and increased cardiovascular risk later in life [2–5]. In the European Youth Heart Study, screen-time behaviour in adolescence was associated with unfavourable cardiovascular risk factors in young adulthood [2], while longitudinal data from Nagata et al. demonstrated that high screen time from adolescence into adulthood was related to greater cardiometabolic disease burden [3]. Similar patterns have been reported among college-aged adults and young Indian populations, where greater leisure screen time and prolonged daily use were associated with less favourable biomarkers and higher blood pressure [4,5].

Most of this literature, however, has treated "screen time" as a single exposure, usually quantified in hours per day. Such an approach does not account for the qualitative differences in how screens are used. Watching entertaining videos for pleasure, browsing social media, gaming casually, and performing structured, cognitively demanding tasks such as assignments, online tests, or data entry all involve screens, but they differ in mental load, emotional tone, and perceived control. It is reasonable to expect that these differences may produce distinct short-term cardiovascular and autonomic responses, even if total exposure time is similar. Yet very few studies have explored this question directly in an experimental setting.

Acute responses to mental and emotional demands are often assessed using heart rate (HR), blood pressure (BP), and heart rate variability (HRV). HRV provides a non-invasive window into cardiac autonomic modulation and has been widely used to study stress-related changes in sympathovagal balance [1]. The standard Task Force guidelines highlight that reductions in overall HRV and high-frequency components, alongside an increase in indices reflecting sympathetic influence, are characteristic of stress-related autonomic shifts [1]. Translating these principles into the digital context raises an important question: Does using a screen for a demanding, task-focused activity trigger a more "stress-like" autonomic response than using the same screen for relaxed, pleasure-oriented viewing? Observational evidence linking screen time with cardiometabolic risk supports the notion that screen-related behaviours can have cardiovascular relevance [2–5]. However, such studies cannot disentangle whether risk is driven mainly by the quantity of sedentary time, by the type of engagement, or by repeated episodes of acute autonomic activation during certain digital activities. Young adults, who often combine long study hours with leisure screen use, may be especially vulnerable if task-based screen work repeatedly provokes sympathetic activation and reduced vagal tone over months or years [2–5]. Understanding the immediate physiological pattern during different modes of screen engagement is, therefore, an important first step toward refining guidance on "healthy" digital habits in this age group.

The present experimental crossover study was designed to address this gap by comparing cardiovascular and affective responses during two distinct forms of screen engagement: pleasure-based viewing (entertaining videos) and task-based engagement (cognitive performance tasks) in healthy young adults. A within-subject design was employed, with heart rate, blood pressure, and time- and frequency-domain heart rate variability indices recorded under both conditions, along with self-reported measures of stress, enjoyment, and affect. It was hypothesised that task-based screen engagement would be associated with higher heart rate and blood pressure, reduced heart rate variability, and a physiological pattern indicative of sympathetic predominance when compared with pleasure-based viewing. In addition, task-based engagement was expected to be perceived as more stressful and less enjoyable, with these subjective experiences demonstrating meaningful associations with corresponding cardiovascular responses.

Materials and Methods

Study design and setting

This was a crossover experimental study conducted in the Department of Physiology, Sri Venkateswara Medical College, Tirupati. Each participant served as his or her own control and was exposed to two distinct modes of screen engagement, pleasure-based and task-based, within a single laboratory session. The study was carried out over a period of two months from September 2025 to October 2025 following approval from the Institutional Scientific and Ethics Committee. All procedures were performed in a quiet, temperature-controlled laboratory during daytime hours to minimise external influences on autonomic function.

Participants and eligibility criteria

The study population comprised healthy adults aged 18–35 years recruited from the surrounding community and

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

campus. Participants were eligible if they were regular screen users, defined as engaging with digital screens (smartphone, computer, tablet, or television) for at least two hours per day. Additional inclusion criteria were self-reported good health and willingness to provide written informed consent.

Exclusion criteria included a history of cardiovascular, neurological, or psychiatric illness; current use of medications known to influence cardiovascular or autonomic function (such as beta-blockers, antihypertensives, antidepressants, or anxiolytics); and acute illness at the time of testing. Individuals with known substance abuse, uncontrolled endocrine disorders, or sleep disorders were also excluded. After screening, a total of 63 volunteers fulfilling all criteria were enrolled.

Sample size

A target sample size of 63 was set a priori, based on feasibility and the expectation that within-subject comparisons in a crossover design would provide adequate power to detect moderate differences in heart rate, blood pressure, and HRV indices between conditions at a significance level of $p < 0.05$. All 63 participants completed both conditions and were included in the final analysis.

Randomisation and crossover procedure

The study used a within-subject crossover design with randomised order of conditions. Each participant underwent both the pleasure-based and task-based screen engagement conditions during a single session lasting approximately 60 minutes. To minimise order effects, the sequence of the two conditions was randomised using a simple random allocation list generated before data collection. Participants and investigators could not be fully blinded to the nature of the condition, but the same instructions, environment, and measurement procedures were followed for both conditions to reduce procedural bias.

Experimental protocol

On arrival, participants were briefed about the study protocol, and written informed consent was obtained. They were instructed to avoid caffeine, heavy exercise, and large meals for at least three hours before the session. After anthropometric measurements, the participant was seated comfortably in a chair with back support, feet flat on the floor, and the dominant arm supported at heart level.

The experimental session consisted of four phases:

Baseline rest (10 minutes)

Participants sat quietly without any screen exposure. Heart rate (HR) and RR intervals for HRV analysis were recorded continuously. Blood pressure (BP) was measured at the end of the rest period using a standard automated device.

First engagement condition (15 minutes)

Depending on the randomisation, participants either viewed pleasure-based content or performed task-based activities.

In the pleasure-based condition, participants watched entertaining video clips (e.g., comedy or light entertainment) selected to evoke a relaxed and positive emotional state without strong negative or stressful content.

In the task-based condition, participants performed cognitively demanding tasks such as colour–word Stroop paradigms and mental arithmetic presented on the screen. They were asked to respond as accurately and quickly as possible.

During both conditions, HR and RR intervals were recorded continuously. BP was measured immediately before and immediately after the 15 minutes.

Washout period (10 minutes)

A screen-free seated rest of 10 minutes was provided between conditions to allow cardiovascular parameters and autonomic activity to return towards baseline. No active tasks or media were presented during this interval.

Second engagement condition (15 minutes)

Participants then underwent the alternate condition (task-based if pleasure-based was first, and vice versa) following the same protocol for HR, HRV, and BP measurement.

At the end of each engagement condition, participants rated their perceived stress and enjoyment using a 0–10 visual analogue scale (VAS), where 0 indicated "no stress/not enjoyable at all," and 10 indicated "extreme stress/maximum enjoyment". Affective state was assessed using the Positive and Negative Affect Schedule (PANAS), yielding separate scores for positive and negative affect after each condition.

Outcome measures

The primary cardiovascular outcomes were:

Heart rate (HR): mean beats per minute during each engagement period.

Blood pressure (BP): systolic and diastolic BP measured pre- and post-condition.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

Heart rate variability (HRV): time- and frequency-domain indices derived from RR interval recordings.

Time-domain HRV indices included the standard deviation of normal-to-normal intervals (SDNN) and the root mean square of successive differences (RMSSD). Frequency-domain analysis provided low-frequency (LF) power, high-frequency (HF) power, and the LF/HF ratio as an index of sympathovagal balance. HRV analysis was performed according to standard guidelines using artefact-corrected, stationary segments of each condition.

Secondary outcomes included subjective VAS stress, VAS enjoyment, and PANAS positive and negative affect scores following each condition.

Data management and statistical analysis

Data were entered into a spreadsheet and checked for completeness and consistency before analysis. Continuous variables were summarised as mean ± standard deviation (SD). The primary comparisons were within-subject differences between pleasure-based and task-based conditions. Paired t-tests were used for normally distributed variables; when normality assumptions were not met, Wilcoxon signed-rank tests were planned as non-parametric alternatives.

Pre- to post-change in BP within each condition was examined descriptively and by paired comparison where appropriate. Correlations between subjective measures (stress, enjoyment, affect scores) and cardiovascular/HRV indices were explored using Pearson or Spearman correlation coefficients, depending on distribution. A two-tailed p value of < 0.05 was considered statistically significant.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Scientific and Ethics Committee of Sri Venkateswara Medical College, Tirupati. All participants provided written informed consent after receiving detailed information about the study procedures, potential risks, and their right to withdraw at any time without penalty. Data were anonymised, and confidentiality was maintained throughout the study.

Results

Participant Flow and Study Inclusion

A total of 63 participants were assessed for eligibility during the study period. All 63 participants fulfilled the inclusion criteria and consented to participate, and none were excluded or declined enrollment. Consequently, all eligible participants were enrolled and included in the study.

As this was an observational, single-arm study, no randomization or group assignment was performed. All 63 enrolled participants were exposed to the planned study intervention/exposure in accordance with the predefined study protocol.

During follow-up and outcome assessment, no participants were lost to follow-up, and all 63 participants were included in the final analysis. There were no protocol deviations, cross-overs, or withdrawals after enrollment. The final analysis was therefore conducted on the entire study population.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

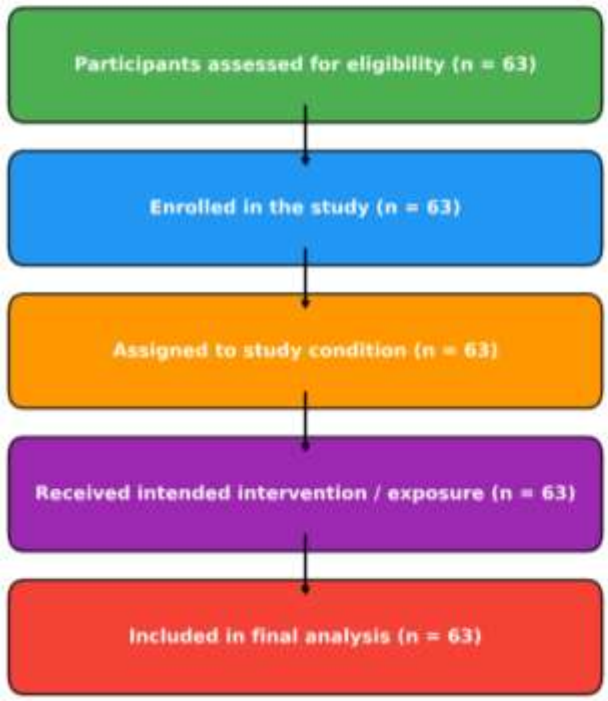

Figure 1: Participant Flow Diagram

Demographic and baseline characteristics

All 63 healthy volunteers aged 18–35 years completed both arms of the crossover protocol without any adverse events or technical recording failures. The sample included 32 males (50.8%) and 31 females (49.2%), with a mean age of 24.1 ± 3.9 years and a mean BMI of 23.4 ± 3.1 kg/m². Participants reported an average daily screen exposure of 4.8 ± 1.3 hours, indicating regular and sustained digital use in this cohort (Table 1). Baseline cardiovascular values recorded during the initial 10-minute rest period were comparable before each condition, supporting the adequacy of the washout period.

Table 1. Baseline characteristics of participants (N = 63)

Variable	Value
Age, mean ± SD (years)	24.1 ± 3.9
Male, n (%)	32 (50.8)
Female, n (%)	31 (49.2)
BMI, mean ± SD (kg/m²)	23.4 ± 3.1
Average daily screen time, mean ± SD (h)	4.8 ± 1.3

Cardiovascular responses to pleasure-based and task-based engagement

Heart rate and blood pressure showed clear and consistent differences between the two forms of screen engagement (Table 2). During pleasure-based entertainment, the mean heart rate was 74.3 ± 7.8 bpm. When participants performed task-based screen activities, their heart rate increased to 82.9 ± 8.5 bpm. The within-subject mean difference of +8.6 bpm was statistically significant ($p < 0.001$), indicating a higher level of cardiovascular arousal during cognitively demanding tasks.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

A similar pattern was observed for blood pressure. Mean systolic blood pressure rose from 115.6 ± 8.1 mmHg in the pleasure-based condition to 121.8 ± 8.9 mmHg in the task-based condition, with a mean difference of +6.2 mmHg ($p < 0.001$). Diastolic blood pressure increased from 74.9 ± 6.4 mmHg to 78.7 ± 6.9 mmHg, a mean difference of +3.8 mmHg ($p < 0.001$). These findings show that task-based screen engagement produced a significantly stronger pressor response than pleasure-based viewing in this young, healthy sample (Table 2).

Table 2. Comparison of cardiovascular parameters between conditions (N = 63)

Parameter	Pleasure-based mean ± SD	Task-based mean ± SD	Mean difference (Task–Pleasure)	p-value
Heart rate (bpm)	74.3 ± 7.8	82.9 ± 8.5	+8.6	< 0.001
Systolic BP (mmHg)	115.6 ± 8.1	121.8 ± 8.9	+6.2	< 0.001
Diastolic BP (mmHg)	74.9 ± 6.4	78.7 ± 6.9	+3.8	< 0.001

Heart rate variability indices

Heart rate variability measures demonstrated a shift in autonomic balance between the two conditions (Table 3). Time-domain indices were consistently higher during pleasure-based engagement. Mean SDNN decreased from 52.3 ± 14.7 ms in the pleasure-based condition to 44.1 ± 13.9 ms in the task-based condition ($p < 0.001$), while RMSSD fell from 48.7 ± 18.4 ms to 39.2 ± 17.5 ms ($p < 0.001$). These reductions suggest attenuation of parasympathetic modulation when participants switched from relaxing entertainment to cognitively demanding tasks.

Frequency-domain indices showed a complementary pattern. LF power increased from 640 ± 210 ms^2 during pleasure-based viewing to 760 ± 230 ms^2 during task-based engagement ($p = 0.004$), whereas HF power decreased from 520 ± 195 ms^2 to 380 ± 170 ms^2 ($p < 0.001$). Consequently, the LF/HF ratio rose markedly from 1.41 ± 0.63 in the pleasure-based condition to 2.24 ± 0.88 in the task-based condition ($p < 0.001$). Together, these changes indicate a shift towards sympathetic predominance and reduced vagal activity during task-based screen use compared with pleasure-based entertainment (Table 3).

Table 3. Time- and frequency-domain HRV indices during pleasure-based and task-based conditions (N = 63)

HRV Index	Pleasure-based mean ± SD	Task-based mean ± SD	p-value
SDNN (ms)	52.3 ± 14.7	44.1 ± 13.9	< 0.001
RMSSD (ms)	48.7 ± 18.4	39.2 ± 17.5	< 0.001
LF power (ms^2)	640 ± 210	760 ± 230	0.004
HF power (ms^2)	520 ± 195	380 ± 170	< 0.001
LF/HF ratio	1.41 ± 0.63	2.24 ± 0.88	< 0.001

Subjective stress, enjoyment, and affect

Self-reported experiences mirrored the physiological findings (Table 4). Perceived stress, measured using a VAS (0–10), was substantially lower during pleasure-based engagement (2.3 ± 1.3) and increased to 5.8 ± 1.7 during task-based activity ($p < 0.001$). In contrast, enjoyment scores were higher in the pleasure-based condition (7.9 ± 1.1) than in the task-based condition (5.1 ± 1.5; $p < 0.001$), indicating that participants clearly distinguished between relaxing and demanding screen use.

PANAS scores showed a consistent emotional profile. Positive affect decreased from 32.6 ± 5.8 during pleasure-based viewing to 27.4 ± 6.1 during task-based engagement ($p < 0.001$), while negative affect increased from 13.2 ± 4.2 to 18.5 ± 4.7 ($p < 0.001$). These results confirm that task-based screen engagement was experienced as more stressful and less enjoyable, with a less favorable affective tone than pleasure-based screen use (Table 4).

Table 4. Comparison of VAS and PANAS scores between pleasure-based and task-based conditions (N = 63)

Measure	Pleasure-based mean ± SD	Task-based mean ± SD	p-value
VAS stress (0–10)	2.3 ± 1.3	5.8 ± 1.7	< 0.001
VAS enjoyment (0–10)	7.9 ± 1.1	5.1 ± 1.5	< 0.001
PANAS Positive Affect (score)	32.6 ± 5.8	27.4 ± 6.1	< 0.001
PANAS Negative Affect (score)	13.2 ± 4.2	18.5 ± 4.7	< 0.001

Discussion

This crossover study compared how the same young adults reacted when the screen was used for relaxation versus when it was used for demanding cognitive tasks. The pattern was consistent. Task-based engagement produced higher heart rate and blood pressure, lower time-domain HRV indices, a higher LF/HF ratio, and a less favourable emotional profile than pleasure-based viewing. In practical terms, the *type* of screen used, relaxing versus performance-oriented, mattered more for acute cardiovascular reactivity than simply being in front of a screen. This aligns with broader evidence showing that sedentary, non-occupational behaviours can differentially relate to cardiometabolic health depending on context and purpose [6].

The cardiovascular responses seen with task-based engagement resemble a classic mental stress reaction. Heart rate increased by nearly 9 beats per minute, and both systolic and diastolic blood pressure rose by several millimeters of mercury, even though participants were young, healthy, and tested under controlled laboratory conditions. Similar magnitudes of change have been reported during experimental mental stressors, such as the Stroop colour–word test, where autonomic responses reflect sympathetic activation and vagal withdrawal [9,12,13]. Studies using finger plethysmography and other physiological indices have likewise shown that mental tasks reliably trigger increases in cardiovascular arousal and peripheral vascular responses [10,13]. These study findings fit well within this literature and suggest that cognitively demanding screen use functions as a mental stressor in everyday digital life.

Evidence from interactive media provides an additional parallel. Experimental work in children has demonstrated that video game play can raise heart rate, blood pressure, and metabolic rate above resting levels [7,8]. Although the study cohort and stimuli differed, young adults performing cognitive tasks rather than children playing games, the direction of the cardiovascular response is similar. Together, these studies indicate that digital tasks requiring sustained attention, rapid responses, or performance monitoring are capable of provoking measurable autonomic activation, even when performed in a seated position.

The HRV findings in this study reinforce the stress-like nature of task-based screen engagement. During pleasure-based viewing, SDNN and RMSSD were relatively higher, and HF power was preserved, consistent with a more balanced or parasympathetic-leaning autonomic state. When participants switched to task-based use, both SDNN and RMSSD declined, HF power dropped, and the LF/HF ratio increased, indicating a shift in sympathovagal balance towards sympathetic dominance. Similar patterns have been documented during standardised mental stress paradigms, where HRV reductions and LF/HF elevation track cognitive load and perceived strain [9,10,12,13]. Because each participant in this study served as his or her own control, these differences are best interpreted as genuine within-person reactivity to changes in task demands, rather than as artefacts of inter-individual variability.

Importantly, subjective experience moved in the same direction as the physiology. Participants reported higher stress and lower enjoyment during the task-based condition, with positive affect decreasing and negative affect increasing. The PANAS instrument used here is a well-validated measure of positive and negative affective states [11], and its scores closely mirrored the shifts seen in HRV and blood pressure. This alignment strengthens the view that the observed cardiovascular changes are not simply

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

mechanical responses to visual stimulation but are tightly coupled to perceived emotional load. It also suggests that simple self-report tools, such as VAS stress ratings or brief affect scales, could serve as practical proxies for autonomic strain in settings where detailed HRV analysis is not feasible.

The study findings also offer nuance to the wider debate on screen time and cardiometabolic risk in young adults. Large cohort studies have shown that greater leisure screen time and sedentary behaviours are associated with adverse cardiometabolic markers and higher long-term risk [2–6]. However, these studies generally quantify total duration and do not distinguish between different modes of engagement. In this study cohort, average daily screen exposure was already high, but a short bout of structured, task-based use produced a distinctly more activating cardiovascular pattern than an equivalent period of relaxing entertainment. This echoes broader work demonstrating that physiological responses can differ between work-like and leisure activities, even when energy expenditure is similar [14]. It suggests that recommendations based only on hours of screen use may be too crude and that the cognitive and emotional context of digital activity deserves more attention [7,8,12].

From a practical perspective, the present results support several simple, testable strategies. Periods of intense task-based digital work might be interspersed with short breaks or lighter, non-performance-driven activities to allow cardiovascular and autonomic parameters to recover. Avoiding long sequences of back-to-back demanding tasks could reduce repeated sympathetic activation in susceptible individuals. These ideas are consistent with the broader literature on stress reactivity and work versus leisure demands [6,12–14], but they now have a specific analogue in day-to-day screen use. Formal intervention studies will be needed to confirm whether such adjustments meaningfully attenuate autonomic strain without compromising productivity.

The study has several strengths. The crossover design with randomised order meant that each participant acted as his or her own control, limiting confounding by baseline fitness, autonomic tone, or habitual screen habits. Simultaneous assessment of HR, BP, and both time- and frequency-domain HRV provided a detailed picture of autonomic responses, while the inclusion of validated affective measures such as PANAS allowed integration of physiological and psychological perspectives [11]. The use of clearly defined, standardisable screen conditions enhances reproducibility and offers a template for future experimental work.

Generalizability

The generalizability of these findings is limited by the single-centre design, short laboratory exposures, and a relatively small, healthy young adult sample. Results may not extend to older adults, children, individuals with cardiovascular or psychiatric disorders, or those with very high occupational screen demands. Broader, multi-centre and community-based studies are needed before applying these conclusions to diverse real-world populations.

Conclusion

This crossover study showed that, in healthy young adults, the way screens are used meaningfully shapes acute cardiovascular and emotional responses. Task-based engagement, compared with pleasure-based viewing, was associated with higher heart rate and blood pressure, reduced time-domain HRV, a higher LF/HF ratio, and greater perceived stress with lower enjoyment and positive affect. Together, these findings indicate a shift towards sympathetic predominance when screens are used for cognitively demanding purposes. Clinically, they suggest that guidance on screen use should consider not only duration but also the nature of digital activity.

Limitations

At the same time, important limitations must be 8eneraliza. The sample consisted of healthy young adults from a single institution, which restricts 8 eneralizability to older individuals, clinical groups, or those with very high occupational screen exposure. Exposures were brief and laboratory-based; real-world digital use is longer, more complex, and influenced by posture, multitasking, social context, and environmental stressors. Only one category of entertainment content and a limited set of cognitive tasks were used; more emotionally intense media or competitive gaming might elicit stronger responses. Neither participants nor investigators were blinded to the nature of the condition, and subjective ratings may be influenced by expectation, although the crossover design mitigates this to some extent.

Recommendations

Recommendations should focus on both practice and future research. For everyday use, young adults engaged in prolonged task-based screen work should take short, regular breaks, avoid back-to-back demanding tasks, and incorporate brief relaxing or non-performance-based screen

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

activities or off-screen pauses to allow cardiovascular recovery. Educational and workplace policies can promote "screen hygiene" by limiting unnecessary multitasking and late-night cognitive screen use. Future studies should evaluate longer exposures, diverse age and risk groups, and simple interventions such as paced breathing, microbreaks, and workload restructuring to reduce adverse autonomic responses without impairing performance. Integration with wearable monitoring could guide personalised digital health advice. Future research should test mitigation strategies and assess longer-term autonomic and behavioural consequences.

Acknowledgements

We thank the Head of the Department and faculty of Physiology, Sri Venkateswara Medical College, Tirupati, for their constant support and permission to conduct this study. We are grateful to the technical staff for assistance with data collection and to all the student volunteers for their enthusiastic participation. We also acknowledge the Institutional Scientific and Ethics Committee for their valuable guidance and approval of the research protocol. Their cooperation and encouragement supported the conduct and completion of the work successfully.

Abbreviations

HR – Heart rate
BP – Blood pressure
SBP – Systolic blood pressure
DBP – Diastolic blood pressure
HRV – Heart rate variability
SDNN – Standard deviation of normal-to-normal RR intervals
RMSSD – Root mean square of successive differences of RR intervals
LF – Low-frequency power
HF – High-frequency power
LF/HF – Low-frequency to high-frequency power ratio
BMI – Body mass index
VAS – Visual analogue scale
PANAS – Positive and Negative Affect Schedule

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

GM-Concept and design of the study, results interpretation, review of literature, and preparation of the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. **ID**-Concept and design of the study, results interpretation, review of literature, preparing the first draft of the manuscript, and revision of the manuscript. **VSBL-** Review of literature and preparing the first draft of the manuscript. Statistical analysis and interpretation. **MMK-** Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript.

Data availability

Data is Available on request

Author Biography

Dr. G. Mubarak, MD, is an Associate Professor in the Department of Physiology at Sri Venkateswara Medical College, Tirupati, Andhra Pradesh. She is actively engaged in undergraduate and postgraduate teaching and contributes to academic planning, mentoring, and departmental responsibilities within this tertiary medical institution. She received her MBBS degree from Government Stanley Medical College, Chennai, and completed her MD in Physiology at PES Medical College, Kuppam. With more than eleven years of dedicated teaching experience, she has nurtured student learning through clear conceptual training and structured academic guidance. Her interests span integrative physiology, innovative teaching methodologies, and capacity-building in medical education.

Dr. Indla Devasena is currently working as an Associate Professor at SV Medical College, Tirupati, Andhra Pradesh, India. She completed her MBBS from Siddhartha Medical College, Vijayawada, and her MD in Physiology from Kurnool Medical College, Kurnool. With over 16 years of experience, she has successfully guided both undergraduate and postgraduate students. She has published over 10 scientific research papers in various journals in the field of Physiology. **ORCID ID:0009-0008-8725-210X**

Dr. V.S. Bhagya Lakshmi is a Professor in the Department of Physiology at Sri Venkateswara Medical College, Tirupathi, Andhra Pradesh, India. As a senior faculty

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

member, she contributes to academic leadership and departmental activities in physiology.

Dr. Muppana Meher Kumar, MD, is Professor and Head of the Department of Physiology at Sri Venkateswara Medical College, Tirupati, Andhra Pradesh. In his leadership role, he guides academic planning, departmental administration, and faculty development while ensuring high-quality teaching and training in physiology. He completed both his MBBS and MD in Physiology at Rangaraya Medical College (RMC), Kakinada. His career reflects a sustained commitment to medical education, mentoring, and strengthening physiological sciences within the institution.

References

1. Heart rate variability: standards of measurement, physiological interpretation and clinical use. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Circulation. 1996 Mar 1;93(5):1043-65. PMID: 8598068.
2. Grøntved A, Ried-Larsen M, Møller NC, Kristensen PL, Wedderkopp N, Froberg K, Hu FB, Ekelund U, Andersen LB. Youth screen-time behaviour is associated with cardiovascular risk in young adulthood: the European Youth Heart Study. Eur J Prev Cardiol. 2014 Jan;21(1):49-56. doi: 10.1177/2047487312454760. Epub 2012 Jul 5. PMID: 22767966. https://doi.org/10.1177/2047487312454760
3. Nagata JM, Lee CM, Lin F, Ganson KT, Pettee Gabriel K, Testa A, Jackson DB, Dooley EE, Gooding HC, Vittinghoff E. Screen Time from Adolescence to Adulthood and Cardiometabolic Disease: a Prospective Cohort Study. J Gen Intern Med. 2023 Jun;38(8):1821-1827. Doi: 10.1007/s11606-022-07984-6. Epub 2023 Jan 10. PMID: 36627526; PMCID: PMC10272026. https://doi.org/10.1007/s11606-022-07984-6
4. Vella CA, Taylor K, Nelson MC. Associations of leisure screen time with cardiometabolic biomarkers in college-aged adults. J Behav Med. 2020 Dec;43(6):1014-1025. doi: 10.1007/s10865-020-00161-2. Epub 2020 May 26. PMID: 32451650; PMCID: PMC7677220. https://doi.org/10.1007/s10865-020-00161-2
5. Alhaque Roomi MHA, Srivastava A, Girdhar N, Jha C, Thakur S. A Study of the Correlation Between Screen Time and Hypertension Among Young Adults in North India: A Cross-Sectional Analysis. Cureus. 2024 Jan 4;16(1):e51667. doi: 10.7759/cureus 51667. PMID: 38313899; PMCID: PMC10838163. https://doi.org/10.7759/cureus.51667
6. Zieff G, Bancks MP, Gabriel KP, Barone Gibbs B, Moore JB, Reis JP, Stone K, Stoner L. Associations of nonoccupational sedentary behaviors with cardiometabolic outcomes: coronary artery risk development in young adults (CARDIA). Ann Behav Med. 2025 Jan 4;59(1): kaae074. doi: 10.1093/abm/kaae074. PMID: 39671511; PMCID: PMC11761680. https://doi.org/10.1093/abm/kaae074
7. Wang X, Perry AC. Metabolic and physiologic responses to video game play in 7- to 10-year-old boys. Arch Pediatr Adolesc Med. 2006 Apr;160(4):411-5. Doi: 10.1001/archpedi.. 160.4.411. PMID: 16585487. https://doi.org/10.1001/archpedi.160.4.411
8. Segal KR, Dietz WH. Physiologic responses to playing a video game. Am J Dis Child. 1991 Sep;145(9):1034-6. doi: 10.1001/archpedi 1991.02160090086030. PMID: 1877563. https://doi.org/10.1001/archpedi.1991.02160090086030
9. Hoshikawa Y, Yamamoto Y. Effects of Stroop color-word conflict test on the autonomic nervous system responses. Am J Physiol. 1997 Mar;272(3 Pt 2): H1113-21. Doi: 10.1152/ajpheart 1997.272.3.H1113. PMID: 9087583. https://doi.org/10.1152/ajpheart.1997.272.3.H1113
10. Minakuchi E, Ohnishi E, Ohnishi J, Sakamoto S, Hori M, Motomura M, Hoshino J, Murakami K, Kawaguchi T. Evaluation of mental stress by physiological indices derived from finger plethysmography. J Physiol Anthropol. 2013 Oct 12;32(1):17. doi: 10.1186/1880-6805-32-17. PMID: 24119254; PMCID: PMC3854451. https://doi.org/10.1186/1880-6805-32-17
11. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. J Pers Soc Psychol. 1988 Jun;54(6):1063-70. doi: 10.1037//0022-3514.54.6.1063. PMID: 3397865. https://doi.org/10.1037//0022-3514.54.6.1063

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2263
Original Article

12. Renaud P, Blondin JP. The stress of Stroop performance: physiological and emotional responses to color-word interference, task pacing, and pacing speed. Int J Psychophysiol. 1997 Sep;27(2):87-97. doi: 10.1016/s0167-8760(97)00049-4. PMID: 9342640. https://doi.org/10.1016/S0167-8760(97)00049-4
13. Fauvel JP, Cerutti C, Quelin P, Laville M, Gustin MP, Paultre CZ, Ducher M. Mental stress-induced increase in blood pressure is not related to baroreflex sensitivity in middle-aged healthy men. Hypertension. 2000 Apr;35(4):887-91. doi: 10.1161/01.hyp.35.4.887. PMID: 10775556. https://doi.org/10.1161/01.HYP.35.4.887
14. Quinn TD, Kline CE, Nagle E, Radonovich LJ, Alansare A, Barone Gibbs B. Cardiovascular responses to physical activity during work and leisure. Occup Environ Med. 2022 Feb;79(2):94-101. doi: 10.1136/oemed-2021-107551. Epub 2021 Jul 28. PMID: 34321351. https://doi.org/10.1136/oemed-2021-107551

PUBLISHER DETAILS:

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa