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Psychological and physiological effects of online gaming on adolescents: a descriptive cross-sectional study on sleep quality and internet gaming disorder in rural Karnataka, India

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ABSTRACT

The cheap smart phones and mobile internet access has led to increased online gaming in adolescents, but very little research has been done in India to assess the psychological and physiological consequences. Adolescence is a time of heightened susceptibility to gaming-related health problems including Internet Gaming Disorder (IGD) and sleep disturbance. Objectives of this study were to assess the level of sleep quality and severity of Internet Gaming Disorder (IGD) among school-going adolescents, to explore the association of daily duration of gaming with these outcomes, and to determine significant socio-demographic and gaming-related predictors. A descriptive cross sectional study was conducted among 136 adolescents (15-18 years) of Government Pre-University College, Harohalli, Karnataka by cluster sampling. Data were collected by Pittsburgh Sleep Quality Index (PSQI) and Internet Gaming Disorder Scale-Short Form (IGDS9-SF), and descriptive statistics, Pearson correlation and chi-square tests were used for the analysis. Majority (57%) reported poor sleep quality (PSQI 11-21), 36.8% had moderate disruption and only 6.6% had good sleep. Daily gaming hours were significantly correlated with poor sleep quality ($r = 0.357$, $p < 0.01$) and severity of IGD ($r = 0.363$, $p < 0.01$). Gender, game genre, and daily gaming hours were significant predictors of sleep quality ($p < .05$ for all). Age, gender, class, game genre, daily gaming hours, and the availability of gadgets were significant predictors of IGD ($p < .05$ for all). Behavioural variables related to gaming were more predictive of adolescent health outcomes than socio-demographic variables. We need school-based digital wellness interventions, parental guidance programs and nursing-led screening protocols.

Keywords: Adolescents, Internet gaming disorder, Sleep quality, Cross-sectional studies, Online gaming, Rural population, India.

INTRODUCTION

The leisure time of Indian teenagers has changed dramatically with the rapid growth of digital infrastructure in India, low-cost smartphones, cheap data plans and widespread 4G/5G coverage. What was once a niche pastime has now become one of the most dominant leisure pursuits of teenagers across the country. At present, Indian adolescents are using gaming applications for 3-4 hours daily, and this has increased considerably during and post COVID-19 pandemic [1].

The World Health Organisation (WHO) officially recognised Gaming Disorder in the 11th Revision of the International Classification of Diseases (ICD-11). It describes this disorder as a pattern of gaming behaviour characterised by impaired control, an increasing prioritisation of gaming over other activities and continued engagement despite negative consequences. The American Psychological Association also listed Internet Gaming Disorder (IGD) in DSM-5 as a condition that requires more study. The prevalence of IGD is estimated to be between 0.7%-11.9% worldwide, with a pooled prevalence of about 4.6% in recent meta-analyses [2-4].

This problem is of particular urgency in the Indian context.

India has over 250 million adolescents. The prevalence of IGD has been reported to be 0.6% to 10.6% in different regions [5-8]. However, there is a lack of holistic research involving both the psychological and physiological outcomes among Indian adolescents, especially in semi-urban and rural settings. Most of the Indian studies are limited to college students and mainly focused on the prevalence of IGD. Quality of sleep in relation to IGD is rarely assessed.

Adolescence is a neurobiologically sensitive period. Virtual games have built-in reinforcement mechanisms like instant rewards, competition leaderboards, and immersive social environments that could exert particularly strong influences on the development of reward pathways. Excessive gaming has been linked to anxiety, depression, emotional dysregulation, social isolation and academic decline. Physiologically, long-term gaming has been linked with sleep disturbances, eye strain, musculoskeletal pain, sedentary behaviour and fatigue.

The present study was conducted to bridge the gap identified by studying sleep quality and severity of IGD among adolescents in a semi-rural Karnataka government college using validated instruments. Such understanding is important to design evidence-based nursing interventions and public health strategies suitable to the Indian adolescent context [9].

MATERIALS AND METHODS

Study design and setting

A descriptive and cross-sectional research design was used. The study was conducted in the Government Pre-University College (PU College), Harohalli, Ramanagara District, Karnataka, India, a semi-rural locality from November 2024 to January 2025. Ethical clearance for the study has been obtained from the Institutional Ethics Committee of the College of Nursing Sciences, Dayananda Sagar University. A statement that ethics committee approval and written informed consent of participants and, for participants under the age of 18 years, of parents or guardians have been obtained.

Participants and sampling

Study population: Adolescents between 15-18 years of age actively playing internet-based games and enrolled at the study site. We used cluster sampling with classrooms as clusters. The sample size of 136 was determined using Cochran's formula at 95% confidence (p = 0.5, d = 0.05).

Inclusion criteria were: (a) adolescents aged between 15 and 18 years, (b) play internet-based games for at least 3 h per week and (c) written informed consent. Exclusion criteria: (a) previously diagnosed with a psychiatric or sleep disorder; (b) absent on the day of data collection or refusal to participate.

Instruments

Data were collected using a structured questionnaire divided into three parts. The first part (Part A) included socio-demographic and gaming-related variables such as age, gender, class of study, number of siblings, birth order, parental education and occupation, game genre, hobbies, daily gaming hours and availability of devices.

In Part B, sleep was assessed using the Pittsburgh Sleep Quality Index (PSQI), a 19-item self-report measure that has been widely validated to measure seven components of sleep over the past month. Global scores are on a 0–21 scale, with scores >5 indicating poor sleep quality (Cronbach's $\alpha = 0.70–0.83$).

Part C used the Internet Gaming Disorder Scale-Short Form (IGDS9-SF), which is a nine-item 5-point Likert scale (1 = Never to 5 = Very Often) based on DSM-5 IGD criteria, with a higher score indicating greater severity (Cronbach's $\alpha = 0.87-0.94$).

Statistical analysis

Data were entered in Microsoft Excel and analysed by SPSS v25.0. Descriptive statistics (frequency, percentage, mean, standard deviation) were computed for all variables. The association between each outcome and daily hours of gaming was tested using Pearson's correlation coefficient. Chi-square tests were used to test the association between categorical variables and health outcomes. Statistical significance was set at $p < 0.05$ [10]

RESULTS

Socio-demographic characteristics

Of 136 participants, the majority were 17 years old (42.64%), followed by 16-year-olds (33.81%). Females constituted 55% (n = 75) and males 45% (n = 61). The majority were enrolled in 2nd PUC (75.01%, n = 102). The majority of the fathers were agricultural labourers (50.73%), and the majority of the mothers were housewives (71.32%), which indicates a rural socio-economic context. Educational games (27.94%), sports/racing (19.85%) and puzzle games (17.64%) had the largest proportion of games played. 71.32% of the participants played games for 1-2 hours daily, with only 2.2% playing more than four hours. Gadgets were not always available; 41.91% said they could rarely access gadgets. The details are in Table 1.

Table 1: Extractive values, extract colour and appearance in leaves of the selected plant

Variable	Category	n	%
Age (years)	15	6	4.40
	16	46	33.81
	17	58	42.64
	18	26	17.00
Gender	Male	61	45.00
	Female	75	55.00
Daily Gaming Hours	< 1 hour	18	13.23
	1–2 hours	97	71.32
	3–4 hours	18	13.23
	> 4 hours	3	2.20
Game Genre	Educational	38	27.94
	Sports & Racing	27	19.85
	Puzzle	24	17.64
Gadget Availability	Always	36	26.47
	Sometimes	43	31.61
	Rarely	57	41.91

Sleep Quality

The majority of participants (57%, n = 77) fell in the 'poor sleep quality' category (PSQI scores 11–21). A further 36.8% (n = 50) scored in the 'moderate' range (PSQI 6–10), and only 6.6% (n = 9) demonstrated good sleep quality (PSQI 0–5). The mean PSQI score was 4.38 (SD = 2.32). Distribution is shown in Table 2.

Table 2: Distribution of participants by sleep quality level (N = 136)

Sleep Quality (PSQI Score)	n	%	Mean	SD
Good (0–5)	9	6.60	4.38	2.32
Moderate (6–10)	50	36.80	—	—
Poor (11–21)	77	57.00	—	—

Internet gaming addiction

No participant reached clinically significant IGD severity. A total of 40.44% (n = 55) fell in the moderate range (IGDS scores 21–35), indicating emerging gaming-related difficulties. The majority (59.56%, n = 81) were in the 'good' range (IGDS scores 36–45). The mean IGDS score was 19.15 (SD = 5.10). See Table 3.

Table 3: Distribution of participants by internet gaming addiction level (N = 136)

IGD Category (IGDS Score)	n	%	Mean	SD
Good (36–45)	81	59.56	19.15	5.10
Moderate (21–35)	55	40.44	—	—
Severe (9–20)	0	0.00	—	—

Correlation analyses

A statistically significant positive correlation was observed between daily gaming hours and poor sleep quality ($r = 0.357$, $p < 0.01$), indicating that longer gaming duration was associated with worsening sleep. Similarly, daily gaming hours correlated significantly with IGD severity ($r = 0.363$, $p < 0.01$). See Table 4.

Table 4: Pearson correlation between daily gaming hours and health outcomes (N = 136)

Variable Pair	r	p Value
Daily gaming hours × Sleep Quality (PSQI)	0.357	< 0.01**
Daily gaming hours × IGD Severity (IGDS)	0.363	< 0.01**

*** p < 0.01*

Associations with demographic and gaming variables

Table 5: Chi-square association results for socio-demographic and gaming variables

Variable	Sleep Quality (p)	IGD (p)
Gender	0.003*	0.038*
Age	0.160 (NS)	0.002**
Class of study	0.610 (NS)	0.023*
Game genre	0.048*	< 0.001**
Daily gaming hours	< 0.001**	< 0.001**
Gadget availability	0.145 (NS)	0.004**
Parental education/occupation	NS	NS

*NS = not significant; * p < 0.05; ** p < 0.01*

Chi-square analysis revealed that gender ($\chi^2 = 29.53$, df = 12, $p = 0.003$), game genre ($\chi^2 = 93.16$, df = 72, $p = 0.048$), and daily gaming hours ($\chi^2 = 92.44$, df = 36, $p < 0.001$) were significantly associated with sleep quality. Parental education, occupation, birth order and number of siblings were not significant. For IGD, significant associations were found for age ($p = 0.002$), gender ($p = 0.038$), class of study ($p = 0.023$), game genre ($p < 0.001$), daily gaming hours ($p < 0.001$), and gadget availability ($p = 0.004$). Family-related variables were non-significant. Results are shown in Table 5.

DISCUSSION

The finding that 57% of participants exhibited poor sleep quality is consistent with international evidence. In their systematic review and meta-analysis of 33 studies and 26 countries, Kristensen et al. found consistent associations between problematic gaming and shorter sleep duration, poorer sleep quality, daytime somnolence and sleep complaints. Our correlation ($r = 0.357$, $p < 0.01$) between gaming hours and sleep quality supports the hypothesis that gaming duration adversely impacts sleep architecture—likely through blue-light-mediated melatonin suppression, psychological arousal from competitive play, and displacement of sleep time.

The prevalence of moderate IGD risk is 40.44%, which is higher than the pooled global estimate of approximately 4.6%, but direct comparisons are confounded by methodological heterogeneity. Importantly, none of the participants reached clinically significant IGD severity, which may reflect in part restricted access to gadgets (41.91% had gadgets only rarely), a structural protective factor in this semi-rural population. The significant correlation between gaming duration and IGD severity ($r = 0.363$, $p < 0.01$) aligns with findings from Ahmedabad by Barot et al., who reported IGD correlations with daily gaming duration exceeding three hours and identified weekly gaming hours as the strongest predictor of IGD among Indian adolescents.

Game genre emerged as a significant predictor of both outcomes ($p = 0.048$ for sleep quality; $p < 0.001$ for IGD). Thus, health may be affected differentially by genre-specific engagement patterns (session length, competitive pressure and social interaction elements). Across-the-board screen-time limits may not be as effective as genre-specific guidance.

Interestingly, there were no significant associations for parental education, occupation or family structure. The predominance of gaming-behavioural variables (duration, genre, gadget availability) over socio-economic background indicates that behaviour-specific interventions will be more effective in this population. Gender differences in gaming-related outcomes ($p = 0.003$ for sleep quality; $p = 0.038$ for IGD) are consistent with global literature showing male-predominant IGD prevalence. More research on gender-based gaming patterns and protective factors in the Indian context is warranted.

Findings from this nursing perspective provide support for the inclusion of validated brief screening tools such as the PSQI and IGDS9-SF in routine school health assessments. Early identification of at-risk gaming behaviour allows for timely referral and intervention, including sleep hygiene counselling and digital wellness education [11].

CONCLUSION

Amongst the gaming-related behavioural factors, daily gaming duration and game genre are the strongest predictors of poor sleep quality and risk of internet gaming addiction in adolescents in a semi- rural setting in Karnataka. Over half of participants exhibited poor sleep quality, and over 40% showed moderate IGD risk. The significant positive correlations ($r \approx 0.36$, $p < 0.01$) affirm the need for structured, evidence-based interventions. There were no significant associations with parental education and socio-economic background. These findings underscore the need for multi-stakeholder action: health education in schools on responsible gaming; parental supervision of screen access; nursing-led community screening; and policy frameworks on adolescent digital wellness. Future longitudinal studies with larger and more geographically diverse samples and with objective physiological measurements are recommended.

Limitations

Because the design is cross-sectional, no causal inferences can be drawn. Both outcomes are self-reported and subject to social desirability bias. The sample was drawn from one institution, which limits the generalisability to urban adolescents or private school students. Sleep architecture was not assessed objectively using actigraphy or polysomnography. Confounders such as peer pressure, academic stress and familial relationships were not fully controlled.

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Conflict of interest statement

The authors declare no conflicts of interest.

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