

CORRELATION BETWEEN INTERNET ADDICTION AND PHYSICAL ACTIVITY AMONG YOGYAKARTA STATE UNIVERSITY STUDENTS: THE MEDIATING ROLE OF SLEEP QUALITY

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Abstract: Internet addiction has become an increasingly prevalent concern among university students, adversely affecting various aspects of their quality of life. Overusing the internet is associated with sedentary behaviour, poor sleep quality and less physical activity, which could adversely impact students' health in general. The present study was conducted to investigate the correlation of internet addiction with physical activity in Yogyakarta State University's students because of sleep quality mediation. Quantitative cross-sectional design was used with purposive sampling of 210 respondents. Standardized questionnaires were administered, including the Internet Addiction (IA), Pittsburgh Sleep Quality Index (PSQI), and International Physical Activity Questionnaire (IPAQ). Path analysis and the Sobel test were used to analyse data from a mediation view. According to the results, there is a significant negative correlation between internet addiction and physical activity ($t = -8.225, p < 0.05$) and between internet addiction and sleep quality ($t = -7.86, p < 0.05$). Physical activity was highly positively associated with sleep quality ($t = 8.34, p < 0.05$). Additionally, the Sobel test ($Z = -8.31, p < 0.05$) showed that the mediating role of sleep quality in the association between internet addiction and physical activity was significant. These findings highlight the need for interventions in healthy use and sleep behaviour designed to enhance physical activity among students and overall well-being.

Keywords: Internet addiction, physical activity, sleep quality, mediating role, university students

INTRODUCTION

Internet addiction has been identified as an increasing issue, especially in adolescents and young adults. It also has detrimental effects on several health behaviours, such as diet, physical activity, and sleep quality, which present a complex health problem among students (Mathew et al., 2019). Several studies have shown a positive association between problematic internet use and the prevalence of mental health problems, e.g., anxiety and depression (Shafi et al., 2023; Domenech et al., 2023). Furthermore, internet-related technology addiction (e.g., internet and social networks) has been suggested to decrease physical activity and increase feelings of social isolation (Lee & Ahn, 2020), which can ultimately exacerbate psychiatric conditions. The association of internet addiction with academic achievement is important because excessive use of the Internet may usually interfere with the study characteristics and efficiency of students (Mathew et al., 2019).

On the other hand, regular exercise is widely reported to be salutary for mental health and general well-being. It helps in decreasing stress and increasing sleep quality in university students (Lindgård et al., 2019). A well-being model that builds physical activity into daily life can counteract some of the adverse effects of internet addiction. More specifically, research has shown that higher levels of physical activity are associated with lower work-related exhaustion and more favourable mental health (Lindgård et al., 2019). Exercise is not just good for the physical, but it is also a helpful way to deal with the psychological side effects of excessive internet use. The quality of sleep is another critical axis for perceiving the health dynamics of the students. Low-quality sleep has been demonstrated to be a side effect of and an epicentre for internet addiction (Sağar & Eren, 2022). Increased screen viewing due to internet use correlates with impaired sleep quality, leading to negative consequences for cognitive performance and academic achievement (Mao et al., 2022; Okano et al., 2019). More importantly, there is evidence that improving sleep should be a priority in breaking the pathway of internet addiction and associated mental health problems, as sound sleep can promote positive academic achievements and emotional well-being (Rafi et al., 2021).

The research evidence on these elements creates complexity in the lives of university students. Inasmuch as sleep quality functions as a mediator between internet addiction and physical activity, it is a crucial nexus for health intervention approaches. Encouraging physical activity and promoting good sleep hygiene would aid universities in reducing the harms associated with internet addiction, as well as promote student health and academic performance (SAĞAR & Eren, 2022; Rafi et al., 2021). Recent research has also demonstrated an association of IA with several physical and psychological health consequences, such as reduced physical activity or poor sleep quality. For instance, Liu et al. (2024) indicated that high internet addiction was associated with more depressive symptoms and lower physical activity levels among college students, suggesting they may overuse the Internet and suffer from health-related problems. Similarly, Noroozi et al. (2011) emphasized that excessive use of internet routines converges into an unhealthy way of living, considering factors such as sleep quality and general physical health. Thus, it stands to reason that Yogyakarta State University students' physical activity levels may be affected by their degree of internet addiction.

Overall, despite these results with respect to the co-occurrence of internet addiction, physical health, and sleep quality, several limitations merit attention. That is, despite many studies reporting that internet addiction is associated with low sleep quality (Ozcan & Acımiş, 2020), the mediating role of sleep quality between internet addiction and the physical activity relationship was not well explained for college students. For example, Peris et al. (2020) concluded that psychological variables play a predictive role in internet addiction and do not empirically investigate how sleep quality could influence these relationships. In addition, previous reviews have not fully explored how sleep quality could moderate the relationship between internet addiction and levels of physical activity in specific populations or soft variables, such as university students in Yogyakarta, Indonesia (e.g., Özparlak & Karakaya, 2020).

This paper aims to develop further the theories on internet addiction with physical symptoms, which include sleep quality as a mediating variable. Previous studies focused more on the linear relationships between IA and PA, overlooking the complex mechanisms involved in sleep. For example, research shows that overuse of the internet can hurt lifestyle and psychological well-being, which may then lead to reduced physical activity levels (Sun et al., 2025). The current study seeks to fill this gap by systematically examining the moderation effect of sleep quality on these two key influential processes, adding layers of understanding beyond existing models on the pathways inter-relating these constructs. Furthermore, by confining the discussion to a specific demographic (students at Yogyakarta State University), this study can contribute to the literature, which suggests that existing models have been considered universal factors. It can be validated in other situations, especially for the Southeast Asian community, with cultural factors affecting people's internet use habits as well as lifestyle. The relationship between cultural context and mental health, especially in university settings, is critical in the management of public health problems such as internet addiction (Doğru & Kabasakal, 2023). The moderate influence of sleep quality as a mediating factor on internet addiction not only expands knowledge about mediation mechanisms but also offers potential directions for intervention research. Exploring such mediating pathways could aid our understanding of why lifestyle interventions and mental health treatments are effective. Some studies indicate possible bidirectional relations between physical activity and indicators of mental health, although the exact dynamics need to be further investigated (Yang et al., 2022).

The results of this study can be used to develop policy and practical application in the field of Yogyakarta State University and related institutions. By investigating digital device use as a function of sleep mediation, insights are gained that could be useful for interventions aimed at drawing positive attention to students' technology habits. The role of good sleep quality highlights that interventions focusing on improving sleep hygiene might mitigate the negative impact of internet addiction on physical activity levels (Martino et al., 2020). This investigation can also be incorporated into campus health initiatives, such as prevention workshops for balanced internet use, encouraging physical activity, and monitoring sleep. Universities might be able to improve the overall well-being of students by promoting environments that consider the interconnectivity between the variables. This kind of integrated approach relates well to physical activity policy frameworks, which argue for a holistic health perspective within schools (Pogrmilović et al., 2019). Based on previous studies, it was hypothesized that internet addiction would negatively affect sleep quality and physical activity, while sleep quality would positively influence physical activity. Furthermore, it was suggested that sleep quality mediates the internet addiction-physical activity association among students at Yogyakarta State University.

METHODS

This research is a quantitative study with a cross-sectional design, which aims to analyse the relation among internet addiction, sleep quality, and physical activity of undergraduate students from the Sports Science at Yogyakarta State University. Survey responses were collected online from March 2025 to April 2025.

Inclusion: Participants were enrolled purposively through program WhatsApp groups and submitted an online Google Form, which commenced with an electronic informed-consent form. The inclusion criteria were being enrolled in the 1st year of a sports science degree (S1) and being physically active; non-students and individuals not practicing physical activity were excluded. The three instruments and demographic questions were interspersed in the online questionnaire. The study link was sent to the department's communications channels, and publications were anonymous, with a secure email system used. After reading an informed consent statement, respondents voluntarily completed the form. Bachelor students of the study population ($N \approx 445$) were registered for a sports Science course. Using the Yamane formula created by Taro-Yamane (Tapping, 1968) with a 5% error margin, the calculated value $n \approx 211$; the final sample analysis included 210 respondents who met the inclusion criteria.

Young Diagnostic Questionnaire (YDQ) is a well-known instrument to detect internet addiction, especially for problem use of the internet. Young, 1996), proven to be reliable and valid among Chinese adolescents (Li et al., 2014). The YDQ is an 8-item yes/no measure with a score of 0–8 (each item scored for “yes”=1 and “no”=0). Larger scores indicated a greater risk of internet addiction. The subjects were classified into three subgroups according to the total score: (1) adaptive internet use AIU (total score ≤ 2), (2) maladaptive internet use MIU (3–4), and pathological internet use PIU (≥ 5).

The Chinese version of the PSQI was used to scale sleep disturbance (Buysse et al., 1989), which is validated for the Chinese population. The 19-item questionnaire consists of seven components: subjective sleep quality (1 item), sleep latency (2 items), sleep duration (1 item), habitual use of sleeping medication (3 items), sleep disturbance (9 items), and interference with daily activity due to daytime fatigue (2 items). Scoring was 0-3 for each dimension. A global PSQI score (range from 0 to 21) was also obtained by summing scores of the seven components, with higher scores representing worse sleep quality. Sleep disorder was identified by a total score of PSQI >7 according to prior work in the Chinese general population (Liu, 1996).

To determine the levels of physical activity (vigorous, moderate, and low) in the previous week among participants, Craig et al. (2003) developed an instrument called the IPAQ (International Physical Activity Questionnaire). It includes seven questions that can generate data for collecting information on global trends in physical activity related to health. Employed IPAQ, which is one of the most widely used tools to assess PA level due to its cost-effectiveness, global applicability, sound validity, accessibility, and standardized protocol. Physical activity is assessed using the IPAQ scoring system that considers time spent walking, in moderate exercise (eg, cycling or brisk walking), and vigorous exercise (eg, intense workout or running). Walking counts for 3.3 METs, moderate activity for 4.0 METs, and vigorous activity for 8.0 METs. Each activity is expressed in MET-min-wk-1. The MET value is then multiplied by the number of days and minutes an individual exercises every week to calculate a total score. Students are categorized as low (no active group), moderate (active group) if their weekly MET min is 600 or more, and vigorous (high-activity group) if their weekly MET min is 3000 or greater, according to the total score.

Data were analysed using SPSS (version 25) and path-analysis methods. Descriptive statistics were conducted, and normality was assessed (Kolmogorov–Smirnov). Bivariate relationships were evaluated with Pearson's r (parametric) or Spearman's ρ (nonparametric), as applicable. For the estimation of direct effects, multiple linear regression and path analysis were employed; mediation was analysed by following the steps defined in Baron-Kenny's Screencast 2009 procedures and with the Sobel test to assess if an indirect effect ($X \rightarrow M \rightarrow Y$) is significantly different from zero. When appropriate, we reported effect sizes, p-values, and standardized path coefficients. Missing data were accounted for via listwise deletion in the reported analyses.

RESULT AND DATA ANALYSIS

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Internet Addiction	210	1	8	3.88	1.830
Physical Activity	210	30.600	578062.500	7652.712	39919.598
Sleep Quality	210	0	17	7.50	3.395

The descriptive statistics of Internet addiction, physical activity, and sleep quality for the 210 involved students are shown in Table 1. Internet addiction scores ranged from 1 to 8 (mean = 3.88, SD = 1.83), suggesting medium level of differences in internet use among the participants. Physical activity scored on an average 7,652.71 on physical activity and had a large standard deviation of 39,919.60 (range:30.60 to 578,062.50). This large spread indicates a high diversity in the physical activity, which may be due to outliers or extreme values. The sleep quality scores had a mean of 7.50 (standard deviation: 3.40) and were distributed from 0 to 17 indicating moderate deviations in participants’ sleeping behaviours. The normality of the data was tested using Kolmogorov–Smirnov test. The results demonstrated that all 3 main variables (Internet addiction, physical activity, and sleep quality) appeared as distribution of non-normal. Namely, the Kolmogorov–Smirnov statistics of Internet addiction, PA and sleep quality were 0.135, 0.424 and 0.101 (all p-values < 0.05) respectively. Since the obtained p-values for all the variables were less than 0.05, failed to fulfil the normal distribution assumption, and thus data did not meet with normality. In terms of gender, the sample included 152 men (72.4%) and 58 women (27.6%). This indicates that most of the subjects were males and there was a minority of females in the sample.

Table 2. Internet Addiction

	Frequency	Percent
Adaptive Internet Use	51	24.3
Maladaptive Internet Use	91	43.3
Pathological Internet Use	68	32.4
	210	100.0

Table 2, Percentage distribution of Internet addiction among the participants (n = 210) More than half (67.3%) were in non-problematic levels of internet use, leaving the rest in problematic levels. Findings showed that 51 (24.3%) were assigned to adaptive Internet use, characterized by balanced and controlled involvement in the online worlds. More participants, 91 persons (43.3%), were categorized in maladaptive Internet use which is defined as an excessive or problematic use that may disrupt daily life but does not fulfill the criteria of pathology dependence. At the same time, pathological Internet use was identified in 68 participants (32.4%): showing signs of severe compulsive Internet Web use, novelty seeking-impulsivity trait and addictive behavior leading to disability in everyday life and total disability).

Table 3. Physical Activity

	Frequency	Percent
High	120	56.7
Low	31	14.3
Moderate	59	28.1
Total	210	100.0

The prevalence of physical activity within three levels, high, moderate, and low is summarized in Table 3 among the total 210 participants. Most of the sample (n = 120; 56.7%) became classified as highly active, demonstrating and overall active lifestyle. Fifty-nine (28.1%) of the participants demonstrated moderate practice PA, indicating that they were living a balanced life without exercising very physically active lifestyle. In contrast, 31 participants (14.3%) had a low election of PA indicating insufficient physical activity, which is not healthy and narrows down the human well-being. These results indicate most respondents does still exercise, but that it is almost half (42.4%) who

engaged in moderate to low activity range; underscores the relevance of advocating the continuous and appropriate practice among them.

Table 4. Sleep Quality

No	Frequency	Percent
0	1	.5
1	4	1.9
2	6	2.9
3	13	6.2
4	16	7.6
5	25	11.9
6	20	9.5
7	29	13.8
8	20	9.5
9	21	10.0
10	13	6.2
11	15	7.1
12	11	5.2
13	4	1.9
14	6	2.9
15	2	1.0
16	3	1.4
17	1	.5
Total	210	100.0

The distribution of scores for Sleep Quality among the 210 participants is shown in Table 4 scores range from 0 to 17. The score distribution shows a peak at 7 (29 respondents—13.8%), followed by 5 (11.9%) and 9 (10.0%). Scores of 6 and 8 were also relatively common, with 9.5% for each score. Conversely, 0.5% of participants reported 0 or a maximum score of 17. Overall, the distribution indicates that there is a great deal of variation in sleep quality among participants and little inclination towards obtaining high or low scores. Although many responses indicated good sleep quality, the presenting low scores revealed poor sleep among some participants and their ability to manage daily activities and project well-being may have been impacted. The mediation model structure, as derived from the causal steps approach proposed by Baron and Kenny (1986), is shown in Figure 1. A path diagram was used to illustrate the theoretical model of mediation. In doing so, two independent sets of axioms are recognised and included in the model.



Figure 1. The mediation model structure, as derived from the causal steps approach proposed by Baron and Kenny

In the first framework, the direct path model depicts the overall effect of Internet addiction (independent variable) on physical activity (dependent variable). As shown in Figure 2, this relationship is represented by pathway c, which illustrates the total effect of Internet addiction on physical activity when the mediating variable is excluded from the model.

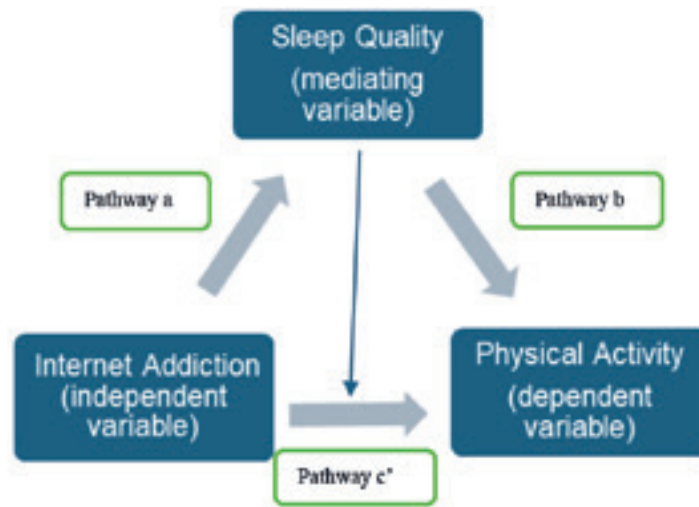


Figure 2. Mediating Variable in Study

The second diagram shows the relationships and paths variable included in this study “a” measuring path from Internet Addiction (independent variable) to Sleep Quality (mediating variable), “b’ points out path from Sleep Quality (mediating variable) to Physical Activity (dependent variable) while ‘c’ pointing Direct effect from Internet Addiction (independent variable) to Physical Activity(Dependent Variable) when ‘Sleep Quality’ Mediating between those Variables under Study.

Further path models were performed utilizing Causal Steps and Product of Coefficients to capture direct and indirect effects among the study variables. In interpreting results, we used beta coefficients from regression tests. In the first path (path a), internet addiction was regressed on sleep quality and the score of $-0.495(a)$ represented by coefficient (a, b and c). There was a significant effect of physical activity on sleep quality (M) in the second step (path b), change in coefficient, = 6.11. The overall of Internet addiction on physical activity while not controlling the meditating effect was denoted as path c with a coefficient $c = -0.341$. The direct effect (path c’) was calculated by performing a simultaneous regression of physical activity (Y) on Internet addiction (X) and sleep quality(M), which resulted in $c' = -0.187$. The indirect effect (ab) was estimated by the product of a and b coefficients, $ab = (-0.495 \times 6.11) = -3.254$. According to these results, the mediation model and relations between Internet addiction, sleep quality, and physical activity were established as follows and are shown in the subsequent mediation figure.

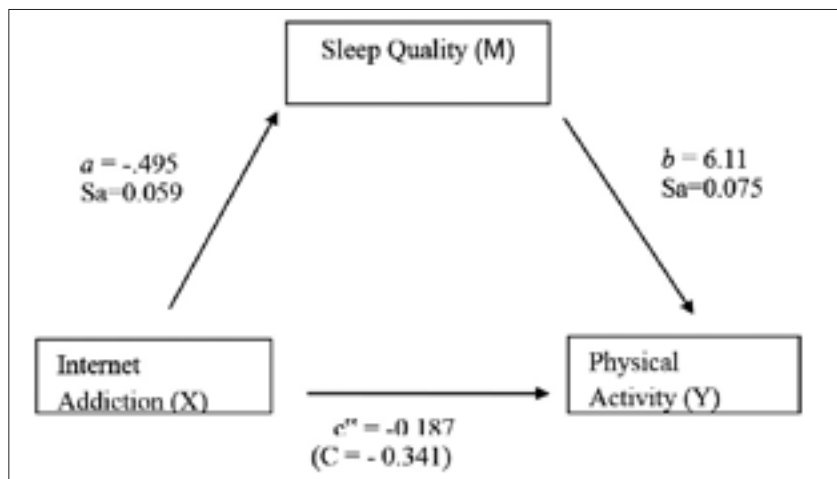


Figure 3. Apply Sobel Test on Product of Coefficient to test whether the indirect effect of the association between Internet addiction and physical activity is significant or not

Figure 3, Apply Sobel Test on Product of Coefficient to test whether the indirect effect of the association between Internet addiction and physical activity is significant or not. According to Sobel Test the computed Z (26.8)

was even greater in absolute value than 1.96, which is the critical value at a level of significance of .05. This shows that the association between independent and dependent variables is sensitive to mediator variable. The results of these findings demonstrate that the association between personality trait (internet addiction) and dependent variable (physical activity) is influenced significantly indirectly by the mediator variable (sleep quality). The finding of significance for coefficients a and b in the regression analysis suggests Causal Steps that there is mediation. The most critical condition for mediation, according to David A. Kenny (1986), is that paths a and b are significant. The mediation model is said to be complete mediation if the c'' pathway is insignificant or has a value of 0. If the path c'' causes the value of the dependent variable coefficient then and significantly, then partial mediation occurs.

A significant 'mediator' sleep quality mediates the connection between DV (physical activity) and IV (internet addiction). It is, however, significant when the coefficient value β on physical activity passing through the mediator variable reduces compared to the model where it does not pass through the mediator variable. This means that internet addiction variable influences the physical activity variable either with or without mediation of the sleep quality variable. That is, internet addiction has the statistically significant indirect effect on physical activity by sleep quality. Internet addiction is a negative effect upon sleep, as students who have poorer sleep are less physically active. At 95% confidence level, Z-value -8.34 is greater than critical value ± 1.96 indicating there is very little chance of this result occurring by mere luck. Thus, sleep quality has a substantial mediating role in this association and can shed light on the how or why alterations in physical activity are linked with internet addiction. These findings suggest that improving students' sleep quality may help reduce the negative impact of excessive internet use on their physical activity behaviours.

DISCUSSION

Internet Addiction and Physical Activity

The results show a significant negative relationship between IA and physical activity, which verifies H1. This finding indicates that the higher level of internet addiction the less physical activity among students in Universitas Negeri Yogyakarta. The p-value (0.000) falls lower than the α -level of 0.05, and the given t-count value in absolute terms (-8.225), is greater than ± 1.96 for a confidence level of 95%. These findings imply that internet addicts become more sedentary, i.e., spend too much time on the Internet instead of staying physically active. This result is like that of Sun et al. (2025) who found a large and negative sign correlation between internet addiction and college students' physical exercise were highly significant ($P < 0.001$, $Z = -12.40$), indicating that the risk of internet addiction was less likely if they have higher levels of body activity. Engaging in physical activity has also been shown to improve psychological and emotional health, which could also result in decreased preference for addictive behaviour including excessive internet use. Similarly, a previous study on international student in Java reported a significantly positive relationship between physical activity and life satisfaction ($r = 0.806$, $p = 0.002$), where 63% of the variance in life satisfaction were accounted for by physical activity (Salman et al., 25). Collectively, these results reinforce that regular exercise improves both physical health and mental & emotional well-being.

Similar findings were reported by Alshehri and Mohamed (2019) who found a negative relationship between eGaming and PA involvement. Their results point to a shared pathway by which screen addictions diminish the opportunities for exercise. Furthermore, Lin et al. participants "physical activity moderated or buffered the negative effects of internet addiction on psychological and physical health. The evidence highlights the necessity to have an active lifestyle to mitigate untoward health consequences of excessive internet especially among students performing their academic duties.

Internet Addiction and Sleep Quality

These findings provide strong support for H2: internet addiction had a significant negative relationship with sleep quality. The t-value (-7.86) is higher than the critical t-value (± 1.96) at a 95% confidence level and $p = 0.000$ which means that the result obtained is very significant ($p < 0.05$). This result implies that people with greater internet addiction had worse quality of sleep. Spending too much time on the internet, especially late into the night, is upsetting people's internal clocks and depriving them of quality sleep. This finding agrees with Arayici et al. (2025) who reported an association ($r = 0.593$, $p < 0.001$) between the use of computer and sleep quality degradation. Results of Lin et al agreed with these. (2019) failed to find any individual subtypes of online addiction symptoms that have a

negative influence on healthy sleep quality in female students. Hammad et al. (2024) further showed that difference in sleep patterns accounted for much of the variance in internet addiction and remained significant even after controlling demographic/lifestyle variables such as smoking habits and living status.

Corroborating evidence from alternative settings can also strengthen these conclusions. During the COVID-19 pandemic, Saudi Arabian medical students and university students who spent more time on screens had decreased sleep times as well as higher daytime dysfunction (Nagori et al., 2019; Kumar et al., 2022). Similarly, Karki et al. (2021) found a significant negative correlation of internet addiction with sleep quality in Nepalese adolescents, which was congruent to those reported from Taiwanese and Turkish sample. Taken together, these results reflect the pattern that there appears to be a robust association between internet over-use and negative sleep outcomes across national contexts.

Sleep Quality and Physical Activity

The findings of this study show a significant positive association between sleep quality and physical activity which support H3. The t-statistic (8.34) is greater than the critical value, and the p-value (0.000) is less than 0.05 alpha level of significance. These results indicate that sleep quality could be used to predict whether an individual will participate in physical activity, and vice versa. In line with this observation, Alime et al. (2024) observed that greater physical activity is protective against sleep disruption, emphasising its contribution to the maintenance of good health. Byun et al. (2024) also remarked that regular exercise significantly increases sleep quality, yet not at a cost of side effects. In addition to this, the evidence demonstrates that acute physical activity has a positive effect on deep sleep, REM sleep and total duration of slept – all three are significant indicators of sleep quality (Wunsch et al., 2017). Thermogenic effects of physical activity that further contribute to metabolic control, and potentially the regulation of restorative sleep, could explain these associations (Master et al., 2019).

These conclusions are also supported by meta-analytic evidence indicating that exercise is an effective non-pharmacological treatment for sleep problems (Oudjedi et al., 2022). More specifically, a moderate exercise routine has been shown to promote total sleep time and decrease latency of sleep onset. This bidirectional relationship posits that good sleeping quality boosts motivation and energy for physical activity, but at the same time exercise is associated with better sleep (Gothe et al., 2020). This relationship has been demonstrated to hold true among different age categories such as college students and elderly people (Santos et al., 2023; Osundiya et al., 2021).

Mediating Effect

There is a significant mediating effect of sleep quality in the relationship between internet addiction and physical activity as well. The Z-statistic (-8.34) is higher than the critical value of ± 1.96 at $\alpha = .05$, suggesting that sleep quality mediates the relationship. More specifically, sleep suffers from internet addiction and poor sleep quality leads to less physical activity. These findings indicate that enhancing sleep quality may help reduce the harmful effects of IA among students' PA behaviours. Byun et al. (2024) have shown that those who sleep better are more likely to be active, indicating a reciprocal association between the two variables. This emphasizes the mediating effect of sleep in the relationship between IA and PA. Similarly, Gothe et al. (2019) found that sleep quality is an independent factor for physical activity and HRQL, implying that interventions focused on high-quality sleep can contribute to both behavioural outcomes and health status.

There is also more evidence for the mediating role of sleep quality. Kashfi et al. (2023) and Bhandari et al. (2017) stated that young adults with high internet addiction display more sleep difficulties, which reduce their willingness and ability to engage in regular physical activity. The work of Tran et al. (2016) found that internet addicted students were more sleep-deprived, resulting in lower physical activity levels. In parallel, Zhao and Kou (2024) confirmed that internet addiction, especially short video content one, decreased sleep quality and ultimately reduced physical activity in college students. Overall, these results indicate that sleep quality is an important mediating process to interpret the relation between internet addiction and physical activity. Improving the sleep quality of students may be helpful to reduce the maladaptive behavioural patterns and health problems that result from excessive internet use.

CONCLUSION AND SUGGESTION

Findings from this study revealed a negative association between Internet addiction behaviour and physical activity among the Yogyakarta State University students, sleep quality as an important mediator. Higher amounts of

internet use anomalies were associated with worse sleep quality and less physical activity in students, thereby suggesting both behavioural and health physiological risk for problematic online involvement. In contrast, high sleep quality was significantly correlated with an increase of physical activity as well, reflecting a mutual benefit between enough sleep and active life. The mediation analysis supported sleep quality as a partial mediator in the link between internet addiction and physical activity which is crucial to preserve overall health status of students. Considering these findings, interventions targeting sleep behaviour might effectively counteract the negative effects of internet use on PA levels. Practically, the universities need to establish a combined health-promotion programme that targets digital balance, sleep, and physical activity. Workshops might also be introduced that focus on responsible internet use, sleep hygiene and organised exercise for improvements in both physical and psychological health. Longitudinal or experimental research is needed to better describe causal models and more broadly generalizable psychosocial pathways explaining the association between internet use, sleep, and physical activity among a variety of student populations.

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Conflict of Interest

The authors have no conflicts of interest to disclose.

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