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Exploring the Link Between Physical Activity and Mobile Phone/Smartphone Addiction in University Students

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Дослідження зв'язку фізичної активності та залежності від мобільного телефону/смартфону у здобувачів вищої освіти

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Introduction

Digital technologies have become deeply embedded in modern daily life, reshaping not only key economic and social dynamics but also the lifestyle and well-being of millions worldwide [1]. As of January 2021, there were 4.66 billion active internet users, 4.32 billion mobile internet users, and 4.2 billion social media users, each spending an average of 6.7 hours online per day [2]. By February 2025, internet usage had expanded to 5.56 billion people – representing 67.9% of the global population – and this number continues to grow steadily [3]. In this era of advanced development of mobile information technology, cell phone has become an indispensable and important tool in the daily life. Moreover, smartphones are no longer considered simply as "mobile phones", but real-time information providers and powerful portable computers. These versatile gadgets offer a wide range of features, including calling, photography, multimedia playback, web browsing, GPS navigation, and email access, while also enabling social networking and gaming experiences [4]. Currently, around 6.6 billion people worldwide use smartphones, and this number is projected to reach 7.8 billion by 2028 [5].

Despite the advantages associated with smartphone use, such as enhanced social networking, increased productivity, and more dynamic and immediate ways of living and working, many studies indicate that a significant number of individuals engage in excessive phone use, leading to disruptions in their daily routines, safety, and general well-being [6]. Furthermore, prolonged and excessive smartphone usage has been associated with negative effects on mental health and behavior [7], including addiction. Currently, there is no consensus on the definition of mobile phone addiction (MPA)/smartphone addiction (SA) [8]. MPA/SA is characterized by a strong and persistent psychological dependence and behavioral compulsion toward mobile phone/smartphone use, such that individuals continue using their devices excessively despite being aware of the negative consequences [9]. Y.H. Lin et al. defined SA as users underestimating the amount of time spent on their smartphones, or being unable to regulate their use, resulting in negative consequences in daily life [10]. In addition, the terms "problematic mobile phone use (PMPU)" or "problematic smartphone use (PSU)" are more frequently applied, and are defined as a form of behavior, which is characterized by the compulsive use of the device, resulting in various forms of physical, psychological, or social harm [8].

Data show that MPA/SA is more common among adolescents and young adults, especially university students, where the detection rate is as high as 21.4–27.4%, making it a widespread phenomenon. The COVID-19 pandemic has exacerbated students' MPA/SA due to the need for online learning and social networking, making "the phone is never separated from the user" a daily habit of university students [11]. Among medical students, the risk of MPA/SA may be even higher due to intensive academic demands, high levels of stress, and the integration of smartphones into medical education. A recent meta-analysis has reported the global prevalence of SA among medical students to be around 39.0% [12]. Similarly, its prevalence in Asian medical students was found to be 41.9% (95% CI [36.2%, 47.7%]) [13] and in Indian medical students – 60.0% (95% CI [45.0% to 73.0%]) [14]. As for university students, mobile phone overuse not only leads to a poor academic performance, but can also contribute to some mental disorders such as depression, social anxiety, stress, and insomnia as well as negative emotions in general [15]. J. Luo et al. found that MPA is often accompanied by symptoms such as attention deficits, emotional instability, social withdrawal, heightened loneliness, and academic procrastination. These symptoms may further lead to psychological disorders such as anxiety, depression, and impulse control issues, thereby adversely affecting individuals' quality of life, social adaptability, and mental wellbeing [16].

The possible negative impact of MPA/SA on academic performance has been theoretically explained by the time trade-off between smartphone use and studying. Frequent switching between academic tasks and social smartphone activities may cause cognitive overload, reduce efficiency, impair concentration, and hinder sustained mental effort – all of which can undermine students' academic success [17]. The high prevalence of MPA/SA among university students underscores the need for targeted awareness, preventive strategies, and support systems within institutions. Regular physical activity (PA) is vital for promoting a healthy lifestyle, positively impacting cardiovascular, respiratory, neural, and musculoskeletal systems while also enhancing emotional state and reducing risks associated with lifestyle-related diseases (hypertension, diabetes mellitus, metabolic syndrome, etc.) [18; 19; 20]. A substantial body of empirical evidence suggests that regular physical exercise enhances cognitive flexibility, inhibitory control, and emotional resilience, which in turn improves individuals' self-regulatory capacity when faced with behaviorally triggering stimuli [21]. Hence, regular engagement in PA may serve as a viable preventive measure against MPA/SA among university students.

The aim of the study was to provide an overview of the research concerning the relationship between PA and MPA/SA among university students, recognized as a high-risk group.

Object, materials and research methods

This study employed general scientific methodologies, including comprehensive literature search, analytical review, synthesis, and generalization. A systematic review of the literature was conducted to examine the relationship between PA and MPA/SA among university students. Relevant studies were retrieved from the PubMed electronic database, covering publications dated between January 1, 2021, and October 1, 2025. We included studies meeting the following criteria: published in English, available as free full text articles, included validated measures of MPA or SA, assessed any form of PA, focused on university student populations. The keywords used in the search were "physical activity and mobile phone addiction in university students", "physical activity and smartphone addiction in university students", "physical activity and problematic mobile phone use in university students", "physical activity and problematic smartphone use in university students".

Research Results

The results are summarized in the Table 1. Our review included twenty-nine studies, with the vast majority (21) employing cross-sectional designs [15; 22–41]. The remaining eight studies consisted of two randomized controlled trials (RCTs) [42; 43], one meta-analysis of RCTs [44], three systematic reviews [45; 46; 47], one general meta-analysis [48], and one systematic review combined with a meta-analysis [49]. Most cross-sectional studies established a significant and consistent negative relationship between PA (or exercise) and MPA/SA (higher levels of PA were associated with lower levels of addiction among university students). A few cross-sectional studies found that PA was not only inversely correlated with MPA/SA but also was a significant negative predictor of it [34; 39]. However, W. Kumban et al. demonstrated no correlation between PA and screen time in university students [26]. At the same time a weak positive correlation of PA with study time and weak negative correlation of PA with study level were established. Several studies highlighted that the relationship between PA and MPA/SA is often indirect, mediated by other psychological variables, suggesting PA improves mental health, which in turn reduces the risk of digital addiction: increasing self-acceptance [23], self-evaluation [25], trait mindfulness [28], self-control [32], e-health literacy [35], and decreasing irrational procrastination [31], social anxiety [33], perceived stress [23]. L. Zou et al. showed that PA has significantly reduced the association between PMPU with depression, anxiety, and stress symptoms [41]. Physical exercise was linked to higher trait mindfulness and lower MPA, while mindfulness was also strongly linked to lower addiction [28]. Aerobic exercise was identified as a type of PA where greater participation led to lower addiction levels [24; 38]. T. Xiao et al. investigated if group-based basketball and Baduanjin exercise (a type of Qigong (an ancient Chinese mind-body practice)) would reduce PSU and improve the mental health of college students and whether such effects would be sustained [42]. Researchers found that both exercise interventions demonstrated significant effects on decreasing PSU (basketball: $p<0.01$; Baduanjin:$p<0.01$), feelings of anxiety (basketball: $p<0.01$; Baduanjin:$p=0.04$), loneliness (basketball: $p<0.01$; Baduanjin: $p<0.01$), inadequacy (basketball: $p<0.01$; Baduanjin:$p<0.01$), and perceived stress (basketball: $p<0.01$; Baduanjin: $p=0.04$), at the end of interventions. At two months after interventions, both exercise interventions demonstrated significant effects on decreasing PSU, but not for feeling of stress. K. Zhang et al. showed that for college students with PMPU, incorporating aerobic exercise or Tai Chi Chuan offers a solution that is both safe and highly efficient. These interventions not only confer physiological and psychological advantages but also positively influence the students' intestinal flora [43]. Systematic review and meta-analysis by Z. Li et al. specifically focused on the causal evidence RCTs to determine the effectiveness of exercise interventions in reducing MPA [44]. The results confirmed that exercise intervention significantly reduced MPA in adolescents. The effectiveness of the intervention was found to be moderated by several specific factors: frequency and duration, cycle and type of exercise. Recent systematic review by N. Pirwani and A. Szabo (2024) found a consistent inverse relationship between PA and SA among university students [46]. Researchers have indicated that although cross-sectional studies reveal only a modest inverse link between PA and the risk of SA, more rigorous experimental and longitudinal research demonstrates stronger, more consistent

results. Specifically, two longitudinal studies combining PA with cognitive behavioral therapy, and one acute cycling intervention, demonstrated significant improvements with large effect sizes on addiction risk scores and response inhibition, respectively. In updated systematic review (2025) the same authors analyzed sixteen new studies, finding that inverse relationship between PA and SA among university students is mediated by psychological factors (self-control, self-esteem, resilience), and moderated by exercise type/intensity [47]. Researchers suggested that future research should prioritize longitudinal/experimental studies, use objective data, and integrate biological/qualitative measures. Furthermore, more Western studies are required, given the global concern [47]. A systematic review by H. Liu et al. investigated the effectiveness of physical exercise and psychological interventions for reducing SA among university students [45]. The authors found that combining of physical exercise and psychological interventions is more effective at reducing SA and improving mental health in university students than either intervention alone. Future research should focus on this combined approach in university students, especially females, who are vulnerable to SA. The meta-analysis by W. Xiao et al. found a moderate negative correlation between PA and MPA among adolescents and young adults [49]. Although none of the hypothesized moderators (pre- and during-COVID data collection, country or region, and type of population) significantly affected the overall relationship, subgroup analysis revealed key differences: the correlation remained significant before COVID-19 ($r=-0.333$, $p<0.001$) and during COVID-19 ($r=-0.207$, $p<0.001$) data collection; the correlation was significant in developing countries – China and others ($r=-0.201$, $p<0.001$ and $r=-0.217$, $p<0.001$, respectively), but not significant in developed countries ($r=-0.446$, $p=0.39$); the correlation was significant in young adults ($r=-0.250$, $p<0.001$) but not significant in adolescents ($r=-0.129$, $p=0.24$). Meta-analytic structural equation modeling study by H. Lin et al. investigated the specific pathway through which PA influences MPA in adolescents [48]. The results strongly suggest that one of the primary mechanisms by which increasing PA reduces MPA in adolescents is by enhancing their level of self-control.

Table 1

Summary of study characteristics and main findings on the association between PA and MPA/SA in university students

Author and year	Coun-try	Study type	Sample	Measure-ment of PA	Main findings
1	2	3	4	5	6
Chen H., et al. (2022)	China	Cross-sectional	n=9406 (3516 males and 5890 females, mean age: 19.50±1.07)	IPAQ	PA significantly reduced MPA ($\beta = -0.049$, $p<0.001$).
Ding Z, et al. (2025)	China	Cross-sectional	n=1392 (506 males and 886 females)	PARS-3	PE showed a significant negative correlation with MPA ($r=-0.293$) and perceived stress ($r=-0.326$), and a positive correlation with self-acceptance ($r=0.408$). (All $p<0.01$).
Fan H, et al. (2021)	China	Cross-sectional	n=30 (17 males, 13 females, mean age: 20.03±0.96 years)	Go/NoGo task	Thirty minutes of acute aerobic exercise at all intensities (high, moderate, and low) significantly improved response inhibition (increased NoGo accuracy) in individuals with SA. The moderate-intensity exercise yielded the most significant improvement compared to high and low intensity.
Gong Y., et al. 2023	China	Cross-sectional	n=643 (363 males and 280 females, mean age: 19.68±1.40 years)	PARS-3	PE was negatively linked to SA ($r=-0.30$) and positively linked to core self-evaluation ($r=0.25$). Core self-evaluation, in turn, was strongly negatively linked to SA ($r=-0.52$) (all $p<0.01$).
Guo K.L., et al. (2022)	China	Cross-sectional	n=1,433 (704 males and 729 females, mean age: 19.67±1.62)	PARS-3	PE and MPA tendency were negatively related ($r=-0.158$, $p < 0.05$).
Kumban W., et al. (2025)	Thai-land	Cross-sectional	n=120 (43 males and 77 females, mean age: 20.44±1.31	GPAQ	PA showed no correlation with screen time ($p\geq0.05$). However, a weak correlation was observed with study time ($r^2=0.27$, $p<0.05$) and study level ($r^2=-0.31$, $p<0.05$).
Lai C., et al. (2025)	China	Cross-sectional	n=3,506 (1.743 males and 1.763 females aged 19.0 (19.0, 20.0) years	PARS-3	PA was negatively associated with SA (OR=0.70, $p<0.001$). Furthermore, exercise intensity showed an inverse relationship: compared to low-intensity exercise, moderate (OR=0.81, $p=0.034$) and vigorous (OR=0.83, $p=0.046$) intensity exercises were also associated with lower odds of addiction.

Continuation of Table 1

1	2	3	4	5	6
Li J., et al. (2025)	China	Cross-sectional	n=554 (554 females)	PARS-3	PE showed a positive correlation with trait mindfulness (r=0.20) and a negative correlation with MPA (r=−0.17). MPA was also negatively correlated with trait mindfulness (r=−0.45) (all p<0.01). Structural modeling revealed that while the direct effect of PE on mindfulness was significant (β=0.071), MPA played a significant indirect mediating role (indirect effect: 0.044), accounting for 35.77% of the total effect.
Li Z, et al. (2023)	China	Meta-analysis of randomized controlled trials	n=12 (studies)	–	PE intervention significantly reduced MPA in adolescents (p<0.001). The intervention's effect was moderated by several factors, including the measurement tools, exercise type, cycles, frequency, and duration of the single exercise session.
Lin H., et al. (2025)	China	Meta-analysis	n=48 (studies)	–	PA showed a moderate negative correlation with MPA (effect size: −0.204). This relationship was significantly mediated by self-control (effect size: −0.091), which accounted for 49.7% of the total effect.
Liu C. and Sun Z. (2023)	China	Cross-sectional	n=488 (370 males and 118 females), mean age: 19.21±1.22 years)	PARS-3	PA was a direct predictor of poorer interpersonal relationships (β=−0.108, 95% CI [−0.210,−0.005]). It also had a significant indirect effect on interpersonal relationship distress via the path: self-control → MPA (β=−0.012, 95% CI [−0.033,−0.003]).
Liu H., et al. (2022)	Malay-sia	Systematic Review	n=23 (studies)	–	Combining of PE and psychological interventions is more effective at reducing SA and improving mental health in university students than either intervention alone.
Pirwani N. and Szabo A. (2024)	Hunga-ry	Systematic review	n=31 (studies)	–	PA appears to reduce the risk of SA in university students. Resilience and other factors may mediate this relationship.
Pirwani N. and Szabo A. (2025)	Hunga-ry	Systematic review	n=16 (studies)	–	PA consistently acts as a protective factor against SA in university students. This inverse relationship is mediated by psychological factors (self-control, self-esteem, resilience), and moderated by exercise type/ intensity.
Shi B., et al. (2025)	China	Cross-sectional	n=702 (271 males and 431 females)	PARS-3	Frequent PE is the most obvious way to significantly reduce MPA, particularly decreasing withdrawal symptoms (β=−0.34) and salience behavior (β=−0.30).
Shi M., et al. (2021)	China	Cross-sectional	n=6294 (4,310 males and 1984 females, mean age: 18.57±1.82 years)	IPAQ-SF	The duration of PA was negatively correlated with irrational procrastination across all intensities (vigorous: β=−0.107; moderate: β=−0.083; light: β=−0.069). Higher intensity showed a stronger correlation. In the regression analysis, vigorous (β=−0.043) and moderate (β=−0.033) PA significantly predicted lower irrational procrastination only in males, while light PA (β=−0.053) did so for both genders.
Shuai-shuai Z. (2025)	China	Cross-sectional	n=1,052 (500 males and 552 females, mean age: 19.27±1.08 years)	PARS	The findings indicate that PA is negatively associated with both psychological sub-health and MPA, yet positively correlates with self-control. Additionally, self-control is inversely linked to psychological sub-health and MPA, whereas MPA is directly associated with psychological sub-health. The analysis shows that self-control and MPA partially mediate the impact of PA on psychological sub-health.
Song Y., et al. (2024)	China	Cross-sectional	n=2,905 (1,181 males and 1,724 females, mean age: 19.31±0.95 years)	PARS-3	PA was significantly and negatively correlated with both PSU and social anxiety (P<0.001). Social anxiety was found to partially mediate this relationship, explaining some of the effect between PA and PSU (β = −0.04, 95%*CI* = −0.05 to −0.02).

End of Table 1

1	2	3	4	5	6
Tong W.X., et al. (2022)	China	Cross-sectional	n=3609 (1891 males and 1718 females)	IPAQ-SF	PA inversely correlated with PMPU (r=−0.173, p<0.001) and was a significant predictor of it (F(3,3605)=11.296, p<0.001).
Tong W.X. and Meng S.Q. (2023)	China	Cross-sectional	n=4399 (2481 males and 1918 females, mean age: 19.20±2.98 years)	IPAQ-SF	PE showed a strong negative correlation with MPA (r=−0.713) and negative emotion (r=−0.571). Conversely, PE was positively correlated with e-health literacy (r=0.616). (all P<0.01).
Wang F. (2025)	China	Cross-sectional	n=413 (208 males and 205 females, mean age: 20.59±1.17 years)	PARS-3	PA significantly reduced MPA behaviors ($\beta = -0.22$, $p < 0.01$).
Wu J, et al. (2024)	China	Cross-sectional	n=590 (272 males, 318 females, mean age: 19.67±1.48 years)	IPAQ-SF	PA was negatively correlated with MPA (r=−0.21, p<0.01).
Xiao T., et al. (2021)	China	Randomized Controlled Trial	n=96 (71 males and 25 females, mean age: 19.21±1.02 years)	–	Both the Basketball and Baduanjin exercise interventions significantly decreased PSU, as well as feelings of anxiety, loneliness, inadequacy, and perceived stress (all p≤0.01). All positive effects, except for the reduction in perceived stress, were sustained for two months post-intervention.
Xiao W., et al. (2022)	China	Systematic Review and Meta-analysis	n=17 (studies)	–	A significant negative correlation was found between PA and MPA (summary r=−0.243, p<0.001). Subgroup analysis revealed that the correlation remained significant before COVID-19 and during COVID-19 data collection; the correlation was significant in developing countries – China and others, but not significant in developed countries; the correlation was significant in young adults but not significant in adolescents.
Yang G., et al. (2021)	China	Cross-sectional	n=608 (158 males and 450 females, mean age: 20.06±1.98 years)	PARS-3	PA significantly decreases MPA (β=−0.266, p<0.001). A dose-response effect exists up to medium exercise levels ($F_{(3,604)} = 4.799$, $p < 0.01$). Crucially, this effect is strongest with aerobic endurance exercise: greater participation in this type of activity leads to lower addiction levels.
Ye Z, et al. (2025)	China	Cross-sectional	n=559 (226 males and 333 females, mean age: 18.82± years)	PARS-3	PA was a significant negative predictor of SA (β=−0.038, p<0.001). Even with the inclusion of self-control and stress perception as mediators, the negative prediction remained significant (β=−0.017, p<0.01).
Zhahg K., et al. (2024)	China	Randomized controlled trial	n=90 (36 males and 54 females,) mean age: 20.11±0.644 years	–	The eight-week of aerobic exercise and Tai Chi Chuan intervention led to significant reductions in PMPU, as well as significant improvements in physical fatigue and mental fatigue.
Zhu X., et al. (2025)	China	Cross-sectional	n=268 (168 males and 100 females, mean age: 20.36±1.73 years)	PARS-3	PA significantly reduced MPA (β= −0.11, p<0.05) with a total effect of β = –0.28 (p<0.001).
Zou L, et al. (2022)	China	Cross-sectional	n=251 (52 males and 199 females, mean age: 19.01±0.85 years)	IPAQ-C	PA significantly reduced the association between PMPU with depression (p=0.002), anxiety (p=0.017), and stress (p=0.005) symptoms.

Note: 95% CI – 95% confidence interval; GPAQ – Global Physical Activity Questionnaire; IPAQ – International Physical Activity Questionnaire; IPAQ-C – Chinese version of the International PA Questionnaire; IPAQ-SF – International Physical Activity Questionnaire-short form; MPA – mobile phone addiction; PA – physical activity; PARS – Physical Activity Rating Scale; PARS-3 – Physical Activity Rating Scale-3; PE – physical exercise; PMPU – problematic mobile phone use; PSU – problematic smartphone use; SA – smartphone addiction; r – correlation coefficient; OR – an odds ratio; β – non-standardized regression coefficient.

Discussion of the Research Results

In recent years, the impact of PA on MPA/SA has attracted widespread attention. Following the latest 2020 report by the World Health Organization (WHO), increasing PA can improve both physical and mental health [50]. Regular PA plays a vital role in enhancing metabolic health, particularly by improving glucose regulation and insulin sensitivity. When performed consistently, exercise stimulates glucose uptake in skeletal muscles through both insulin-dependent and insulin-independent pathways. This dual mechanism facilitates more efficient cellular glucose utilization and contributes to long-term improvements in insulin responsiveness. These effects are especially beneficial in preventing and managing conditions like type 2 diabetes mellitus and metabolic syndrome. Aerobic training, in particular, has been shown to induce significant physiological adaptations in skeletal muscle. It increases the number and function of mitochondria, boosts the activity of oxidative enzymes, and enhances the capacity for glucose and fatty acid oxidation. These changes not only improve energy metabolism but also elevate the expression of proteins involved in insulin signaling pathways, such as glucose transporter type 4 and insulin receptor substrates. As a result, muscle cells become more responsive to insulin, reducing the likelihood of insulin resistance over time. In addition to its impact on glycemic control, regular PA contributes to a healthier lipid profile. It helps lower levels of total cholesterol, triglycerides, and low-density lipoprotein cholesterol, while simultaneously increasing high-density lipoprotein cholesterol. These lipid modifications are associated with a reduced risk of cardiovascular disease, as they promote better vascular function and decrease the likelihood of atherosclerotic plaque formation. PA also exerts anti-inflammatory effects, which are crucial for maintaining overall health. Chronic low-grade inflammation is a known contributor to various metabolic and cardiovascular disorders. Exercise helps mitigate this by reducing the infiltration of inflammatory cells into tissues, suppressing the production of pro-inflammatory cytokines, and lowering circulating levels of C-reactive protein [51–53].

Moreover, PA has been shown to enhance psychological well-being, thus alleviating the emotional vulnerabilities that contribute to MPA/SA [54]. A growing body of research indicates that regular aerobic exercise promotes relaxation, enhances feelings of pleasure, satisfaction and self-acceptance, reduces anxiety and depression, improves sleep quality, and relieves perceived stress. These benefits collectively reduce individuals' reliance on digital media for instant gratification and may lower the risk of MPA/SA [23; 38; 55]. PA also plays an important role in the development of social interactions, contributing to the formation of a sense of collective belonging and support among peers, which, in turn, stimulates the development of interpersonal skills, reduces the level of social isolation, and helps strengthen social ties, all of which positively affect the psycho-emotional well-being of adolescents and young people [56]. Therefore, adequate PA, which is defined as 300 min of moderate activity, 150 min of vigorous activity, or an equivalent combination of both types of PA per week [50] could be a promising approach for the prevention and mitigation of MPA/SA in youth which is supported by our literature review.

Despite differences in sample size, national origin of the research, methods of determining PA, and MPA/SA assessment, most studies involved in our review support significant negative correlation between PA and MPA/SA among university students. The findings collectively suggest that PA mitigates MPA/SA through two main pathways: directly (by potentially providing an alternative, healthier source of reward, structure, and routine, or through physiological mechanisms) and indirectly (by enhancing protective factors (self-control, self-acceptance, core self-evaluation and resilience) and reducing risk factors (stress, negative emotion, anxiety, and depression)). The intensity and type of exercise matter for maximizing the benefits: moderate and vigorous exercise intensities are associated with lower odds of MPA/SA compared to low intensity; aerobic exercise is highlighted as having the strongest effect in decreasing MPA/SA levels. PA enables students to better regulate their emotions and impulses, lessening their reliance on the Internet as a maladaptive "escape" from stress or negative feelings. On the other hand, a number of researchers have shown the existence of a significant negative correlation between MPA/SA and PA among university students [57–59]. Furthermore, path analysis of the factors related to MPA/SA and engagement in PA revealed that several factors, including sex, socioeconomic status, academic performance, and sitting time, directly and indirectly affected PA [20]. Therefore, as population of university students is especially vulnerable to the negative impacts of excessive online engagement, promoting regular PA can serve as a powerful tool to enhance mental well-being, reduce addictive behaviors, and foster healthier lifestyle habits. Therefore, integrating PA into campus health programs and student support initiatives should be considered a key component in the broader strategy to combat MPA/SA.

Prospects for further research

To advance the understanding of the relationship between PA and MPA/SA, further research should prioritize the implementation of longitudinal studies. These studies are essential for establishing a robust cause-and-effect framework: specifically, to determine whether regular engagement in PA actively contributes to the prevention or reduction of MPA/SA, or whether individuals who are inherently less prone to such behavioural dependencies are simply more inclined to be physically active. Clarifying this directionality is critical for informing targeted interventions and public health strategies. In addition to observational designs, RCTs should be conducted wherein structured physical exercise programs are employed as interventional tools to treat MPA/SA. Such trials would

provide high-quality evidence regarding the therapeutic efficacy of physical activity in mitigating addictive behaviours associated with excessive smartphone use. The outcomes of these RCTs could serve as the foundation for developing standardized, evidence-based clinical guidelines aimed at integrating physical activity into behavioural health interventions. Given the widespread nature of MPA/SA across diverse populations and cultural contexts, it is imperative that future studies be conducted on a large scale and encompass multiple geographic regions, including Europe, Africa, North America, and South America. This global approach will ensure that findings are generalizable and reflective of varied sociocultural influences on both physical activity patterns and technology use behaviours. Moreover, there is a pressing need for the international standardization and harmonization of assessment tools used to measure physical activity and mobile phone addiction. Currently, the lack of uniformity in measurement instruments poses a significant barrier to cross-study comparisons and meta-analytic synthesis.

Conclusions

This literature review reveals a notable inverse relationship between PA and MPA/SA among university students. PA consistently emerges as a significant negative predictor of MPA/SA within this demographic. Its protective role is closely tied to enhancements in psychological well-being, as PA demonstrates positive associations with self-control, self-acceptance, core self-evaluation, and resilience, while concurrently mitigating stress, negative affect, anxiety, and depressive symptoms. Furthermore, both the intensity and type of PA are critical in optimizing these benefits: moderate to vigorous exercise is linked to reduced likelihood of MPA/SA compared to low-intensity activity, with aerobic exercise showing the most pronounced effect in lowering addiction levels. This evidence supports the use of PA not only as a general health recommendation but as a targeted, evidence-based strategy to reduce the risk of MPA/SA in student populations.

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Purpose. The aim of this paper is to provide an overview of the research concerning the relationship between physical activity (PA) and mobile phone addiction/smartphone addiction (MPA/SA) among university students, recognized as a high-risk group.

Material and methods. We employed general scientific methodologies, including comprehensive literature search, analytical review, synthesis, and generalization. Relevant studies were retrieved from the PubMed electronic database, covering publications dated between January 1, 2021, and October 1, 2025.

Results. This literature review reveals a notable inverse relationship between PA and MPA/SA among university students. PA consistently emerges as a significant negative predictor of MPA/SA within this demographic. Its protective role is closely tied to enhancements in psychological well-being, as PA demonstrates positive associations with self-control, self-acceptance, core self-evaluation, and resilience, while concurrently mitigating stress, negative affect, anxiety, and depressive symptoms. Furthermore, both the intensity and type of PA are critical in optimizing these benefits: moderate to vigorous exercise is linked to reduced likelihood of MPA/SA compared to low-intensity activity, with aerobic exercise showing the most pronounced effect in lowering addiction levels.

Conclusions. This evidence supports the use of PA not only as a general health recommendation but as a targeted, evidence-based strategy to reduce the risk of MPA/SA in student populations.

Key words: physical activity, exercise, mobile phone/smartphone addiction, relationship, university students.

У наш час цифрові технології глибоко інтегрувалися в щоденне життя, змінюючи не лише ключові економічні та соціальні механізми, а й впливаючи на стиль і рівень життя мільйонів людей у всьому світі. У нинішню епоху стрімкого розвитку мобільних інформаційних технологій мобільний телефон став незамінним і важливим інструментом, при цьому смартфони вже не сприймаються лише як «мобільні телефони», а як джерела інформації в реальному часі та потужні портативні комп'ютери. Водночас тривале та надмірне використання мобільних телефонів/смартфонів пов'язане з негативними наслідками для психічного здоров'я та поведінки, зокрема із розвитком залежності. Згідно з емпіричними даними, феномен такої залежності є більш поширеним серед підлітків та молоді, особливо серед здобувачів закладів вищої освіти. Пандемія COVID-19 інтенсифікувала прояви залежності від мобільного телефону/смартфону (ЗВМТ/ЗВС) у університетської молоді, що зумовлено переходом до дистанційних форм навчання та зростанням ролі соціальних мереж у підтриманні міжособистісних комунікацій.

Мета – провести систематичний огляд публікацій, що стосуються взаємозв'язку між фізичною активністю (ФА) та ЗВМТ/ЗВС серед здобувачів закладів вищої освіти, які вважаються групою підвищеного ризику.

Матеріали і методи. У цьому дослідженні були застосовані загальнонаукові методи, зокрема пошук літератури, аналітичний огляд, синтез і узагальнення. Відібрані релевантні дослідження з електронної бази даних PubMed охоплювали публікації, датовані з 1 січня 2021 року по 1 жовтня 2025 року. До аналізу були включені дослідження, що відповідали таким критеріям: опубліковані англійською мовою, доступні у повнотекстовому форматі, містили валідні інструменти вимірювання ЗВМТ/ЗВС, оцінювали будь-яку форму ФА, були зосереджені на студентській аудиторії. Ключовими словами, використаними для пошуку були: «фізична активність і залежність від мобільного телефону серед студентів університетів», «фізична активність і залежність від смартфону серед студентів університетів», «фізична активність і проблемне використання мобільного телефону серед студентів університетів», «фізична активність і проблемне використання смартфону серед студентів університетів».

Результати. Нами проаналізовано двадцять дев'ять досліджень, з яких більшість (21) мали крос-секційний дизайн. Решта 8 досліджень включали два рандомізовані контрольовані випробування, один мета-аналіз рандомізованих контрольованих випробувань, три систематичні огляди, один загальний мета-аналіз та один систематичний огляд у поєднанні з мета-аналізом. Проведений огляд літератури показав наявність значимої негативної кореляції між ФА та ЗВМТ/ЗВС серед здобувачів вищої освіти. Більш того, ФА виявилася значущим негативним предиктором виникнення ЗВМТ/ЗВС у цій демографічній групі. Ймовірно, ФА знижує рівень ЗВМТ/ЗВС у здобувачів вищої освіти двома основними шляхами: прямо – шляхом надання альтернативного, більш здорового джерела винагороди, структури та рутинних дій або через фізіологічні механізми; та опосередковано – шляхом покращення психологічного добробуту, оскільки ФА демонструє позитивні асоціації із самоконтролем, самоприйняттям, базовою самооцінкою та стресостійкістю, водночас зменшуючи рівень стресу, негативного емоційного стану, тривожності та симптомів депресії. Крім того, як інтенсивність, так і тип ФА мають вирішальне значення для максимізації цих переваг: помірні та інтенсивні фізичні вправи пов'язані з меншою ймовірністю виникнення ЗВМТ/ЗВС порівняно з низькоінтенсивною ФА; при цьому аеробні вправи демонструють найсильніший ефект у зниженні рівня ЗВМТ/ЗВС. З огляду на глобальну поширеність ЗВМТ/ЗВС, подальші дослідження у цьому напрямі мають охоплювати різні регіони світу, включно з Європою, Африкою, Північною та Південною Америкою. Водночас актуальною є потреба у міжнародній стандартизації та гармонізації інструментів вимірювання ФА та ЗВМТ/ЗВС, адже відсутність єдиних методик суттєво ускладнює порівняння даних та проведення мета-аналітичних узагальнень.

Висновки. Результати огляду публікацій вказують на доцільність впровадження ФА помірної та високої інтенсивності не лише як загальної рекомендації для зміцнення здоров'я, а і як цілеспрямованої, науково обґрунтованої стратегії для зниження ризику виникнення ЗВМТ/ЗВС серед університетської молоді.

Ключові слова: фізична активність, фізичні вправи, залежність від мобільного телефону/смартфону, взаємозв'язок, здобувачі вищої освіти.

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