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Sports and exercise-related smartphone use is antagonistic to hedonic use in regular exercisers: A cross-sectional study examining the roles of exercise frequency and duration

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Abstract

Background: Hedonic smartphone use has been associated with dependence and addiction studied under the umbrella term Problematic Smartphone Use (PSU). Research usually explores total screen time as an index of PSU. A few studies suggest that exercise is inversely related to smartphone use time. However, it is unknown which primary characteristics of exercise behavior are related to more moderate smarthone use. Furthermore, the purpose of smartphone use, such as hedonic use associated with PSU versus utilitarian use, was not tested in the sports and exercise contexts. Hedonic use generally means *playing with the smartphone* for joy, distraction, and satisfaction. Utilitarian use implies practical and valuable use. There is a conjecture that sports involvement may foster utilitarian use through increased involvement in sports-related information-seeking, goal-setting, and self-monitoring.

Methods: Therefore, we examined whether weekly exercise frequency, workout duration, and perceived exercise intensity relate to total daily smarthone and hedonic use and whether this relationship is mediated by sports-related utilitarian device use. We tested regularly exercising adults ($n = 360$, 132 males, $M_{age} = 39.0 \pm 9.8$, $M_{weekly\ exercise} = 5.8 \pm 1.9$) who volunteered for this study and provided demographic information about their exercise habits and smartphone use.

Results: The results revealed that all exercise parameters mediated the total daily smartphone use, with perceived exercise intensity being a negative predictor. Further, exercise frequency and duration (but not intensity) positively predicted sports-related smartphone use, which inversely predicted hedonic use.

Conclusion: These results suggest that exercise parameters directly relate to daily smartphone use, which completely mediates hedonic use. These findings may partially account for the frequently reported inverse relationship between regular exercise and PSU by suggesting that the connection is mediated via sports-related smartphone use.

KEYWORDS

dependence, entertainment, internet, leisure, mobile phone

1 | INTRODUCTION

Smartphones are easily accessible and affordable portable devices in most nations worldwide. Apart from several means of communication, they grant access to the Internet anywhere. It is estimated that there are more than 7.2 billion smartphones worldwide,[1] and the number of users now exceeds half of the world's population.[2] Users benefit from smartphones through diverse applications with a broad spectrum of practical and leisure-oriented functions.[3] Indeed, the choice is vast; as of March 06, 2024, 8.93 million smartphone applications were available worldwide.[4] Exploring, understanding, and using these applications requires substantial time, and many people are distracted from other life activities while losing control over their usage patterns.[5] The worst and philosophically unethical scenario is that software designers create addictive applications, especially games, using designated strategies to achieve their purpose.[6] Consequently, productive life activities and participation in sports and physical activity diminish.[7]

Unsurprisingly, problematic smartphone use (PSU) is a focal concern worldwide because it constantly increases.[8] Pararlley, increasing research attention is devoted to the problem. For example, on March 11, 2024, a Google Scholar title search resulted in 2053 articles containing the terms "problematic smartphone use (PSU)" or "smartphone addiction" in their titles (authors' search). Although the term *smartphone addiction* was thrice as frequent as PSU, currently, there is no clinical classification for smartphone addiction. Yu and Sussman[9] conjecture that PSU could range from mild symptoms to classical addiction with self-harming consequences. However, since there are no medical diagnostic criteria for smartphone addiction, there is a call for avoiding overpathologizing the behavior and treating it as PSU, which, of course, can vary in problematic manifestations.[10]

Conceptually, the term "smartphone addiction" makes no sense because one cannot be addicted to the device itself. Addictive tendencies emerge through behavioral interaction with the application(s) accessed through the device. This difference can be the reason why Csibi et al.[11] named their tool, assessing symptoms of addictive usage patterns, as a "smartphone application-based addiction scale." Indeed, different applications have different purposes, and some may be more addictive than others.[12] The purpose of smartphone use can be generally classified into two categories.[13] One is *utilitarian* use, which serves productive functions associated with daily living, like work, reading, translation, self-monitoring, information, banking, education, etc. The other is *hedonic* use, fueled by an inner motivation to experience joy, entertainment, or other types of distractions that, apart from satisfaction, can have stress-alleviating or relaxing effects but have no tangible future impact on a person's life.[14] Still, stress release, distraction from physical or mental pain, and relaxation have a therapeutic effect, which, based on the "interactional model," might be a path to behavioral addictions.[15] Indeed, hedonic use has been associated with PSU more than utilitarian use.[13,16,17] While no causal relationship has been reported, favoring utilitarian use over hedonic may be preferred to avoid or reduce PSU.[18]

Regular sports and exercise have been connected to the utilitarian use of sports-related applications.[19] Furthermore, at least in young adults, regular physical activity is inversely related to PSU.[20–22] Still, the mechanism of the inverse relationship is unclear. One theory that could account for such observations is the Self-Determination Theory (STD[23]). Accordingly, the STD is based on three primary human needs that sports can fulfill: (1) the first is *autonomy* stemming from the need to feel in control of one's actions and choices; (2) the second is *competence*, mirrored in the need to feel capable and efficient in one's actions; and (3) the third is *relatedness*, surfacing in the need to form meaningful connections with others and experience a sense of belonging and social connection. Gong et al.[24] speculate that if basic psychological needs are not satisfied in real life, individuals try to compensate for them in the low-effort-demanding, always-at-hand smartphone-accessed virtual world, which fosters PSU. Sports and exercise participation create opportunities for satisfying basic psychological needs and, thus, might reduce PSU through real-life rather than virtual experiences.

Key points

- Exercise frequency and duration are positive predictors of daily smartphone use.
- Exercise intensity is a negative predictor of total daily smartphone use.
- Exercise frequency and duration are positively related to sports-related smartphone use.
- Sports-related smartphone use is a negative predictor of hedonic smartphone use.

While regular physical activity is critical for a healthy lifestyle,[25] research evidence confirms the inverse relationship between smartphone use volume and physical activity. In a study measuring objectively total smartphone use in college students, the physically less active participants were about three times more likely to exhibit increased smartphone use than those with higher physical activity levels.[21] An inverse connection between physical activity and smarthone use was also noted in children.[26] In adults, however, a study found that regular physical activity was positively related to daily smartphone use.[27] Similarly, a study with regular adult exercisers unveiled a positive relationship between high exercise involvement and PSU.[28] The explanation for the positive connection between regular physical activity and daily smartphone use is connected to hedonic and utilitarian use. It was speculated that physically active individuals may show more interest in sports-related "apps," which may reinforce and motivate their exercise behavior.[27,29]

Despite the inverse connection between physical activity and smartphone use, research has failed to untangle the specific component of exercise behavior in the examined relationship. For example, whether frequency, exercise workout duration, or intensity is more closely related to total daily smartphone (mobile phone) use (TMU) is unknown. Furthermore, a positive relationship between physical activity and TMU was evident in adults and regular exercisers, and it was associated with sport-related (utilitarian) smartphone use. Therefore, this exploratory work examined how three exercise parameters relate to TMU in regular exercisers and whether the latter is mediated by sports-related smartphone use. Furthermore, we tested whether sports-related use could be inversely associated with hedonic use, which could partly account for the positive relationship between physical activity and TMU disclosed in earlier studies.[27,29] Knowing that age and gender affect our dependent measures,[30] we exerted control over these variables.

1.1 | Hypotheses

In this study, we examined three hypotheses: (1) Based on Fennel et al.,[27] after controlling for age and gender, exercise frequency, workout duration, and perceived exercise intensity will positively relate to the TMU and negatively relate to hedonic use. (2) Exercise frequency, workout duration, and perceived exercise intensity will relate indirectly to TMU and hedonic use via the mediation effect of sports-related smartphone use. (3) Age and gender will directly affect TMU and hedonic use. All tests were pre-planned.

2 | MATERIALS AND METHODS

2.1 | Sample size calculation

We calculated the required sample size for multiple linear regressions, also used in mediation analyses,[31] by using the G*Power (V3) software.[32] using the following input parameters: power ($1–\beta$) = 0.80, medium effects size (Cohen's f) = 0.15, and $\alpha = 0.05$, which yielded a minimal sample size of 55. However, we also determined the required sample size based on a medium effect on both *paths a* and *b* generated with the Sobel test (minimum $n = 90$) and bias-corrected bootstrap (minimal sample size = 71) using the simulation data of Fritz and MacKinnon.[33] For Chi-square [χ^2] tests with a $df = 2$, $1–\beta = 0.80$, and medium effect size phi (φ) = 0.30, the required minimum sample size was 108. Based on two-tailed tests with a significance level α =0.05 and a power level ($1–\beta$) of 0.80, using medium effect size $r = 0.30$, the required sample size for correlations was 82. Finally, to compare males and females on all measures using multivariate analysis of variance (MANOVA) with the following parameters: power ($1–\beta$) = 0.80, medium effects size (V) = 0.06, and $\alpha = 0.05$, with a maximum of seven predictors, the required minimum sample size was 153. This number was the largest among the statistical tests we planned to use. Our final sample size was more than twice as high as the minimum sample size required for any of the planned statistical analyses.

2.2 | Ethical permission

This study was conducted with ethical permission (Number 2023-538) issued by the Research Ethics Committee of the Faculty of Education and Psychology at ELTE Eötvös Loránd University in Budapest, Hungary, which also ensured that the research conforms to the ethical principles for research with humans of the Helsinki Declaration.[34] All participants provided informed consent before completing the study.

2.3 | Participants

Exercising volunteers were recruited in person from fitness centers in a large metropolitan area and via calls for participation on social media (LinkedIn, Facebook, Twitter, and Instagram). The inclusion criteria were regular weekly participation in planned sports or exercise, age 18 years or over, and consent to participation. Only the fully completed data were retained for statistical analyses, and data from those reporting no smartphone use at all or unrealistically high daily use of smartphones (i.e., >16 h/day) were deleted from the data file. Research suggests that university students, who are the most prone to smartphone addiction,[35] use their smartphones in the range of one to 16 h per day, and their internet use also amounts to this maximum period.[36] Consequently, more than 16 h of smartphone use in a general (mixed-age) adult sample can be considered unrealistic. In this way, the final sample consisted of 360 participants, 132 males and 228 females.

The sample's mean age was 39.0 ± 9.8 years, and its average exercise volume amounted to 5.8 ± 1.9 h per week. More than 92% of the participants exercised four or more times every week. They reported practicing six general forms of exercise: aerobics, CrossFit, cycling, running, swimming, and triathlon. Participants exercise effort was 5.08 ± 1.06, corresponding to the "hard" category on Borg's Rated Perceived Exertion (RPE) scale.[37] Most of the sample (330, or 91.67%) were employed, 22 (6.11%) were students, and eight (2.22%) were unemployed. The majority (213, or 59.17%) were in a relationship but not cohabiting with a partner, 107 (29.72) were cohabiting with a partner, and 40 (11.11%) were single. There were no gender differences in work or partnership ratios.

Concerning smartphone usage, participants reported using their smartphones for an average of 3.55 ± 2.08 h daily. More than half of this time (58.60%) reflected utilitarian use (34.83 ± 22.17% for work, information, or practical purposes, and 23.78 ± 18.83% for sports-related activities). Hedonic use accounted for 41.40% of the total smartphone usage time. As reported in the Results section, there were no gender differences in these measures.

2.4 | Materials

Demographic questions asked participants about their gender, age, partnership and working status, form of exercise, weekly exercise frequency, duration of typical exercise sessions, and perceived exercise intensity during their average workout on the 20-point RPE[37] scale comprising seven categories, ranging from *very, very light* to *very, very hard*. We recoded the RPE categories to a 1–7 range to denote each category with a single number and simplify interpretation and data analyses.

Further, we also asked participants to read from their smartphone if they have a tracking application or to subjectively estimate, as accurately as possible, their mean daily smartphone use (screen time) in hours. Next, we presented three sliding bars, ranging from 0 to 100, to ask participants to estimate the percentage of time they use their smartphone for (a) sports-related activities (information, tracking, etc.), (b) utilitarian/

work-related tasks (including all practical uses other than sports), and (c) hedonic use (defined as activities for entertainment, fun, joy, or distraction). The answer was acceptable only if the three added up to 100%. Nevertheless, one could also select 100% for a single category (i.e., if one used a smartphone for work/utilitarian purposes only) or any combination of only two categories as long as the sum was 100%.

2.5 | Procedure

This study was pre-registered on the Open Science Foundation (OSF) Registries without embargo (doi:10.17605/OSF.IO/7TRMH). Individuals interested in the study were provided a link to access the survey posted on the Qualtrics research platform.[38] The first page contained the conditions for participation and the informed consent that had to be accepted by selecting and clicking a *yes* ("I accept") button. Subsequently, respondents could access the questions (Appendix). Anonymous data collection lasted 3 months and ended in the winter of 2023/2024. The raw data retrieved from the Qualtrics were exported in SPSS files, checked, cleaned, and subjected to statistical analyses using the SPSS (v. 28) and JASP (Version 0.18.3) softwares.

2.6 | Data analyses

The data on which this study is based are available at the Mendeley data repository (doi:10.17632/crhtw2dwy3.1). Using SPPS, we calculated Pearson's *r* correlations. Next, we tested gender differences in age, exercise- and smartphone use measures using Chi-square tests (χ^2) for frequency data (partnership and work status) and employed MANOVA for continuous data. We used the JASP software for linear regression analyses to examine the feasibility of mediation analyses that examined the pre-planned mediating role of sports-related smartphone use on TMU and hedonic use. Mediation analysis was performed with the same software.

3 | RESULTS

3.1 | Normality check

The current data were not normally distributed as calculated with Kolmogorov–Smirnov and Shapiro–Wilk tests. However, considering a relatively recent robust re-evaluation of the Central Limit Theorem, non-normality should not pose a concern if the sample size exceeds 50.[39] The current study's sample size was more than seven times greater. Furthermore, in the MANOVA test, we relied on Pillai's trace statistic (*V*), which is considered sufficiently robust when parametric assumptions are violated.[40]

3.2 | Correlations

The Pearson correlations revealed that age was statistically significantly, but weakly, related to all measures except perceived workout intensity. Exercise frequency was positively related to workout duration and intensity and sports-related smartphone use. At the same time, it was inversely related to work-related smartphone use. Workout (training) duration was positively related to perceived exercise intensity, total smartphone use, and sports-related smartphone use. In contrast, like exercise frequency, it was negatively related to work-related smartphone use. Perceived exercise intensity was positively associated with sports-related smartphone use and negatively related to work-related smartphone use. Hence, all three exercise parameters were positively associated with *sports-related* smartphone use and negatively related to *work-related* smartphone use. The latter two were also significantly related in a negative direction. Finally, hedonic smartphone use was strongly and inversely associated with both sports-related and work-related smartphone use. These correlations are summarized in Table 1.

TABLE 1 Pearson's correlation coefficients between exercise characteristics and smartphone use patterns.

	1.	2.	3.	4.	5.	6.	7.
1. Age	–						
2. Weekly exercise frequency	0.113*	–					
3. Workout duration (min)	−0.147**	0.192**	–				
4. Perceived workout intensity (Borg scale)	−0.045	0.330**	0.347**	–			
5. Total daily smartphone use (TMU; hours)	−0.223**	0.077	0.125*	−0.080	–		
6. Sports-related smartphone use (percent of TMU)	0.163**	0.310**	0.209**	0.182**	−0.036	–	
7. Work-related smartphone use (percent of TMU)	0.104*	−0.196**	−0.140**	−0.122*	0.009	−0.366**	–
8. Hedonic smartphone use (percent of TMU)	−0.231**	−0.064	−0.036	−0.031	0.020	−0.461**	−0.657**

Note: Statistically significant correlations.

Abbreviation: TMU, total daily smartphone use.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (two-tailed tests) $n = 360$.

3.3 | Gender differences

Chi-square tests revealed statistically no significant gender differences in partnership status (χ^2 (2) = 4.67, $p = 0.10$) or work status (χ^2 (2) = 3.45, $p = -10$). However, the MANOVA yielded statistically significant gender multivariate main effects (Pillai's Trace = 0.044, $F(7, 352) = 2.29$, $p = 0.027$, effect size (partial Eta squared [$p\eta^2$]) = 0.044). The associated univariate tests revealed that gender differences existed only in the reported duration of the workouts and perceived workout intensity, with males reporting higher scores on both measures than females. These results are illustrated in Table 2.

3.4 | Mediation analyses

The criteria for mediation were examined based on Baron and Kenny's[41] suggestion to test three regressions. First, the independent measures (exercise frequency, workout duration, and perceived exercise intensity) predicted TMU statistically significantly ($F(3, 356) = 5.22$, $p = 0.002$, $R^2 = 0.042$). Second, they were also significant predictors of the mediator, sports-related smartphone use ($F(3, 356) = 16.29$, $p < 0.001$, $R^2 = 0.121$). Third, the mediator predicted statistically significantly the hedonic smartphone use ($F(4, 355) = 25.34$, $p < 0.001$, $R^2 = 0.222$), while the independent measures were not significant, indicating complete mediation by sports-related smartphone use on hedonic smartphone use.

Thus, to test the hypotheses, we used mediation analyses with three predictors (exercise frequency, workout duration, and perceived exercise intensity), two outcome measures (TMU and proportion dedicated to hedonic use), one mediator (sports-related smartphone use), and two background confounders based on preliminary tests (age and gender). The results yielded three statistically significant direct and total effects between three exercise parameters and TMU (Table 3 and Figure 1). The effects of exercise frequency and duration were positive, while perceived exercise intensity was negatively related to TMU. Two statistically significant indirect effects indicated that sport-related smartphone use mediated the relationship between exercise frequency, workout duration, and hedonic smartphone use. Gender only predicted exercise duration and perceived intensity. Finally, age predicted significantly all measures except exercise intensity.

4 | DISCUSSION

The take-home message of this study is that exercise frequency and training duration positively impact TMU, while perceived exercise intensity has the inverse effect. Furthermore, sports-related smartphone use, positively associated with three exercise parameters, bears an inverse relationship with hedonic use. Therefore, this work suggests that regular exercise participation is not antagonistic to TMU, but the perceived intensity is.

TABLE 2 The results of the univariate tests contrasted the measures between males and females.

Gender		Median	Mean	SD	*F*	*p*	$p\eta^2$
Age	Male	40.00	39.91	9.29	1.80	0.180	0.005
	Female	37.00	38.47	10.09			
Weekly exercise frequency	Male	6.00	5.86	1.63	0.22	0.638	0.001
	Female	6.00	5.76	2.03			
Workout duration (min)	Male	60.00	68.64	19.65	5.67	0.018[a]	0.016
	Female	60.00	63.81	17.85			
Perceived workout intensity (Borg scale)	Male	6.00	5.27	1.08	6.22	0.013[a]	0.017
	Female	5.00	4.98	1.03			
Total daily smartphone use (TMU; hours)	Male	3.00	3.40	1.87	1.02	0.313	0.003
	Female	3.00	3.63	2.19			
Sports-related smartphone use (percent of TMU)	Male	20.00	23.08	18.79	0.28	0.597	0.001
	Female	20.00	24.18	18.89			
Work-related smartphone use (percent of TMU)	Male	30.00	34.10	22.61	0.23	0.635	0.001
	Female	32.00	35.25	21.95			
Hedonic smartphone use (percent of TMU)	Male	40.00	42.82	24.15	0.78	0.378	0.002
	Female	39.00	40.57	22.71			

Abbreviations: $p\eta^2$, effect size (partial Eta squared); SD, standard deviation; TMU, total daily smartphone use.

[a]Statistically significantly different between males and females based on univariate analyses of variances, following up the statistically significant multivariate analysis of variance (MANOVA).

TABLE 3 Path coefficients associated with Figure 1.

			Estimate	Standard error	*z* Value	*p*	95% Confidence Interval Lower	Upper
SPU	→	HDC	−0.465	0.050	−9.374	<0.001	−0.562	−0.368
EFR	→	HDC	0.094	0.051	1.854	0.064	−0.005	0.193
EDR	→	HDC	0.012	0.051	0.230	0.818	−0.087	0.111
INT	→	HDC	0.006	0.051	0.115	0.909	−0.095	0.106
SPU	→	TMU	−0.044	0.054	−0.810	0.418	−0.151	0.063
EFR	→	TMU	0.147	0.056	2.645	0.008	0.038	0.256
EDR	→	TMU	0.139	0.055	2.508	0.012	0.030	0.248
INT	→	TMU	−0.174	0.056	−3.089	0.002	−0.284	−0.064
EFR	→	SPU	0.238	0.052	4.562	<0.001	0.136	0.341
EDR	→	SPU	0.177	0.053	3.348	<0.001	0.073	0.281
INT	→	SPU	.060	0.054	1.102	0.270	−0.047	0.166
GMF	→	EFR	−0.035	0.109	−0.323	0.747	−0.248	0.178
Age	→	EFR	.011	0.005	2.136	0.033	0.001	0.022
GMF	→	EDR	−0.282	0.107	−2.626	0.009	−0.492	−0.071
Age	→	EDR	−0.016	0.005	−3.025	0.002	−0.026	−0.006
GMF	→	INT	−0.279	0.108	−2.572	0.010	−0.491	−0.066
Age	→	INT	−0.006	.005	−1.046	0.295	−0.016	0.005
GMF	→	SPU	0.157	0.102	1.536	0.125	−0.043	0.358
Age	→	SPU	0.017	0.005	3.403	<0.001	0.007	0.027
GMF	→	HDC	−0.085	0.097	−0.876	0.381	−0.274	0.105
Age	→	HDC	−0.0170	0.005	−3.508	<0.001	−0.027	−0.008
GMF	→	TMU	0.078	0.106	0.734	0.463	−0.130	0.286
Age	→	TMU	−0.022	0.005	−4.149	<0.001	−0.033	−0.012

Note: Path analysis, delta method standard errors, normal theory confidence intervals, ML estimator; SPU stands for sport-related smartphone use; EFR stands for exercise frequency; EDR stands for workout (training) duration; INT stands for perceived exercise intensity; HDC stands for hedonic smartphone use; GMF stands for gender (male, female); and TMU stands for total daily smartphone use (hours).

Accordingly, exercise alone is positively connected to TMU, but high exercise intensity is related to lower smartphone use. Furthermore, despite no total effect on hedonic use, two exercise parameters (frequency and duration) are indirectly related to lower hedonic smartphone use. However, this association is *entirely mediated* by sports-related smartphone use.

The data partially supported the first hypothesis, presuming that exercise characteristics—frequency, duration, and perceived exercise intensity—would directly affect TMU while being inversely related to hedonic smartphone use after controlling for age and gender. Two of three exercise characteristics (frequency and duration) were indeed positively related to TMU, but exercise intensity had a significant negative connection with these outcome measures. We have no explanation based on the literature for this unexpected finding. However, we posit that those working with greater intensity might be more involved in sports and have less time to use their smartphones, or alternately, based on the SDT, they might seek more gratification in real life than in the virtual world, which partially could also explain their perception of more arduous exercise training. Still, these conjectures are speculative; if further research using objective measures replicates this finding, the mechanism beyond it should also be addressed.

Furthermore, while support emerged for exercise frequency and workout duration being positively related to TMU, no direct mediation effect could be observed on hedonic smartphone use. The second hypothesis was also only partially supported because only two of the three exercise features (frequency and duration, not intensity) have indirectly negatively impacted hedonic use, but not TMU, through the mediating effects of sports-related smartphone use. Finally, the third hypothesis, conjecturing that age and gender would directly affect TMU and hedonic use, was underpinned by age but not gender. Consequently, all hypotheses posed in the current work were partially supported.

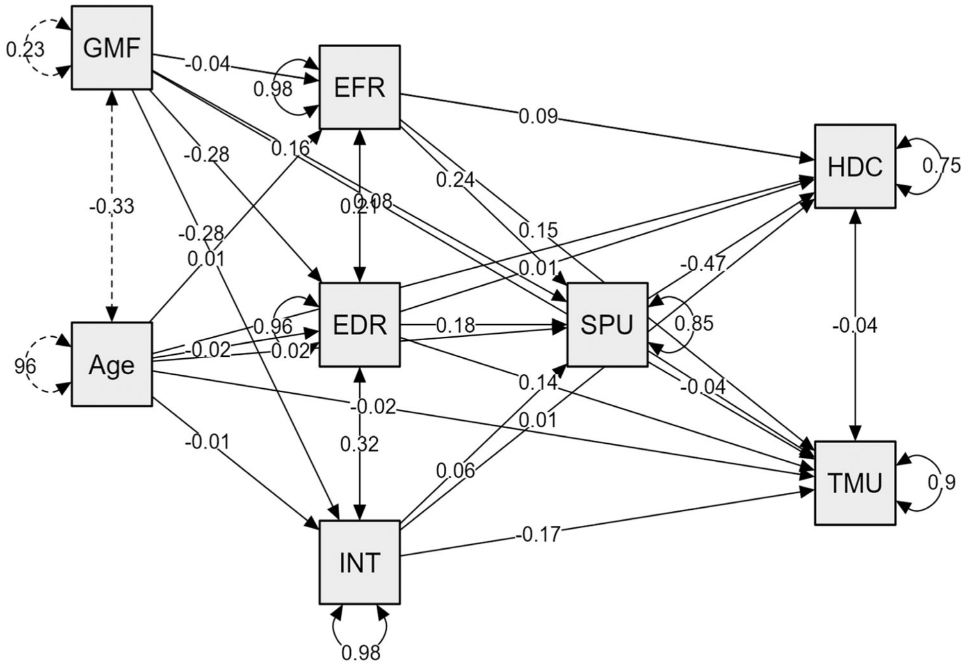

FIGURE 1 Path diagram of the hypothesized model. SPU stands for sport-related smartphone use; EFR stands for exercise frequency; EDR stands for workout (training) duration; INT stands for perceived exercise intensity; HDC stands for hedonic smartphone use; GMF stands for gender (male, female); and TMU stands for total daily smartphone use (hours). For statistical significance levels, see Table 3.

The positive relationship between exercise frequency and duration with TMU and the inverse association between perceived exercise intensity and TMU are novel findings that have not been examined to date in the literature. They disagree with a few similar, but not identical, research in the field. For example, Demirbilek and Minaz[42] found no relationship between university students' smartphone use and physical activity levels. Similarly, Dahlgren et al.[43] found no relationship between smartphone screen time and physical activity among children and adolescents aged 10–15. Furthermore, an inverse relationship between physical activity and smartphone use time was reported in college students.[21,23] In contrast, a study with regular adult exercisers, similar to the current study, revealed a positive relationship between higher exercise involvement and smartphone use and abuse.[28] Overall, there appears to be a connection between exercise characteristics and daily TMU, but it depends on the participants' age and levels of exercise or physical activity involvement.

Indeed, age was correlated with all measures in the current study except for exercise intensity. It was positively related to exercise frequency, workout duration, and sports-related smartphone use and inversely related to TMU and hedonic smartphone use. Concerning TMU, our findings agree with two extensive studies showing an inverse relationship between TMU and age.[30,44] Andone et al.[30] also showed gender differences, contrasting our findings, but while Andone et al. examined a general population, we tested a regularly exercising sample. It is possible that while gender differences in TMU exist in the general population, they might vanish in regular exercisers.

This study expands the works on the relationship between TMU and age by showing that age is also inversely related to hedonic use. While these findings are not new, they support similar research reporting a negative association between age and hedonic smartphone use.[13,30] Hedonic use is closely related to PSU.[13,17] Therefore, its moderation is essential in preventing PSU. Our findings show that exercise characteristics indirectly affect hedonic use via their positive association with sports-related smartphone use. Indeed, exercise characteristics may foster sports-related utilitarian use for athletic records, diaries, progress evaluations, weight and caloric monitoring, general information, and so forth[27,29] which, as based on the current results, are inversely associated with hedonic use. Thus, sports-related smartphone use seems to be antagonistic to hedonic use. The current findings may have implications for the mechanisms in studies linking exercise intervention to reduced PSU.[45,46]

4.1 | Limitations

This study has limitations that render the findings only tentative. Still, they can motivate future research in this area. One limitation is that we studied volunteers and collected anonymous data online, thus lacking control over the measures. Another pitfall of the work is that all data were subjective approximations that might be subject to memory distortions. Furthermore, we did not ask the participants about their socioeconomic status and education level, which could influence the results. Finally, the cross-sectional design employed in the current study does not permit causation. Thus, future research should replicate this work using *objective* exercise and smartphone measurements.

5 | CONCLUSIONS

The current cross-sectional study suggests a positive relationship between exercise frequency, workout duration, and TMU, which might be associated with increased sports-related smartphone use in regular exercisers. An inverse relationship between self-reported exercise intensity and TMU begs for further research, as there is no explanation for these findings based on the extant literature. Exercise frequency and workout volume affect hedonic use through the mediation effect of sports-related smartphone use, to which they are positively related. The current study supports past explanations for more utilitarian, specifically sports-related smartphone use, which may be a reason behind a positive association between regular exercise and overall smartphone use. This study expands the field by showing that exercise behavior fostering sports-related utilitarian smartphone use, through the mediating effect of the latter, is inversely related to hedonic use, which is a factor in PSU.

AUTHOR CONTRIBUTIONS

Neha Pirwani: Conceptualization; investigation; visualization; software; data curation; writing—review and editing. **Attila Szabo**: Supervision; formal analysis; conceptualization; visualization; validation; methodology; writing—review and editing; writing—original draft.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Mendeley at https://data.mendeley.com/datasets/crhtw2dwy3/1, reference number crhtw2dwy3/1.

TRANSPARENCY STATEMENT

The lead author Attila Szabo affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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APPENDIX

Three question groups in the survey.