



## Effects of 72-hour abstinence from instant messaging on craving, withdrawal, and affect

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### ABSTRACT

The effects of abstinence from digital services and/or devices (aka “digital detox”) on mental health have received increased interest in recent years. Regular breaks and abstinent periods are advised to help individuals who overuse digital technology, but the psychological benefits and related consequences require empirical attention. While some studies have examined the impact of abstinence from smartphone or social networks (SN) on mental health, there is a dearth of literature on the effects of abstinence from Instant Messaging (IM) services. This study examined the association between a 72-h abstinence from IM and subjective craving toward IM, IM withdrawal-like symptoms, affect (positive and negative), and time spent on IM. Thirty-five undergraduates who regularly engaged in IM were assessed one day before (baseline), during (daily), one day after, and one week after refraining from using IM for 72 h. Results revealed a moderate-to-large decrease in craving ( $\eta^2 = 0.438$ ) and negative affect ( $\eta^2 = 0.386$ ) during and after the abstinence, whereas withdrawal-like symptoms and positive affect remained stable ( $\eta^2$  between 0.009 and 0.140). One week after abstinence, participants reported a small-to-moderate decrease in their IM use ( $d = 0.32$ ). These results suggest that abstinence from IM is associated with reduced preoccupation and/or obsession (i.e., craving) with this use and lower negative affect. However, withdrawal-like symptoms and positive affect did not change. These findings support recommendations that IM users experiencing negative affect states may benefit from short-term abstinence. Further research should investigate strategies to support users in undertaking abstinence and regulating their digital device use.

### 1. Introduction

Smartphones are a fundamental tool for more than 5 billion users worldwide (Statista, 2022). These devices have revolutionized people’s lives, bringing multiple advantages in terms of developing and maintaining social relationships, personal and professional communications, work productivity, or leisure time (Gowthami & Kumar, 2016; Ricoy et al., 2022). However, some individuals can develop a dysregulated pattern of smartphone use characterized by: excessive time/effort spent on its use, impaired ability to limit or control its use, frequent failure to

fulfill family, social, or work responsibilities due to the smartphone use, and persistence in its use despite negative consequences (e.g., driving while texting, erratic social interactions, etc.; Billieux et al., 2015). These phenomena have been termed Problematic Smartphone Use (PSU); Billieux, 2012; Elhai et al., 2017), and have received an increasing focus of research in the last two decades.

PSU was initially conceptualized as a generalized, unspecified overuse of smartphones. More recently, research on this problematic behavior has progressively focused on specific online activities for which individuals exhibit problematic involvement (i.e., generalized

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versus specific PSU; Starcevic et al., 2021). Among the activities that might become excessive and uncontrolled, real-time communication services (e.g., instant messaging, IM, or social network, SN) are particularly relevant (Busch & McCarthy, 2021). Closely linked to these services, Billieux et al. (2015) proposed an integrative model of PSU in which one of the hypothesized pathways leading to its excessive and problematic use is driven by the need of excessive reassurance. Reassurance refers to the use of smartphone as a way to obtain and maintain interpersonal reassurance, as well as to be constantly communicating with others, potentially leading the emergence of addiction-like symptoms (Pivetta et al., 2019). In this context, IM services and SN, which are designed to prolong the time spent on applications (Flayelle et al., 2023), may further promote PSU, including loss of control, experiences akin to craving and withdrawal, and mood disturbances (such as stress, anxiety, and/or depression; Billieux et al., 2015; Harris et al., 2020).

Research suggests that addiction-like symptoms, such as craving or withdrawal symptoms, are relevant in the context of non-substance-related addictive behaviors (see Fernández et al., 2020), despite some criticisms of their definition (e.g., Kardefelt-Winther, 2017; Starcevic, 2016). In the context of online gaming, withdrawal symptoms are described as aversive emotional states (e.g., irritability, anxiety, moodiness) arising from reduced involvement or abstinence from the activity (Kaptis et al., 2016). Similarly, desire thinking (associated with visual imagery and verbal thoughts) and craving have been proposed to play an important role in the perpetuation of Internet use disorders (Brandtner et al., 2021).

Craving and withdrawal are promoted by deprivation or interruption of the problematic behavior (Dong et al., 2018). Specifically, craving and withdrawal may be induced by abstinence periods in which individuals are asked to refrain from engaging in a potentially problematic behavior ("forced abstinence"; Castro-Calvo et al., 2018; Dong et al., 2019). Wilcockson et al. (2019) observed an increase in craving responses after a 24-h abstinence from smartphone use, that appeared immediately before the abstinence period and remained stable for the duration of the study. Similarly, Eide et al. (2018) reported an increase in withdrawal symptoms during a 72-h abstinence from smartphone use in a sample of 127 regular users (particularly between the first and last day of abstinence and decreasing in the follow-ups). Finally, Stieger and Lewetz (2018) reported an increase in craving and withdrawal symptoms during a 7-day abstinence from SNs, which was maintained over time. Nevertheless, other studies exploring craving and withdrawal responses during abstinence from general smartphone use or SN have reported contrasting results. For example, Zinn and Rademacher (2019) observed a progressive decrease of craving in regular users over a 10-day abstinence from smartphone (i.e., including but not limited to the use of IM).

Abstinence from an activity in which one is highly involved—whether it is problematic or not—is likely to alter and change the users' mood (Kardefelt-Winther et al., 2017; King et al., 2016). However, findings from studies examining the impact of smartphone and/or SN abstinence on emotional states are limited and have produced inconsistent results. While some studies report no impact of abstinence use on positive (PA) and negative affect (NA) (Eide et al., 2018; Wilcockson et al., 2019), other studies have reported mixed results. Stieger and Lewetz (2018) reported that PA decreased during a 7-day abstinence from SN and then returned to baseline. The authors concluded that SN was a central part of everyday life such that being without it decreased wellbeing. Similarly, a study conducted with 138 regular Facebook users found that well-being significantly decreased after five days of SN abstinence (Vanmann et al., 2018). In contrast, two studies reported an increase of PA and well-being during a 7-day abstinence from SN (Brown & Kuss, 2020; Tromholt, 2016). This increase was associated with a decrease in daily time spent on SN after the abstinence period (Brown and Kuss, 2020), suggesting that the so-called "digital detox" might reduce the negative impact of smartphone use on outcomes like well-being or emotional states (Radtke et al., 2022).

## 1.1. The present study

Given the growing evidence that the use of IM services might elicit addiction-like symptoms (e.g., craving and withdrawal) (Clemons, 2021), as well as the lack of studies exploring the short-term impact of abstinence from this digital service, the aim of this research was to examine the association between a 72-h abstinence period from IM and: (i) craving responses, (ii) withdrawal-like symptoms, (iii) positive and negative affect, and (iv) time spent on IM (assessed one-week post-abstinence). To address these aims, regular IM users were asked to refrain from IM for three days. Participants were assessed prior to the 72-h abstinence, during (through daily assessments), and two times after (one time immediately after finishing the abstinence period and the other one week after). A 72-h abstinence period was established for several reasons. According to Szabo (1998), the optimal length of an abstinence period should allow the beginning of the addiction-related symptoms but not enough so participants do not agree to participate or drop out. The typical frequency of the target behavior (in our case, IM) is a relevant factor in determining an optimal length so that abstinence effects and addictive-related symptoms emerge (Fernández et al., 2020). Given that IM is used daily and frequently, the effects may appear within a day (or even within hours). Thus, as we aimed to explore the progression of symptoms, the study employed a brief but representative period (72 h). Also, this design was consistent with a previous study which employed this time period with similar aims and methodology and reported positive results (Eide et al., 2018).

Based on previous findings, we expected to identify a short-term increase in craving and withdrawal-like symptoms from the beginning of the abstinence period (Stieger & Lewetz, 2018; Wilcockson et al., 2019), followed by a significant reduction of these symptoms over time (Eide et al., 2018). Considering the potential effect of abstinence on daily well-being (Vanmann et al., 2018), we also hypothesized that the first 24 h of the abstinence period would be followed by a decrease in PA and increase in NA. Finally, we expected that participants would show a change in the time spent using IM after the abstinence period. Given the mixed results of previous studies, the cessation of the abstinence period may be followed by a reduction of the time spent on it use (Brown & Kuss, 2020) or, conversely, by a significant increase (Galla & Duckworth, 2015).

## 2. Method

### 2.1. Participants and procedure

We recruited a convenience sample of undergraduate students who reported a high daily use of IM services. Recruitment was made via flyers and posters displayed at the University of Luxembourg (UL), as well as emails sent to UL students. Students expressing interest in participating in the study received a link to a short online survey assessing their eligibility. Participants were eligible if they were aged between 18 and 33 years old, fluent in English, and daily users of IM services.

From the 69 undergraduate students that completed the eligibility survey, 35 (20 women;  $M_{age}=26.37$ ,  $SD=3.16$ ) met the inclusion criteria and took part in the study. In terms of smartphone use, self-reported time spent per day on smartphone use ranged between 40 and 900 min ( $M = 232.26$ ,  $SD = 203.27$ ). Specifically, the time spent on IM ranged between 3 and 600 min ( $M = 137.31$ ,  $SD = 144.96$ ). WhatsApp was the main app for IM for most participants (58.8%), followed by Facebook Messenger (28.6%), Telegram (5.9%), iMessage (2.9%), and Instagram (2.9%). Sociodemographic and IM use characteristics of the sample are provided in Table 1.

Participants received an e-mail describing the research protocol and timing (see Fig. 1). In this e-mail, it was explained that the study involved abstinence from any IM app. The study started with an initial in-office assessment appointed on Monday (pre-abstinence assessment), in which participants were informed that the study aimed to explore the

**Table 1**  
Participants' characteristics.

Sample size (n = 35) % (n) or M (SD)	
Sociodemographic	
Age	26.37 (3.16)
Gender	
Men	42.9% (n = 15)
Women	57.1% (n = 20)
Smartphone use	
Time spent on smartphone use per day (in min)	332.26 (203.27)
IM use	
Time spent on IM use per day (in min)	137.31 (144.96)
Less than 60 min (-1h)	25.7% (9)
Between 60 and 180 min (1-3h)	45.7% (16)
Between 180 and 300 min (3-5h)	17.2% (6)
More than 300 min (+5h)	11.4% (4)
Main app used for IM purposes	
WhatsApp	58.8% (21)
Messenger	28.6% (10)
Telegram	5.9% (2)
iMessage	2.9% (1)
Instagram	2.9% (1)

commitment (Bell et al., 2023). Participants were allowed to use social media services (e.g., Facebook), but were explicitly asked to refrain from exchanging messages with other users or checking their messages. Similarly, the use of dating apps based on instant messaging (e.g., Tinder) were not allowed. During the 72-h abstinence period, participants received an email (always at 6 p.m.) including a personalized link to an online survey measuring craving (CEQ), withdrawal (CSW<sup>2</sup>), and affect (PANAS). On Friday (i.e., first day following the 72-h abstinence), participants attended a second in-office assessment in which they answered the scales assessing craving (CEQ) and affect (PANAS). In the follow-up assessment one-week later, participants completed the CEQ, PANAS, and the initial ad hoc scale measuring IM use.<sup>3</sup> After the end of the experiment, all participants received 20€ as compensation for taking part in the study. No participants reported breaching the abstinence period.

2.2. Measures

2.2.1. Instant messaging use

Participants completed a set of questions assessing basic aspects of

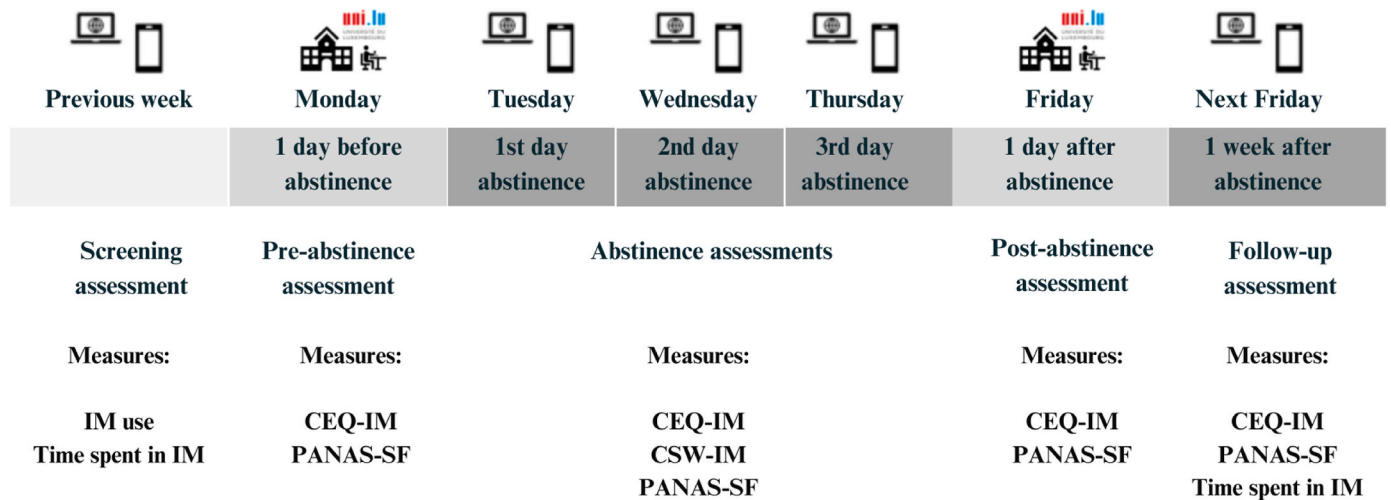


Fig. 1. Study procedure.

psychological outcomes of abstinence from IM applications. They were then informed that, to take part in the study, they need to commit to abstaining from these apps for three consecutive days, during which they had to complete a few questionnaires. To this end, participants were encouraged to answer “as honestly as possible”. We insisted on the relevance of reporting any breach of abstinence during the abstinence period, and that this would not affect the financial compensation they would receive for participating. Afterwards, participants were asked to complete self-report scales assessing craving (CEQ), affect (PANAS), and IM use. Participants also completed other questionnaires which were not considered for the present study (<https://osf.io/y6njm/>); however, no other study was published with part or all the current dataset. For the following three days, participants were asked to abstain from using IM applications (on their smartphones or other electronic devices) and to disable pop-up notifications to prevent potential breaches of abstinence

their IM use, including: (1) which applications participants use for IM (11 IM apps, Yes/No); (2) which app is the most frequently used for IM purposes (open answer); (3) use of IM services on a computer (Yes/No); (4) time using smartphone per day during the last week (in minutes); and (5) time using IM services per day during the last week (in minutes).

2.2.2. Craving responses

Craving responses were assessed using the Craving Experience Questionnaire (CEQ, May et al., 2014) adapted to IM. We used the “strength” version of the scale (i.e., items assessing the intensity of craving urges), adapting the wording of the items to IM (e.g., “At that time, how much did you want to use your instant messaging applications?”).

<sup>2</sup> Given that withdrawal symptoms may arise during periods of abstinence from the problematic behavior (Fernández et al., 2020), the scale used (i.e., CSW) was administered only during the 72-h abstinence assessments. On the contrary, craving may be manifested during abstinence periods but also as a short-term urge right after engaging in the problematic behavior (Canale et al., 2019). Therefore, the CEQ was administered systematically in all the study assessments.

<sup>3</sup> Given that participants were asked to refrain from the use of IM services during the abstinence period, the ad hoc scale used to measure IM use was administered only before (one day) and after (1 week) this abstinence period.

Items were rated on a Likert scale ranging from 0 ("Not at all") to 10 ("Extremely"). Total scores represented the intensity of participants' craving experience. Cronbach's  $\alpha$  of the CEQ in the original validation study was 0.91, whereas in the present study was 0.92.

### 2.2.3. Withdrawal-like responses

Withdrawal-like symptoms were assessed with the Cigarette Withdrawal Scale (CSW, Etter, 2005) adapted to IM. This 21 item-scale is composed of five subscales examining the usual manifestations of withdrawal in non-substance related addictive behaviors (Fernández et al., 2020). In line with the clinical descriptions of behavioral addictions and available research evidence (King et al., 2016), physical symptoms of withdrawal were not expected. Therefore, we administered the three subscales assessing psychological withdrawal: "depression-anxiety", "irritability-impatience", and "difficulty concentrating". Items were rated on a Likert scale ranging from 1 ("totally disagree") to 5 ("totally agree"). Cronbach's  $\alpha$  in the original study ranged from 0.83 to .96. In the present study, internal consistency was 0.89 for "irritability-impatience"/"difficulty concentrating" and 0.91 for "depression-anxiety".

### 2.2.4. Positive and negative affect

Positive and negative affect were assessed using the Positive and Negative Affect Schedule (PANAS-SF, Watson et al., 1988). Participants rated the extent to which they experienced different positive (e.g., "enthusiastic") and negative mood experiences (e.g., "upset"). Items were rated on a 5-point Likert scale ranging from 1 ("very slightly or not at all") to 5 ("very much"). Cronbach's  $\alpha$  in the original validation study ranged between 0.86 and 0.90 for PA and between 0.84 and 0.87 for NA. In the present study, internal consistency was 0.70 for PA and 0.80 for NA.

## 2.3. Statistical analysis

Statistical analyses were carried out using IBM SPSS Statistics (version 26.0). Descriptive statistics were first conducted to characterize participants in terms of craving, withdrawal-like symptoms, and positive and negative affect.

Repeated measures ANOVAs (within-subjects ANOVAs), followed by post-hoc comparison, were then conducted to examine potential differences on craving, withdrawal (analyzing the three psychological dimensions of withdrawal independently), PA and NA between the six assessment moments (before the 72-h abstinence, during abstinence [day 1, 2, and 3] and after abstinence [1-day and 1-week after abstinence assessment]). Time invested in IM before starting the abstinence period was included as a covariate in these analyses. Effect sizes were assessed by partial eta squared ( $\eta^2$ ). For eta-squared, recommended minimum effect size representing a "practically" significant effect size was 0.04, an effect size of approximately 0.25 was considered moderate, and greater than 0.64 large (Ferguson, 2009).

Finally, we conducted *t* tests to explore changes in the weekly time spent on IM use before and after the abstinence period. For the corresponding effect size index (i.e., Cohen's *d*), values around 0.20 were considered small, close to 0.50 moderate, and greater than 0.80 large (Cohen, 1988). Database and analytical codes can be retrieved from the OSF at the following link: (<https://osf.io/y6njm/>).

## 2.4. Ethics

The study procedure was carried out in accordance with the Declaration of Helsinki. The Ethics Review Panel of the University of Luxembourg approved the study (ERP 18–047). All the participants were informed about the study and provided the informed consent to take part.

## 3. Results

Average scores on craving and affect before, during, and after the abstinence period are reported in Table 2. This table also includes average withdrawal-like scores during the abstinence period and weekly time spent on IM before and after the abstinence period. Likewise, scores on these variables across the different assessment moments are depicted in Fig. 2.

### 3.1. Craving

Scores on craving progressively decreased during and after the abstinence period (from 53.09 at one day before abstinence to 36.66 at the one week follow up). Differences on craving scores between the different assessments were moderate-to-large ( $F=4.05$ ;  $p=.007$ ;  $\eta^2=.438$ ). In particular, post hoc comparisons evidenced that craving scores at 1-week after abstinence were lower to those obtained 1-day before abstinence or during the first two days of abstinence ( $p < 0.01$ ).

### 3.2. Withdrawal-like responses

Average scores on the three withdrawal subscales remained stable during the three abstinence days ( $M$  between 10.4 and 10.7 for depression-anxiety [ $F=0.14$ ;  $p=.86$ ;  $\eta^2=.009$ ];  $M$  between 8.73 and 9.27 for irritability-impatience [ $F=0.32$ ;  $p=.60$ ;  $\eta^2=.034$ ]; and between 8.36–7.82 for difficulty concentrating [ $F=0.96$ ;  $p=.33$ ;  $\eta^2=.030$ ]).

### 3.3. Positive and negative affect

As for NA scores, our results revealed a moderate-to-large reduction during and after the abstinence period ( $F=3.28$ ;  $p=.020$ ;  $\eta^2=.386$ ). Bonferroni post hoc comparisons evidenced that the decrease in NA was more pronounced between the baseline and 1-day after abstinence ( $p < 0.01$ ). As in the case of withdrawal, average scores on PA remained stable in the different assessment moments ( $M$  from 30.24 to 32.03;  $F=.845$ ;  $p=.530$ ;  $\eta^2=.140$ ).

### 3.4. Time spent on IM

Average time spent on IM dropped from 140.2 min at the initial assessment to 99.1 per week at the 1-week follow up. These differences reached a small-to-moderate effect size ( $t=1.971$ ;  $p=.057$ ;  $d=0.32$ ), and persisted even after controlling for craving ( $p=.085$ ), withdrawal (depression-anxiety [ $p=.256$ ]; irritability-impatience [ $p=.976$ ]; difficulty concentrating [ $p=.933$ ]), or affect scores (NA [ $p=.594$ ]; PA [ $p=.540$ ]). That said, this result should be interpreted with caution, as the inclusion of potential covariates was limited by the small sample size.

## 4. Discussion

This research aimed to examine whether abstinence from IM use would result in addiction-like symptoms of craving and withdrawal and changes in emotional states in daily users of IM. We also wanted to examine whether these variables changed during and after a three-day IM abstinence. In partial support of our hypotheses, the abstinence period was moderately associated with a progressive decrease in craving levels from the beginning of the abstinence period to the 1-week-post-abstinence follow-up (at which point differences reached statistical significance). These results were consistent with studies showing a decrease in craving symptoms after abstinence (King et al., 2017; Zinn & Rademacher, 2019). This suggests the presence of a positive short-term effect of abstinence on craving. In our study, craving involved preoccupation with IM (including recurrent and intrusive thoughts, worries about the interruption of consumption or diminished cognitive performance), a characterization that is consistent with cognitive

**Table 2**  
Time spent on IM, Craving, withdrawal, and affect before, during and after IM abstinence.

	Before abstinence			During abstinence			After abstinence		Inferential statistic	Effect size	Bonferroni post-hoc comparisons
	Screening assessment	1-day before abstinence (BA)	Day 1 of abstinence (DA1)	Day 2 of abstinence (DA2)	Day 3 of abstinence (DA3)	1-day after abstinence (AA1)	1-week after abstinence (AA2)				
Craving	53.09 (22.48)	49.71 (21.79)	47.17 (26.93)	44.17 (22.87)	42.49 (23.12)	36.66 (18.95)	Wilks' $\lambda = 0.562$ ; $F = 4.05$ ; $p = 0.007$	$\eta^2 = .438$	AA2 < BA** AA2 < DA1** AA2 < DA2**		
Withdrawal							Wilks' $\lambda = 0.991$ ; $F = 0.142$ ; $p = 0.868$	$\eta^2 = .009$	NS		
Depression-anxiety		10.58 (3.97)	10.39 (4.52)	10.70 (4.88)			Wilks' $\lambda = 0.966$ ; $F = 0.320$ ; $p = 0.600$	$\eta^2 = .034$	NS		
Irritability-impatience		9.15 (4.12)	9.27 (4.46)	8.73 (3.63)			Wilks' $\lambda = 0.970$ ; $F = 0.963$ ; $p = 0.334$	$\eta^2 = .030$	NS		
Difficulty concentrating		7.82 (3.12)	7.82 (3.12)	8.36 (3.90)					NS		
Affect							Wilks' $\lambda = 0.614$ ; $F = 3.28$ ; $p = 0.020$	$\eta^2 = .386$	AA1 < BA**		
Negative Affect	22.29 (6.71)	20.60 (6.47)	19.77 (6.09)	20.64 (7.28)	18.57 (5.77)	18.32 (6.52)	Wilks' $\lambda = 0.860$ ; $F = 0.845$ ; $p = 0.530$	$\eta^2 = .140$	NS		
Positive Affect	32.03 (5.65)	31.71 (6.29)	31.03 (5.79)	30.24 (7.08)	31.37 (7.06)	31.97 (6.89)	$t = 1.971$ ; $p = 0.057$	$d = 0.32$			
Time spent on IM (in min)	140.18 (146.14)					99.09 (102.80)					

**Note:** \* =  $p < 0.05$ ; \*\* =  $p < 0.01$ ; \*\*\* =  $p < 0.001$ . In the case of the ANOVA results (i.e., the results for the variables "craving", "withdrawal", and "affect"), the column labelled "inferential statistic" corresponds to the general model effect size and significance. When differences between measures were significant at this general level, pairwise comparisons between the different assessment points were then conducted to determine the particular moments in which the measurement differed significantly (these results are displayed in the column labelled "Bonferroni post-hoc comparisons"). Furthermore, average scores on "craving", "withdrawal", and "affect" in the different assessment points are illustrated in Fig. 2.

manifestation of craving in the context of substance use (Hormes, 2017). Contrary to our hypothesis and previous research (Eide et al., 2018; Stieger & Lewetz, 2018), withdrawal-like scores remained stable around low-to-moderate levels during the 72-h abstinence from IM use. In other words, the abstinence period did not appear to promote withdrawal responses. Considering that withdrawal-like symptoms may be considered an indicator of problematic IM severity (Fernández et al., 2020), this result may be explained by the fact that our sample comprised regular but not problematic IM users. As most participants did not experience problematic engagement in this behavior, abstinence from IM did not result in withdrawal-like symptoms. Supporting this rationale, the inclusion of time spent on IM as a covariate influencing the experience of withdrawal-like symptoms did not result in a significant effect.

As for affect, abstinence period was moderately related to NA. But, contrary to our hypothesis, NA scores decreased over the course of the study, particularly at 1-week after the abstinence period. This reduction, concomitant to the 72-h abstinence period, supports the potential beneficial effect of a short-term "digital detox" on negative affect that was observed in other studies (Radtko et al., 2021). This finding suggests that IM users with elevated negative affect may benefit from short-term abstinence periods to reduce their negative emotional state.

In terms of PA, participants did not report a significant change in this emotional state during or after the abstinence period. In other words, our 72-h abstinence from IM did not result in an improvement in mood. This finding is inconsistent with previous studies in which a short-term digital detox resulted in a significant improvement of mood (Brown & Kuss, 2020; Tromholt, 2016). This inconsistency may be due to the fact that, although the methodology used in our research shares certain similarities with that employed in these studies (e.g., in terms of the general procedure), our study differs in some important aspects. For example, our study did not comprise participants with dysfunctional or problematic smartphone use (characterized by loss of control and associated with negative consequences in daily life). Moreover, previous studies had a broader scope, encompassing abstinence from multiple social media services (not only from IM). As our study only focused on IM, differences in the scope of our study may explain the discrepancies with previous observations. It is also worth noting that we did not measure whether participants used other services offered by the electronic devices to compensate or cope with the forced abstinence period (Castro-Calvo et al., 2018). Another important difference is the abstinence period in these studies was longer (one week rather than three days). Thus, examining whether the length of the abstinence period determines its effectiveness when it comes to improve PA warrants further research. In this regard, recent approaches in social media research suggest that studies should focus on particular psychological processes that may be responsible for generating emotional changes (Kross et al., 2021). Therefore, future studies should also examine whether certain psychological dispositions may explain the success of a brief abstinence period.

This study is not without limitations. First, the limited sample size and the nature of the study sample (non-problematic regular users of IM services) prevent us from extending or generalizing our findings to excessive and problematic IM users. Second, it is uncertain to what extent a period of abstinence may have an effect on someone who is not motivated to reduce or change their IM use (e.g., participants in our research). Although participants were asked to refrain from IM during the abstinence period, we cannot preclude that some of them breached the abstinence. Third, we cannot rule out that participants used other services also included in SNs sites but not restricted in our study (e.g. commenting on posts). Therefore, our study cannot take into account the potential compensatory behaviors deployed by the participants during the abstinence period. Fourth, craving, withdrawal-like symptoms, and affect scores were obtained with self-reported, static measures. Research shows that these variables are dynamic processes that change continuously, meaning future research should consider the use of alternative

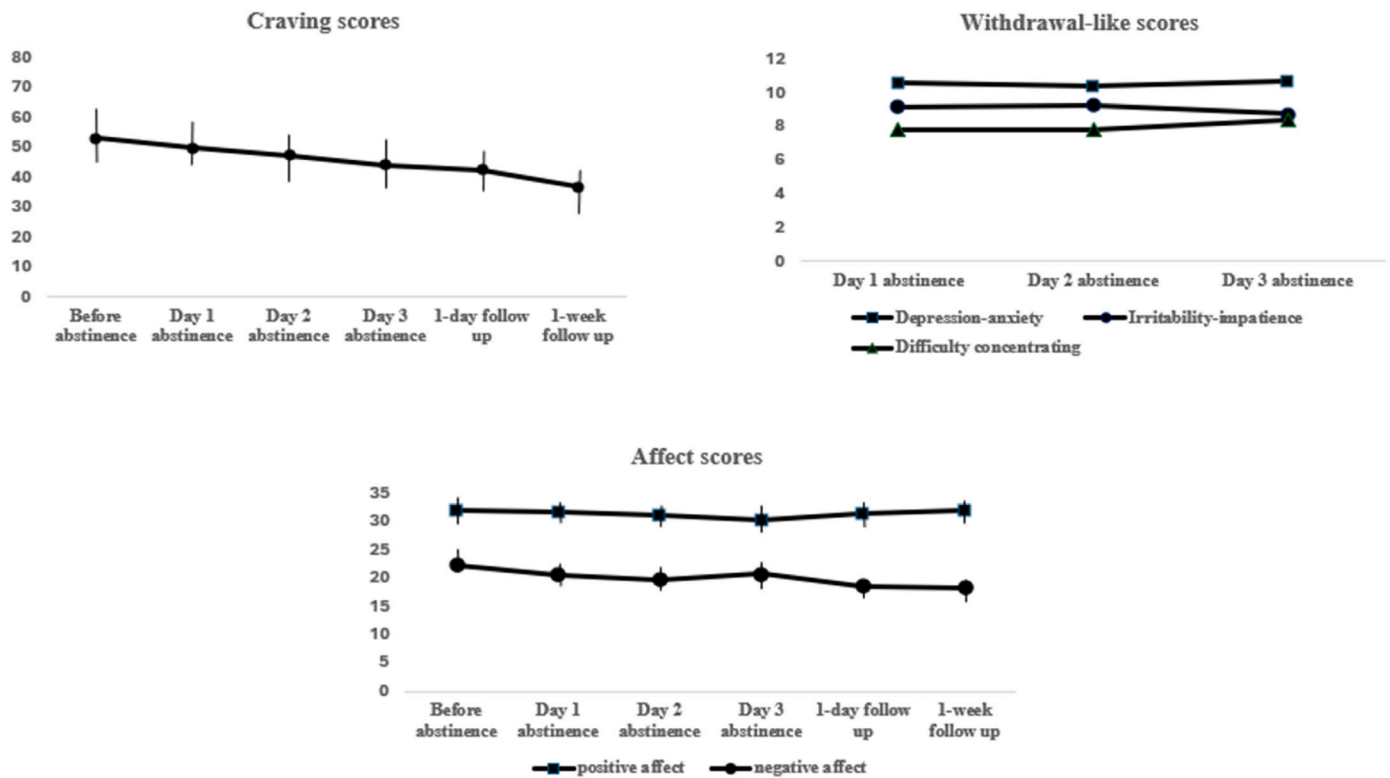


Fig. 2. Average scores on craving, withdrawal, PA, and NA before, during, and after the abstinence period.

longitudinal designs comprising a higher number of assessment moments (e.g., ecological momentary assessment) (Serre et al., 2015; Spencer et al., 2015). Finally, given the lack of measures assessing craving or withdrawal particularly focused on IM, we adapted scales initially developed in the context of substance use.

## 5. Conclusions

The present study shows that a 72-h abstinence from IM may be related to a reduction of “craving” (preoccupation and ruminative thoughts related to IM use) and negative affect, yet do not influence the manifestation of withdrawal-like symptoms and positive affect. Due to the preliminary nature of this study, further research is needed to confirm these results.

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## CRedit authorship contribution statement

**V. Cervigón-Carrasco:** Writing – original draft, Formal analysis. **S. Politi:** Writing – review & editing, Methodology. **D. Brevers:** Writing – review & editing, Validation. **C. Giménez-García:** Writing – review & editing, Validation, Supervision. **D.L. King:** Writing – review & editing, Validation. **J. Billieux:** Writing – review & editing, Validation, Supervision, Conceptualization. **J. Castro-Calvo:** Writing – review & editing, Validation, Supervision, Methodology.

## Declaration of competing interest

The sixth author of this article, Prof. Joël Billieux, serves as a scientific board member of Computers in Human Behavior. Please note,

however, that he was not involved at any stage during the editorial process. All other authors have not COI to declare.

## Data availability

. Database and analytical codes can be retrieved from the OSF at the following link: <https://osf.io/y6njm/>

## References

- Bell, L., Garnett, C., Bao, Y., Cheng, Z., Qian, T., Perski, O., Potts, H. W. W., & Williamson, E. (2023). How notifications affect engagement with a behavior change app: Results from a micro-randomized trial. *MIR Mhealth Uhealth*, 11, Article e38342. <https://doi.org/10.2196/38342>, 2023.
- Billieux, J. (2012). Problematic use of the mobile phone: A literature review and a pathways model. *Current Psychiatry Reviews*, 8(4), 299–307. <https://psycnet.apa.org/doi/10.2174/157340012803520522>.
- Billieux, J., Maurage, P., López-Fernández, O., Kuss, D. J., & Griffiths, M. D. (2015). Can disordered mobile phone use be considered a behavioral addiction? An update on current evidence and a comprehensive model for future research. *Curr. Addict. Rep.*, 2(2), 156–162. <https://doi.org/10.1007/s40429-015-0054-y>
- Brandtner, A., Antons, S., Cornil, A., & Brand, M. (2021). Integrating desire thinking into the I-PACE model: A special focus on internet-use disorders. *Curr. Addict. Rep.*, 8. <https://doi.org/10.1007/s40429-021-00400-9>, 459–458.
- Brown, L., & Kuss, D. J. (2020). Fear of missing out, mental wellbeing, and social connectedness: A seven-day social media abstinence trial. *International Journal of Environmental Research and Public Health*, 17(12), 4566. <https://doi.org/10.3390/ijerph17124566>
- Busch, P. A., & McCarthy, S. (2021). Antecedents and consequences of problematic smartphone use: A systematic literature review of an emerging research area. *Computers in Human Behavior*, 114. <https://doi.org/10.1016/j.chb.2020.106414>
- Canale, N., Cornil, A., Giroux, I., Bouchard, S., & Billieux, J. (2019). Probing gambling urge as a state construct: Evidence from a sample of community gamblers. *Psychology of Addictive Behaviors*, 33(2), 154–161. <https://doi.org/10.1037/adb0000438>
- Castro-Calvo, J., Ballester-Arnal, R., Potenza, M. N., King, D. L., & Billieux, J. (2018). Does “forced abstinence” from gaming lead to pornography use? Insight from the april 2018 crash of fortnite’s servers. *J. Behav. Addict.*, 7(2), 501–502. <https://doi.org/10.1556/2006.7.2018.78>
- Clements, J. A. (2021). Technology craving and withdrawal: Exploring compulsive mobile app use. In G. Salvendy, & J. Wei (Eds.), *Lecture notes in computer science: Vol. 12796. Design, operation and evaluation of mobile communications*. Cham: Springer. [https://doi.org/10.1007/978-3-030-77025-9\\_17](https://doi.org/10.1007/978-3-030-77025-9_17). HCII 2021.

- Dong, G., Wang, Z., Wang, Y., Du, X., & Potenza, M. N. (2019). Gender-related functional connectivity and craving during gaming and a mandatory break: Implications for development and progression of internet gaming disorder. *Progress in Neuro-Psychopharmacology and Biology Psychiatry*, 88, 1–10. <https://doi.org/10.1016/j.pnpbp.2018.04.009>
- Dong, G., Zheng, H., Liu, X., Wang, Y., Du, X., & Potenza, M. N. (2018). Gender-related differences in cue-elicited cravings in Internet gaming disorder: The effects of deprivation. *J. Behav. Addict.*, 7(4), 953–964. <https://doi.org/10.1556/2006.7.2018.118>
- Eide, T. A., Aarestad, S. H., Pallesen, S., Andreassen, C. S., & Bilder, R. M. (2018). Smartphone restriction and its effect on subjective withdrawal related scores. *Frontiers in Psychology*, 9, 144. <https://doi.org/10.3389/fpsyg.2018.01444>
- Elhai, J. D., Dvorak, R. D., Levine, J. C., & Hall, B. J. (2017). Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. *Journal of Affective Disorders*, 207, 251–259. <https://doi.org/10.1016/j.jad.2016.08.030>
- Etter, J. F. (2005). A self-administered questionnaire to measure cigarette withdrawal symptoms: The Cigarette Withdrawal Scale. *Nicotine & Tobacco Research*, 7(1), 47–57. <https://doi.org/10.1080/14622200412331328501>
- Ferguson, C. J. (2009). An effect seize primer. A guide for clinicians and researchers. *Professional Psychology. Res. Pract.*, 40, 532–538. <https://psycnet.apa.org/doi/10.1037/a0015808>
- Fernández, D. P., Kuss, D. J., & Griffiths, M. D. (2020). Short-term abstinence effects across potential behavioral addictions. *Clinical Psychology Review*, 76, Article 101828. <https://doi.org/10.1016/j.cpr.2020.101828>
- Flayelle, M., Brevers, D., King, D. L., Maurage, P., Perales, J. C., & Billieux, J. (2023). A taxonomy of technology design features that promote potentially addictive online behaviours. *Nature Rev. Psychol.*, 2, 136–150. <https://doi.org/10.1038/s44159-023-00153-4>
- Galla, B. M., & Duckworth, A. L. (2015). More than resisting temptation: Beneficial habits mediate the relationship between self-control and positive life outcomes. *Journal of Personality and Social Psychology*, 109(3), 508–525. <https://psycnet.apa.org/doi/10.1037/pspp0000026>
- Gowthami, S., & Kumar, V. K. (2016). Impact of smartphone: A pilot study on positive and negative effects. *Int. J. Sci. Eng. Appl. Sci.(USEAS)*, 2(3), 473–478.
- Harris, B., Regan, T., Schueler, J., & Fields, S. A. (2020). Problematic mobile phone and smartphone use scales: A systematic review. *Frontiers in Psychology*, 5(11), 672. <https://doi.org/10.3389/fpsyg.2020.00672>
- Hormes, J. M. (2017). The clinical significance of craving across the addictive behaviors: A review. *Curr. Addict. Rep.*, 4, 132–141. <https://doi.org/10.1007/s40429-017-0138-y>
- Kaptis, D., King, D. L., Delfabbro, P. H., & Gradisar, M. (2016). Withdrawal symptoms in Internet gaming disorder. A Systematic review. *Clinical Psychology Review*, 43, 58–66. <https://doi.org/10.1016/j.cpr.2015.11.006>
- Kardefelt-Winther, D. (2017). Conceptualizing Internet use disorders: Addiction or coping process? *Psychiatry and Clinical Neurosciences*, 71(7), 459–466. <https://doi.org/10.1111/pcn.12413>
- Kardefelt-Winther, D., Heeren, A., Schimmenti, A., van Rooij, A., Maurage, P., Carras, M., Edman, J., Blaszczynski, A., Khazaal, Y., & Billieux, J. (2017). How can we conceptualize behavioral addiction without pathologizing common behaviors? *Addiction*, 112, 1709–1715. <https://doi.org/10.1111/add.13763>
- King, D. L., Kaptis, D., Delfabbro, P. H., & Gradisar, M. (2016). Craving for multiplayer online gaming. *Computers in Human Behavior*, 62, 488–494. <https://doi.org/10.1016/j.chb.2016.04.020>
- King, D. L., Kaptis, D., Delfabbro, P. H., & Gradisar, M. (2017). Effectiveness of brief abstinence for modifying problematic internet gaming cognitions and behaviors. *Journal of Clinical Psychology*, 73(12), 1573–1585. <https://doi.org/10.1002/jclp.22460>
- Kross, E., Verduyn, P., Sheppes, G., Costello, C. K., Jonides, J., & Ybarra, O. (2021). Social media and well-being: Pitfalls, progress, and next steps. *Trends in Cognitive Sciences*, 25(1), 55–66. <https://doi.org/10.1016/j.tics.2020.10.005>
- May, J., Andrade, J., Kavanagh, D. J., Feeney, G. F. X., Gullo, M. J., Statham, D. J., Skorka-Brown, J., Connolly, J. M., Cassumatis, M., Young, R. M. D., & Connor, J. P. (2014). The craving experience questionnaire: A brief, theory-based measure of consummatory desire and craving. *Addiction*, 109(5), 728–735. <https://doi.org/10.1111/add.12472>
- Pivetta, E., Harkin, L., Billieux, J., Kanjo, E., & Kuss, D. J. (2019). Problematic smartphone use: An empirically validated model. *Computers in Human Behavior*, 100, 105–117. <https://doi.org/10.1016/j.chb.2019.06.013>
- Radtke, T., Apel, T., Schenkel, K., Keller, J., & von Lindern, E. (2022). Digital detox: An effective solution for the smartphone era? A systematic literature review. *Mobile Media & Communication*, 10(2), 190–215. <https://doi.org/10.1177/20501579211028647>
- Ricoy, M. C., Martínez-Carrera, S., & Martínez-Carrera, I. (2022). Social overview of smartphone use by teenagers. *International Journal of Environmental Research and Public Health*, 19(22), Article 15068. <https://doi.org/10.3390/ijerph192215068>
- Serre, F., Fatseas, M., Swendsen, J., & Auriacombe, M. (2015). Ecological momentary assessment in the investigation of craving and substance use in daily life: A systematic review. *Drug and Alcohol Dependence*, 148, 1–20. <https://doi.org/10.1016/j.drugalcdep.2014.12.024>
- Spencer, B., Roche, D. J. O., Sheets, E. S., Krull, J. L., Guzman, I., & Ray, L. A. (2015). Modeling naturalistic craving, withdrawal, and affect during early nicotine abstinence: A pilot ecological momentary assessment study. *Experimental and Clinical Psychopharmacology*, 23(2), 81–89. <https://doi.org/10.1037/a0038861>
- Starcevic, V. (2016). Tolerance and withdrawal symptoms may not be helpful to enhance understanding of behavioural addictions. *Addiction*, 111(7), 1307–1308. <https://doi.org/10.1111/add.13381>
- Starcevic, V., King, D. L., Delfabbro, P. H., Schimmenti, A., Castro-Calvo, J., Giardina, A., & Billieux, J. (2021). “Diagnostic inflation” will not resolve taxonomical problems in the study of addictive online behaviours. *J. Behav. Addict.*, 9(4), 915–919. <https://doi.org/10.1556/2006.2020.00083>
- Statista. (2022). *Smartphones – statistics & facts*. available at: <https://www.statista.com/topics/840/smartphones/#topicOverview>. (Accessed 22 February 2022).
- Stieger, S., & Lewetz, D. (2018). A week without using social media: Results from an ecological momentary intervention study using smartphones. *Cyberpsychology, Behavior, and Social Networking*, 21(10), 618–624. <https://doi.org/10.1089/cyber.2018.0070>
- Szabo, A. (1998). Studying the psychological impact of exercise deprivation: Are experimental studies hopeless? *Journal of Sport Behavior*, 21(2), 139–147.
- Tromholt, M. (2016). The Facebook experiment: Quitting Facebook leads to higher levels of well-being. *Cyberpsychology, Behavior, and Social Networking*, 19(11), 661–666. <https://doi.org/10.1089/cyber.2016.0259>
- Vanmann, E. J., Baker, R., & Tobin, S. J. (2018). The burden of online friends: The effects of giving up Facebook on stress and well-being. *The Journal of Social Psychology*, 158(4), 496–508. <https://doi.org/10.1080/00224545.2018.1453467>
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect scales: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>
- Wilcockson, T. D., Osborne, A. M., & Ellis, D. A. (2019). Digital detox: The effects of smartphone withdrawal on mood, anxiety, and craving. *Addictive Behaviors*, 99, Article 106013. <https://doi.org/10.1016/j.addbeh.2019.06.002>
- Zinn, C., & Rademacher, U. (2019). Abschalten – Psychische Belastungen durch bewusste Smartphone-Auszeiten abbauen. *Wirtschaftspsychologie Heft*, 1(2), 28–39.