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ORIGINAL RESEARCH

The Impact of Problematic Social Media Use on Inhibitory Control and the Role of Fear of Missing Out: Evidence from Event-Related Potentials

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Introduction: The general deficit in inhibitory control of problematic social media users has received widespread attention. However, the neural correlates of problematic social media use (PSMU) and inhibitory control remain unclear. Additionally, the co-occurrence of the fear of missing out (FoMO) with social media use is common, yet its role in the relationship between PSMU and inhibitory control has not been investigated.

Methods: This study aimed to examine the electrophysiological correlates of PSMU and inhibitory control using a modified two-choice oddball task combined with event-related potentials (ERPs), and to explore the role of FoMO in this relationship. A total of 66 participants with varying degrees of PSMU were included in the analysis based on the Problematic Mobile Social Media Usage Questionnaire.

Results: The study found that PSMU could impact inhibitory control. Specifically, as the PSMU score increases, the N2 amplitude is greater for social media-related pictures, and the P3 amplitude is smaller, while no significant differences are observed for neutral pictures. This suggests that PSMU affects inhibitory control by consuming more cognitive resources in the early conflict detection stage and leading to insufficient cognitive resources in the later stages of the inhibitory process. Furthermore, FoMO played a mediating role between PSMU and inhibitory control. PSMU could further impact inhibitory control through FoMO.

Conclusion: This study provides electrophysiological evidence for deficits in inhibitory control in PSMU and suggests that FoMO may further reduce inhibitory control in PSMU individuals.

Keywords: problematic social media use, inhibitory control, fear of missing out, event-related potentials

Introduction

The prevalence of social media has led to an increase in research examining its impact on psychology and behavior.[1,2] Recent studies have focused on problematic social media use (PSMU), which refers to individuals' excessive and compulsive use of social media.[3] One study discovered that PSMU can impact executive functions.[4] In the field of problematic behavior research, inhibitory control has received significant attention, researchers commonly believe that individuals with problematic use exhibit impaired inhibitory control.[5,6] Inhibitory control refers to the ability to restrain oneself from engaging in inappropriate or unnecessary behaviors.[7] Studies investigating the effects of PSMU on inhibitory control have found that increased social media use is associated with reduced inhibitory control.[8,9]

Extensive research has demonstrated that PSMU impairs inhibitory control, with problematic users performing less accurately in inhibitory control tasks compared to non-problematic users.[5,10,11] Similar findings have been observed at the neural level, as inhibitory control involves various processes such as conflict detection and response inhibition.[5,12] Previous studies have primarily examined inhibitory control using event-related potentials (ERPs), focusing on two major ERP components. The first component is the N2, a negative waveform that emerges approximately 200–400 ms after signal presentation and is associated with conflict detection.[12–14] The increase in N2 amplitude signifies a greater

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consumption of cognitive resources required for early conflict detection.[15] The second component is the P3, a positive waveform that arises 300–600 ms after signal onset and is linked to response inhibition.[16–18] The larger the amplitude of P3, the allocation of more cognitive resources during later inhibitory processes.[14]

To investigate inhibitory control deficits among PSMU, researchers commonly use the Go/NoGo task. This task requires participants to respond as quickly as possible to the Go stimulus when presented with both stimuli: the Go stimulus and the NoGo stimulus, and to inhibit their responses when presented with the NoGo stimulus.[8,14] Findings from these studies indicate that PSMU is associated with inhibitory control deficits, although the results are not consistent. For example, Gao et al[5] investigated the inhibitory control of PSMU in different backgrounds related to mobile phones. They found a decreased NoGo-P3 on the mobile phone application background among problematic users compared with healthy controls, and no difference in NoGo-N2 amplitude was found regardless of the background. However, Chen et al[19] found that problematic users showed larger NoGo-N2 amplitude when faced with smartphone-related cues compared to healthy controls, while there was no difference in NoGo-P3 amplitude. Gao et al[8] found that problematic users showed larger NoGo-N2 amplitude and smaller NoGo-P3 amplitude than non-problematic users irrespective of stimuli. The above results provide evidence at the neurophysiological level that inhibitory control is impaired in problem users. However, limited by the inconsistency of the results, it is unclear whether this impairment is related to early conflict monitoring or to later deficits in response inhibition.

It is important to note that the inconsistent results described above may be related to the nature of the Go/NoGo task. In this task, Go trials require motor responses, whereas NoGo trials do not. The inhibitory control effects observed in studies using the Go/NoGo task may be influenced by response-related processes.[20,21] This influence is particularly noticeable in ERP studies, given that P3 components are particularly susceptible to movement-related potentials.[22] To mitigate this potential confound, previous studies have used a two-choice oddball task to assess inhibitory control.[21,23,24] This task required participants to respond accurately and quickly to both high-frequency standard stimuli and low-frequency deviant stimuli. Because of the two-choice oddball task requires responses to both standard and deviant stimuli, the results are less likely to be influenced by potential contamination related to motor response processing.[25] Previous research has demonstrated that the two-choice oddball task is equally effective as the Go/NoGo task in eliciting inhibitory control.[24,26,27] Therefore, the present study used a two-choice oddball task to assess inhibitory control, and combined it with electrophysiology to provide evidence for inhibitory control deficits in PSMU.

Furthermore, according to the Interaction of Person-Affect-Cognition-Execution (I-PACE) model, problematic behavior develops as a consequence of interactions between core characteristics of a person and several moderating and mediating variables, such as affective and cognitive responses to specific stimuli in combination with reduced executive functioning.[28,29] Therefore, there may be potential variables affecting inhibitory control in PSMU individuals. Previous studies have indicated that individuals with smartphone addiction often experience negative emotions, such as anxiety and depression.[30–32] PSMU is likely to influence inhibitory control through emotions. Recent studies have found that PSMU is often associated with fear of missing out.[33–35] Fear of missing out (FoMO) refers to a pervasive anxiety individuals experience about potentially missing out on important information or novel events.[36] Cai et al[37] found that individuals with FOMO are experiencing a diffuse anxiety at the emotional level. At the cognitive level, they anticipate knowing what others are doing, leading to non-adaptive social media usage behaviors at the behavioral level. A meta-analysis conducted by Fioravanti et al[38] found a significant positive association between social media use and FoMO (Fisher's $Z = 0.322$, 95% CI [0.226, 0.418]). Sun et al[39] also found that individuals with FOMO are more prone to PSMU due to decreased self-control. These studies indicate that individuals with higher levels of PSMU also tend to experience higher levels of FoMO. Przybylski et al[36] found that individuals with FoMO are easily distracted by engaging in social media activities, leading to a lack of attention in other tasks such as driving or studying. Previous studies have concluded that distractions may result in reduced attentional control during ongoing tasks, which may further reduce individuals' inhibitory control.[40,41] Individuals with FoMO may become excessively preoccupied with experiences and information on social media platforms, potentially impacting their inhibitory control. Therefore, individuals anxious about missing out on the rewarding experiences of others may further contribute to PSMU individuals' impact on inhibitory control.

Overall, the present study aimed to examine the effect of PSMU on inhibitory control and the role of FoMO in it. We used a two-choice oddball task to avoid the contamination of the reaction-related processes in the Go/NoGo task.

Previous studies have shown that related-cues are more likely to attract the attention of individuals with addiction and further generate poor inhibitory control.[6,42,43] Accordingly, the present study utilized three types of deviant stimuli: high social media, low social media, and neutral pictures. We hypothesized that PSMU would have a deficit in inhibitory control in social media related cues, and more severely at high social media-related pictures (Hypothesis 1). The study further examined the role of FoMO in the effect of inhibitory control of PSMU. We hypothesized that FoMO is the mechanism of the impact on inhibitory control of PSMU; that is, FoMO plays a mediating role between PSMU and inhibitory control (Hypothesis 2). Specifically, we construct a mediation model to investigate whether inhibitory control is further reduced when individuals with PSMU experience FoMO.

Methods

Participants

Posting a poster through online chat software, inviting participants to come offline and participate in the experiment. Seventy participants with varying degrees of PSMU were recruited for this study. Four participants were excluded due to low accuracy during the task and a large number of ocular artifacts. As a result, a total of 66 participants were included in the data analysis that comprised 36 females (53.03%). The mean age was 20.38 years (SD = 2.06). All participants reported that they had no history of psychiatric disorders or other types of behavioral addiction. Participants were given full instructions, and all provided written informed consent before the study. The study has been approved by the local Ethical Committee of the Institute.

Measures and Procedures

Problematic Social Media Use

Problematic social media use was assessed by the Problematic Mobile Social Media Usage Questionnaire.[44] The questionnaire consists of 20 items. Each item is rated on a five-point Likert scale ranging from 1 = "Not at all" to 5 = "Completely matches". The higher the score, the more problematic the individual's tendency to use mobile social media. The Cronbach's α was 0.94 in this study.

Fear of Missing Out

FoMO was measured by the Fear of Missing Out scale.[36] The scale consists of 10 items. This 10-item measure asked participants to rate how true each statement was of their general experiences (1 = "Not at all true of me", 5 = "Extremely true of me"). The higher score indicates greater fear of missing out. The Cronbach's α was 0.86 in this study.

Materials

There were two kinds of stimuli: standard stimuli and deviant stimuli. A natural scene of a lamp served as the standard stimulus (70%). The deviant stimuli consisted of three kinds of pictures: high social media (HSM, 10%), low social media (LSM, 10%), and neutral pictures (10%).

The neutral pictures were obtained from the International Affective Picture System (IAPS). The HSM stimuli consisted of HSM related icons (eg, WeChat and TikTok); The LSM stimuli consisted of LSM related icons (eg, Map and Music Player). Before the formal experiment, 36 additional participants (16 males, M_{age} = 21.97 ± 2.71 years) were recruited to rate each picture on valance (1 = "very unpleasant"; 5 = "no apparent pleasant or unpleasant experience"; 9 = "very pleasant"), arousal (1 = "very relaxing"; 9 = "very exciting"), familiarity (1 = "very familiar"; 9 = "very unfamiliar"), and social media relevant (1 = "not at all relevant"; 9 = "very relevant") on a 9-point scale. Finally, a total of thirty pictures were selected for each category. The scores of the picture types in terms of valance, arousal, familiarity, and social media relevance are shown in Table 1.

The repeated measures ANOVA revealed that the main effect of valence, arousal, and familiarity were not significant, $F_{Valence}$ (2, 58) = 0.081, $p > 0.05$, $\eta_p^2 = 0.003$, $F_{Arousal}$ (2, 58) = 2.634, $p > 0.05$, $\eta_p^2 = 0.083$, $F_{Familiarity}$ (2, 58) = 1.99, $p > 0.05$, $\eta_p^2 = 0.064$. The main effect of social media relevant was significant, F (2, 58) = 166.007, $p < 0.001$, $\eta_p^2 = 0.851$. Post hoc analyses revealed that social media relevance scores were higher for the HSM pictures than for the LSM and neutral pictures.

Table 1 Valence, Arousal, Familiarity and Social Media Relevant Scores of Stimuli Pictures (M±SD)

Rating Items	Neutral	High Social Media	Low Social Media
Valence	5.45±0.63	5.44±0.79	5.39±0.46
Arousal	4.11±0.81	4.54±1.03	4.10±0.80
Familiarity	5.43±1.16	5.60±1.85	4.87±1.57
Social media relevant	2.63±0.68	6.28±1.08	5.26±0.70

Abbreviations: M, mean value; SD, standard deviation.

Procedures

Prior to the experiment, participants were asked to complete questionnaires. Then, the participants were seated in a quiet room approximately 80 cm away from a computer screen with horizontal. Before the formal experiment, participants had 20 trials to get familiar with the operation and experimental process. The formal experiment began only when performance on the practice trials was 100% accurate.

The present study used a modified two-choice oddball task. The experiment comprised 5 blocks of 600 trials. Each block presented 84 standard stimuli and 36 deviant stimuli. Participants had a one-minute break between each block. Each trial began with a small white cross displayed for 300 ms. A blank screen was then presented for a randomly varying duration between 500 to 1500 ms. The picture stimulus then appeared. When the standard picture appeared, the participants needed to quickly and accurately press the "F" on the keyboard with their left index finger, and when the deviation picture appeared, they needed to press the "J" with their right index finger (keyboard keys were balanced between participants). The stimulus picture disappeared after the key press or if 1000 ms elapsed. Each response was followed by 1000 ms of a blank screen. The sequence of standard and deviant stimuli was randomized. Please refer to Figure 1 for specific experimental procedures.

Electrophysiological Recording

The EEG was recorded by using the ANT-NEURO system (Enschede, The Netherlands) with 64 Ag/ AgCl electrodes arranged in a 10/20 system layout (including left and right mastoids, AFz serving as ground, and CPz serving as the on-line reference). The scalp impedances were less than 5 kΩ with a sample rate of 500 Hz.

This study used EEGLAB toolbox running on MATLAB software to analyze the data. The data were filtered with a band-pass of 0.01–40 Hz. Adopt the reference electrode standardization technique (REST) as re-reference method.[45,46] Ocular artifacts were removed from data using independent component analysis (ICA). EEG was segmented in epochs

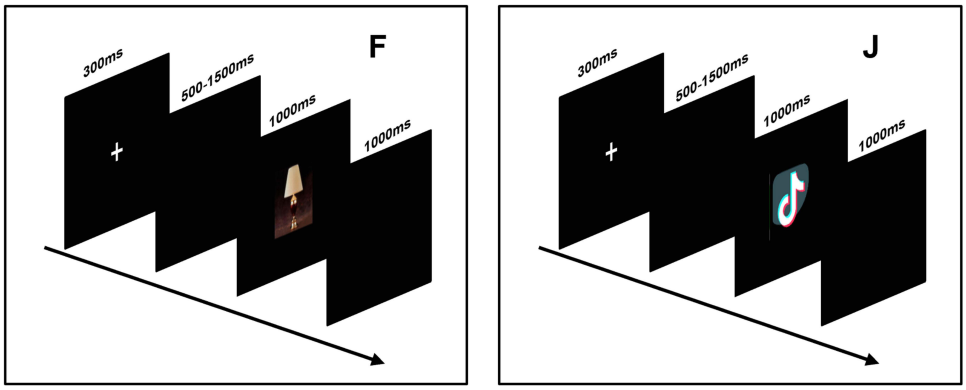

Figure 1 The sequence of events in the experimental trial and an example of standard stimuli and deviant stimuli (high social media). Each trial presented a single stimulus.

beginning 200 ms before stimulus onset and continuing through 800 ms (ie – 200–800 ms). The period of 200 ms pre-stimulus was used as the baseline to align ERP amplitude. Any trials in which the ERP sweeps exhibited amplitudes exceeding ± 80 μV were excluded.

Statistics

All data analyses were performed using SPSS 25.0, and Bonferroni correction was used to correct for multiple comparisons in post hoc tests. All statistical values were reported with Greenhouse–Geisser corrections.

One-way repeated-measures ANOVA with picture type as a within-subject factor was performed for accuracy (ACC) and reaction times (RTs) respectively. Both ACC cost and RT cost typically serve as behavioral indices of inhibitory control. The ACC cost was defined as the decrease in accuracy from standard to deviant trials (standard – deviant). The RT cost was defined as the increase in reaction time from deviant to standard trials (deviant – standard). Increases in both ACC cost and RT cost can represent a reduction in the inhibitory control.

ERP amplitudes (N2 and P3) were analyzed using a one-way repeated-measures ANOVA, with picture type (HSM, LSM, neutral) as the within-subject factor. For the inhibitory control, the deviant wave minus the standard wave can exclude the response-related processes. The difference wave (deviant–standard) can more accurately represent inhibitory control.

According to previous studies, P3 amplitude reflects the actual inhibition of the motor system,[17] and the P3 amplitude is a marker for impaired inhibitory control.[20,24,47] Therefore, the P3 amplitude was measured as the inhibitory control value. Model 4 in the PROCESS was employed to analyze the relationship between PSMU, inhibitory control and FoMO.

Results

Behavior Results

ACC

The repeated measures ANOVA revealed a significant main effect of trial type, F (1, 65) = 33.580, $p < 0.001$, η_p^2 = 0.341. ACC was significantly lower for the deviant stimuli (97.35%) than it was for the standard stimuli (98.52%). In the deviant stimuli, there was a significant main effect of picture type, F (2, 130) = 11.079, $p < 0.001$, η_p^2 = 0.146, HSM (97.95%) and LSM (97.68%) stimuli elicited ACC higher compare with neutral stimuli (96.41%).

RT

The repeated measures ANOVA of RT on correct trials showed a significant main effect of trial type, F (1, 65) = 488.195, $p < 0.001$, η_p^2 = 0.883, with longer RT on correct trials for deviant stimuli (537.38 ms) than on those for standard stimuli (453.01 ms). For deviant stimuli, there was a significant main effect of picture type, F (2, 130) = 132.261, $p < 0.001$, η_p^2 = 0.670, HSM (527.16 ms) and LSM (528.99 ms) stimuli elicited RT lower compare with neutral stimuli (555.99 ms). These results are shown in Figure 2.

To determine the relationship between PSMU and inhibitory control, linear regression was used to examine whether PSMU scores predicted ACC cost and RT cost. The results showed that PSMU scores did not significantly predict ACC cost, β = – 0.087, t = – 0.697, $p > 0.05$, or RT cost, β = – 0.037, t = – 0.293, $p > 0.05$.

ERP Results

N2 and P3 amplitudes (deviant – standard) and topographic maps are displayed in Figure 3A and B.

N2 Component

The repeated measures ANOVA revealed that the main effect of picture type was significant, F (2, 130) = 467.950, $p <$ 0.001, η_p^2 = 0.878, Post hoc analyses revealed that N2 amplitude was larger for the neutral picture (M = – 5.96 μV) than for the LSM picture (M = 2.50 μV), and larger for the LSM picture than the HSM picture (M = 3.27 μV). Furthermore, the linear regression was used to examine whether PSMU scores predicted the N2 amplitudes (HSM, LSM, neutral). The results showed that PSMU scores were negatively predict N2 amplitude (HSM), β = – 0.256, t = – 2.116, $p < 0.05$, N2 amplitude (LSM), β = – 0.331, t = – 2.804, $p < 0.05$. However, PSMU scores did not significantly predict N2 amplitude for the neutral condition, β= – 0.137, t = – 1.106, $p > 0.05$ (Figure 4A and B).

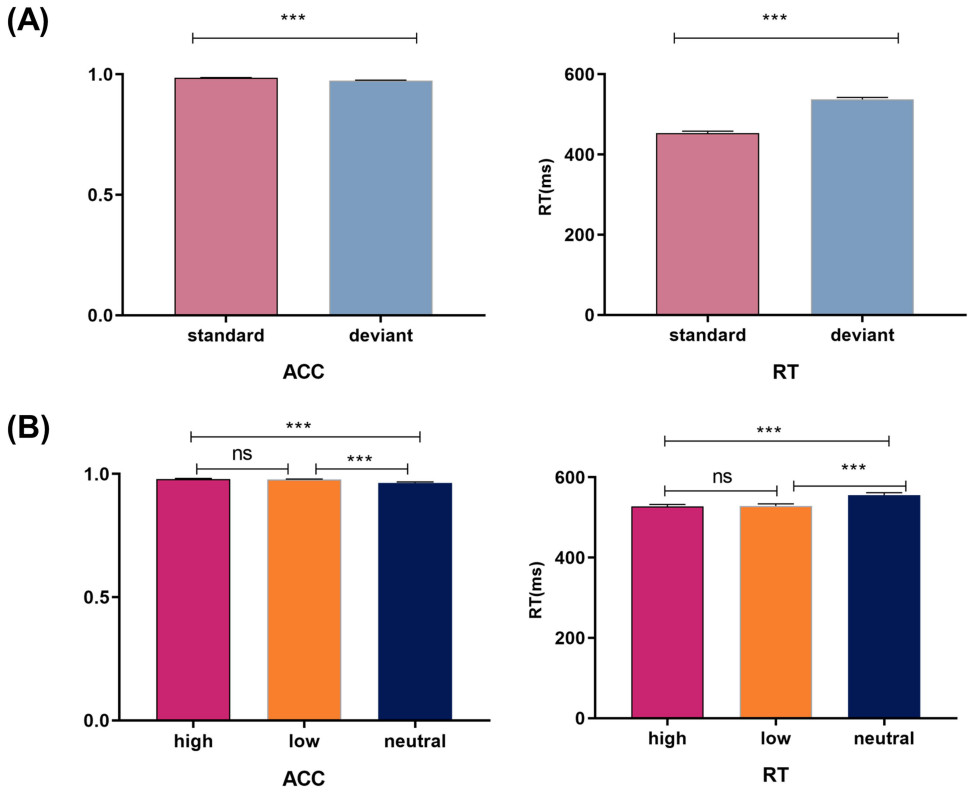

Figure 2 (**A**) RT and ACC for standard and deviant stimuli; (**B**) RT and ACC for picture types (HSM, LSM and neutral) in the deviant stimuli.
Notes: Bars represent standard error of the mean. ***p < 0.001.
Abbreviations: ns, no significance; RT, reaction time; ACC, accuracy; high, high social media; low, low social media.

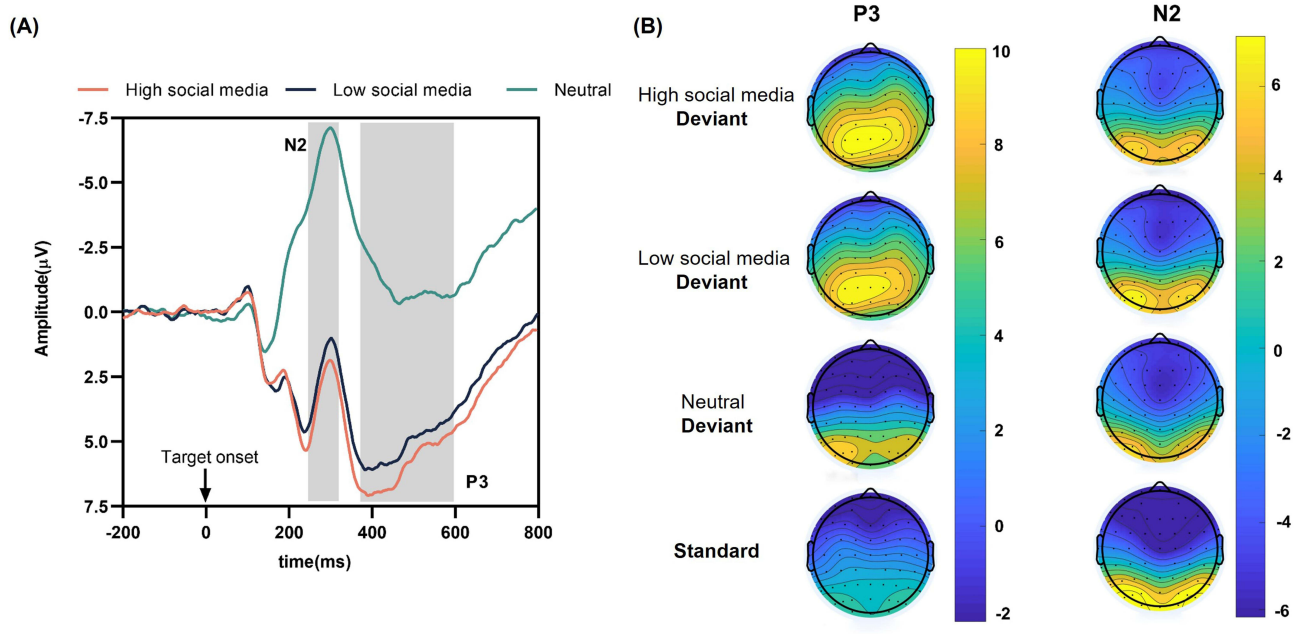

Figure 3 (**A**) The grand means of the difference ERP waveforms of the high social media, low social media and neutral pictures. Difference ERPs were calculated by averaging the data at the electrodes of Fz, Cz, FCz, and Pz; (**B**) Topographic maps for P3 (370-600ms) and N2 (240-320ms).

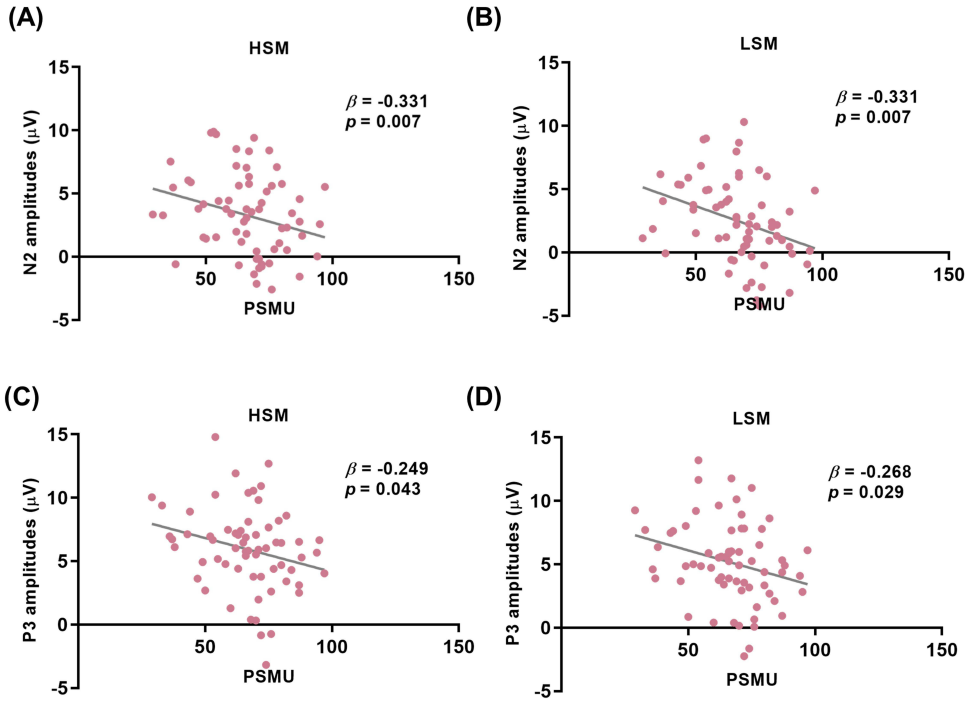

Figure 4 (**A** and **B**) Regression analyses between PSMU and N2 amplitudes; (**C** and **D**) Regression analyses between PSMU and P3 amplitudes.
Abbreviations: HSM, high social media; LSM, low social media; PSMU, problematic social media use.

P3 Component

The repeated measures ANOVA revealed that the main effect of picture type was significant, F (2, 130) = 373.798, p < 0.001, η_p^2 = 0.852. Post hoc analyses revealed that P3 amplitude were larger for the LSM picture (M = 5.17 μV) than for the neutral picture (M = – 1.01 μV), and larger for the HSM picture (M = 5.95 μV) than the LSM picture. Likewise, the linear regression was used to examine whether PSMU scores predicted the P3 amplitudes (HSM, LSM, neutral). The results showed that PSMU scores were significantly predict P3 amplitude (HSM), β = – 0.249, t = – 2.060, p < 0.055, and P3 amplitude (LSM), β = – 0.268, t = – 2.229, p < 0.05. But did not significantly predict P3 amplitude (neutral), β = – 0.200, t = – 1.635, p > 0.05 (Figure 4C and D).

Model Validation Result

The correlation results (see Table 2) showed that: PSMU scores were positively correlated with FoMO. PSMU scores were negatively correlated with P3 amplitude (HSM) and P3 amplitude (LSM). FoMO scores were negatively correlated with P3 amplitude (HSM) and P3 amplitude (LSM).

Table 2 Descriptive Statistics and Correlation Analysis of Each Variable (N = 66)

Variable	M±SD	1	2	3	4	5
1. PSMU	66.33±15.18	1				
2. FoMO	24.15±6.62	0.52***	1			
3. P3 amplitude (HSM)	5.95±3.25	–0.25*	–0.35**	1		
4. P3 amplitude (LSM)	5.17±3.21	–0.27*	–0.40**	0.88***	1	
5. P3 amplitude (Neutral)	–1.01±3.07	–0.20	–0.19	0.70***	0.66***	1

Notes: *p < 0.05, **p < 0.01, ***p < 0.001. P3 amplitude was deviant minus standard difference wave.
Abbreviations: PSMU, problematic social media use; FoMO, fear of missing out; HSM, high social media, LSM, low social media.

Table 3 Mediating Effect Test of FoMO in the HSM Pictures (N = 66)

Predictive Variable	Result Variables	Step 1: P3 Amplitude		Step 2: FoMO		Step 3: P3 Amplitude	
		β	t	*β*	t	*β*	t
PSMU		–0.25	–2.06*	0.52	4.87***	–0.10	–0.70
FOMO						–0.30	–2.14*
R^2		0.06		0.27		0.13	
F		4.25*		23.67***		4.54*	

Notes: *p < 0.05, ***p < 0.001. All variables are brought into the regression equation using standardized variables.
Abbreviations: PSMU, problematic social media use; FoMO, fear of missing out; HSM, high social media.

Table 4 Mediating Effect Test of FoMO in the LSM Pictures (N = 66)

Predictive Variable	Result Variables	Step 1: P3 Amplitude		Step 2: FoMO		Step 3: P3 Amplitude	
		β	t	*β*	t	*β*	t
PSMU		–0.27	–2.23*	0.52	4.87***	–0.08	–0.61
FOMO						–0.36	–2.67**
R^2		0.07		0.27		0.17	
F		4.97*		23.67***		6.28**	

Notes: *p < 0.05, **p < 0.01, ***p < 0.001. All variables are brought into the regression equation using standardized variables.
Abbreviations: PSMU, problematic social media use; FoMO, fear of missing out; LSM, low social media.

The mediating role of FoMO was tested using Model 4 in PROCESS. The results (see Tables 3 and 4) showed that the direct effect of FoMO on P3 amplitude (HSM, LSM) was significant, $\beta = -0.25$, $t = -2.06$, $p < 0.05$; $\beta = -0.27$, $t = -2.23$, $p < 0.05$. After mediating variables were put in, the predictive effect of PSMU on FoMO was significant, $\beta = 0.52$, $t = 4.87$, $p < 0.001$; $\beta = 0.53$, $t = 4.87$, $p < 0.001$. In addition, FoMO was a significant predictor of P3 amplitude (HSM, LSM), $\beta = -0.30$, $t = -2.14$, $p < 0.05$; $\beta = -0.36$, $t = -2.67$, $p < 0.01$. These results indicated that PSMU predicted P3 amplitude through the mediating effect of FoMO (see Figure 5).

Discussion

The primary objective of this study was to investigate the impact of problematic social media use (PSMU) on inhibitory control and the mediating role of fear of missing out (FoMO). The effect of PSUM on inhibitory control was observed at

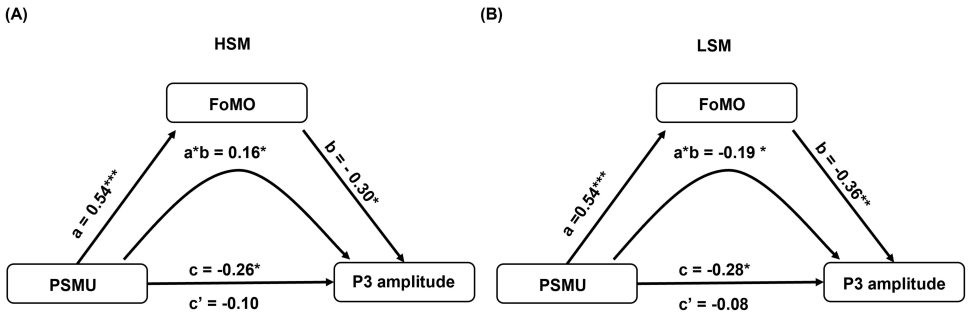

Figure 5 (**A**) Theoretical model of the role of FoMO in the relationship between PSMU and P3 amplitude (HSM); (**B**)Theoretical model of the role of FoMO in the relationship between PSMU and P3 amplitude (LSM).
Notes: All variables are brought into the regression equation using standardized variables. *p < 0.05, **p < 0.01, ***p < 0.001.
Abbreviations: HSM, high social media; LSM, low social media; PSMU, problematic social media use; FoMO, fear of missing out.

the electrophysiological level. Under the condition of high and low social media pictures, PSMU significantly predicts larger N2 amplitude (deviant – standard) and smaller P3 amplitude (deviant – standard). Subsequently, a mediation model was constructed in this study, with FoMO as the mediating variable. The results of this study revealed that PSMU can further impact inhibitory control by increasing FoMO.

The present study found that RT was faster for social media pictures compared to neutral pictures, while PSMU scores do not significantly predict ACC cost and RT cost. This finding is inconsistent with previous studies on behavioral level, which indicated that participants exhibit slower reaction times to social media-related images compared to neutral images.[5,10] The reason for this discrepancy may lie in the fact that previous studies have recruited mainly both problematic and healthy participants, whereas the present study only covered participants with various degrees of social media overuse (PSMU). Since the degree of individual differences in PSMU among participants in the present study was smaller compared to previous studies, this limited the significance of inhibitory control at the behavioral level. And differences were found at the electrophysiological level, which aligns with previous research.[8,19,47] Specifically, the results of this study found that the N2 amplitude of social media pictures was significantly lower than neutral pictures. For P3 amplitude, this study found that the P3 amplitude of social media pictures was significantly larger than neutral pictures. Importantly, the present study found that PSMU would impact inhibitory control. Specifically, as the PSMU score increases, there are larger N2 amplitude and smaller P3 amplitude for social media-related pictures, while no significant differences are observed for neutral pictures.

Previous studies have suggested that the N2 reflects the conflict monitoring process, primarily the detection of conflict between response execution and inhibition. An increase in N2 amplitude could be interpreted as reflecting higher demands on inhibitory control.[12,48–50] The present study found that the N2 amplitude of social media pictures was significantly lower than neutral pictures and that the HSM pictures were lower than LSM pictures. This indicates that when confronted with social media pictures, participants invest fewer cognitive resources in the conflict monitoring process. A previous study found that individuals with Internet addiction disorder (IAD) exhibited lower N2 amplitude than their normal peers.[47] Moreover, they suggest that the reduced N2 amplitude of IAD is aimed at reducing the cognitive resources for detecting conflict and allocating more cognitive effort to complete the later inhibition task (larger P3 amplitude). This is consistent with our findings. The present study found that the P3 amplitude of social media pictures was significantly higher than neutral pictures and that the HSM pictures were higher than LSM pictures.

Previous studies on P3 amplitude have shown that the P3 component can indicate the efficiency of inhibitory control.[7,22,51] In the two-choice oddball task, the amplitude of P3 increases with the growth of cognitive resources,[24] and a larger P3 amplitude indicates that more cognitive resources are needed to complete the task. The findings of this study revealed that the P3 amplitude was significantly higher for social media pictures compared to neutral pictures, with HSM pictures eliciting a greater P3 amplitude than LSM pictures. These results suggest that individuals require more cognitive resources to effectively engage in inhibitory control tasks when confronted with social media stimuli. Moreover, PSMU scores only significantly predicted the P3 amplitude in social media-related stimuli. The P3 amplitude of social media pictures decreased as the PSMU score increased. Gao et al[8] have found that individuals with PSMU exhibit difficulties in the later stages of inhibitory control, manifested by consistently higher P3 amplitudes in problematic users compared to non- problematic users. This is consistent with the results of the present study. As PSMU scores increased, individuals' P3 amplitude decreased, indicating that individuals used fewer cognitive resources in the later stages of the inhibition process. Additionally, the study observed an increase in the N2 amplitude of social media pictures as PSMU scores increased. This result suggests that problematic social media users experience more conflict and use more cognitive resources in the early stages of inhibitory processing. As the PSMU scores increase, individuals allocate more cognitive resources during the early conflict detection stage (increased N2 amplitude), consequently leaving fewer cognitive resources available for inhibitory processes (decreased P3 amplitude). Consequently, PSMU exerts an impact on inhibitory control by consuming more cognitive resources during the early conflict detection stage, and fewer cognitive resources in the later stages of the inhibitory process.

Furthermore, the results of this study show that FoMO plays a mediating role between PSMU and inhibitory control. FoMO weakens inhibitory control in PSMU individuals. FoMO is closely linked to unfulfilled social connection needs,[36] prompting individuals to resort to social media as a means of satisfying their relational requirements.[52] This reliance, in

turn, contributes to compromised inhibitory control. As a negative emotional state, FoMO further erodes self-control capabilities by depleting limited cognitive resources, resulting in an inability to regulate social media usage.[39] Additionally, attentional control theory suggests that anxiety can impair inhibitory control.[40] This has been demonstrated by numerous studies.[53–56] Social media use can lead to executive function deficits, especially inhibitory problems.[11] Individuals who exhibit heightened social media usage are more prone to experiencing FoMO.[57] As FoMO intensifies, their heightened concern about missing social media information consumes cognitive resources, exacerbating impairments in inhibitory control functions.

Limitations and Future Directions

Several limitations require further attention. First, studies have indicated that a growing number of ageing people are improving their well-being by using social media.[58] However, the FoMO is not limited to a specific age group,[59] and ageing people exhibited less efficient inhibitory control.[60] Therefore, future research could further investigate the impact of PSMU on inhibitory control among ageing people. Second, previous studies found associations between PSMU and executive functions.[11,61] The executive function consists mainly of inhibition, working memory and cognitive flexibility.[62] The present study found the effect of PSMU on inhibition. Thus, future research could further investigate the effects of PSMU on other cognitive processes within the realm of executive function. Third, the present study found that PSMU can further influence inhibitory control through FoMO. Future research could continue to explore suitable interventions for FoMO as a way to improve inhibitory control, such as mindfulness[63] and unconscious emotion regulation.[64,65]

Conclusion

The present study used event-related potentials to demonstrate that in social media related cues, PSMU affected inhibitory control, especially for high social media-related pictures. PSMU exerts an impact on inhibitory control by consuming more cognitive resources during the early conflict detection stage, and fewer cognitive resources in the later stages of the inhibitory process. This implies that future interventions for this population should focus on reducing exposure to social media cues and enhancing inhibitory control. In addition, the present study revealed that FoMO mediates the relationship between PSMU and inhibitory control. Specifically, FoMO further reduces inhibitory control in PSMU individuals. Considering the unavoidable use of social media in the digital age, the findings of the present study imply that modulating FoMO may be a beneficial way to enhance inhibitory control.

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