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Severity of depression and anxiety in relation to problematic smartphone use in the United Arab Emirates: The mediational roles of rumination and fear of missing out

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Abstract

Social scientists have increasingly examined psychological constructs that may mediate the relationship between depressive and anxious affect and excessive, problematic smartphone use (PSU). The aim of this study was to examine two potential mediational variables – the fear of missing out (FOMO) and rumination – in accounting for the relationship between levels of both depression and anxiety with PSU. A sample of 264 Emirati (citizens of the United Arab Emirates) college students completed measures of depression, anxiety, FOMO, rumination, and PSU via an online-administered survey. At the bivariate correlational level, all psychological variables were significantly related to PSU severity. Mediational analyses revealed that FOMO significantly mediated relations between both depression and anxiety with PSU severity. These results were mirrored when rumination was tested as a mediator. This study joins growing recent work on the importance of FOMO and rumination to PSU, and this is the first study to test these psychological variables related to PSU in a Middle Eastern sample. Our results suggest that both FOMO and rumination may be important factors accounting for this association.

KEYWORDS
anxiety, Arab, depression, fear of missing out, internet addiction, mediation, problematic smartphone use, rumination, smartphone addiction, smartphone usage

1 | INTRODUCTION

While the exponential development of mobile phone technology has revolutionized the way in which communication takes place, smartphone overuse is also associated with a number of deleterious outcomes. A plethora of research studies now indicate that individuals' overuse of their smartphones is associated with a range of mental health difficulties. Specifically, research conducted primarily in Europe and North America, and to a lesser extent in East Asia, points to depression, anxiety, stress, and low self-esteem as being common mental health correlates of smartphone overuse (Elhai, Dvorak, et al., 2017; Vally & Alowais, 2020). More recently, scholars' attention has turned to investigate dysfunctional cognitive coping variables

accounting for relationships between mental health symptoms and smartphone overuse.

A variety of alternative, interchangeable terminology is used to refer to smartphone overuse, such as problematic smartphone use (PSU), smartphone use disorder (Lachmann et al., 2018), and smartphone addiction (Vally & Alowais, 2020). However, there is controversy regarding the use of the term "addiction" within the context of technology-related behaviors (Petry & O'Brien, 2013), and there is no formal smartphone use disorder in either ICD-11 or DSM-5. In the present study, we therefore elected to employ the term "PSU." PSU is characterized by maladaptive use of one's smartphone, which is accompanied by functional impairment and symptoms that are reminiscent of those typically observed in substance use disorders, for

example, increased tolerance, difficulty exerting control over use of the device, experiencing withdrawal after a period during which the individual has not used the device, and an inability to cease use despite the experience of negative effects (Billieux, Maurage, et al., 2015; De-Sola Gutierrez, Rodriguez de Fonseca, & Rubio, 2016). Smartphones are particularly susceptible to misuse and functional impairment because they can be used to engage in a number of pleasurable activities and release chemicals in the brain that fortify their sustained use (Brand, Young, Laier, Wolfling, & Potenza, 2016; Montag, Sindermann, Becker, & Panksepp, 2016).

1.1 | Mediators between PSU and mental health

Research has consistently demonstrated that PSU is associated with a range of adverse mental health variables and the principal hypothesis for this association is that mental health problems tend to provoke the onset of PSU, rather than the inverse (Brand et al., 2016; Kardefelt-Winther, 2014), although some researchers have proposed a bidirectional relationship (e.g., van Deursen, Bolle, Hegner, & Kommers, 2015). The majority of research has found that PSU severity appears to be associated with depression severity with effect sizes that are medium in magnitude, approximate rs between 0.30 and 0.50 (Demirci, Akgonul, & Akpinar, 2015; Elhai, Dvorak, et al., 2017; Smetaniuk, 2014), and with anxiety severity with effect sizes that are small to moderate in magnitude (Elhai, Levine, & Hall, 2019; Elhai, Levine, et al., 2017; Vahedi & Saiphoo, 2018).

In addition to these mental health variables associated with PSU severity, research has also shown that additional variables play a mediational role in this relationship, particularly maladaptive cognitive and emotion processes and behavioral disinhibition. There is evidence that the following variables mediate the relationship between both depression and anxiety with PSU severity: impaired self-control (Cho, Kim, & Park, 2017), emotion dysregulation and distress intolerance (Elhai, Tiamiyu, et al., 2018; Elhai, Levine, Dvorak, & Hall, 2016), and boredom proneness (Elhai, Vasquez, et al., 2018).

Fear of missing out (FOMO) also appears to be an important variable in relation to PSU. FOMO is defined as a prevalent sense of unease about missing out on experiences that the individual deems to be potentially pleasurable and rewarding, and is accompanied by the consequent need to maintain constant contact with members of one's social network to avert this fear (Przybylski, Murayama, DeHaan, & Gladwell, 2013). FOMO is highly correlated with both depression (Dhir, Yossatorn, Kaur, & Chen, 2018; Elhai et al., 2016; Elhai, Levine, et al., 2018; Oberst, Wegmann, Stodt, Brand, & Chamarro, 2017) and anxiety (Dhir et al., 2018; Elhai et al., 2016; Elhai, Levine, et al., 2018; Oberst et al., 2017; Wolniewicz, Tiamiyu, Weeks, & Elhai, 2018), as well as with increasing levels of PSU (Chotpitayasunondh & Douglas, 2016; Elhai et al., 2016; Elhai, Levine, et al., 2018; Fuster, Chamarro, & Oberst, 2017; Oberst et al., 2017; Wolniewicz et al., 2018). FOMO also appears to be a significant mediator between depression and anxiety and PSU (Elhai, Levine, et al., 2018; Elhai, Yang, Fang, et al., 2020; Oberst et al., 2017).

In addition to FOMO, the present study also examines the potential mediational role of rumination. Rumination represents a maladaptive coping strategy in response to the experience of negative affect (Watkins & Roberts, 2020). It serves the function of magnifying individuals' emphasis on the negative cognitions related to their negative affect (and the experiences associated with it) as opposed to the more adaptive response of processing the experienced affect (Watkins & Roberts, 2020). Rumination is also of particular interest in the context of the current study when considering its demonstrated association with a range of psychological variables, including depression and anxiety (Joormann & Gotlib, 2010). Finally, given that both rumination and PSU are maladaptive coping strategies (Kardefelt-Winther, 2014; Watkins & Roberts, 2020), it is likely that these two constructs should evidence a statistically significant association.

1.2 | The need for PSU research in the Middle East

The Gulf countries in the Middle East have, over the last few decades, experienced exponential infrastructural development driven, in part, by the economic prosperity of the region. Governments in this region of the world have also placed an overt emphasis on the economic and infrastructural growth of its countries directing exorbitant funding toward the telecommunications, construction, tourism, and financial industries. Consequently, personal disposable income has soared, which, alongside the diminishing cost of smartphones and the availability of high-speed internet at low cost, has resulted in rates of smartphone ownership substantially higher than elsewhere in the world. In the United Arab Emirates (UAE), for example, total smartphone ownership almost tripled between 2007 and 2017 with some individuals owning more than one device (International Telecommunication Union, 2017). Additionally, in a population of approximately 9.83 million individuals, 9.73 million are active social media users (98.9%) and 92% of these individuals use their smartphones to access their social media accounts (Global Media Insight, 2020). Thus, investigation of PSU in this region of the world, and the UAE more specifically, is especially relevant and timely.

1.3 | Aims

While the existing literature overwhelmingly supports the association between severity of PSU with both FOMO and rumination, as well as the mediational roles of FOMO and rumination between depression/anxiety and PSU severity (e.g., Elhai, Levine, et al., 2018; Elhai, Tiamiyu, et al., 2018; Elhai, Vasquez, et al., 2018; Elhai, Yang, & Montag, 2020; Wolniewicz et al., 2018; Wolniewicz, Rozgonjuk, & Elhai, 2020), these relationships remain unstudied in the Middle East. The literature on this subject is limited to European and North American samples, with a handful of exceptions in Asia (e.g., Elhai, Yang, Fang, et al., 2020; Elhai, Yang, & Montag, 2020). As such, the present study investigated both FOMO and rumination as potential mediators of the relationship between depression/anxiety and PSU severity.

We hypothesize that given the unique social rules that govern the UAE, a country in which individuals are primarily of Arab descent and practicing Muslims, a unique pattern of PSU may be evident in relation to the other psychological variables. In this context, the formation of offline friendships/relationships between the genders is typically not encouraged (Larsson, 2011; Rochadiat, Tong, & Novak, 2018; Vally & Alowais, 2020). Thus, to circumvent these social rules, adolescents and young adults tend to favor (and must use) smartphone-facilitated online communication as a primary means of social connection (Vally & El Hichami, 2019). If in-person socialization between genders is not feasible, then FOMO may be especially important in this culture as driving PSU severity.

1.4 | Theoretical framework

There are two theories that provide a relevant framework from which to examine studies of PSU. First, Compensatory Internet Use Theory (CIUT; Kardefelt-Winther, 2014) suggests that internet overuse, or indeed PSU, is a maladaptive form of coping with and processing the experience of negative affect, a contention that is empirically supported across a number of studies (Elhai, Tiamiyu, et al., 2018; Long et al., 2016; Zhitomirsky-Geffet & Blau, 2016). A significant limitation of this theory, however, is its overt emphasis on the singularly causal role of negative affect in the development of problematic or "addictive" use of technologies.

A theoretical model that posits a more comprehensive model of excessive internet and smartphone use is Brand et al.'s (2016) Person-Affect-Cognition-Execution (I-PACE) model. The I-PACE model proposes that there are multiple categories of variables that collectively impact excessive use of internet communications. The first category of variables, termed personal determinants, includes variables related to genetics, biology, personality, psychopathology, and internet use motives. Then, variables that represent responses to personal determinants, termed risk and resilience variables, include cognitive and attention bias, expectancies about internet use, coping strategies, inhibitory control, and craving. Within the I-PACE framework, this second category of variables is proposed to act as potential mediators and moderators of the relationship between personal determinants and consequent excessive internet use as they may either act as protective factors or potentially exacerbate the impact of the personal determinants (Brand et al., 2016). This model has received substantial empirical support (Elhai, Yang, Fang, et al., 2020; Elhai, Yang, & Montag, 2020; Oberst et al., 2017; Wolniewicz et al., 2018).

1.5 | Hypotheses

Following the empirical findings previously reviewed and against the backdrop of the theoretical frameworks described, we formulated the following hypotheses. None of these hypotheses have previously been examined in a Middle Eastern context.

Hypothesis 1. *PSU severity should be positively related to both FOMO (H1a) and to rumination (H1b).*

FOMO is frequently positively correlated with PSU severity, and this finding appears consistently across numerous regions of the world (Chotpitayasunondh & Douglas, 2016; Elhai et al., 2016; Elhai, Levine et al., 2018; Fuster et al., 2017; Oberst et al., 2017; Wolniewicz et al., 2018). According to CIUT, FOMO is likely to correlate significantly with PSU severity because this behavior serves as a means of regulating the apprehension and negative affect about missing out on potentially rewarding experiences (Kardefelt-Winther, 2014). FOMO would be conceptualized in I-PACE as a cognitive bias in which individuals fear missing out on rewarding experiences and, as a result, this fear drives PSU to avert this envisaged negative outcome (Elhai, Yang, Fang, et al., 2020).

Rumination is also frequently associated with depression and anxiety severity (Joormann & Gotlib, 2010) as well as with PSU (Elhai, Tiamiyu, et al., 2018). Rumination is typically conceptualized as a maladaptive and avoidant coping strategy that promotes the active avoidance of negative affect (Watkins & Roberts, 2020). PSU is also an avoidant coping method that averts an explicit focus on negative affect. Thus, given that both rumination and PSU serve similar functions, as maladaptive coping methods, the hypothesis that these two constructs should be correlated is sound.

Hypothesis 2. *FOMO should mediate the relationship between both depression (H2a) and anxiety (H2b) with PSU severity.*

A number of studies have previously shown FOMO to be a significant mediator of the relationship between both depression and anxiety and PSU severity (Elhai, Levine, et al., 2018; Elhai, Yang, Fang, et al., 2020; Elhai, Yang, & Montag, 2020; Oberst et al., 2017). According to I-PACE, FOMO would likely belong to the category of response variables, serving to mediate between personal determinants (such as depressive and anxious affect) and the onset of excessive internet or smartphone use (Brand et al., 2016).

Hypothesis 3. *Rumination should mediate the relationship between both depression (H3a) and anxiety (H3b) with PSU severity.*

This hypothesis is based on the evidence of the association between depression, anxiety, and increasing levels of PSU (Elhai, Dvorak, et al., 2017). Additionally, existing research also demonstrates a predictive association between increasing levels of depression and anxiety and a tendency to engage in rumination (McLaughlin & Nolen-Hoeksema, 2011). And rumination relates to PSU severity (Elhai et al., 2020; Elhai, Tiamiyu, et al. 2018). Given these considerations, we hypothesize that rumination will likely act as a mediator between both depression and anxiety and increasing levels of PSU, fitting with I-PACE's conceptualization of rumination as a cognitive bias and as a mechanism between personal determinants and excessive internet/smartphone use.

1.6 | Research model

We propose the mediation relationships in Table 2. Specifically, depression and anxiety are predictor variables, separately tested in different analyses. FOMO and rumination are separate mediating variables in different analyses. PSU severity is the dependent variable in each analysis. In both mediational hypotheses, sex is included as a covariate of PSU in the model, given that females typically show higher levels of PSU severity (De-Sola Gutierrez et al., 2016).

2 | METHODOLOGY

2.1 | Participants and procedure

Data were collected during the Fall semester of the 2019/2020 academic year at the campus of a large state-funded university in the UAE. Participants were recruited via in-class announcements in undergraduate and postgraduate psychology and general education courses, and by means of notices posted on campus notice boards and student-used social media accounts. Participants were provided with an electronic link to access the online-administered survey, which, when accessed, first presented an informed consent statement. All measures were administered in English – the official language of instruction at this institution.

A total of 264 individuals participated. We excluded three participants, as detailed below, for careless, insufficiently effortful responding on the survey instruments, resulting in an effective sample of 261 participants. Age ranged from 18 to 36 years (M = 21.51, SD = 2.99), with the vast majority being 18–25 years old (n = 240, 92.0%). Years of schooling averaged 14.25 years (SD = 2.11). A majority of participants were women (n = 170, 65.1%). Most were currently single, not in a relationship (n = 245, 93.9%).

2.2 | Ethics

The Social Sciences Research Ethics Committee at the first author's institution provided ethical approval for the conduct of this study (Ref. No.: ERS_2019_6001).

2.3 | Instruments

Participants completed a demographic questionnaire in which we inquired about the following characteristics: age, gender, years of schooling, and relationship status. This was followed by administration of the following psychological scales.

2.3.1 | Smartphone Addiction Scale-Short Version

The smartphone addiction scale-short version (SAS-SV; Kwon, Kim, et al., 2013) was utilized to measure the severity of PSU. It is a self-report scale that measures smartphone-related health and social impairment, withdrawal, and tolerance. The SAS-SV is an abbreviated version of the original SAS (Kwon, Lee, et al., 2013) and consists of 10 items that are completed using a six-point Likert scale from 1 (Strongly disagree) to 6 (Strongly agree). The SAS-SV is a reliable measure and has been shown to possess convergent validity (Kwon, Kim, et al., 2013; Lopez-Fernandez, 2017). Cronbach's alpha in the present study was .73.

2.3.2 | Depression Anxiety Stress Scale-21

The Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995) consists of 21 items that measure symptoms of depression, anxiety, and stress. The scale consists of three subscales of seven items each in which responses are rated in reference to the previous week, using the following response options, 0 (Did not apply to me) to 3 (Applied to me very much or most of the time). We employed only the depression and anxiety subscales, with adequate internal consistency (Lovibond & Lovibond, 1995). Internal consistency for the current sample was .81 for depression and .82 for anxiety.

2.3.3 | Fear of Missing Out Scale

The Fear of Missing Out (FOMO) scale (Przybylski et al., 2013) consists of 10 items that measure apprehension about missing out on social activities. Items are rated using response options that range from 1 (Not at all true of me) to 5 (Extremely true of me). Internal reliability for this measure is adequate and scores generally converge well with measures of social media engagement and poor life satisfaction (Przybylski et al., 2013), depression, anxiety, and negative affect (Elhai et al., 2016; Wolniewicz et al., 2018), collectively indicating adequate convergent validity. Cronbach's alpha in the current study was .85.

2.3.4 | Ruminative Thought Style Questionnaire

The Ruminative Thought Style Questionnaire (RTSQ; Brinker & Dozois, 2009) is a 20-item self-report measure of ruminative thinking in which participants' responses are rated on a seven-point Likert scale that ranges from 1 (does not describe me at all) to 7 (describes me very well). This measure is psychometrically sound, internally consistent, and possesses adequate convergent validity (Brinker & Dozois, 2009). In the present study, Cronbach's alpha was excellent (α = .93).

2.4 | Analysis

We used R software 3.62 (R Core Team, 2019) for data cleaning and descriptive/correlational analyses. We used R's *careless* package to

screen out three participants (mentioned above) who did not provide adequate effort in responding to the instruments, with at least one instance of inputting the same response more than 20 times on consecutive items. We implemented R's *mice* package to impute small amounts (<5%) of missing item-level values (with the expectation maximization algorithm) before summing scale scores. We used R's *fmsb* package for calculating internal consistency, *pastecs* for descriptives, *apatables* for correlations, and *ez* for ANOVA effects.

We used Mplus version 8.3 (Muthén & Muthén, 2019) for regression and mediation testing. All scale scores were normally distributed, with the largest absolute skewness value of .57 (FOMO), and largest kurtosis value of 1.12 (anxiety). Scale scores were treated as continuous variables, with linear regression paths used for modeling direct effects and maximum likelihood estimation. For testing mediation, we computed cross-products for direct path coefficient pairs to derive mediation/indirect effects. We used nonparametric bootstrapping to more accurately compute indirect effect of standard errors with the Delta method, and 1,000 bootstrapped replications (MacKinnon, 2008).

We first tested FOMO as a mediating variable between depression severity (predictor) and PSU severity (dependent variable). We repeated this analysis, instead using anxiety severity as the predictor. Next, we tested rumination as a mediating variable between depression severity (predictor) and PSU severity (dependent variable), repeating this analysis instead using anxiety as the predictor. All analyses included sex as a covariate of PSU severity, because women engage in greater smartphone use than men (De-Sola Gutierrez et al., 2016).

3 | RESULTS

Scale descriptive statistics are displayed in Table 1. Table 1 also displays bivariate Pearson correlations among the scale scores, and internal consistency estimates. Correlational results demonstrate that psychological scale scores were significantly related to PSU severity. We also assessed sex differences on the scale scores, finding significant results only for PSU severity, $F(1, 259) = 5.99$, $p = .02$, $p = .02$ (H2), and anxiety, $F(1, 259) = 4.37$, $p = .04$, $p = .02$ (H2). Specifically, women scored higher than men on PSU severity (Women $M = 35.17$, $SD = 8.67$; Men $M = 32.53$, $SD = 7.60$) and anxiety severity (Women $M = 9.25$, $SD = 5.27$; Men $M = 7.75$, $SD = 5.96$).

Table 2 presents direct and indirect effect results, using FOMO as a mediator. FOMO mediated the relations between depression and PSU severity. FOMO also mediated the relations between anxiety and PSU severity (see Figures 1 and 2). The only nonsignificant effects in these analyses were between depression and PSU severity, and between anxiety and PSU severity.

Table 2 also demonstrates the results for rumination as a mediator. Rumination mediated the relations between depression and PSU severity. Rumination also mediated the relations between anxiety and PSU severity (see Figures 3 and 4). As with the above-noted findings, depression and anxiety were not significantly related to PSU severity in these analyses.

TABLE 2 Standardized direct and indirect/mediation tests

Test	β	SE	z	p
Depression → FOMO → PSU	.14	.04	3.69	<.001
Sex → PSU	.40	.11	3.47	.001
FOMO → PSU	.33	.08	3.94	<.001
Depression → PSU	.05	.07	.77	.444
Depression → FOMO	.43	.05	8.41	<.001
Anxiety → FOMO → PSU	.11	.03	3.60	<.001
Sex → PSU	.37	.12	3.06	.002
FOMO → PSU	.32	.08	3.96	<.001
Anxiety → PSU	.06	.07	.91	.362
Anxiety → FOMO	.34	.05	6.38	<.001
Depression → Rumination → PSU	.07	.03	2.03	.042
Sex → PSU	.33	.11	2.91	.004
Rumination → PSU	.18	.08	2.33	.020
Depression → PSU	.12	.07	1.63	.104
Depression → Rumination	.38	.06	6.34	<.001
Anxiety → Rumination → PSU	.07	.04	2.00	.046
Sex → PSU	.28	.12	2.27	.024
Rumination → PSU	.19	.08	2.30	.022
Anxiety → PSU	.11	.08	1.38	.167
Anxiety → Rumination	.37	.06	6.20	<.001

Note: Indirect effects are presented in bold.
Abbreviations: FOMO, fear of missing out scale; PSU, problematic smartphone use.

TABLE 1 Means, standard deviations, and correlations

Variable	M	SD	1	2	3	4	5
1. PSU	34.25	8.39	(.73)				
2. Rumination	81.44	22.00	.23**	(.93)			
3. FOMO	25.57	8.29	.33**	.54**	(.85)		
4. Depression	7.75	5.45	.18**	.38**	.43**	(.81)	
5. Anxiety	8.72	5.56	.20**	.37**	.34**	.74**	(.82)

Note: Coefficient alpha values are on the diagonal in parentheses.
Abbreviations: FOMO, fear of missing out; PSU, problematic smartphone use severity.
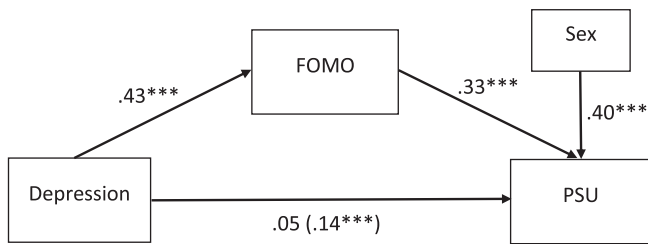*p <.05.
**p <.01.

FIGURE 1 Standardized direct effect of depression severity predicting PSU and the indirect effect mediated by FOMO (adjusting for sex). FOMO, fear of missing out; PSU, problematic smartphone use. ***$p \leq .001$
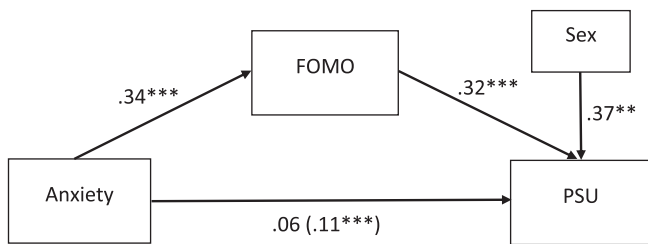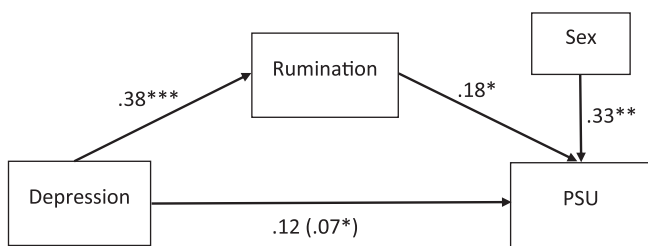

FIGURE 2 Standardized direct effect of anxiety severity predicting PSU and the indirect effect mediated by FOMO (adjusting for sex). FOMO, fear of missing out; PSU, problematic smartphone use. **$p < .01$, ***$p \leq .001$

FIGURE 3 Standardized direct effect of depression severity predicting PSU and the indirect effect mediated by rumination (adjusting for sex). PSU, problematic smartphone use. *$p < .05$, **$p < .01$, ***$p \leq .001$
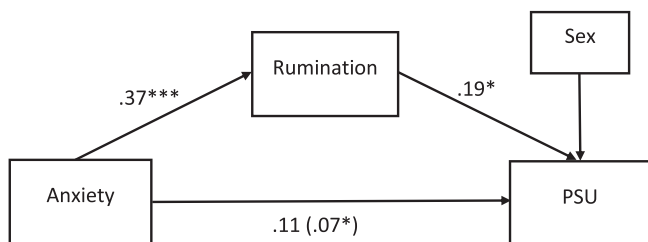

FIGURE 4 Standardized direct effect of anxiety severity predicting PSU and the indirect effect mediated by rumination (adjusting for sex). PSU, problematic smartphone use. *$p < .05$, ***$p \leq .001$

4 | DISCUSSION

This study sought to examine the mediational role of two maladaptive coping variables, FOMO and rumination, for their potential to explain

the association between both depression and anxiety with PSU severity. This study focused explicitly on a sample of Arab young adults from the Middle East as the issue of PSU has received scant empirical attention among populations living in this region of the world.

In support of H1a, our analyses revealed that FOMO was significantly related to PSU severity. This result is in concurrence with previous findings on the FOMO–PSU relationship (Elhai et al., 2016; Elhai, Levine, et al., 2018; Wolniewicz et al., 2018) and fits well within the proposed theoretical frameworks of both CIUT and I-PACE. Specifically, CIUT's (Kardefelt-Winther, 2014) contention that individuals engage in excessive use of their devices in an attempt to regulate the experience of negative emotion is noteworthy when considering that FOMO comprises negative affect including apprehension, unease, and fear. This result also fits with the proposition of I-PACE (Brand et al., 2016) in which cognitive bias-related variables such as FOMO are theorized to impact excessive technology use. It is, however, noteworthy that this correlational relationship, although significant, was slightly lower ($r = .33$) compared to that of associations from samples elsewhere in the world. Bivariate Pearson's r correlations have typically ranged from .40 to .60 in American, Western European, and Asian samples (Chotpitayasunondh & Douglas, 2016; Elhai et al., 2016; Elhai, Levine, et al., 2018; Fuster et al., 2017; Oberst et al., 2017; Wolniewicz et al., 2018) with only one exception from China, which resulted in a comparable finding (Elhai, Yang, Fang, et al., 2020; Elhai, Yang, & Montag, 2020). It is likely that, in this context, a myriad of other factors, other than FOMO, potentially account for PSU severity.

Our data also found support for H1b as PSU severity was significantly associated with rumination. This finding corroborates other work on the relationship between rumination and PSU severity (Elhai et al., 2020; Elhai, Tiamiyu, et al., 2018). It is possible that, for some, rumination about one's interpersonal relationships may motivate engagement in excessive smartphone use (e.g., checking for messages and notifications, and social networking site use) as this behavior may relieve the negative affect typically associated with ruminating about these relationships (Billieux, Philippot, et al., 2015). Similar to the FOMO–PSU relationship, the finding of an association between rumination and PSU is also in line with CIUT's explicit emphasis on the role of negative affect in precipitating excessive technology use (Kardefelt-Winther, 2014), as well as the postulation of I-PACE that cognitive bias factors such as rumination are risk factors for excessive use of technologies (Brand et al., 2016).

In relation to the mediation analyses, we found the following. For H2, we tested whether FOMO would mediate the relationship between two psychological variables, depressive (H2a) and anxious (H2b) affect, and PSU severity. Our analyses revealed significant mediation effects for both variables, confirming both H2a and H2b. In first-world, Western countries, the mechanisms that underpin the demonstrated association between mental health outcomes and excessive smartphone use have increasingly received attention; however, outside of these contexts, these dynamics have remained unexplored. This study's findings are therefore novel and in agreement with much of the related work in North America, which has

steadily demonstrated that FOMO mediates the relationship between anxiety and a number of Internet-related variables including frequency of internet use, smartphone use frequency, social networking site use, and between depression and PSU (Dempsey, O'Brien, Tiamiyu, & Elhai, 2019; Oberst et al., 2017; Wolniewicz et al., 2018; Wolniewicz et al., 2020). The magnitude of our mediation effects for both depression and anxiety (with FOMO as the mediator and PSU as the dependent variable) is also in keeping with much of the existing literature from Western countries (mediation effect involving depression: $\beta = .14$; mediation effect involving anxiety: $\beta = .11$). This is a surprising finding given the sociocultural and religious context in this region of the world that often places immense control and restriction on young adults' capacity to socialize freely with others. Socialization with similarly aged individuals of the opposite sex is typically discouraged and access to experiences outside of the family or home may be limited (Rochadiat et al., 2018). In response, many young adults may engage in excessive use of their devices to gain access to experiences that they have been excluded from and to alleviate the negative emotion resulting from missing out (Vally & El Hichami, 2019). A similar hypothesis about the prominence of FOMO in the development of PSU in a non-Western sample of smartphone users in China has been proposed (Elhai, Yang, Fang, et al., 2020; Elhai, Yang, & Montag, 2020). The authors found a substantial mediation effect ($\beta = .63$), much larger than previous estimates, with the posited explanation being the varying social rules regarding offline interactions in China contributing to this mediation effect. While the UAE also exhibits social exchange rules that deviate from those found in Western countries, it appears that variables other than FOMO may account for the depression/anxiety affect–PSU relationship.

In H3, rumination was tested as a mediator variable, again between depression (H3a) and anxiety (H3b) and PSU. Our results revealed support for both hypotheses in relation to rumination. These findings reinforce those from elsewhere in the world and confirm the conceptualization of I-PACE that response variables such as FOMO and rumination play an intermediary role between predisposing variables such as depression and anxiety and the severity of subsequent internet and/or smartphone use (Brand et al., 2016). Billieux, Phillipott, et al.'s (2015) description of rumination as a mechanism for managing online interpersonal relationships is an important consideration in reflecting on this study's result. Elhai, Tiamiyu, et al. (2018) suggest that individuals who employ the use of rumination as a method for coping with depressive or anxious affect may be more vulnerable to develop PSU. This is a contention that was empirically supported (in Elhai, Tiamiyu, et al., 2018) and is further reinforced by this study's significant mediational result with the UAE sample.

The present study had several limitations that should be borne in mind when considering its findings. First, we employed a convenience sample of university students and thus a sample that was relatively truncated in terms of age. While young adulthood is an especially relevant developmental stage in which to investigate concepts of technology use, this sample may not be representative of the population from which it was drawn. Second, we relied primarily on self-report measures. We recognize that structured diagnostic measures of

psychopathology would be ideal as these tend to be more rigorous. Moreover, self-report measures are susceptible to issues related to accuracy of recall and the impediment of social acceptability. Third, our model included only two personal determinant factors and two potential mediators. I-PACE posits that a cacophony of factors may potentially precipitate the development of PSU (Brand et al., 2016). There exists the possibility that some of these variables, which were not included in the present analyses, may be confounding variables that could better explain the significant results evidenced in the present study.

This study provides an initial view of the factors driving excessive smartphone use in a sample of young adult smartphone users in the UAE. Our results closely mirror those of samples in other parts of the world and provide a basis for the design and conduct of further studies in this part of the world.

CONFLICT OF INTEREST

The authors declare that there are no conflict of interests.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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