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Mediated effects of insomnia in the association between problematic social media use and subjective well-being among university students during COVID-19 pandemic

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ABSTRACT

Recently, the use of social media has penetrated many aspects of our daily lives. Therefore, it has stimulated much debate and polarisation regarding its impact on mental well-being. The present study investigated the association between problematic use of social media, subjective well-being, and insomnia's potential mediator. A proportionate random sample was collected from a Univerity in Algeria between March and April 2020.The participants (n=288; mean [SD] age = 20.83 [2.13]) involved 101 (35.1%) males. Nearly three-fourths of the participants (n=214; 74.3%) used up more-than three hours daily surfing on social media. Their mean (SD) score was 15.64 (4.80) on the Bergan Social Media Addiction Scale, 16.19 (9.15) on the Arabic Scale of Insomnia, and 28.13 (7.90) on the overall subjective well-being. Structural equation modeling (SEM) revealed an indirect correlation between problematic use of social media and the overall subjective well-being of users. Similarly, the indirect but not direct effects were found for the overall subjective well-being subdomains. Moreover, all SEM models have a satisfactory fit with the data.

Based on the results, it can be concluded that insomnia appears to play an important role in mediating the association between subjective well-being and problematic social media use. This suggests the importance of tackling the issues of insomnia and problematic use of social media for university students. It also has important implications in dealing with the misuse of social media, especially during the covid-19 pandemic.

1. Background

The Covid 19 Pandemic brought social policy changes such as a lockdown and social distancing laws to limit the transmission of the virus. The changes brought so many effects on people's social and psychological well-being. A study in Algeria reported varying levels of mental distress due to Covid-related confinement [1]. Nearly half of the population suffered anxiousness, stress, and a greater proportion of Algerians (87.9%) seemed to be challenged by following the confinement instructions. Moreover, the population displayed a significant change in their daily habits, including waking up, going to bed for sleep, and even using the Internet. [1]. Recently, cross-sectional studies recorded high psychological distress among Arab countries' populations due to the COVID-19 pandemic [2–4]. In another study, Covid restrictions affect students' psychological well-being [5]. As an alternative, students opted for social media for various purposes. With the advancement in mobile Internet technology and the availability of smartphones, social media has become a daily learning medium and life of young adults in most countries [6]. It is also expected that there will be an increase in using social media during the 21st century [7], which will reach around 3.09 billion by the end of 2021 [6].

The rate of social media use was reported in China [6] and North America has the highest percentage (89.4%) compared to other countries [8]. However, Saquib et al. [9] claimed that electronic gadgets among Arab youths are as common as in any other place in the world. Although there were increases in internet use among adults, studies suggested most internet users are categorized as teenagers and young people [8].

Social media use as a normal social behavior may positively or negatively affect students [[6],[7],[10]]. For instance, the Internet provides

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excellent educational benefits for students and access to communication, information, and social interaction [11]. Social networking sites can also promote interpersonal relationships, increase closeness, and enhance community involvement [12]. Additionally, during the COVID-19 pandemic, university teaching methods changed to online instructions, and social media allowed teachers to conduct online teaching and answer questions, thereby increasing social media usage among students [6].

Despite its benefits, excessive internet use can lead to problematic social media use associated with negative mental well-being [[10],[11],[13–17]]. Other crucial issues caused by people's addiction to the internet are relevant to users' sleep disturbances [8]. Problematic social media use is synonymous with compulsive, pathological, and/or problematic internet use [8]. Problematic social media use denotes obvious psychological and social impairment due to excessive internet use and negatively affects the users' physical and mental health [18]. Empirical studies also distinguish between adaptive and pathological or problematic internet use. The habitual users see the internet as a supportive media instead of a coping measure. Social media in this group facilitates communication, improves self-esteem and socialization, and minimizes social isolation [8]. However, pathological users spend more hours on social media for compulsive gambling, excessive gaming, watching pornography, and unnecessary shopping [8].

Using a theory of compensatory internet use [19], Tandon et al. [20] proposed and tested a model that showed a significant relationship between psychological well-being, compulsive social media use, and sleep disturbances. Other studies have also linked the problematic use of social media and the subjective well-being of young people [[16],[17]].

An earlier longitudinal study establishes that Facebook use is negatively associated with the well-being of users [21]. In a recent cross-sectional study conducted among 1,791 students joining three universities in Qazvin (Iran), the authors have examined how problematic use of social media, mental distress in morningness/eveningness, and day sleepiness are related to the participants' quality of sleep and insomnia as potential mediating factors. The results demonstrated the impacts of morningness-eveningness on problematic use of social media, depression, day sleepiness, anxiety, and. Furthermore, the mediated effects of insomnia and sleep quality were observed [22]. Similarly, Lin, Namdar, et al. [10], in their study among 1073 Iranian adults, revealed that problematic use of social media negatively impacts their quality of life and overall happiness. Still, it significantly reduced their depression and anxiety levels. This positive effect was mediated by social media users' generalized trust and Perceived Social Support. Bányai et al. [14] surveyed a Hungarian sample comprising 5,961 school adolescents with problematic social media use. Their results indicate that 4.5% of the teenagers participating in the survey were classified as at-risk based on their high depression symptoms, low self-esteem, and high social media use.

Excessive Facebook intrusion leads to excessive attachment, interfering with relationships and daily activities [12]. A review by Bekalu et al. [7] found that routine use is related to positive health effects. Still, the emotional connection to social media uses results in altered social well-being and negative mental. Howard [12] also found a significant relationship between problematic use of social media with self-worth and social physique anxiety. However, it did not significantly affect overall well-being [12]. In another online survey, overweight children who had COVID-19 infection fear and stress were more likely to have problematic use of social media, significantly predicting mental distress [5].

Sleep disorders due to excessive internet use are a significant cause of 'pathological internet use' induced depression [23]. Zhang et al. [24] established no significant relationship between the use of the internet and sleep. However, previous studies have shown an association between problematic internet use and sleep disturbances such as reduced sleep time, increased fatigue, sleep late and insomnia [8], sleep quality, and adolescent insomnia [25], resulting in public health problem concerning Sleep [26]. Thus, problematic internet use might initiate and/or increase students' sleep disturbances [8], and negatively affect students' mental health and academic performance [27]. Additionally, it results in poor sleep, depression, anxiety, and low self-worth [17] and drastically affect the overall quality of life [16].

Empirical evidence from the meta-analysis showed a significant odd ratio for sleep difficulties and shortened sleep duration among people dependent on the Internet [8]. Internet addiction is significantly associated with sleep latency, sleep duration, subjective sleep quality [28], students' mental health, and academic performance [27]. A recent study also found the mediated effects of sleep quality and insomnia between problematic use of social media and mental distress [22].

Good night's sleep is essential for individuals' effective emotional and cognitive well-being [[29],[30]]. Furthermore, sleep is related to social, physical, and mental health and the overall quality of life [[29],[31]]. Unfortunately, with the rapid development in technology, many people in advanced society might find it challenging to achieve a good sleep [32].

In addition, exposure to bright light during internet surf may suppress melatonin secretions and consequently delay sleep, increasing sleep disturbances and consciousness [33]. As described Kitazawa et al. [34], almost 50% of university students suffering from internet addiction were more prone to sleep disturbances than those students who were normal users of the internet. Yet, this study provided inconsistent evidence on the correlation between internet addiction and sleep disturbances [[8],[10]]. While previous studies have not well described the mediating effect of insomnia in the relationship between problematic use of the internet and subjective well-being, this study investigates the complex relationship between subjective well-being, problematic use of social media, and the potential mediating effect of insomnia.

2. Material and methods

2.1. Sample

The study was conducted among undergraduate students at the University of Djillali Liabes, Sidi Bel Abbes, Algeria, between March and April 2020.Using a proportionate random sampling, 288 participants with mean [SD] age = 20.83 [2.13]) participated in the study (101 (35.1%) males). The ethics committee of the Psychological and Educational Research Lab study approved the protocol at the University of Djillali Liabes, Sidi Bel Abbes, Algeria [UDL/Lab RPE04/2021].

2.2. Measures

A self-report survey was developed comprising socio-demographic and social media-related questions and three psychometric scales (see below). The participants' data included gender, age, and academic specialization concerning socio-demographics. Data concerning the average number of days spent online every week; hours/day spent using social media.

2.2.1. Problematic social media use (PSMU)

Participants' social media dependence was assessed using a translated Arabic form of the Bergen Social Media Addiction Scale (BSMAS) [35]. The original (English) version was developed by Andreassen et al. [36], adapted from the Bergen Facebook Addiction Scale [37]. The original BSMAS was translated from English to Arabic using the standardized translation technique [38]. This scale was developed based on the six essential constituents of behavioral addictions (i.e., salience, mood, modification, tolerance, withdrawal conflict, and relapse; [39]. The BSMAS comprises six items regarding problems related to the use of social media over the past year (e.g., "How often during the last year did you spend a lot of time thinking about social media or planned use of social media?") with a five-point Likert scale ranging from 1 ('very rarely') to 5 ('very often'). The total score is obtained by summing the raw score

from each item ranging from 6 to 30, with a higher score indicating a greater likelihood of addiction to social media [36]. In this study, the Cronbach's α of the BSMAS was 0.73.

2.2.2. The Arabic Scale of insomnia

Abdel-Khalek [40] developed Arabic Scale of Insomnia (ASI) to identify insomnia symptoms. The structure of the scale is based on the theoretical frameworks of insomnia and two criteria for diagnosis: the 4th edition of the Diagnostic and Statistical Manual of mental disorders (DSM IV) and the International Classification of Sleep Disorders (ICSD). It has 12 items (rated on a five-point Likert scale which ranges between 0 to 4); possible scores between zero to 48, where the higher score signifies insomnia symptoms. The ASI's good internal consistency has been reported (α = 0.86 and 0.87 for boys and girls) [41]. The internal consistency of the ASI in this study was good (α = 0.84). Moreover, the ASI was recently validated for use among adolescents, adults, and the elderly (Rashid. A.S & [42]).

2.2.3. Scales of subjective well-being

The SRS.SWB, developed by Abdel-Khalek [43], is four distinct rating scales used to assess satisfaction with life, mental health, physical health, and happiness in the form of questions. These scales are as follows:

(1) Do you feel happy in general?
(2) Do you feel satisfied with your life in general?
(3) How is your mental health?
(4) How is your physical health?

Each of the questions was assigned a range between 0 to 10. Hence, the participants taking part in the study were demanded (a) to respond according to their appraisal and general feeling (not their present states); (b) to have knowledge that the zero is the minimum and that 10 is the maximum score, and (c) to choose the number that seems to describe their feelings accurately. A high score indicates the rating of the trait or the attribute at a high level. The one-week test-retest reliability of the four self-rating scales ranged between 0.76 and 0.88, indicating high temporal stability and corroborating the trait-like nature of the scores. Criterion-related validity of these scales has been adequately demonstrated [[44],[45],[46]]. In the present study, the Cronbach's α of the SRS.SWB was 0.69, 0.71, 0.73 and 0.83.

2.3. Data analysis

Descriptive statistics, including mean and frequency, were used to understand the participants' characteristics. Then, Pearson correlation coefficients were used to understand the associations between the studied variables (i.e., gender, age, problematic social media use assessed using BSMAS, insomnia assessed using ASI, overall subjective well-being, happiness, satisfaction, mental health, and physical health) that were included in the later analyses of structural equation modeling (SEM). Five models were constructed using the same independent variable, mediator, and controlled variables but different dependent variables in the SEM. Specifically, the independent variable was problematic social media use; the mediator was insomnia, and the controlled variables were gender and age. The five dependent variables were (i) overall subjective well-being, (ii) happiness, (iii) satisfaction, (iv) mental health, and (v) physical health. Moreover, problematic social media use, insomnia, and overall subjective well-being were constructed as latent variables using each instrument's items. Mental health, physical health, satisfaction, and happiness, were constructed as observed variables in the SEM. The SEM models were analyzed using the diagonally weight least squares estimator with 1000 bootstrapping resamples. Mediated effects in the five SEM models were evaluated using the 95% confidence interval (CI) in the bootstrapping resamples, where the 95% CI does not across 0 indicates a significant mediated effect [47]. Furthermore, several fit indices were used to examine whether the SEM models fit well with the data, where a comparative fit index (CFI) > 0.9, a Tucker-Lewis index (TLI) > 0.9, a root mean square error of approximation (RMSEA) < 0.08, together with a standardized root mean square residual (SRMR) < 0.08 indicate good fit [48–51]. Descriptive statistics and Pearson correlations were done using the IBM SPSS 20.0 (Armonk, NY: IBM Corp.); the SEM models were done using the lavaan package in the R software [52]

3. Results

Table 1 presents the participants' characteristics. Specifically, the participants (n=288; mean [SD] age = 20.83 [2.13]) involved 101 (35.1%) males with their studied majors distributed into technology, foreign language, electronics engineering, law, humanities, medical sciences, nature sciences, and exact sciences. Nearly three-fourths of the participants (n=214; 74.3%) spent more than three hours a day on social media. Moreover, their mean (SD) score was 15.64 (4.80) in the BSMAS, 16.19 (9.15) in the ASI, and 28.13 (7.90) in the overall subjective well-being (6.81 [2.22] for happiness; 7.03 [2.58] for satisfaction; 6.84 [2.67] for mental health; and 7.45 [2.53] for physical health).

Pearson correlation coefficients in the studied variables showed that problematic use of social media had a significant positive association with insomnia (r = 0.34) and negatively related to well-being (rs = -0.16 to -0.27). Moreover, insomnia had a significant negative association with well-being (rs = -0.24 to -0.50) (Table 2).

With the use of 1000 bootstrapping resamples, the SEM findings (Fig. 1) indicated that problematic social media use was associated with overall subjective wellbeing indirectly via insomnia (coefficient=-0.775; 95% confidence interval [CI]=-1.266, -0.463) but not directly (coefficient=-0.111; 95% CI=-0.628, 0.376) after controlling for the age and gender effects. Similarly, the indirect effects via insomnia (coefficient=-0.836; 95% CI=-1.389, -0.500 for happiness; coefficient=-0.963; 95% CI=-1.629, -0.526 for satisfaction; coefficient=-0.990; 95% CI=-1.613, -0.580, mental health; and coefficient=-0.442; 95% CI=-0.903, -0.099 for physical health) but not direct effects (coefficient=-0.143; 95% CI=-0.554, 0.802 for happiness; coefficient=0.229; 95% CI=-0.491, 0.938 for satisfaction; coefficient=-0.426; 95% CI=-1.161, 0.229 for mental health; and coefficient=-0.375; 95% CI=-1.054, 0.187 for physical health) were found for the subdomains of the overall subjective wellbeing. Moreover, all SEM models has satisfactory fit with in-

Table 1
Participants' characteristics (N=288).

	n (%) or Mean (SD)
Age (year)	20.83 (2.13)
Major	
Technology	29 (10.1)
Foreign languages	51 (17.7)
Electronics engineering	18 (6.3)
Law	28 (9.7)
Humanities	50 (17.4)
Medical sciences	62 (21.5)
Nature sciences	33 (11.5)
Exact sciences	17 (5.9)
Gender	
Male	101 (35.1)
Female	187 (64.9)
Hours spent on social media per day	
3 hours or less	74 (25.7)
3-4 hours	81 (28.1)
4-5 hours	56 (19.4)
6 hours or more	77 (26.7)
Bergan Social Media Addiction Scale score	15.64 (4.80)
Arabic Scale of Insomnia score	28.13 (7.90)
Overall subjective well-being score	16.19 (9.15)
Happiness	6.81 (2.22)
Satisfaction	7.03 (2.58)
Mental health	6.84 (2.67)
Physical health	7.45 (2.53)

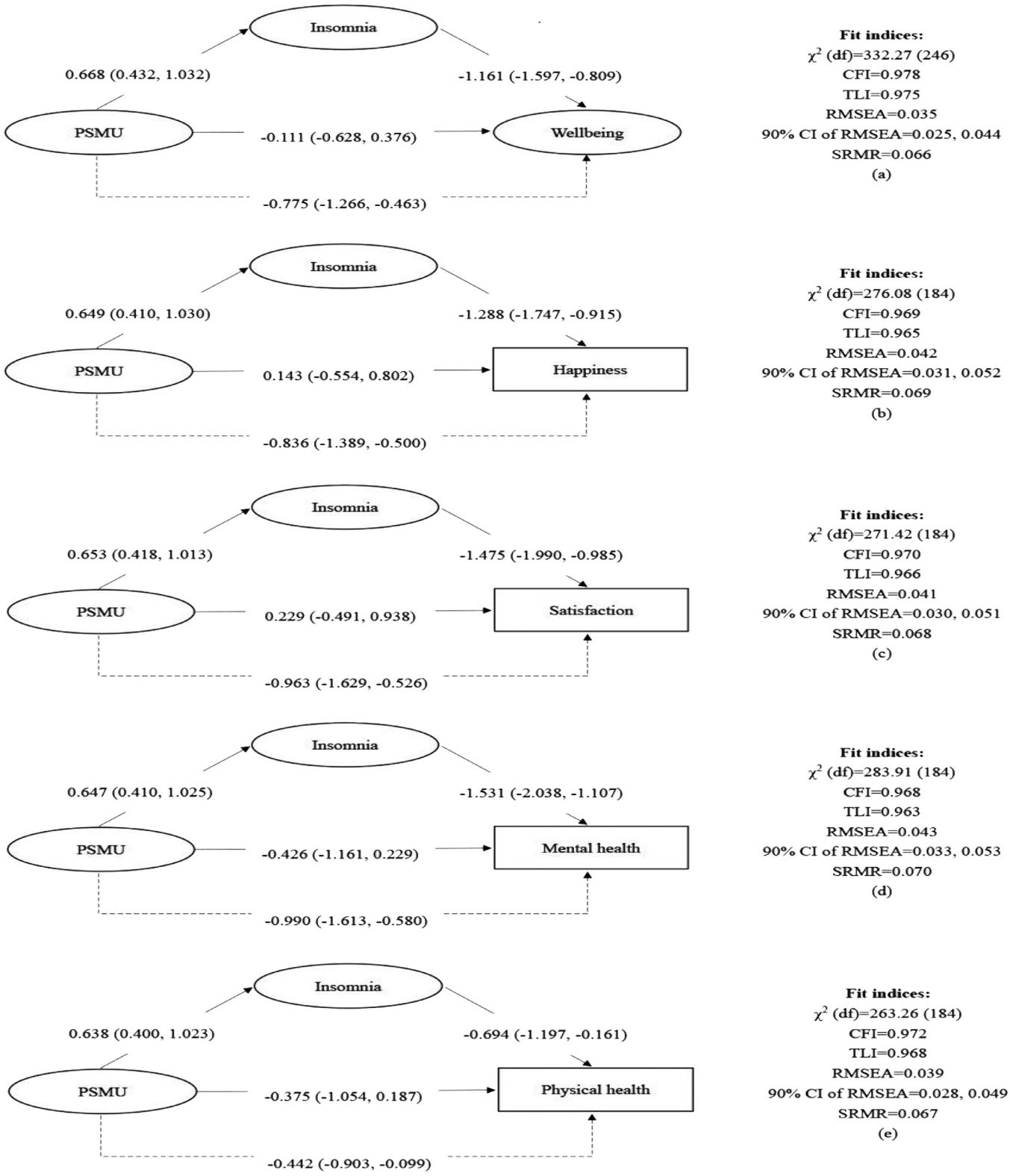

Fig. 1. Results of the proposed mediation model reporting with coefficients and 95% bootstrapping confidence interval. Solid lines indicate direct effects; dashed line indicates indirect effect. (a) with the dependent variable of overall subjective well-being; (b) with the dependent variable of happiness; (c) with the dependent variable of satisfaction; (d) with the dependent variable of mental health; (e) with the dependent variable of physical health. CFI=comparative fit index; TLI=Tucker-Lewis index; RMSEA=root mean square error of approximation; SRMR=standardized root mean square residual; PSMU=problematic social media use assessed via the Bergan Social Media Addiction Scale; Wellbeing=overall subjective well-being. Insomnia was assessed using the Arabic Scale of Insomnia. *Note: Age and gender were controlled in the mode.*

Table 2
Correlations between studied variables in the proposed mediation model.

	r (p-value)								
	Gender	Age	PSMU	Insomnia	Well-being	Happiness	Satisfaction	Mental health	Physical health
Gender	–								
Age	-0.33 (<0.001)	–							
BSMAS	0.11 (0.07)	-0.01 (0.81)	–						
ASI	0.03 (0.59)	-0.07 (0.27)	0.34 (<0.001)	–					
Wellbeing	-0.09 (0.12)	0.10 (0.09)	-0.24 (<0.001)	-0.50 (<0.001)	–				
Happiness	-0.01 (0.88)	0.02 (0.78)	-0.16 (0.006)	-0.44 (<0.001)		–			
Satisfaction	-0.04 (0.47)	0.07 (0.26)	-0.16 (0.008)	-0.42 (<0.001)	0.83 (<0.001)	0.64 (<0.001)	–		
Mental health	-0.15 (0.01)	0.14 (0.01)	-0.27 (<0.001)	-0.47 (<0.001)	0.86 (<0.001)	0.59 (<0.001)	0.65 (<0.001)	–	
Physical health	-0.08 (0.17)	0.08 (0.19)	-0.16 (0.006)	-0.24 (<0.001)	0.68 (<0.001)	0.34 (<0.001)	0.34 (<0.001)	0.45 (<0.001)	–

PSMU= problematic social media use assessed via the Bergan Social Media Addiction Scale.
ASI= Insomnia was assessed using the Arabic Scale of Insomnia.
Well-being = overall subjective well-being.

dices (comparative fit index=0.968 to 0.978; Tucker-Lewis index=0.963 to 0.975; root mean square error of approximation=0.035 to 0.043; standardized root mean square residual=0.066 to 0.070).

4. Discussion

The current study was conducted among Algerian undergraduate students with the aim of investigating the relationship between subjective well-being, problematic use of social media, and the potential mediating effect of insomnia during the COVID-19 pandemic. The present findings support the expected positive association between problematic social media use and insomnia. The time spent on social media correlates with increased insomnia. This significant correlation was expected given the accumulated research that reported the association between social media addiction and sleep disturbance [[53],[54]], sleep problems [8], short night-time sleep duration, and subjective insomnia [55], poor sleeping habits [56], and poor sleep quality [57].

In addition, the study has shown a significant negative association between problematic social media use and well-being. Previous research suggests that problematic use of social media use is associated with lowering mental health [58], lower well-being [[59],[60]], and higher depressive symptoms scores, and mental illness [[61],[62]]. Moreover, insomnia was negatively and significantly associated with well-being. This result does not seem to be surprising due to the growing body of research that has revealed reduced sleep quality results into an increased risk of mental problems [63], including depression and anxiety [64]. Poor sleep quality is expected to cause serious psychological well-being issues such as anxiety and depression [65].

These complex relations between problematic social media use, well-being, and insomnia led us to study the potential mediating role of insomnia between problematic social media use and the overall well-being (and its subscales), which is supported by current study results. The significant negative correlation between problematic social media use from one hand and well-being, mental health, physical health, satisfaction, and happiness, on the other hand, turned nonsignificant once insomnia is introduced to the models. Moreover, all indirect effects via insomnia were statistically significant in all models. This finding provides empirical support for the idea that problematic social media use can have a negative impact on different aspects of well-being through sleep disturbance and problems. These findings suggest that the mechanism behind the significant correlation between excessive social use and decreased level of well-being could be understood, given the level of insomnia one might experience. One legitimate explanation could be provided by fear of missing out [66]. As defined by Przybylski and his colleagues, fear of missing out is one's feeling of apprehension which suggests that he/she misses out on information, events, experiences, or life decisions that could make one's life better. Accordingly, people are motivated to spend more time on social media to feel socially connected and prevent the feeling of fear of missing out [[67],[68]]. According to previous research, people can manage their sleep habits in order to connect with social media at night [69] and avoid the fear of missing out [70], which can lead to sleep disturbance and problems [71]. Therefore, people may be able to self-regulate their desire to retain social ties using social media in a problematic way, which leads to insomnia.

On the other hand, insomnia is associated with stress system activation [72], which can harm one's well-being. Therefore, research has found that insomnia correlates physical disability, physical discomfort, and social and emotional distress [73]. Moreover, sleep and indications of subjective well-being are linked in the daily diary research. For instance, research revealed that fibromyalgia patients' daily sleep duration and quality were associated with higher dysphoric effects, a stronger emotional response to stress and pain, and incomplete emotional recovery from stressful days [74]. Studies on human's brain while sleeping indicate that getting a good night's sleep can assist a person in building mental and emotional resilience. On the other hand, sleep deprivation makes it more difficult for the person to access the portions of his/her brain that help them manage their emotions [75], which has a harmful effect on well-being.

Our results have important implications. The significant correlation of problematic use of social media and subjective well-being claims the negative impact of social media on happiness, satisfaction, mental health, and physical health. However, the significant indirect effect via insomnia suggested that an effective way for clinicians to improve the well-being of people who experience excessive social media use is by correctly diagnosing disorders of initiating and maintaining sleep and correctly addressing them. Therefore, clinicians need to assess the sleep quality in people who have problematic use of the internet and social media and accurately treat it. This implication is supported by prior research; for instance, Espie et al. [76] reported that a digital cognitive behavioral therapy for enhancing insomnia symptoms resulted in a significant improvement in psychological well-being, functional health, and sleep-related quality of life. Similarly, Freeman et al. [77] found that a digital CBT sleep intervention aimed at reducing insomnia for ten weeks had a significant effect on some mental health indicators such as paranoia and hallucinations. Moreover, they conclude that insomnia was a mediator of change in paranoia and hallucinations.

5. Limitations

The use of just self-report measures is one of the study's limitations. Although some of the components are self-reported (e.g., subjective well-being), other variables, such as problematic use of social media, might benefit from a second data source, such as reports from parents. As this study used only self-report measures for simultaneously collecting data from the same participants, common method variance (CMV) may be a concern [78].

Moreover, this study used a cross-sectional design, which does not enable the researchers to assess its causality. It is hard to say whether

insomnia results from the problematic use of social media and if insomnia is the cause of subjective well-being. An alternative explanation is that when people experience high levels of well-being, they may have fewer sleep problems. Similarly, rather than the problematic use of social media influencing insomnia, it is possible that people have excessive use of social media because they have sleep disturbances and problems. Nonetheless, our proposed model is stronger than any of the alternative models. However, longitudinal research and/or experimental design is an essential direction for future research to preclude alternative explanations.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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