


Social media exposure during COVID-19 lockdowns could lead to emotional overeating via anxiety: The moderating role of neuroticism

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Abstract

China was a major hotspot during the beginning of the COVID-19 pandemic. Several studies have reported changes in residents' eating behaviors and appetite during city wide lockdowns and home confinements. However, few have investigated how neuroticism interacts with the impact of COVID-19 to influence eating behaviors during city lockdowns. Thus, the current study aims to establish a pathway model to understand social media exposure, negative affect, neuroticism, and their interaction with eating behaviors during the COVID-19 lockdowns. We present data from 1,128 participants (Mage = 24.34 ± 10.48 years) who completed an online survey between February 17 and 27, 2020. The extent of respondents' social media exposure, negative affect, eating behaviors, and desire for high-calorie food during city lockdowns, as well as the personality trait of neuroticism, were measured. Results show that city lockdowns and home confinements had a negative impact on residents' eating behaviors and appetite. Forty-eight percent of respondents showed moderate to constant emotional overeating, and respondents' desire for high-calorie food significantly increased. Correlation analysis showed that emotional overeating is

positively associated with social media exposure, neuroticism, and anxiety. Then, a moderated mediation model was established, showing that heavy social media exposure could lead to emotional overeating through anxiety, and the association between social media exposure and anxiety varies depending on the extent of neuroticism. The current study provides novel insight into how the interaction of a personality trait and the stressful situation of COVID-19 influence people's negative emotions and eating behaviors.

KEYWORDS

anxiety, COVID-19, emotional eating, neuroticism, social media exposure

INTRODUCTION

In January 2020, after the first outbreak of COVID-19 in China, people's activities were restricted in an effort to slow the spread of the virus. Since then, social media platforms have been an important source of information during the COVID-19 pandemic, and people's use of social media has increased significantly as a result (Gottlieb & Dyer, 2020). For example, the Centers for Disease Control and Prevention, the World Health Organization (WHO), numerous academic journals, and other health care organizations have regularly posted pandemic guidance on their social media accounts (Merchant & Lurie, 2020). Meanwhile, people have begun to spend more time on social media while under widespread lockdowns and stringent stay-at-home orders, especially to seek news about the pandemic (Ni et al., 2020). However, social media can also elicit negative emotions and spread rumors and fake news, especially during an epidemic or pandemic (for a review, see Venegas-Vera et al., 2020). For example, a study involving 4,872 participants in China observed a positive association between social media exposure and anxiety (Gao et al., 2020). Another study in Iraqi Kurdistan reported that social media has the significant effect of spreading fear and panic related to the COVID-19 outbreak, as well as a potential negative effect on people's mental health and psychological well-being (Ahmad & Murad, 2020). Similarly, a meta-analysis using a random-effects model of time spent on social networking sites and depression symptom severity found that the time spent on social media platforms is related to a depressive emotional state (Yoon et al., 2019). This leads us to believe that social media exposure could be used to predict other negative emotional states.

At the end of January 2020, Public Cognition and Public Prevention Behavior of COVID-19 Research Group (2020) investigated 11,479 people from 31 provinces and autonomous regions in China and found that most people showed moderate to great degrees of anxiety (66.9%), worry (71.7%), and fear (58.2%); only about 3% of the respondents showed no worry or fear at all. Negative emotions such as these can trigger palatable food consumption, otherwise known as emotional eating. According to Van Strien et al. (1986), emotional eating is defined as eating

in response to negative emotions, including anxiety (Dalrymple et al., 2018), depression (Dingemans et al., 2015), anger (Giovanni et al., 2011; Holliday et al., 2006; Zeeck et al., 2011), and fatigue (Constant et al., 2018). Compared with neutral or positive emotions, negative emotions—especially stress and anxiety—can increase one's impulse to eat (Macht & Simons, 2000) and even lead to bulimia nervosa (Block et al., 2009; Dallman, 2010; Epel et al., 2001; Hilbert et al., 2011; Kandiah et al., 2006; Smyth et al., 2007; Sulkowski et al., 2011).

Several studies have reported changes in eating behavior during the COVID-19 pandemic. One investigation conducted in Poland reported that a large proportion of people changed their eating habits and began to eat more snacks (Sidor & Rzymiski, 2020). Another research team observed that women in Italy stated they were more prone to emotional eating during the lockdowns, and they had increased their food intake to feel better or to relieve anxious or negative moods (Renzo et al., 2020). Nathaniel and Ashby (2020) observed that negative emotions lead to consumption of unhealthy foods in populations who suffer from obesity.

It should be noted that how people face stressful events varies markedly, and to a great extent, this is determined by the personality trait of neuroticism. Growing evidence has shown that neuroticism is a psychological trait of profound public health significance (for a review, see Lahey & Benjamin, 2009). Neuroticism has been associated with all kinds of eating disorders (for a review, see Farstad et al., 2016) and is likely to be a predisposing personality factor for eating disorder development (Brown et al., 2019; Lilenfeld et al., 2006).

A pronounced emotional response to stressful events and a poor coping style has been suggested as a crucial mechanism underlying the casual link between neuroticism and mental health disorders. Mounting evidence has shown that individuals high in neuroticism often exhibit negative emotions, and they usually respond to stressful situations with negative emotions more frequently and intensely (Bolger & Zuckerman, 1995; Hankin et al., 2005; Kendler et al., 2003; Ong et al., 2010). Furthermore, when coping with stress, individuals high in neuroticism use fewer problem-focused strategies and more emotion-focused (Watson & Hubbard, 1996) and escape-avoidance strategies (Bolger, 1990). Unsurprisingly, research has found that emotional eating, as one maladaptive coping strategy for relieving negative affect, is associated with neuroticism among different populations, including children (Vollrath et al., 2018), adults (Heaven et al., 2001; Keller & Siegrist, 2015), and patients with morbid obesity (Gade et al., 2014).

To the best of the authors' knowledge, few studies have investigated how personality traits interact with the impact of COVID-19 to influence eating behaviors during city lockdowns. Due to the incredible significance neuroticism has to public health, an intensive research effort to fully understand the relationships among social media exposure, neuroticism, and eating behaviors is well justified. Therefore, the current study aims to establish a pathway model to understand how social media exposure, negative affect, and neuroticism affect eating behaviors during COVID-19 lockdowns. Although many studies have discussed the influence of personality on eating behavior or emotion changes using neuroticism as an independent variable, it remains unclear whether neuroticism can interact with emotions.

According to previous literature, social distancing requirements may constitute a barrier to social support, making individuals more susceptible to the negative effects of stressful environments and thus more likely to choose less adaptable emotion regulation strategies, such as emotional eating and restrictive eating (Jáuregui-Lobera et al., 2009). Based on existing evidence that shows the association between neuroticism and pronounced emotional responses to

stressful events, as well as evidence showing the association between neuroticism and poor coping styles, we hypothesize the following (Figure 1):

Hypothesis 1. Social media exposure would influence emotional overeating through negative affect (anxiety and/or depression).

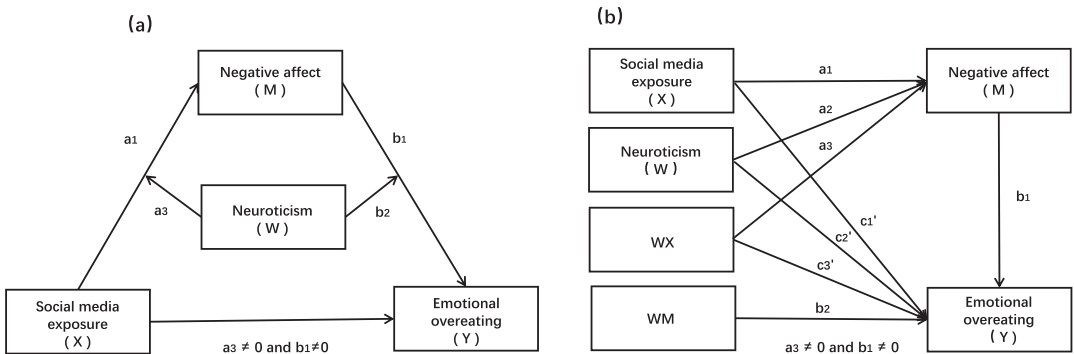
Hypothesis 2. Neuroticism would moderate the association between social media exposure and negative affect, and the impact of social media exposure on negative affect would be greater among people high in neuroticism than those low in neuroticism.

Hypothesis 3. Neuroticism would moderate the association between negative affect and emotional overeating, and the impact of on negative affect on emotional overeating would be greater among people high in neuroticism than those low in neuroticism.

METHODS

Methodology

The current study is part of the Sleep, Eating Behaviors, Emotion, Physical Activity (SEEPA) project being conducted in China during the COVID-19 pandemic; the project has received approval from the Human Research Ethics Committee at the Faculty of Psychology, Southwest University. The SEEPA project has connected more than 1,000 subjects with four types of questionnaires, focused on sleep disorders, eating behavior disorders, emotion problems and physical activity. All participants provided informed consent before taking part in this study. Data were collected between February 17th and 27th, during which confirmed cases of COVID-19 in China rose from 70,548 to 78,497. Participants could use their mobile phones to scan a QR code



Hypothesis 1 (a, b₁): social media exposure would lead to emotional overeating through negative affect (anxiety and/or depression).
 Hypothesis 2 (a₂): neuroticism would moderate the association between social media exposure and negative affect.
 Hypothesis 3 (b₂): neuroticism would moderate the association between negative affect and emotional eating.

FIGURE 1 Conceptual diagram and statistical diagram of the moderated mediation model. (a) The hypothesized conceptual model with the corresponding statistical pathway. (b). The specific path in the conceptual model

or follow a link (on a mobile phone or a computer) to complete the questionnaire. Data were collected from 32 Chinese provinces (all provinces and cities except Heilongjiang Province and Jiangxi Province) through an online platform (www.wjx.cn). The numbers of participants in each province were illustrated in Figure S1.

Measures

Demographic information

Demographic information included gender, age, education level, marital status, occupation and working status (no work, work from home or at workplace).

Predictive variable

Social media exposure was measured via one question: *how many hours do you spend each day reading news about the COVID-19 epidemic through social media*. The question was rated on a five-point Likert scale. 1 = *Less than 1 h*, 2 = *1–2 h*, 3 = *2–4 h*, 4 = *4–6 h*, 5 = *more than 6 h*. Higher scores indicate more social media use during the COVID-19 lockdown.

Mediating variables

Negative affect during COVID-19 epidemic was measured on nine items including *depressed, uninterested, stressful, irritable, anxious, painful, tired, distracted, and forgetful*. Participants were asked by “To what degree do you feel each of the following emotion since the COVID-19 break out”. Each item was rated on a five-point Likert scale ranging from 1 = *Not at all* to 5 = *Extremely*. Higher scores indicate greater negative affect. The Cronbach's α coefficient of the scale was 0.90 in the current study.

Moderator variable

Neuroticism was measured using Big Five Personality Questionnaire-Neuroticism subscale adopted from the Neuroticism-Extraversion Openness Five Factor Inventory-3 (NEO-FFI-3; McCrae & Costa, 2010). Neuroticism subscale contains 12 items inquiring about the respondent's tendencies towards negative emotionality (such as “I am not a worrier”, “sometimes I feel completely worthless”), and each question was rated on a five-point Likert scale ranging from 1 = *Strongly disagree* to 5 = *Strongly agree*. Higher scores indicate greater neuroticism. The Cronbach's α coefficient of the scale was 0.86 in the current sample.

Outcome variable

Adult Eating Behavior Questionnaire (AEBQ, Hunot et al., 2016) was used to assess eating behaviors in the current study. Four dimensions including the emotional overeating

(e.g. *I eat more when I'm in a bad mood*), emotional undereating (e.g. *I eat less when I'm in a bad mood*), Hunger (e.g. *I often feel so hungry that I have to eat something right away*) and food responsiveness (e.g. *When I see or smell food that I like, it makes me want to eat*) were focused, and one item in each of the four subscales was adopted in the current investigation. Items were rated on a five-point Likert scale ranging from 1 = *Never* to 5 = *Always*.

Desire for high-calorie food

Four questions were used to assess the desire for high-calorie food: 1) *how strong do you desire to have sweet milk-tea during the last couple of days*, 2) *how strong do you desire to have fried chicken during the last couple of days*, 3) *how strong do you desire sweet milk-tea before the COVID-19 lockdowns*, and 4) *how strong do you desire fried chicken before the COVID-19 lockdowns*? A study published in *The Lancet Global Health*, which reviewed 325 dietary surveys covering 90% of the world's population between 1990 and 2010, found that China had the highest growth in junk food consumption in the world (Imamura et al., 2015). Several surveys on the dietary choices of young adults in China have reported that fried chicken was the most frequently ordered takeaway food (Zhang et al., 2020), and nearly 90% of young people consumed sweet milk tea more than once per week (Gao et al., 2011; Shen et al., 2019; Zhang et al., 2021). These data showed the popularity of fried chicken and sweet milk tea among young adults in China. Each question was rated on a five-point Likert scale ranging from 1 = *I do not want it at all* to 5 = *I do want it very much*. The Cronbach's α coefficient of the scale was 0.85 in the current study.

Statistical analysis

First, a descriptive statistical analysis of the demographic characteristics of the participants, as well as of the predictive variable, the moderate variable, the mediating variables, and the outcome variable was conducted. A correlation analysis between each variable was then conducted using SPSS 24.0. Then, several regression analyses were conducted using PROCESS 3.5¹ in order to test the moderating effect of neuroticism between social media exposure and emotional overeating. The interaction between social media exposure and neuroticism, as well as the interaction between neuroticism and anxiety, were examined using SPSS 24.0, and the coefficients of each path were determined. The fitting index of the mediated moderation model was calculated using Amos 24.

RESULTS

Demographic characteristics

A total of 1,128 participants completed the questionnaire; 215 incomplete questionnaires were excluded from the analysis, leaving 912 valid questionnaires (Figure S1). Among them, 189 respondents were male and 723 were female; 661 were current students, 240 were working authors, 13 were unemployed, and 31 were retirees; 684 participants had a bachelor's degree or a college degree, 112 participants had a postgraduate degree or above, and 116 participants had

a high school degree or below; 191 were married, 711 were unmarried, and 10 were divorced. The mean age of all participants was 24.34 years ($SD = 10.48$ years). The number of respondents with a monthly household income of less than RMB 1,000 was 104, those with an income of RMB 1,000–5,000 was 407; RMB 5,000–10,000 was 212; RMB 10,000–20,000 was 121; RMB 20,000–50,000 was 48; and RMB 50,000 or above was 20. At the time of the survey, 705 people were on vacation, 201 people were working from home, and only six people had returned to work at their office.

Factor analysis of negative affect

Using SPSS 24, factor analysis (Tables S1 and S2) was conducted on nine items of negative affect ($KMO = 0.814$, $df = 36$, $p < .00$). *Anxious*, *stressed*, and *irritable* were classified as one dimension, named “anxiety.” *Pain*, *tired*, *depressed*, *uninterested*, *distracted*, and *forgetful* were classified as another dimension, named “depression.” In the current study, Cronbach's α coefficient of the anxiety and depression subscales was 0.82 and 0.88, respectively. In the following analysis, the scores for the anxiety subscale were averaged from *anxious*, *stressed*, and *irritable*, and the scores for the depression subscale were averaged from *pain*, *tired*, *depressed*, *uninterested*, *distracted*, and *forgetful*.

Descriptive statistics

Since the outbreak of the COVID-19 pandemic, the number of respondents spending < 2 hours/day, 2–4 hours/day, 4–6 hours/day, and more than 6 hours/day reading COVID-19 news on social media platforms is 69 (7.5%), 180 (19.7%), 245 (26.9%), and 418 (45.8%), respectively (Figure 2a).

The number of respondents who felt lightly anxious (scores of 1–2), moderately anxious (scores of 2–4), and severely anxious (scores > 4) is 395 (43.3%), 461 (50.5%), and 56 (6.2%), respectively. The number of respondents who felt lightly depressed (scores of 1–2), moderately depressed (scores of 2–4), and severely depressed (scores > 4) were 494 (54.2%), 387 (42.4%), and 31 (3.4%), respectively (Figure 2b).

When in a negative state, the number of respondents who never, sometimes, usually, often, and constantly engage in emotional overeating is 235 (25.8%), 238 (26.1%), 273 (29.9%), 131 (14.4%), and 35 (3.8%), respectively (Figure 2c).

Population density distribution maps of social media exposure, anxiety, and emotional overeating among high and low neuroticism groups were created using ggplot2 of R (Figure 3). The results show that the proportion of respondents who spent more than 6 hours per day using social media platforms to read COVID-19 news and information, who felt moderately to strongly anxious, and who reported experiencing emotional overeating frequently and constantly was much higher among those respondents high in neuroticism.

Correlation analysis

A correlation analysis was conducted between variables of interest (Table 1). Results show that social media exposure, anxiety, and emotional overeating are positively correlated with one

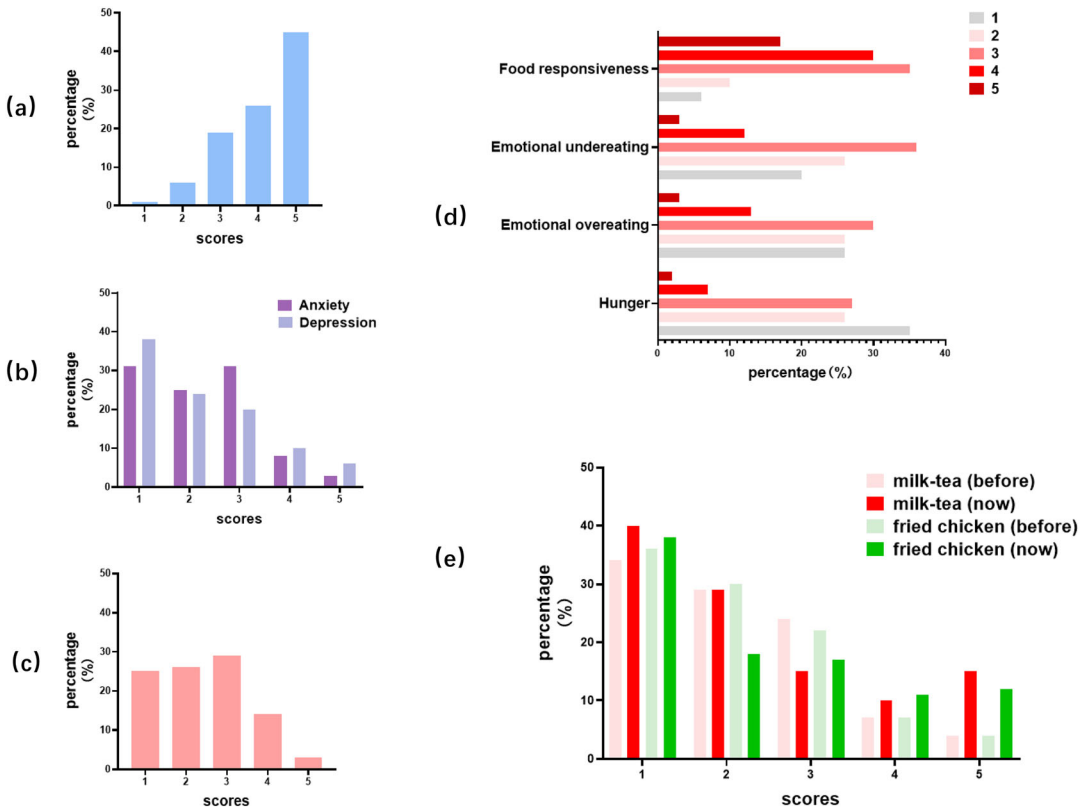


FIGURE 2 Proportion of respondents with each score of the (a) social media use, (b) anxiety and depressed, (c) emotional overeating, (d) four categories of eating behaviors, (e) desire for high calorie food. *Note.* The X axis labels in panel (a): five-point Likert scale ranging from 1 = less than 1 h to 5 = more than 6 h; the X axis labels in panel (b): five-point Likert scale ranging from 1 = not at all to 5 = extremely; the X axis labels in panels (c) and (e): five-point Likert scale ranging from 1 = never to 5 = constantly; the labels in panel (d): five-point Likert scale ranging from 1 = I do not want it at all to 5 = I do want it very much [Color figure can be viewed at wileyonlinelibrary.com]

another. However, no significant correlation was found between social media exposure and depression. Therefore, a mediational pathway analysis among social media exposure, anxiety, and emotional overeating was conducted.

Mediational model of social media exposure, anxiety, and emotional overeating

To test Hypothesis 1, which states that social media exposure influences emotional overeating through anxiety, several stepwise regression analyses were conducted (Table 2). In the first and the second regression model, social media exposure ($\beta = .15, p < .01$) and anxiety ($\beta = .11, p < .01$) significantly predicted emotional overeating. In the third regression model, the direct effect of the social media exposure on emotional overeating was significant ($\beta = .13, p < .01$), and the coefficient of anxiety was significant ($\beta = .20, p < .01$). The mediational pathway was

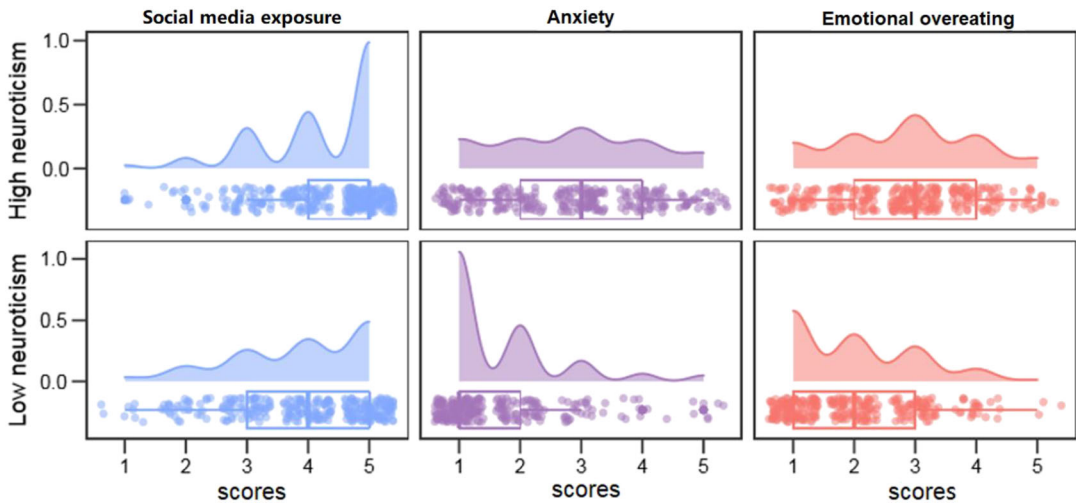


FIGURE 3 Population density in social media exposure, anxiety and emotional overeating between two groups high and low neuroticism. (Artificially high neuroticism groups with more than one standard deviation above the mean score and artificially low neuroticism groups with less than one standard deviation below the mean score). By using gplot2 of R to plot the population density distribution on each variable score, in terms of social media exposure, both groups had higher attention to the epidemic situation, but the high neuroticism population was more concentrated. In terms of anxiety level, the even score of high neuroticism was higher than that of low neuroticism, indicating that high neuroticism has a higher level of anxiety. In terms of emotional overeating, the even score of the high neuroticism group was higher than that of the low neuroticism group, indicating that the high neuroticism group was more likely to have emotional overeating. The first 27% were defined as high neuroticism group and the last 27% were classified as low neuroticism group [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 1 Descriptive statistical results and correlation factor of each variable

	M	SD	1	2	3	4	5
1. Social media exposure	4.07	1.03	-				
2. Emotional overeating	2.42	1.12	.15**	-			
3. Desire for high calorie food	2.41	1.26	< .01	-.002	-		
4. Neuroticism	2.66	0.64	.18**	.33**	0.03	-	
5. Anxiety	2.17	1.02	.11**	.21**	0.04	.39**	-
6. Depression	2.12	0.94	< .01	.07*	.21**	.07*	.08*

Note: Means of emotional overeating, neuroticism, anxiety, depression and desire for high calorie food are average scores ranging from 1 to 5.

* $p < .05$; ** $p < .01$; *** $p < .001$.

then verified using the PROCESS macro for SPSS, and the same results were obtained. The Sobel test showed that the mediating effect of anxiety was significant ($Z = 3.09$, $p < .01$).

The effects of social media exposure on emotional overeating were also tested using the PROCESS macro for SPSS. The total effect of social media exposure on emotional overeating

TABLE 2 The mediational pathways and Sobel tests of the social media use → anxiety → emotional overeating

		DI	VI	β	t	Adjust R^2	ΔR^2
Step 1	Liner regression	Emotional overeating	Social media exposure	0.15	4.99***	0.02	0.02
Step 2	Liner regression	Anxiety	Social media exposure	0.11	3.57***	0.01	0.01
Step 3	Liner regression	Emotional overeating	Social media exposure + anxiety	0.13 + 0.20	(3.98 + 6.19)***	0.06	0.06
Step 4	Sobel test	Z = 3.09, $p < .01$					

Abbreviations: DV, dependent variable; IV, independent variable.

* $p < .05$; ** $p < .01$; *** $p < .001$.

was 0.17, in which the direct effect was 0.14 and the indirect effect was 0.03, with the indirect effects accounting for 17.65%. The mediational model indicated that anxiety is a partial mediator between the effects of social media exposure on emotional overeating (Figure 4a). Thus, Hypothesis 1 is supported.

Moderating effect of neuroticism on the social media exposure and anxiety pathway

To test Hypothesis 2, Muller et al. (2005) test procedure for moderated mediating effects was used. The following two conditions must be met to confirm the moderating effect: (1) the interaction between social media exposure and neuroticism must have significant effects on anxiety (path a_3 shown in Figure 1b), and (2) the effects of anxiety on emotional overeating must be significant (path b_1 shown in Figure 1b). Before testing, all variables were transformed to Z -scores, and the Z -scores of anxiety and neuroticism were multiplied as interaction scores. The indicators of the model are as follows: $\chi^2 = 0$, $df = 0$, CFI = 1.00, SRMR = 0. Since the relationship between variables allows free estimation, the model df is 0, and this is a saturated model. Each index shows that the data fits the model well.

The moderated mediation model was established using structural equation modeling. Table 3 shows that the interaction between social media exposure and neuroticism has a significant effect on anxiety ($a_3 = 0.008$, $p < .05$), and anxiety has a significant effect on emotional overeating ($b_1 = 0.12$, $p < .01$). Therefore, the path of “social media exposure → Anxiety” is moderated by neuroticism (Figure 4b).

In order to determine how neuroticism moderates the association between social media exposure and anxiety, an interaction diagram was drawn according to Hayes and Matthes' (2009) regulation effect test procedure (Figure 4c). The results of a simple slope test for this interaction (Cohen & Cohen, 1983) show that social media exposure is significantly associated with anxiety among participants high in neuroticism ($\beta = .13$, $p < .01$); however, this association was not observed among participants low in neuroticism ($\beta = .001$, $p = .97$). Thus, Hypothesis 2 is supported.

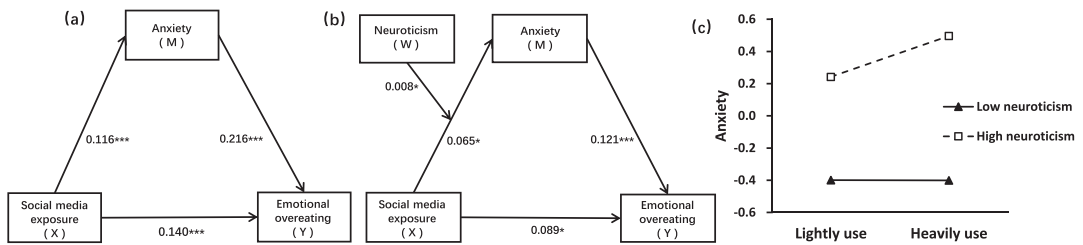


FIGURE 4 The final moderated mediation model with the pathway coefficients. (a) The mediation model. (b) The final moderated mediation model. (c) The moderating effect of neuroticism between the social media usage time and anxiety. Divide a standard deviation above the mean into high groups, and a standard deviation below the mean into low groups

TABLE 3 Results of mediating/moderating effects

Predictor variable	M: Anxiety		Y: Emotional overeating	
	β	<i>t</i>	β	<i>t</i>
X: Social media exposure	$a_1 = .07$	2.04*	$c_1' = .09$	2.49*
W: Neuroticism	$a_2 = .05$	12.15**	$c_2' = .04$	7.70**
XW: Social media exposure \times neuroticism	$a_3 = .008$	2.15*	$c_3' = -.01$	-2.21*
M: Anxiety			$b_1 = .12$	3.21**
MW: Anxiety \times neuroticism			$b_2 = -.003$	-0.62

Note: In addition to the interaction term, the other regression coefficients are standard solution; a_1 is the path coefficient of $X \rightarrow Y$; a_2 is the path coefficient of $W \rightarrow M$; a_3 is the path coefficient of X and $W \rightarrow M$; b_1 is the path coefficient of $M \rightarrow Y$; b_2 is the path coefficient of M and $W \rightarrow Y$; c_1' is the path coefficient of $X \rightarrow Y$; c_2' is the path coefficient of $W \rightarrow Y$; c_3' is the path coefficient of X and $W \rightarrow Y$.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Moderating effect of neuroticism on the anxiety and emotional overeating pathway

Muller's (2005) test procedure was also used to test Hypothesis 3. The following two conditions must be met to confirm the moderating effect: (1) the interaction between anxiety and neuroticism must have a significant effect on emotional overeating (path b_2 shown in Figure 1b), and (2) the effects of anxiety on emotional overeating must be significant (path b_1 shown in Figure 1b).

All variables were transformed to Z-scores, and the Z-scores of anxiety and neuroticism were then multiplied as interaction scores. The indicators of the model were as follows: $c^2 = 0$, $df = 0$, CFI = 1.00, SRMR = 0. Since the relationship between variables allows free estimation, the model df is 0, and the model is saturated. Each index shows that the data fit the model well.

The moderated mediation model of neuroticism, social media exposure, anxiety, and their interaction terms (social media exposure \times neuroticism, anxiety \times neuroticism) with emotional overeating were established using structural equation modeling. The interaction term of anxiety and neuroticism has no significant effect on emotional overeating ($b_2 = -0.003$, $p = -0.62$, Table 3). Therefore, the moderating effect of neuroticism on the anxiety and emotional overeating pathway is not significant, and Hypothesis 3 is not supported.

DISCUSSION

We observed obvious changes in respondents' eating behaviors during the COVID-19 lockdowns: 48% of respondents exhibited moderate to constant emotional overeating. This is considerably higher than previous observations showing that approximately 30% of the population exhibit emotional overeating (Stancioiu et al., 2020). Furthermore, the respondents' desire for high-calorie food significantly increased. More specifically, the percentage of participants who reported moderate and strong desire for high-calorie food before the COVID-19 outbreak was 12%, and this increased to 25% after the outbreak (Figure 2d, Figure 2e). Thus, respondents' eating behaviors and appetite were affected by the outbreak of COVID-19 to a considerable extent.

Of particular importance, the results of this research show that emotional overeating is positively associated with social media exposure. The more time people spend reading COVID-19 news and information on social media platforms, the more often they engage in emotional overeating. An in-depth analysis showed that social media exposure could directly and indirectly lead to emotional overeating; that is, social media exposure could increase anxiety, which in turn could result in emotional overeating. These findings support Hypothesis 1. Previous studies have reported that emotional eating is associated with stressful life events (Loth et al., 2008) and anxiety (Giel et al., 2016; Houldcroft et al., 2014; Webb et al., 2011). During the present study's research period, the Chinese government had taken strict measurements to control the spread of COVID-19. These measurements included city lockdowns, home confinements, and similar social distancing measures. Thus, social media platforms were residents' main channel for obtaining information related to the COVID-19 pandemic, as well as the main channel for maintaining their social networks (Bao et al., 2020; Gao et al., 2020). Nearly half of the respondents (about 45%) in the current investigation spent more than 6 hours per day using social media platforms to read COVID-19 information (Figure 2a). Social media platforms disseminated reliable information about the development of the COVID-19 pandemic by the government and health care providers. Also, the platforms were utilized as a diagnostic tool and referral system by residents. However, social media has also "become a conduit for spreading both rumors and deliberate misinformation" (Merchant & Lurie, 2020). As stated by the WHO, "the 2019-nCoV outbreak and response has been accompanied by a massive 'infodemic'—an over-abundance of information—some accurate and some not—that makes it hard for people to find trustworthy sources and reliable guidance" (World Health Organization, 2020). Indeed, our data show a positive association between social media exposure and anxiety.

However, it is worth noting that each person responds differently to the information they read on social media platforms. The current moderated mediation model demonstrates that the personality trait of neuroticism moderates the effect that social media exposure has on anxiety. A further analysis indicated that social media exposure is positively correlated with anxiety only among individuals high in neuroticism; the same correlation was not observed among respondents low in neuroticism. Thus, the results support Hypothesis 2. These observations are consistent with previous research that has found that individuals high in neuroticism respond to situations with negative emotions more frequently and intensely when experiencing stressful life events (Finan et al., 2010; Hankin et al., 2005; Kendler et al., 2003). Furthermore, the current findings provide insight into why some previous studies have reported an association between social media exposure and negative affect during the COVID-19 pandemic (Gao et al., 2020), while other studies did not observe the same (Ni et al., 2020).

In regard to Hypothesis 3, the current study did not observe a moderating effect of neuroticism between anxiety and emotional overeating. Anxiety is generalized, whereas emotional overeating is idiosyncratic; therefore, overeating is not the only way one can deal with anxiety. In other words, neuroticism does not moderate the means of coping with anxiety. However, the population density map in Figure 3 shows that the proportion of respondents who spent more than 6 hours per day using social media to get COVID-19 news and information, who felt moderately to strongly anxious, and who reported frequent and constant emotional overeating was much greater among those high in neuroticism than those low in neuroticism. In the Eysenck's personality model (1968), people high in neuroticism have a strong tendency to react emotionally, they pay more attention to the negative aspects of life events (Vinkers et al., 2014), and they more easily feel negative emotions. People high in neuroticism also respond to situations with negative emotions more frequently and more strongly when experiencing stressful life events. For instance, in the negative emotional induction task, the negative effects of the experiment had a greater effect on participants high in neuroticism (Larsen & Ketelaar, 1991). Another explanation for the current findings would be that ineffective coping strategies may be responsible for the stronger emotional reactions that occur among people high in neuroticism (Matthews et al., 2003). For example, neurotic individuals tend to use emotion-focused strategies (intended to reduce the emotional distress that accompanies the problem) instead of problem-focused strategies (which are aimed at the source of the problem and thereby help one overcome their anxiety) to cope with stress (Watson & Hubbard, 1996).

Obviously, overuse of social media during the city lockdowns and home confinements had a negative impact on residents' eating behaviors and appetite during the critical period. Thus, it is particularly important to determine how to prevent and reduce unhealthy eating behaviors in similar situations that may occur in the future. Social media should be used as a critical tool to help people while adhering to social distancing and isolation guidelines. Guidance about maintaining a healthy diet and preventing eating disorders, such as information about food nutrition, how to cook and eat in a healthy way, and the symptoms of eating disorders, should be posted regularly on social media platforms. Furthermore, since neurotic individuals are more vulnerable to negative affect, emotional eating, and eating disorders, social media should be utilized to raise awareness about their needs, as well as deliver psychological assistance and psychological first aid. As suggested by Dr. Merchant, "these targeted efforts can occur in response to what people search for or in a more personalized approach based on an individual's online profile, posts, and underlying risk" (Merchant & Lurie, 2020).

However, this study has some limitations. First, the present study has a cross-sectional design. The items measuring variables—including emotional state, eating behaviors, and sleep—before the outbreak of COVID-19 were rated using a retrospective approach. Second, due to limited resources and the time sensitivity of the COVID-19 pandemic, a convenient sampling strategy was utilized. Third, only one item was used to measure the length of time spent on social media, and the participants' chat time and the length of the other online social activities they engaged were not detailed; this affected the accuracy of variable definitions. Despite the limitations of this strategy, the current study provides valuable information about the initial psychological responses of residents from 32 provinces in China after 3 weeks of strict lockdowns and home confinements.

To our knowledge, this is the first study investigating the impact of social media exposure, neuroticism, and their interaction on emotional overeating during the COVID-19 lockdown. A moderated mediation model was established that heavy social media exposure could lead to emotional overeating through anxiety, and the association between social media exposure and

anxiety varied depending on the extent of neuroticism. The current study provides novel insight into how the interaction of a personality trait and the stressful situation caused by COVID-19 influence people's negative emotion and eating behaviors.

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ETHICS STATEMENT

The current study is part of the Sleep, Eating Behaviors, Emotion, Physical Activity (SEEPA) project being conducted in China during the COVID-19 pandemic; the project has received approval from the Human Research Ethics Committee at the Faculty of Psychology, Southwest University.

CONFLICT OF INTEREST

There is no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. The raw data needed to reproduce these findings could not be shared within two years, as these data are also part of ongoing research. The data are available from the corresponding authors after two years as required.

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ENDNOTE

¹ Process was written by Andrew F. Hayes; <http://www.afhayes.com>.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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