

Empirical Article

Fear of COVID-19 mediates the relationship between negative emotional reactivity and emotional eatingMĂDĂLINA ELENA DOMINTE,¹ VIREN SWAMI^{2,3} and VIOLETA ENEA¹ ¹Department of Psychology, Faculty of Psychology and Education Sciences, "Alexandru Ioan Cuza" University, Iași, Romania²School of Psychology and Sport Science, Anglia Ruskin University, Cambridge, UK³Centre for Psychological Medicine, Perdana University, Kuala Lumpur, Malaysia

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Recent studies have highlighted high levels of emotional eating during the coronavirus (COVID-19) pandemic, but have not satisfactorily explained these changing eating patterns. Here, we tested one potential explanatory model broadly based on a biosocial model of emotional eating. Specifically, we examined the extent to which negative emotional reactivity was associated with emotional eating, as well as the mediating role of fear of COVID-19. A total of 474 women from Romania were asked to complete measures of emotional eating, negative emotional reactivity, and fear of COVID-19. Mediation analysis showed that higher negative emotional reactivity was significantly and directly associated with greater emotional eating. This direct relationship was also mediated by fear of COVID-19. These results highlight one possible route through which the ongoing COVID-19 pandemic may have resulted in elevated rates of emotional eating, though further research is needed.

Key words: Emotional eating, COVID-19, emotional reactivity, eating behavior, anxiety.

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INTRODUCTION

Beyond the threat to physical health, the novel coronavirus (COVID-19) pandemic has had a profound impact on lifestyles and daily routines in populations worldwide (Haleem, Javaid & Vaishya, 2020). For instance, many countries have introduced travel restrictions, mandatory self-quarantine, periods of lockdown or social distancing, and the closure of non-essential services (e.g., bars, gyms, and salons). Such measures have the potential to stop or limit the spread of COVID-19 (Barnett-Howell, Watson & Mobarak, 2021; Tian, Liu, Li *et al.*, 2020), but have also triggered profound challenges in finances, educational opportunities, employment, and lifestyles resulting in high levels of stress and anxiety (Shevlin, McBride, Murphy *et al.*, 2020; Tull, Edmonds, Scamaldo, Richmond, Rose & Gratz, 2020) particularly in at-risk population segments, such as pregnant women (Biviá-Roig, La Rosa, Gómez-Tébar *et al.*, 2020). In addition, emerging research has shown that the stress and anxiety triggered by the COVID-19 pandemic – and attendant changes to daily routines, such as increased screen-time and decreased physical activity (Cooper, Reilly, Siegel *et al.*, 2020; Rodgers, Lombardo, Cerolini *et al.*, 2020) – has also had adverse effects on other aspects of psychological well-being, including negative body image (Swami, Horne & Furnham, 2020; Swami, Todd, Robinson & Furnham, 2021) and unhealthy eating patterns (Ashby, 2020; Flaudias, Iceta, Zerhouni *et al.*, 2020; Phillipou, Meyer, Neill *et al.*, 2020; Pujia, Ferro, Maurotti *et al.*, 2021; Robertson, Duffy, Newman, Bravo, Ates & Sharpe, 2020).

In particular, it has been suggested that the negative affect caused by the COVID-19 pandemic may impede coping

mechanisms and amplify maladaptive coping strategies (Rettie & Daniels, 2021). One such maladaptive coping strategy involves *emotional eating*, defined as food consumption in response to negative emotions (Kaplan & Kaplan, 1957). More specifically, emotional eating represents a failure to discriminate internal hunger cues from the desire to use eating – particularly consumption of energy-dense, high-sugar foods – as a strategy for regulating and reducing negative emotions (Bruch, 1973; Evers, Marijn Stok & de Ridder, 2010). Indeed, recent studies have documented a shift toward unhealthy eating patterns (Ammar, Brach, Trabelsi *et al.*, 2020; Sidor & Rzymiski, 2020) and high rates of emotional eating in adults from a range of national contexts during the COVID-19 pandemic (Bemarian, Mæland, Blomhoff *et al.*, 2021; Cecchetto, Aiello, Gentili, Ionta & Osimo, 2021; Giacalone, Frøst & Rodríguez-Pérez, 2020; Mason, Barrington-Trimis & Leventhal, 2021; Papandreou, Arija, Aretouli, Tsilidis & Bulló, 2020). For instance, one survey of Saudi women reported that more than half of respondents reported moderate or high levels of emotional eating (Al-Musharaf, 2020), whereas more than half of Italian adults surveyed reported that they had increased their food intake to manage their anxiety (Di Renzo, Gualtieri, Cinelli *et al.*, 2020).

These findings are concerning because emotional eating is reliably associated with weight gain and long-term weight retention (van Strien, Konttinen, Homberg, Engels & Winkens, 2016), a finding that has been supported during the ongoing pandemic (Mason *et al.*, 2021). To date, however, most studies on the impact of the COVID-19 pandemic have been concerned with estimating rates of emotional eating in different social identity groups (e.g., Al-Musharaf, 2020; Mason *et al.*, 2021; Papandreou *et al.*, 2020) with women in particular

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identified as being at higher risk for emotional eating (Di Renzo *et al.*, 2020; Giacalone *et al.*, 2020). In contrast, relatively little work has sought to identify potential mechanistic pathways that may explain higher rates of emotional eating during the COVID-19 pandemic. Of note, it has been suggested that stricter lockdown measures may be related to higher rates of emotional eating (Papandreou *et al.*, 2020), which implies a central role for COVID-19-related negative affect (see also Cecchetto *et al.*, 2021; McAtamney, Mantzios, Egan & Wallis, 2021). Consistent with this proposition, one recent study found that perceived stress during the pandemic was significantly associated with greater emotional eating among adults in the United States (Shen, Long, Shih & Ludy, 2020).

However, more work could be done to better understand the pathways that lead to emotional eating during the COVID-19 pandemic. Emotional reactivity is one factor that may be particularly important in this regard. Emotional reactivity refers to an emotional response to a stimulus, which varies across individuals and also by ease of activation, intensity, and duration (Davidson, 1998; Rothbart & Derryberry, 1981). According to the biosocial model (Linehan, 1993), negative emotional reactivity – or the tendency to demonstrate maladaptive responses to emotional events – results from an interaction between biologically-based propensities toward high emotional reactivity and childhood invalidation. This biosocial model has historically been applied to models of disordered eating (Wisniewski & Kelly, 2003), but has recently been extended to understandings of emotional eating (Braden, Anderson, Redondo, Watford, Emley & Ferrell, 2021). Thus, it has been shown that individuals who have greater negative emotional reactivity were more likely to engage in emotional eating (Barnhart, Braden & Jordan, 2020; Braden *et al.*, 2021). In explanation, it has been suggested that emotional eating may be a strategy to cope with and manage emotional discomfort (Braden *et al.*, 2021).

While a direct link between negative emotional reactivity and emotional eating appears likely, this relationship may also be mediated by specific emotional responses to the COVID-19 pandemic. For instance, initial cross-sectional work has shown that fear of COVID-19 is particularly high in adults and that greater levels of COVID-19 fear are associated with higher levels of anxiety and symptoms of depression (Ahorsu, Lin, Imani, Saffari, Griffiths & Pakpour, 2020; Fitzpatrick, Harris & Drawve, 2020). Additionally, greater fear of COVID-19 has been associated with higher levels of emotional eating during the pandemic (Pak, Süsen, Denizci Nazlıgül & Griffiths, 2021). This is consistent with earlier studies showing that catastrophising and anxiety are associated with greater emotional eating (Janke, Jones, Hopkins, Ruggieri & Hruska, 2016; Zysberg, 2018) and that, in the context of the current pandemic specifically, fear of COVID-19 is associated with more negative health behaviors (Nguyen, Do, Pham *et al.*, 2020). Likewise, individuals higher in negative emotional reactivity may also be more likely to express greater fear of COVID-19, although this has not been specifically investigated.

In the present study, therefore, we sought to advance understandings of emotional eating during the COVID-19 pandemic by testing a novel explanatory model in Romanian women. Specifically, we expected that greater negative emotional

reactivity would be significantly and directly associated with greater emotional eating, which is consistent with previous work (Braden *et al.*, 2021). Additionally, we hypothesised that fear of COVID-19 would mediate the relationship between negative emotional reactivity and emotional eating, which would be consistent with – and extend – the findings of Pak *et al.* (2021). A graphical depiction of our hypothesised model is provided in Fig. 1. Should our hypotheses be supported, it would point to one possible mechanistic pathway that explains elevated rates of emotional eating during the ongoing COVID-19 pandemic.

METHOD

Participants

The initial pool of participants included 614 women, but we excluded individuals who self-reported an eating disorder diagnosis ($n = 28$) and who failed attention check items ($n = 112$). The final pool of participants, therefore, included 474 women ranging in age from 18 to 40 years ($M = 22.91$, $SD = 4.36$) and in self-reported body mass index (BMI) from 14.34 to 43.28 kg/m^2 ($M = 22.21$, $SD = 4.92$). All participants were citizens and residents of Romania, and the majority (67.9%) indicated that they were residing in an urban area. In terms of educational qualifications, 50.4% had completed secondary schooling, 2.3% had a post-secondary qualification, 36.3% had an undergraduate degree, and the remainder had a postgraduate degree.

Measures

Emotional reactivity. To measure negative emotional reactivity, we used the General Negative Reactivity (GNR) subscale of the Perth Emotional Reactivity Scale (PERS; Becerra, Preece, Campitelli & Scott-Pillow, 2019). This subscale consists of 15 items measuring the activation, intensity, and duration (five items each) of one's negative emotions. All items were rated on a five-point scale ranging from 1 (*very unlike me*) to 5 (*very like me*). Although the GNR can be scored as three subscales (Becerra *et al.*, 2019), an exploratory factor analysis (EFA) with data from the present study indicated that a single, composite factor consisting of all 15 items should be extracted (see Data S1). Therefore, we computed an overall score as the mean of all 15 GNR items, with higher scores reflecting more negative emotional reactivity. Internal consistency, as measured using McDonald's ω , was 0.92 (95% CI = 0.91, 0.93).

Emotional eating. Emotional eating was assessed using the Emotional Eating Scale-Revised (Koball, Meers, Storfer-Isser, Domoff &

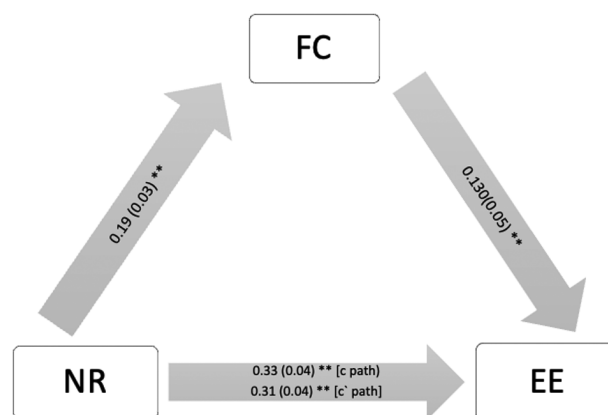


Fig. 1. Mediation model of the relationship between negative emotional reactivity (NR) and emotional eating (EE) via fear of COVID-19 (FC).

Musher-Eizenman, 2012), a 31-item instrument measuring the desire to eat in response to anxiety or anger, depression, and boredom. All items were rated on a five-point scale ranging from 1 (*no desire to eat*) to 5 (*an overwhelming desire to eat*). Scores on the English version of the scale have been found to reduce to three dimensions (Koball *et al.*, 2012), but score dimensionality has not been previously assessed on a Romanian translation of the scale. Therefore, we subjected scores from the present study to EFA. The results of parallel analysis indicated that a single factor, consisting of 19 items, should be retained (see Data S1). Thus, we computed an overall score as the mean of the 19 relevant items, with higher scores reflecting a greater desire to eat emotionally. McDonald's ω for this overall score was 0.95 (95% CI = 0.94, 0.95).

Fear of COVID-19. To measure fear of COVID-19, participants were asked to complete the Fear of COVID-19 scale (FC-19S; Ahorsu *et al.*, 2020). This is a seven-item scale that measures the intensity of fear one has toward COVID-19. All items were rated on a five-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). An EFA of the FC-19S scores from the present indicated that a single factor with all seven items should be extracted (see Data S1). Therefore, we computed an overall score as the mean of all seven items, with higher scores indicating greater fear of COVID-19. Internal consistency, as measured using McDonald's ω , was 0.84 (95% CI = 0.81, 0.86).

Demographics. Participants were asked to self-report their age, area of residence (*urban* or *rural*), highest educational qualification, self-reported diagnosis of an eating disorder, height, and weight. Height and weight data were used to compute self-reported BMI as kg/m².

Procedures

Ethics approval for this project was obtained from the institutional research committee of the Faculty of Psychology and Education Sciences and all research was conducted in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Because Romanian translations of all survey instruments were not available at the time of study, we prepared novel translations using the back-translation method (Brislin, 1970). Between September and October 2020, the study was advertised to potential participants via social media. Inclusion criteria included being a Romanian citizen and resident of adult age, and we excluded participants who had a self-reported diagnosis of an eating disorder. Eligible participants were asked to provide digital informed consent before being asked to complete an online survey, designed and implemented in accordance with best-practice recommendations for online surveys (Eysenbach, 2004). The survey was hosted on Google Forms and consisted of the measures described above, presented in a counter-balanced order for each participant. IP addresses were examined to ensure that no participant took the survey more than once. The anonymous survey also included three attention check items inserted part-way through. Participation was voluntary and, in exchange for completing the survey, participants were eligible for entry into a prize raffle worth 50 RON. All participants received debriefing information upon completion of the survey.

RESULTS

Preliminary analyses

There were no missing data in the retained dataset. Descriptive statistics and inter-scale correlations between all study variables are reported in Table 1. As can be seen, scores on all variables were significantly and positively correlated, with small-to-medium effect sizes. Regression analyses indicated that negative emotional reactivity significantly predicted fear of COVID-19, $F(1, 473) = 26.39$, $p < 0.001$, Adj. $R^2 = 0.05$, $\beta = 0.23$, and emotional eating, $F(1, 473) = 58.90$, $p < 0.001$, Adj. $R^2 = 0.11$,

Table 1. Means, standard deviations, and correlations between all study variables

	<i>M</i>	<i>SD</i>	(1)	(2)	(3)
(1) Negative emotional reactivity	3.36	0.86		0.23*	0.31*
(2) Fear of COVID-19	1.99	0.74			0.17*
(3) Emotional eating	1.11	0.93			

Note: $N = 474$.

* $p < 0.001$.

$\beta = 0.33$, whereas fear of COVID-19 significantly predicted emotional eating, $F(1,473) = 17.91$, $p < 0.001$, Adj. $R^2 = 0.04$, $\beta = 0.19$.

Mediation analysis

We used the bootstrap approach (Hayes, 2017) to conduct mediation analyses (Model 4) based on the hypothesised model depicted in Fig. 1. The bootstrap method does not require normal sampling distribution and has a better balance of Type I error and statistical power than alternative methods (MacKinnon, Lockwood & Williams, 2004; Shrout & Bolger, 2002). As recommended by Preacher and Hayes (2008), 5,000 bootstrap samples were drawn from the dataset to calculate indirect and direct effects, as well as bias-corrected 95% CIs. Effects were considered to be significant if a respective CI did not overlap zero (MacKinnon *et al.*, 2004). As shown in Fig. 1, there were significant direct effects for all pathways in the model. There was also a significant indirect pathway from negative emotional reactivity to emotional eating via fear of COVID-19, (indirect effect = 0.02, $SE = 0.01$, 95% CI = 0.01, 0.51, 7.7% of total effect). These results remained unchanged when BMI was entered as a covariate in the mediation model.

DISCUSSION

A growing body of recent work has highlighted high rates of emotional eating in adults from a wide range of national contexts during the ongoing COVID-19 pandemic (e.g., Al-Musharaf, 2020; Bemanian *et al.*, 2021; Cecchetto *et al.*, 2021; Di Renzo *et al.*, 2020; Giacalone *et al.*, 2020; Mason *et al.*, 2021; Papandreou *et al.*, 2020). With few exceptions (e.g., Cecchetto *et al.*, 2021; McAtamney *et al.*, 2021; Papandreou *et al.*, 2020; Shen *et al.*, 2020), the extant research has not attempted to explicate mechanistic and explanatory pathways that may account for high rates of emotional eating during the pandemic. Here, we tested one potential explanatory model: specifically, we examined whether negative emotional reactivity would be associated with emotional eating both directly and indirectly via fear of COVID-19. Consistent with our hypothesising, we found that more negative emotional reactivity was significantly associated with greater emotional eating. In addition, we also found that fear of COVID-19 mediated the relationship between negative emotional reactivity and emotional eating.

Consistent with recent work (Barnhart *et al.*, 2020; Braden *et al.*, 2021), we found that greater negative emotional reactivity was significantly and directly associated with greater emotional eating. This finding is consistent with Linehan's (1993) biosocial model, which suggests that emotional regulation difficulties are associated with behavioral outcomes. More specifically, both our findings and those of other researchers (Barnhart *et al.*, 2020; Braden *et al.*, 2021) suggest that individuals who experience easily activated, intense, and more persistent negative emotions are more likely to experience stronger patterns of emotional eating. It may be that individuals high in negative emotional reactivity have few effective emotion regulation strategies (Messerli-Bürgy, Stülb, Kakebeeke *et al.*, 2018; Steinsbekk, Barker, Llewellyn, Fildes & Wichstrøm, 2018). Faced with persistent negative affect, these individuals may adopt maladaptive behavioral strategies, such as emotional eating, to manage their emotional states. In this sense, emotional eating may provide individuals high in negative emotional reactivity with a means of reasserting a degree of control over their emotions through eating.

Beyond this direct pathway, however, we also found that higher negative emotional reactivity was significantly associated with greater fear of COVID-19, which in turn was significantly associated with greater emotional eating. In broad outline, this finding is consistent with the suggestion that fear of COVID-19 is significantly associated with greater emotional eating (Pak *et al.*, 2021), as well as with earlier findings. In terms of the latter, perceived stress, financial strain, and loneliness – all factors that are likely related to fear of COVID-19 (Ahorsu *et al.*, 2020; Fitzpatrick *et al.*, 2020) – are related to higher emotional eating (Mason, 2020; Mason, Heron, Braitman & Lewis, 2016; Mason & Lewis, 2014; Spinosa, Christiansen, Dickson, Lorenzetti & Hardman, 2019). It is possible, therefore, that individuals who are high in negative emotional reactivity are more likely to develop intense fear toward COVID-19. In turn, these feelings of fear serve as a further trigger for emotional eating, possibly as a means of regulating or alleviating those feelings of fear. That is, we suggest that, for some individuals, emotional eating may be a maladaptive coping strategy for dealing with the intense feelings of fear triggered by COVID-19.

Our findings are important, first, because they suggest one possible route through which the COVID-19 pandemic leads to high rates of emotional eating. Of course, we do not suggest it is the only such route (Cecchetto *et al.*, 2021; McAtamney *et al.*, 2021; Shen *et al.*, 2020); indeed, it may not even be the primary route. However, in the absence of further research, our findings point to potentially important roles played by negative emotional reactivity and fear of COVID-19 in emotional eating. This is notable because it highlights the impact that the ongoing pandemic may be having on overeating and unhealthy food intake, which could in turn lead to incidental weight gain and negative body image (Swami *et al.*, 2020, 2021). That is, many individuals may be engaging in emotional eating to cope with the fear and anxiety caused by the COVID-19 pandemic, which in turn could bring downstream negative outcomes that exacerbate and perpetuate poorer psychological outcomes, including symptoms of disordered eating. For instance, psychosocial stressors during the pandemic could increase disordered eating

symptomatology by elevating psychological distress (Ramalho *et al.*, 2021) or by promoting unhealthy weight control behaviors, including mindless eating and snacking, increased food consumption, and eating to cope with distress (Simone *et al.*, 2021). In a similar vein, the psychosocial impact of the COVID-19 pandemic may also include an uptick in addictive behaviors (e.g., more frequent alcohol consumption), which in turn may affect eating patterns either directly or via increased psychological distress (see La Rosa, Gori, Faraci, Vicario & Craparo, 2021).

Our study is not without its limitations. First, because of the dearth of appropriate, psychometrically-validated tools for use with Romanian-speaking samples – an issue recognised by scholars (e.g., Swami, Tudorel, Goian, Barron & Vintila, 2017; Vintilă, Todd, Goian, Tudorel, Barbat & Swami, 2020), we relied on EFAs to assess the factorial validity of the instruments included in the present study. In the case of the PERS-GNR and FC19-S, our results broadly supported score dimensionality observed with English-speaking samples. In the case of the EES-R, however, the results of our EFA suggested that emotional eating in our sample should be conceptualised as a unidimensional construct. Although this is consistent with other recent work suggesting that eating-related instruments developed for use in English-speaking samples may not transfer well to Romanian contexts (Vintilă *et al.*, 2020), it nevertheless limits opportunities to examine the extent to which our results are robust across eating in response to different forms of negative emotions, such as anger and boredom. Further, although EFA is a robust method for assessing factorial validity (Swami & Barron, 2019), it would be useful for future work to establish further evidence of factorial validity (e.g., through confirmatory factor analysis) and other psychometric properties. Additionally, although our analytic plans did not change from the point of designing our study through to its execution, it should be noted that our study plan and hypotheses were not preregistered.

Second, due to our recruitment method, caution should be exercised when attempting to generalise our findings to the broader Romanian population. Indeed, Romania is notable for large inter and intra-regional differences in factors such as socioeconomic status, educational outcomes, urban–rural residence, exercise and eating habits, and the prevalence of overweight and obesity (Vintilă *et al.*, 2020). As such, it would be useful for future work to recruit a representative sample of Romanian adults and to request further demographic information that would enable more in-depth examinations of subgroups that may be at heightened risk for emotional eating. In a similar vein, given that our study was limited to Romanian adults, it may not be possible to generalise our findings to other national contexts. Indeed, given differences in the transmission of COVID-19 and in national responses to the threat posed by the coronavirus, it will be important to replicate our findings in other national contexts.

There are additional ways in which the present work could be extended. For instance, it may be useful to examine the impact of positive emotional reactivity on emotional eating (Barnhart *et al.*, 2020), as well as the mediating role of COVID-19-related stress and anxiety (Swami *et al.*, 2020), as separate constructs to fear of COVID-19. Finally, given the cross-sectional nature of our

study, causal inferences should be applied with caution and future work should approach this topic using experimental and longitudinal designs. The above limitations and directions for future research notwithstanding, our findings suggest a possible explanatory model that accounts for high rates of emotional eating during the COVID-19 pandemic. From a practical point-of-view, helping individuals to develop adaptive emotion regulation skills and to enhance strategies to manage COVID-19-related fear may be beneficial to reduce emotional eating.

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee of Alexandru Ioan Cuza University and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

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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SUPPORTING INFORMATION

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

Data S1. Supplementary Materials

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