

# COVID-19 and Eating Problems in Daily Life: the Mediating Roles of Stress, Negative Affect and Posttraumatic Stress Symptoms

Ruike SHENG

Nanjing Normal University

Xiujie YANG

Beijing Normal University

Xiaoyan LIU

Beijing Normal University

Wei XU (✉ [livingxw@163.com](mailto:livingxw@163.com))

Beijing Normal University

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## Research article

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# Abstract

## Background

The 2019 coronavirus disease (COVID-19) epidemic poses a challenge to individuals' mental health. Increased stress, negative affect (NA), and posttraumatic stress symptoms (PTSS) that are being experienced globally may lead to eating problems. The purpose of this study was to explore the impacts of the perceived severity of COVID-19 on eating problems as well as the mediating effects of stress/NA/PTSS both at the within-person level and between-person level.

## Methods

During the COVID-19 outbreak, a total of 108 college students were recruited to report their perceived severity of COVID-19, stress, NA, PTSS, and eating problems 3 times a day for 7 consecutive days using Ecological Momentary Assessment (EMA). Results: State perceived severity of COVID-19 predicted fewer subsequent eating problems in daily life at the within-person level. Both state NA and PTSS were positively associated with eating problems in daily life. At the between-person level, trait-like perceived severity of COVID-19, stress, NA, and PTSS were positively associated with overall eating problems. There were no mediating effects of stress/ NA /PTSS on the relations between perceived severity of COVID-19 and eating problems at the within-person/between-person level.

## Conclusions

The perceived severity of COVID-19, stress, NA, and PTSS might increase the risk of eating problems.

## Plain English Summary

The 2019 coronavirus disease (COVID-19) epidemic affects individuals' lifestyles and behaviors. In order to stop the spread of the COVID-19, many authorities took lockdown actions on cities. The perceived severity of COVID-19 makes the public eating problems. We assessed people's perceived severity of COVID-19, stress, negative affect, posttraumatic stress symptoms, and eating problems three times a day. Then we found that if the public felt higher negative affect and posttraumatic stress symptoms, more eating problems in subsequent life. The overall perceived severity of COVID-19, stress, negative affect, and posttraumatic stress symptoms were positively associated with eating problems. However, the perceived severity of COVID-19 predicted fewer subsequent eating problems in daily life. This discrepancy may indicate that the perceived severity OF COVID-19 has a cumulative effect.

## 1 Introduction

Since December 2019, the coronavirus disease (COVID-19) has attracted worldwide attention for its rapid and exponential diffusion (Forte et al., 2020). China was the first country that identified the COVID-19 as the cause of the outbreak (Wang et al., 2020). The epidemic also affected other countries all across the

world (Rajkumar, 2020). In order to stop the spread of the COVID-19, Chinese authorities took lockdown actions on cities in an unprecedented effort on January 23, 2020 (Wang et al., 2020). Subsequently, many other countries adopted similar measures, such as asking people who were possibly infected to isolate themselves at home or in a dedicated quarantine facility, as well as limiting social interactions to reduce transmission (Brooks et al., 2020; Di Renzo et al., 2020; Fernández-Aranda et al., 2020; Mediouni et al., 2020).

The COVID-19 pandemic has profoundly disrupted daily life across the globe, with profound effects on mental health. Specifically, some studies showed a high prevalence of generalized anxiety, depression symptoms, psychological distress, stress, and posttraumatic stress disorder (PTSS) symptomatology in the general population during the COVID-19 pandemic (Bäuerle et al., 2020; Forte et al., 2020; Huang & Zhao, 2020; Liu et al., 2020; Wang et al., 2020). Recently, a study with 1210 Chinese participants indicated that 8.1% of them reported moderate to severe stress after the two-month occurrence of COVID-19 (Wang et al., 2020). The perceived severity of trauma may be an important factor that leads an individual to experience distress (Quan et al., 2017). For example, Li et al.'s (2020) survey among 4607 Chinese reveals that individuals' perceived severity of COVID-19 was related to emotional problems. Meanwhile, greater perceived severity of an experienced trauma was associated with more PTSD symptomatology (Quan et al., 2017).

Moreover, apart from the mental effect inherent in the COVID-19 epidemic itself, home confinement might also affect an individuals' habits and lifestyles (Ammar et al., 2020; Pišot et al., 2020; Robinson et al., 2020), especially eating behaviors (Di Renzo et al., 2020). Previous studies have revealed that the current COVID-19 epidemic contributed to the risk of developing eating disorders in healthy individuals (Rodgers, 2020; Shah et al., 2020). Home confinement could be a catalyst for disordered eating behaviors (Brown et al., 2021). For instance, in a sample of 5738 French undergraduate students, home confinement was associated with more binge eating and dietary restriction (Flaudias, 2020). During the COVID-19 lockdown, the sense of hunger and satiety changed for more than half of the population, in the manner of less/increased appetite and eating more than usual (Di Renzo et al., 2020; Kriaucioniene et al., 2020; Owen et al., 2020). Another cross-sectional study conducted during the COVID-19 with 3533 respondents from the general population living in Italy found that the perception of weight gain was observed in 48.6% of the population (Di Renzo et al., 2020). Though plenty of new studies about eating problems came out recently, it still lacks research to shed light on the perceived severity of COVID-19 and its impact on eating behaviors. Notably, a finding suggested that the perceived severity of COVID-19 was generally related to behavioral problems (Li et al., 2020), such as eating problems. Therefore, we hypothesized that the higher perceived severity of the COVID-19 in daily life could predict more eating problems.

Another purpose of this study was to explore the mechanism between the perceived severity of COVID-19 and eating problems. Disordered eating is likely to be impacted by the pandemic through multiple pathways (Flaudias et al., 2020). Higher perceived severity of the COVID-19 epidemic might increase stress, NA, and PTSS, which may trigger or maintain eating problems. In the current study, Ecological

Momentary Assessment (EMA) data was adopted to explore the association between the perceived severity of COVID-19, stress, NA, PTSS, and eating problems.

## **1.1 Perceived severity of COVID-19, stress, and eating problems**

The ongoing pandemic has resulted in an obvious rise in stress. Stress affects people's food choices and eating behaviors (Shen et al., 2020). According to the stress-eating-obesity model (Talbot et al., 2013), eating more is a maladaptive response to stressors. When feeling stressed, individuals may shift their preference to more palatable and energy-dense foods, which are less healthy and contain more fat (O'Connor et al., 2007). According to the animal models of binge eating, dietary changes and stress may cause food addiction for animals (Treasure et al., 2020). Furthermore, individuals with binge eating disorder eat more and faster when stressed to distract from that stressful state. That is, rapid eating may be "consuming" their thoughts and behaviors, thereby allowing them to "forget" about their stress (Razzoli et al., 2017). Indeed, stressful life events were positively associated with extreme weight control behaviors and binge eating (Loth et al., 2008), which have been identified as significant precursors of eating disorder onset, maintenance, and relapse (Degortes et al., 2014; Grilo et al., 2012). Moreover, stress was associated with a greater likelihood of binge eating and dietary restriction during the COVID-19 epidemic (Flaudias, 2020). A previous study showed that the perceived severity of COVID-19 was associated with less perceived controllability (Li et al., 2020), which may trigger a sense of stress (Lazarus, 2006). Thus, it is reasonable to deduce that the higher perceived severity of COVID-19 might lead to more stress. Considering the close relationship between the perceived severity of COVID-19, stress, and eating problems, we hypothesized that stress might mediate the relationship between the perceived severity of COVID-19 and eating problems.

## **1.2 Perceived severity of COVID-19, NA, and eating problems**

Preliminary reports indicated that during epidemics many adults experience NA (Castellini et al., 2020). According to the emotion regulation model (Leehr et al., 2015), negative emotion can be a trigger for binge eating and down-regulation NA through binge eating in the short-term (while bingeing) or long-term (after a binge episode). Additionally, Heatherton and Baumeister (1991) proposed the escape theory suggesting that individuals may binge eat in NA presence. A person will overeat in response to emotional tension and uncomfortable sensations (Canetti et al., 2002). Moreover, Rodgers et al. (2020) proposed that fear of contagion, which may, in turn, leads to an increase in restrictive eating patterns and orthorexia-based cognitions, alongside the increasing level of emotional distress, leading to the risk of disordered eating patterns. Notably, substantial literature suggests that NAs, such as generalized uncertainty and anxiety, were associated with the pandemic were associated with overeating and restrained eating (Bongers et al., 2016; Canetti et al., 2002; Cooper et al., 2020; Ouwens et al., 2009). For example, some cross-sectional studies showed that the anxiety and fear of COVID-19 were correlated with more eating restraint, weight, and shape concerns in the whole sample (Haddad et al., 2020). A study

investigated 13829 Australians indicating that clinically significant depression and anxiety were associated with substantially increased odds of reporting being bothered by poor appetite or overeating during the COVID-19 epidemic (Owen et al., 2020). What's more, the perceived severity of COVID-19 was related to NA (Li et al., 2020). Therefore, NA may mediate the relationship between the perceived severity of COVID-19 and eating problems.

## **1.3 Perceived severity of COVID-19, PTSS, and eating problems**

The COVID-19 pandemic could be considered a traumatic event (Forte et al., 2020), resulting in increased PTSS (Liu et al., 2020; Touyz et al., 2020). Perceived severity of disasters mediated the relation of trauma experiences to PTSD (Quan et al., 2017). Thus, the higher perceived severity of the COVID-19 pandemic could predict higher PTSS (Touyz et al., 2020). During the COVID-19, PTSS may also be associated with individuals' eating behaviors. Overconsumption of food may be a common coping strategy for those experiencing significant psychological distress (Brewerton, 2011), such as the current COVID-19 epidemic. Therefore, it is theorized that disordered eating, particularly bingeing and purging, may help cope with PTSD symptoms. These behaviors may serve to blunt or avoid reminders of the trauma (Brewerton, 2007). Furthermore, studies have shown that PTSD symptoms can increase eating disorder symptoms (Karr et al., 2013; Thornley et al., 2016). Mason et al. (2017) also found that PTSD symptoms predicted problematic eating behaviors longitudinally. Therefore, PTSS may mediate the relationship between the perceived severity of COVID-19 and eating problems.

The Public's subjective severity of COVID-19 changes with environmental conditions such as the number of confirmed cases and exposure to COVID-19-related media coverage. However, previous studies of COVID-19 and eating problems have primarily used cross-sectional retrospective questionnaires (Ahmed, 2020; Bäuerle et al., 2020a; Huang & Zhao, 2020; Poelman et al., 2021; Robinson et al., 2020), which did not capture the dynamic variable accurately. Additionally, stress, NA, and PTSS are triggered by the living situation and eating behaviors are also closely correlated with individual living conditions. Accordingly, this study aims to explore the dynamic associations between the perceived severity of COVID-19, stress, NA, PTSS, and eating problems using EMA. EMA is mainly adopted to assess dynamic psychological processes and variables that change over time (Trull & Ebner-Priemer, 2014). Importantly, by collecting real-world data in the natural environment, EMA serves to maximize the ecological validity and generalizability of the assessments (Engel et al., 2016) and minimize the retrospective and heuristic biases of retrospective survey methods (Stone & Shiffman, 1994). Indeed, EMAs have already been adopted in numerous studies of psychology reactions (Ding et al., 2019; Wang et al., 2017) and eating behaviors (Berg et al., 2017; Engel et al., 2016). Therefore, it is feasible to explore the relationships between the perceived severity of COVID-19, stress, NA, posttraumatic stress symptoms, and eating problems in daily life via EMA.

To date, minimal research has explored the effect of the perceived severity of the COVID-19 pandemic on eating problems and the potential mechanism. To the best of our knowledge, few studies has explored

the relationships between the perceived severity of COVID-19, stress, NA, PTSS, and eating problems with the statistical framework of mediation as well as the dynamic association. Thus, the present study attempted to overcome this limitation, adopting an EMA design to test whether stress, NA, and PTSS would mediate the relationship between the perceived severity of COVID-19 and eating problems in daily life during the COVID-19 pandemic. We hypothesized that at the within-person level (a) perceived severity of COVID-19 would predict more subsequent eating problems, (b) state stress, NA, and PTSS would be associated with eating problems in daily life, and (c) state stress, NA, and PTSS would mediate the relationship between perceived severity of COVID-19 and subsequent eating problems. Moreover, at the between-person level (d) trait-like perceived severity of COVID-19 would predict more overall eating problems, (e) trait-like stress, NA, and PTSS would be associated with overall eating problems and (f) trait-like stress, NA, and PTSS would mediate the relationship between perceived severity of COVID-19 and overall eating problems.

## 2 Methods

### 2.1 Participants

We recruited college students living in mainland China during the COVID-19 outbreak, and all of the participants were at home for successively one whole week. The sample included 108 participants, of whom 82 (75.93%) were female. The average age of the sample was 22.09 years (SD = 2.65).

### 2.2 Procedures

This study was approved by the research ethics committee of the university. The EMA time frame covered the outbreak phase of the COVID-19 epidemic in China, conducted from February 1, 2020, until February 7, 2020 (consecutive 7 days). Participants were informed of the objectives and procedures of the study. Then, over the following 7 consecutive days, participants were invited to complete a short questionnaire including measures of perceived severity of COVID-19, stress, NA, PTSS, and eating problems in daily life three times a day (at 10:00 am, 4:00 pm, and 10:00 pm). All procedures were completed online, and the questionnaire was accessed via a web link sent to the participants' mobile phones via WeChat (a Chinese messaging platform) at scheduled time points each day. All participants were asked to complete the questionnaires within 30 minutes after receiving the link. Participants received 40 RMB after completing the EMA.

### 2.3 Measures

#### 2.3.1 Perceived severity of COVID-19

One item (i.e., Now, You think the severity of the pandemic is \_\_\_\_ ) rated on a 7-point scale from 1 (not serious at all) to 7 (extremely serious) was used to assess participants' perceived severity of COVID-19 at each time point. The Intra-class Coefficient (ICC) of the perceived severity of COVID-19 was 0.669 (Cohen, 1988).

## 2.3.2 Stress

Two items assessed stress (i.e., “Right now, how nervous and stress do you feel?” and “Right now, you feel out of control important things in your life”). These items were adapted from the Perceived Stress Scale (PSS; Cohen et al., 1983) and drawn from the past EMA of stress (Mayhugh et al., 2018). The items were rated on a 7-point scale (1 = not at all) to (7 = very much). The sum of the two items was calculated as the total stress score where higher scores denote more stress. The ICC of stress was 0.692.

## 2.3.3 Negative affect (NA)

Participants rated their current levels of several emotions on a 7-point scale from 1 (not serious at all) to 7 (extremely serious) using items in the form of “Right now, how \_\_\_\_ do you feel?”, with five items (“anxious”, “depress”, “angry”, “worry”, “sad”) combined into a measure of NA. These items were largely drawn from the past EMA of NA (Miller et al., 2009; Reichenberger et al., 2018; Spears et al., 2019). The five items' sum was calculated as the total NA score where higher scores denote higher NA. The ICC of NA was 0.648.

## 2.3.4 Posttraumatic stress symptoms

The momentary assessments of PTSS were derived from the PTSD Checklist-Civilian Version (PCL-C; Ruggiero et al., 2003). We compiled four items (e.g., “Right now, you try to avoid memories, thoughts, or feelings related to the COVID-19 epidemic.”) to representatives of the level of PTSS. The items were rated on a 7-point scale (1 = not at all) to (7 = very much). The sum of the four items was calculated as the total PTSS score where higher scores denote severe PTSS. The ICC of PTSS was 0.776.

## 2.3.5 Eating problems in daily life

Four items assessed eating problems in daily life (e.g., “Since the last survey, you deliberately limit the amount of food you eat to change your body shape or weight”). Participants rated their eating problems' intensity since the last survey on a 7-point scale (1 = not at all) to (7 = very much). Three items were adapted from Mond et al.'s (2004) Eating Disorder Examination Questionnaire (EDE-Q) and an overeating dimension item (i.e., “Since the last survey, you overeat to the point where you can't control yourself”) was from Eating Attitudes Test (EAT-26; Garner et al., 1982). The sum of the four items was calculated as the total eating problems in daily life score where higher scores denote severe eating problems. The ICC of eating problems in daily life was 0.867.

## 2.4 Data analysis

Descriptive data analysis and mediational model were conducted using SPSS 20.0 and Mplus 8.0. An indirect effect is considered statistically significant when the 95% bootstrap confidence interval does not include zero (Hayes, 2013). Our analysis examines the relationship between within-person level variables and the relationships between between-person level variables (the mean of within-person level variables for each individual). Perceived severity of COVID-19, stress, NA, and PTSS were group-mean centered at within-person level (centered at each person's mean to ensure that it featured within-person fluctuations

instead of between-person differences) and grand-mean centered at between-person level. We first tested the relationship between the perceived severity of COVID-19 ( $t$ ) and subsequent eating problems at the next time point of assessment ( $t+1$ ). Then, we examined the relationship between the perceived severity of COVID-19 ( $t$ ) and subsequent stress/NA/PTSS ( $t+1$ ) as well as the relationship between stress/NA/PTSS ( $t+1$ ) and eating problems ( $t+1$ ). Finally, we examined the mediating of stress/NA/PTSS ( $t+1$ ). The dynamic relationships found between state perceived severity of COVID-19 ( $t$ ), stress/NA/PTSS ( $t+1$ ), and eating problems ( $t+1$ ) in daily life were investigated respectively.

At the between-person level, variables are averaged from the within-person level data. We considered the averaged data as trait-like data, a common transformation in EMA research (Stevenson et al., 2019). Therefore, in the current study, the trait-like relationships between perceived severity of COVID-19, stress/NA/PTSS, and eating problems were also investigated.

## 3 Results

### 3.1 Descriptive analysis

Each of the 108 participants received 21 message reminders. In the current study, each participant completed 19.19 assessments on average and provided 2073 valid responses (91.40%), representing reasonable response rate for studies using an EMA approach.

#### 3.1.1 Within-person level

At the daily level, perceived severity of COVID-19 ( $B = -0.339$ , 95% CI [-0.580, -0.098]) predicted less subsequent eating problems. Both state NA ( $B = 0.035$ , 95% CI [0.006, 0.064]) and PTSS ( $B = 0.155$ , 95% CI [0.090, 0.220]) were positively associated with eating problems in daily life, whereas state stress ( $B = 0.051$ , 95% CI [-0.007, 0.109]) was not significantly associated with eating problems at within-person level. However, perceived severity of COVID-19 did not predict subsequent state stress ( $B = 0.055$ , 95% CI [-0.075, 0.185]), NA ( $B = 0.071$ , 95% CI [-0.449, 0.592]) or PTSS ( $B = -0.080$ , 95% CI [-0.452, 0.292]), thus the mediating roles of stress/NA/PTSS in the relation between perceived severity of COVID-19 and eating problems were not significant between state perceived severity of COVID-19 and eating problems in daily life. Specific mediating effect results are shown in Table 1.

#### 3.1.2 Between-person level

At the between-person level, trait-like perceived severity of COVID-19 was associated with more overall eating problems ( $B = 1.517$ , 95% CI [0.142, 2.892]). Trait-like stress ( $B = 0.645$ , 95% CI [0.306, 0.985]), NA ( $B = 0.304$ , 95% CI [0.070, 0.483]) and PTSS ( $B = 0.522$ , 95% CI [0.353, 0.691]) were positively associated with overall eating problems in between-person level. However, perceived severity of COVID-19 was not associated with stress ( $B = 0.235$ , 95% CI [-0.437, 0.908]), NA ( $B = 0.261$ , 95% CI [-1.395, 1.916]) or PTSS ( $B = 0.895$ , 95% CI [-0.428, 2.218]), thus the mediating roles of stress/NA/PTSS in the relation between perceived severity of COVID-19 and eating problems were not significant between trait-like perceived

severity of COVID-19 and overall eating problems at between-person level. Specific mediating effect results are shown in Tables 1.

Table 1

The mediating effects of stress/NA/PTSS on the relations between perceived severity of COVID-19 and eating problems at the within-person level and between-person level

Independent variable	Mediator	Dependent variable	Estimate	SE	Bootstrap 95%	
					LLCI	ULCI
Within-person specific indirect effects						
perceived severity of COVID-19 ( $t$ ) →	stress ( $t+1$ )	→ eating problems	0.003	0.004	-0.005	0.012
	NA ( $t+1$ )	( $t+1$ )	0.002	0.007	-0.012	0.016
	PTSS ( $t+1$ )		-0.009	0.022	-0.052	0.034
Between-person specific indirect effects						
perceived severity of COVID-19 →	stress	→ eating problems	0.146	0.219	-0.283	0.576
	NA		0.077	0.253	-0.419	0.574
	PTSS		0.454	0.364	-0.259	1.168

## 4 Discussion

The current study used an EMA to examine the impact of the COVID-19 pandemic on eating problems and the mechanism of what might contribute to eating problems during the COVID-19 pandemic. Our study showed that the relationships between perceived severity of COVID-19, stress, NA, PTSS, and eating problems differed when they were examined at the within-person level versus the between-person level.

Contrary to hypotheses at the within-person level, individuals who perceived higher severity of COVID-19 showed less subsequent eating problems in daily life. State stress, NA, or PTSS failed to mediate the relationship between the perceived severity of COVID-19 and subsequent eating problems because the perceived severity of COVID-19 did not predict the state stress, NA, or PTSS at the next measure time. One potential explanation may be that to raise health awareness, and intensive press coverage was used to arouse widespread fear during the COVID-19 outbreak (Tannenbaum et al., 2015). Indeed, fear appeal campaigns may generate maladaptive fear control actions such as defensive avoidance (Witte & Allen, 2000). Berman and colleagues (2010) suggested that avoidance reduces anxiety in the short term but maintains anxiety in the long term, creating a reinforcing cycle of anxiety-avoidance. Similar to the cycle of anxiety-avoidance, when the public-facing the COVID-19 epidemic, inappropriate coping strategies such as avoidance may not cause more eating problems in the short term. Additionally, Brose et al.

(2020) found that individuals who felt more capable of dealing with the COVID-19 pandemic also felt more able to cope with new challenges in daily life, which may have led to lower NA turn. This may be the reason why the state perceived severity of COVID-19 did not predict the state stress/NA/PTSS in daily life. Moreover, it should be noted that all of our participants were college students. During the pandemic, the role of university support was positively associated with optimism about COVID-19 (Kleiman et al., 2020). Future research should examine more cognitive appraisal factors such as perceived support and control expectancy to explore the COVID-19 effect on mental health. Another possible reason may be that for EMA, choosing the most appropriate sampling frequency is a significant challenge, and it can substantially influence the obtained results (Bolger & Laurenceau, 2013). In the current study, we conducted three times a day to measure state variables, which might have caused us to miss fluctuations, limiting our ability to capture dynamics in relation to state variables accurately. A more intensive sampling frequency should be recommended in future study.

The results at the within-person level partially supported our hypotheses. We found that state NA and PTSS were positively associated with eating problems in daily life. Specifically, higher state NA and PTSS at one moment were associated with more restrained eating or overeating at the same measurement time during the COVID-19 epidemic.

Regarding to the between-person level, concordant with our hypothesis, the perceived severity of COVID-19 was significantly associated with overall eating problems. Specifically, individuals with higher overall perceived severity of COVID-19 reported more eating problems. We found that trait-like stress, NA, and PTSS were positively associated with overall eating problems at the between-person level, which was consistent with previous research (Berg et al., 2017; Mitchell & Wolf, 2016; Torres & Nowson, 2007). Our findings could provide further support to the stress-eating-obesity model (Talbot et al., 2013) and emotion regulation model (Leehr et al., 2015).

However, trait-like stress, NA, or PTSS did not mediate the relationship between trait-like perceived severity of COVID-19 and overall eating problems. We found that the perceived severity of COVID-19 was not significant in associations with trait-like stress, NA, or PTSS at the between-person level, which is inconsistent with previous research (Li et al., 2020; Quan et al., 2017). The discrepancies observed between the literature and our findings on the trait-like association might have the following reasons. First, it might be that a decrease in mental health symptoms occurred after some initial COVID-19 outbreak increase (Brose et al., 2020). For example, Buecker et al. (2020) used a daily diary study to assess daily loneliness and found that loneliness slightly increased during the first two weeks since implementing the pandemic-related measures and slightly decreased thereafter. Notably, Chinese authorities imposed lockdown measures on January 23, 2020 (Wang et al., 2020). We conducted the assessment (February 1, 2020) when the anti-COVID-19 measures were already implemented one week. Therefore, psychological reactions such as stress, NA, and PTSS followed the trajectory of the initial increase and the following decline. Thus, stress/NA/PTSS might decreased after one-week lockdown measures. Accordingly, the overall perceived severity of COVID-19 did not significantly predict the trait-like stress/NA/PTSS at the between-person level. Second, it could be due to our measurement of trait-like

perceived severity of COVID-19, stress, NA, and PTSS as an average of the participant responses across the EMA monitoring period. Compared to assessing the participant how they generally felt, the ambulatory method was more likely to obtain a different result (Stevenson et al., 2019). Third, the measurement of the perceived severity of COVID-19 only contains a single item. Indeed, assessing individuals' mental health using a single-item scale for providing general health indicators is commonly used in epidemiological studies to reduce respondents' burden (Yıldırım et al., 2020). Future studies should assess this variable by using multiple-item scales such as perceived controllability and knowledge of the epidemic to present more solid evidence regarding to the predictive validity of psychological outcomes.

Perhaps the most interesting finding of the current study was the difference of perceived severity of COVID-19's association with eating problems between the within-person level and the between-person level. We found that the overall perceived severity of COVID-19 could cause serious eating problems at the between-person level. However, the perceived severity of COVID-19 predicted fewer subsequent eating problems in daily life at the within-person level. While these results should be interpreted as preliminary, findings highlight the importance of considering the interplay between within-person level and between-person level factors when addressing the COVID-19 epidemic. Remarkably, it should be noted that the positive impact of state perceived severity of COVID-19 only appeared for a moment, and the cumulative effect of perceived severity of COVID-19 could be deleterious in the long term. Also, our findings suggested that subtle differences between within-person and between-person could be considered by EMA.

This study has several theoretical and practical implications. Theoretically, the findings deepen our understanding of the critical role of perceived severity of COVID-19 and several mental health problems (stress, NA, and PTSS) in eating problems during the outbreak of COVID-19. Practically, alleviating the public's state and overall perceived severity of COVID-19, stress, NA, and PTSS might be a promising way to reduce eating problems after the outbreak. Furthermore, individuals with eating problems should be considered at risk of developing eating disorders (Franko & Omori, 1999, Talbot et al., 2013). Therefore, some measures should be adopted to prevent eating problems, such as encouraging individuals to the psychological hotline services to improve mental health, then reduce the problematic eating behaviors in daily life.

Our findings should be evaluated in light of several limitations. First, this study has a relative small sample, and women were over-represented. Second, all of the participants were health college students who were in home confinement. It is unknown whether the results can be generalized to other samples, especially clinical eating disorder samples. Third, participants only reported their subjective eating problems without offering any objective eating behavior information. Further studies are encouraged to gather additional information such as calorie intake, which may reflect individuals' eating problems in both subjective and objective perspectives.

## Declarations

**Ethics approval and consent to participate:** The questionnaire and methodology for this study was approved by the Human Research Ethics committee of the Nanjing Normal University.

**Consent for publication:** Not applicable.

**Availability of data and materials:** The manuscript does not contain clinical studies or patient data. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request, Wei Xu. The data are not publicly available due to restrictions.

**Competing interests:** On behalf of all authors, the corresponding author states that there is no conflict of interest.

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**Authors' contributions:** SRK analyzed the data and was a major contributor in writing the manuscript. YXJ and XW examined each draft and provided advice. LXY examined the manuscript' writing norms. All authors read and approved the final manuscript.

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## References

- Ahmed, H. O. (2020). The impact of social distancing and self-isolation in the last corona COVID-19 outbreak on the body weight in Sulaimani governorate- Kurdistan/Iraq, a prospective case series study. *Annals of Medicine and Surgery*, *59*, 110–117. <https://doi.org/10.1016/j.amsu.2020.09.024>
- Ammar, A., Brach, M., Trabelsi, K., Chtourou, H., Boukhris, O., Masmoudi, L., Bouaziz, B., Bentlage, E., How, D., Ahmed, M., Müller, P., Müller, N., Aloui, A., Hammouda, O., Paineiras-Domingos, L. L., Braakman-Jansen, A., Wrede, C., Bastoni, S., Pernambuco, C. S., ... Hoekelmann, A. (2020). Effects of COVID-19 Home Confinement on Eating Behaviour and Physical Activity: Results of the ECLB-COVID19 International Online Survey. *Nutrients*, *12*(6), 1583. <https://doi.org/10.3390/nu12061583>
- Bäuerle, A., Teufel, M., Musche, V., Weismüller, B., Kohler, H., Hetkamp, M., Dörrie, N., Schweda, A., & Skoda, E.-M. (2020). Increased generalized anxiety, depression and distress during the COVID-19 pandemic: a cross-sectional study in Germany. *Journal of Public Health*, 1–7. <https://doi.org/10.1093/pubmed/fdaa106>

- Berg, K. C., Cao, L., Crosby, R. D., Engel, S. G., Peterson, C. B., Crow, S. J., Le Grange, D., Mitchell, J. E., Lavender, J. M., Durkin, N., & Wonderlich, S. A. (2017). Negative affect and binge eating: Reconciling differences between two analytic approaches in ecological momentary assessment research. *International Journal of Eating Disorders, 50*(10), 1222–1230. <https://doi.org/10.1002/eat.22770>
- Berman, N. C., Wheaton, M. G., McGrath, P., & Abramowitz, J. S. (2010). Predicting anxiety: The role of experiential avoidance and anxiety sensitivity. *Journal of Anxiety Disorders, 24*(1), 109–113. <https://doi.org/10.1016/j.janxdis.2009.09.005>
- Bongers, P., de Graaff, A., & Jansen, A. (2016). 'Emotional' does not even start to cover it: Generalization of overeating in emotional eaters. *Appetite, 107*, 678–679. <https://doi.org/10.1016/j.appet.2016.08.026>
- Brewerton, T. D. (2007). Eating Disorders, Trauma, and Comorbidity: Focus on PTSD. *Eating Disorders, 15*(4), 285–304. <https://doi.org/10.1080/10640260701454311>
- Brewerton, T. D. (2011). Posttraumatic Stress Disorder and Disordered Eating: Food Addiction as Self-Medication. *Journal of Women's Health, 20*(8), 1133–1134. <https://doi.org/10.1089/jwh.2011.3050>
- Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The Lancet, 395*(10227), 912–920. [https://doi.org/10.1016/s0140-6736\(20\)30460-8](https://doi.org/10.1016/s0140-6736(20)30460-8)
- Brose, A., Blanke, E. S., Schmiedek, F., Kramer, A. C., Schmidt, A., & Neubauer, A. B. (2020). Change in mental health symptoms during the COVID-19 pandemic: The role of appraisals and daily life experiences. *Journal of Personality, 1–15*. <https://doi.org/10.1111/jopy.12592>
- Brown, S. M., Opitz, M.-C., Peebles, A. I., Sharpe, H., Duffy, F., & Newman, E. (2021). A qualitative exploration of the impact of COVID-19 on individuals with eating disorders in the UK. *Appetite, 156*, 104977. <https://doi.org/10.1016/j.appet.2020.104977>
- Bolger, N., & Laurenceau, J. P. (2013). *Intensive Longitudinal Methods: An Introduction to Diary and Experience Sampling Research*. New York, NY: Guilford.
- Buecker, S., Horstmann, K. T., Krasko, J., Kritzler, S., Terwiel, S., Kaiser, T., & Luhmann, M. (2020). Changes in daily loneliness for German residents during the first four weeks of the COVID-19 pandemic. *Social Science & Medicine, 113541*. <https://doi.org/10.1016/j.socscimed.2020.113541>
- Castellini, G., Cassioli, E., Rossi, E., Innocenti, M., Gironi, V., Sanfilippo, G., Felciai, F., Monteleone, A. M., & Ricca, V. (2020). The impact of COVID -19 epidemic on eating disorders: A longitudinal observation of pre versus post psychopathological features in a sample of patients with eating disorders and a group of healthy controls. *International Journal of Eating Disorders, 1–8*. <https://doi.org/10.1002/eat.23368>
- Canetti, L., Bachar, E., Berry, E.M. (2002). Food and emotion. *Behavioural Processes, 60*, 157–164. [https://doi.org/10.1016/S0376-6357\(02\)00082-7](https://doi.org/10.1016/S0376-6357(02)00082-7)

- Cohen, J. 1988. *Statistical power analysis for the behavioral sciences (2nd ed.)*. Hillsdale, NJ: Erlbaum.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A Global Measure of Perceived Stress. *Journal of Health and Social Behavior*, 24(4), 385. <https://doi.org/10.2307/2136404>
- Cooper, M., Reilly, E. E., Siegel, J. A., Coniglio, K., Sadeh-Sharvit, S., Pisetsky, E. M., & Anderson, L. M. (2020). Eating disorders during the COVID-19 pandemic and quarantine: an overview of risks and recommendations for treatment and early intervention. *Eating Disorders*, 1–23. <https://doi.org/10.1080/10640266.2020.1790271>
- Degortes, D., Santonastaso, P., Zanetti, T., Tenconi, E., Veronese, A., & Favaro, A. (2014). Stressful life events and binge eating disorder. *European Eating Disorders Review*, 22(5), 378–382. <https://doi.org/10.1002/erv.2308>
- Di Renzo, L., Gualtieri, P., Pivari, F., Soldati, L., Attinà, A., Cinelli, G., Leggeri, C., Caparello, G., Barrea, L., Scerbo, F., Esposito, E., & De Lorenzo, A. (2020). Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. *Journal of Translational Medicine*, 18(1), 229. <https://doi.org/10.1186/s12967-020-02399-5>
- Ding, X., Du, J., Zhou, Y., An, Y., Xu, W., & Zhang, N. (2019). State mindfulness, rumination, and emotions in daily life: An ambulatory assessment study. *Asian Journal of Social Psychology*, 22(4), 369–377.
- Engel, S. G., Crosby, R. D., Thomas, G., Bond, D., Lavender, J. M., Mason, T., Steffen, K. J., Green, D. D., & Wonderlich, S. A. (2016). Ecological Momentary Assessment in Eating Disorder and Obesity Research: a Review of the Recent Literature. *Current Psychiatry Reports*, 18(4), 1–9. <https://doi.org/10.1007/s11920-016-0672-7>
- Fernández-Aranda, F., Casas, M., Claes, L., Bryan, D. C., Favaro, A., Granero, R., Gudiol, C., Jiménez-Murcia, S., Karwautz, A., Le Grange, D., Menchón, J. M., Tchanturia, K., & Treasure, J. (2020). COVID -19 and implications for eating disorders. *European Eating Disorders Review*, 28(3), 239–245. <https://doi.org/10.1002/erv.2738>
- Flaudias, V., Iceta, S., Zerhouni, O., Rodgers, R. F., Billieux, J., Llorca, P.-M., Boudesseul, J., de Chazeron, I., Romo, L., Maurage, P., Samalin, L., Bègue, L., Naassila, M., Brousse, G., & Guillaume, S. (2020). COVID-19 pandemic lockdown and problematic eating behaviors in a student population. *Journal of Behavioral Addictions*, 9(3), 826–835. <https://doi.org/10.1556/2006.2020.00053>
- Forte, G., Favieri, F., Tambelli, R., & Casagrande, M. (2020). COVID-19 Pandemic in the Italian Population: Validation of a Post-Traumatic Stress Disorder Questionnaire and Prevalence of PTSD Symptomatology. *International Journal of Environmental Research and Public Health*, 17(11), 4151. <https://doi.org/10.3390/ijerph17114151>

- Franko, D. L., & Omori, M. (1999). Subclinical eating disorders in adolescent women: a test of the continuity hypothesis and its psychological correlates. *Journal of Adolescence*, 22(3), 389–396. <https://doi.org/10.1006/jado.1999.0230>
- Garner, D. M., Olmsted, M. P., Bohr, Y., & Garfinkel, P. E. (1982). The Eating Attitudes Test: psychometric features and clinical correlates. *Psychological Medicine*, 12(4), 871–878. <https://doi.org/10.1017/s0033291700049163>
- Grilo, C. M., Pagano, M. E., Stout, R. L., Markowitz, J. C., Ansell, E. B., Pinto, A., Zannarini, M. C., Yen, S., & Skodol, A. E. (2012). Stressful life events predict eating disorder relapse following remission: Six-year prospective outcomes. *International Journal of Eating Disorders*, 45(2), 185–192. <https://doi.org/10.1002/eat.20909>
- Haddad, C., Zakhour, M., Bou kheir, M., Haddad, R., Al Hachach, M., Sacre, H., & Salameh, P. (2020). Association between eating behavior and quarantine/confinement stressors during the coronavirus disease 2019 outbreak. *Journal of Eating Disorders*, 8(1), 1–12. <https://doi.org/10.1186/s40337-020-00317-0>
- Huang, Y., & Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Research*, 288, 112954. <https://doi.org/10.1016/j.psychres.2020.112954>
- Hayes, A. F., & Scharkow, M. (2013). The Relative Trustworthiness of Inferential Tests of the Indirect Effect in Statistical Mediation Analysis. *Psychological Science*, 24(10), 1918–1927.
- Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin*, 110(1), 86–108. <https://doi.org/10.1037/0033-2909.110.1.86>
- Karr, T. M., Crosby, R. D., Cao, L., Engel, S. G., Mitchell, J. E., Simonich, H., & Wonderlich, S. A. (2013). Posttraumatic stress disorder as a moderator of the association between negative affect and bulimic symptoms: an ecological momentary assessment study. *Comprehensive Psychiatry*, 54(1), 61–69. <https://doi.org/10.1016/j.comppsy.2012.05.011>
- Kleiman, E. M., Yeager, A. L., Grove, J. L., Kellerman, J. K., & Kim, J. S. (2020). The real-time mental health impact of the COVID-19 pandemic on college students: An ecological momentary assessment study (Preprint). *JMIR Mental Health*, 1–24. <https://doi.org/10.2196/24815>
- Kriaucioniene, V., Bagdonaviciene, L., Rodríguez-Pérez, C., & Petkeviciene, J. (2020b). Associations between Changes in Health Behaviors and Body Weight during the COVID-19 Quarantine in Lithuania: The Lithuanian COVIDiet Study. *Nutrients*, 12(10), 3119. <https://doi.org/10.3390/nu12103119>
- Lazarus, R. S. (2006). *Stress and Emotion: A New Synthesis* (1st ed.). Springer Publishing Company.

- Leehr, E. J., Krohmer, K., Schag, K., Dresler, T., Zipfel, S., & Giel, K. E. (2015). Emotion regulation model in binge eating disorder and obesity - a systematic review. *Neuroscience & Biobehavioral Reviews*, *49*, 125–134. <https://doi.org/10.1016/j.neubiorev.2014.12.008>
- Li, J.-B., Yang, A., Dou, K., Wang, L.-X., Zhang, M.-C., & Lin, X.-Q. (2020). Chinese public's knowledge, perceived severity, and perceived controllability of COVID-19 and their associations with emotional and behavioural reactions, social participation, and precautionary behaviour: a national survey. *BMC Public Health*, *20*(1), 1–14. <https://doi.org/10.1186/s12889-020-09695-1>
- Lin, X., Swift, J., Cheng, Y., An, Q., Liang, H., Wang, Y., & Jia, X. (2020). The Psychological Hotline Services Quality Survey during the Pandemic of COVID-19 in Mainland China. *International Journal of Mental Health Promotion*, *22*(3), 109–113. <https://doi.org/10.32604/ijmh.2020.011128>
- Liu, C. H., Zhang, E., Wong, G. T. F., Hyun, S., & Hahm, H. " . C. ". (2020). Factors associated with depression, anxiety, and PTSD symptomatology during the COVID-19 pandemic: Clinical implications for U.S. young adult mental health. *Psychiatry Research*, *290*, 113172. <https://doi.org/10.1016/j.psychres.2020.113172>
- Loth, K., van den Berg, P., Eisenberg, M. E., & Neumark-Sztainer, D. (2008). Stressful Life Events and Disordered Eating Behaviors: Findings from Project EAT. *Journal of Adolescent Health*, *43*(5), 514–516. <https://doi.org/10.1016/j.jadohealth.2008.03.007>
- Mason, S. M., Frazier, P. A., Austin, S. B., Harlow, B. L., Jackson, B., Raymond, N. C., & Rich-Edwards, J. W. (2017). Posttraumatic Stress Disorder Symptoms and Problematic Overeating Behaviors in Young Men and Women. *Annals of Behavioral Medicine*, *51*(6), 822–832. <https://doi.org/10.1007/s12160-017-9905-1>
- Miller, D. J., Vachon, D. D., & Lynam, D. R. (2009). Neuroticism, negative affect, and negative affect instability: Establishing convergent and discriminant validity using ecological momentary assessment. *Personality and Individual Differences*, *47*(8), 873–877. <https://doi.org/10.1016/j.paid.2009.07.007>
- Mitchell, K. S., & Wolf, E. J. (2016). PTSD, food addiction, and disordered eating in a sample of primarily older veterans: The mediating role of emotion regulation. *Psychiatry Research*, *243*, 23–29. <https://doi.org/10.1016/j.psychres.2016.06.013>
- Mediouni, M., Madiouni, R., & Kaczor-Urbanowicz, K. E. z. (2020). COVID-19: How the quarantine could lead to the depreobesity. *Obesity Medicine*, *19*, 100255. <https://doi.org/10.1016/j.obmed.2020.100255>
- Mond, J. M., Hay, P. J., Rodgers, B., Owen, C., & Beumont, P. J. V. (2004). Validity of the Eating Disorder Examination Questionnaire (EDE-Q) in screening for eating disorders in community samples. *Behaviour Research and Therapy*, *42*(5), 551–567.

- O'Connor, D. B., Jones, F., Conner, M., McMillan, B., & Ferguson, E. (2008). Effects of daily hassles and eating style on eating behavior. *Health Psychology, 27*(1, Suppl), S20–S31. <https://doi.org/10.1037/0278-6133.27.1.s20>
- Ouwens, M. A., van Strien, T., & van Leeuwe, J. F. J. (2009). Possible pathways between depression, emotional and external eating. A structural equation model. *Appetite, 53*(2), 245–248. <https://doi.org/10.1016/j.appet.2009.06.001>
- Owen, A. J., Tran, T., Hammarberg, K., Kirkman, M., & Fisher, J. R. W. (2020). Poor appetite and overeating reported by adults in Australia during the coronavirus-19 disease pandemic: a population-based study. *Public Health Nutrition, 1*–7. <https://doi.org/10.1017/s1368980020003833>
- Pišot, S. š., Milovanović, I., Šimunič, B. š., Gentile, A., Bosnar, K., Prot, F., Bianco, A., Lo Coco, G., Bartoluci, S. č., Katović, D., Bakalár, P., Kovalik Slančová, T., Tlučáková, L., Casals, C., Feka, K., Christogianni, A., & Drid, P. (2020). Maintaining everyday life praxis in the time of COVID-19 pandemic measures (ELP-COVID-19 survey). *European Journal of Public Health, 1*–6. <https://doi.org/10.1093/eurpub/ckaa157>
- Poelman, M. P., Gillebaart, M., Schlinkert, C., Dijkstra, S. C., Derksen, E., Mensink, F., Hermans, R. C. J., Aardening, P., de Ridder, D., & de Vet, E. (2021). Eating behavior and food purchases during the COVID-19 lockdown: A cross-sectional study among adults in the Netherlands. *Appetite, 157*, 105002. <https://doi.org/10.1016/j.appet.2020.105002>
- Quan, L., Zhen, R., Yao, B., Zhou, X., & Yu, D. (2017). The Role of Perceived Severity of Disaster, Rumination, and Trait Resilience in the Relationship Between Rainstorm-related Experiences and PTSD Amongst Chinese Adolescents Following Rainstorm Disasters. *Archives of Psychiatric Nursing, 31*(5), 507–515. <https://doi.org/10.1016/j.apnu.2017.06.003>
- Rajkumar, R. P. (2020). COVID-19 and mental health: A review of the existing literature. *Asian Journal of Psychiatry, 52*, 102066. <https://doi.org/10.1016/j.ajp.2020.102066>
- Razzoli, M., Pearson, C., Crow, S., & Bartolomucci, A. (2017). Stress, overeating, and obesity: Insights from human studies and preclinical models. *Neuroscience & Biobehavioral Reviews, 76*, 154–162. <https://doi.org/10.1016/j.neubiorev.2017.01.026>
- Reichenberger, J., Kuppens, P., Liedlgruber, M., Wilhelm, F. H., Tiefengrabner, M., Ginzinger, S., & Blechert, J. (2018). No haste, more taste: An EMA study of the effects of stress, negative and positive emotions on eating behavior. *Biological Psychology, 131*, 54–62. <https://doi.org/10.1016/j.biopsycho.2016.09.002>
- Robinson, E., Boyland, E., Chisholm, A., Harrold, J., Maloney, N. G., Marty, L., Mead, B. R., Noonan, R., & Hardman, C. A. (2020). Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults. *Appetite, 104853*. <https://doi.org/10.1016/j.appet.2020.104853>

- Rodgers, R. F., Lombardo, C., Cerolini, S., Franko, D. L., Omori, M., Fuller-Tyszkiewicz, M., Linardon, J., Courtet, P., & Guillaume, S. (2020). The impact of the COVID -19 pandemic on eating disorder risk and symptoms. *International Journal of Eating Disorders, 53*(7), 1166–1170. <https://doi.org/10.1002/eat.23318>
- Ruggiero, K. J., Ben, K. D., Scotti, J. R., & Rabalais, A. E. (2003). Psychometric properties of the PTSD checklist–civilian version. *Journal of Traumatic Stress, 16*(5), 495–502. <https://doi.org/10.1023/a:1025714729117>
- Shah, M., Sachdeva, M., & Johnston, H. (2020). Eating disorders in the age of COVID-19. *Psychiatry Research, 290*, 113122. <https://doi.org/10.1016/j.psychres.2020.113122>
- Shen, W., Long, L. M., Shih, C.-H., & Ludy, M.-J. (2020). A Humanities-Based Explanation for the Effects of Emotional Eating and Perceived Stress on Food Choice Motives during the COVID-19 Pandemic. *Nutrients, 12*(9), 2712. <https://doi.org/10.3390/nu12092712>
- Spears, C. A., Li, L., Wu, C., Vinci, C., Heppner, W. L., Hoover, D. S., Lam, C., & Wetter, D. W. (2019). Mechanisms linking mindfulness and early smoking abstinence: An ecological momentary assessment study. *Psychology of Addictive Behaviors, 33*(3), 197–207. <https://doi.org/10.1037/adb0000451>
- Stevenson, B. L., Dvorak, R. D., Kramer, M. P., Peterson, R. S., Dunn, M. E., Leary, A. V., & Pinto, D. (2019). Within- and between-person associations from mood to alcohol consequences: The mediating role of enhancement and coping drinking motives. *Journal of Abnormal Psychology, 128*(8), 813–822. <https://doi.org/10.1037/abn0000472>
- Stone, A. A., & Shiffman, S. (1994). Ecological Momentary Assessment (Ema) in Behavioral Medicine. *Annals of Behavioral Medicine, 16*(3), 199–202. <https://doi.org/10.1093/abm/16.3.199>
- Talbot, L. S., Maguen, S., Epel, E. S., Metzler, T. J., & Neylan, T. C. (2013). Posttraumatic Stress Disorder Is Associated With Emotional Eating. *Journal of Traumatic Stress, 26*(4), 521–525. <https://doi.org/10.1002/jts.21824>
- Tannenbaum, M. B., Hepler, J., Zimmerman, R. S., Saul, L., Jacobs, S., Wilson, K., & Albarracín, D. (2015). Appealing to fear: A meta-analysis of fear appeal effectiveness and theories. *Psychological Bulletin, 141*(6), 1178–1204. <https://doi.org/10.1037/a0039729>
- Thornley, E., Vorstenbosch, V., & Frewen, P. (2016). Gender differences in perceived causal relations between trauma-related symptoms and eating disorders in online community and inpatient samples. *Traumatology, 22*(3), 222–232. <https://doi.org/10.1037/trm0000071>
- Treasure, J., Duarte, T.A., & Schmidt, U., (2020). Eating disorders. *Lancet, 395*: 899–911.
- Torres, S. J., & Nowson, C. A. (2007). Relationship between stress, eating behavior, and obesity. *Nutrition, 23*(11–12), 887–894. <https://doi.org/10.1016/j.nut.2007.08.008>

- Trull, T. J., & Ebner-Priemer, U. (2014). The role of ambulatory assessment in psychological science. *Current Directions in Psychological Science*, 23(6), 466–470.
- Touyz, S., Lacey, H., & Hay, P. (2020). Eating disorders in the time of COVID-19. *Journal of Eating Disorders*, 8(1), 1–3. <https://doi.org/10.1186/s40337-020-00295-3>
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R. S., Choo, F. N., Tran, B., Ho, R., Sharma, V. K., & Ho, C. (2020). A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain, Behavior, and Immunity*, 87, 40–48. <https://doi.org/10.1016/j.bbi.2020.04.028>
- Wang, Y., Xu, W., Zhuang, C., & Liu, X. (2017). Does Mind Wandering Mediate the Association Between Mindfulness and Negative Mood? A Preliminary Study. *Psychological Reports*, 120(1), 118–129. <https://doi.org/10.1177/0033294116686036>
- Witte, K., & Allen, M. (2000). A Meta-Analysis of Fear Appeals: Implications for Effective Public Health Campaigns. *Health Education & Behavior*, 27(5), 591–615. <https://doi.org/10.1177/109019810002700506>
- Yıldırım, M., & Güler, A. (2020). COVID-19 severity, self-efficacy, knowledge, preventive behaviors, and mental health in Turkey. *Death Studies*, 1–8. <https://doi.org/10.1080/07481187.2020.1793434>