

Relationship between stress and weight management behaviors during the COVID-19 pandemic among those enrolled in an internet program

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Abstract

Background: The COVID-19 pandemic resulted in mandated stay-at-home orders, potentially resulting in changes in mental health (e.g., stress, anxiety) and challenges maintaining healthy dietary and physical activity behaviors.

Objective: This study examined how stress was associated with mental well-being and weight loss behaviors during the COVID-19 pandemic among adults enrolled in an internet-based weight loss program.

Methods: Participants enrolled in a weight-loss program residing in Rhode Island or Massachusetts, USA, completed a brief survey on their mental health and current weight-loss behaviors during the COVID-19 pandemic. Surveys were completed between 14 April 2020 and 21 April 2020, approximately one month after stay-at-home orders were mandated. Linear regression was used to examine associations between stress, mental health, and weight-loss behaviors.

Results: A total of 99 participants completed the survey (79% female, 91% white, 52.2 ± 9.8 years, 34.0 ± 5.2 kg/m², 77% reported moderate to extreme stress). Greater stress was associated with higher BMI ($p = 0.04$), higher education ($p = 0.04$), working more hours ($p = 0.003$), and having school-age children at home ($p = 0.002$). Greater stress was also associated with higher levels of anxiety, worry, and concern regarding COVID-19 (p 's < 0.001) and having less time to spend on weight-loss efforts ($p < 0.001$), after controlling for BMI and education.

Conclusions: Many individuals enrolled in a weight-loss program experienced more stress during COVID-19 compared to before the pandemic. This stress was related to more mental health challenges as well as more difficulties finding time for weight management efforts.

KEYWORDS

anxiety, COVID-19, obesity, stress, weight management

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1 | INTRODUCTION

Stay-at-home orders, mandated due to the COVID-19 pandemic, abruptly changed daily life for Americans. Given that mental health and lifestyle behaviors are often negatively impacted by catastrophic events or economic crises,^{1,2} this pandemic provides a unique opportunity to examine the impact of a common major life event on stress and important lifestyle behaviors. Stress and anxiety are associated with diet quality³ and physical activity.⁴ Thus, changes in mental health as a result of the pandemic, combined with societal changes, closures, and stay-at-home orders, could have a detrimental effect on dietary and physical activity behaviors.

Elevated levels of stress are consistently associated with body weight and obesity,^{5,6} suggesting that those with overweight or obesity may be disproportionately affected during this time. Unfortunately, obesity also appears to exacerbate COVID-19 outcomes, with excess weight leading to increased risk of hospital admissions,⁷ longer hospital stays,⁸ or needing respiratory support.⁹ Obesity has also been found to be positively associated with mortality among patients with COVID-19.¹⁰ Given the increased risk of complications from COVID-19, adults with overweight or obesity may face additional stress, resulting in further challenges managing weight. Further, Robinson et al.¹¹ recently demonstrated that adults in the United Kingdom with obesity were less likely to engage in protective weight management behaviors during COVID-19 pandemic and could be more susceptible to weight gain. Therefore, the purpose of this study was to examine stress levels among adults with overweight or obesity enrolled in an internet-based weight-management program during the COVID-19 pandemic and how that stress may be associated with weight-management behaviors.

2 | METHODS

Participants were currently enrolled in the DIALNow Trial, a 1-year, Internet-based behavioral weight-loss program, at the time of the COVID-19 pandemic. At enrollment, participants were aged 18–70, had a BMI between 25 and 45 kg/m², and were not enrolled in any other weight loss programs. As part of DIALNow, participants were given a weight loss goal of 10% of their initial body weight, a daily calorie intake goal, and a weekly exercise minute goal. They were also instructed to watch weekly video lessons and self-monitor their weight, calorie intake, and exercise minutes daily during the first 4 months of the program, and less frequently thereafter. All study procedures, including a full list of inclusion/exclusion criteria, have been reported previously.¹²

Participants live in Rhode Island or Massachusetts and received Stay-at-Home orders during the week of 23 March 2020. On 14 April 2020, DIALNow participants (*n* = 150) were emailed a link to complete a one-time survey related to how their lives and weight loss efforts (e.g., eating and exercise habits, sitting behavior, participation in DIALNow program, progress toward weight-loss goals) were impacted by COVID-19. Given the timeliness of these analyses,

TABLE 1 Participant characteristics

	Participants (<i>n</i> = 99)
Age, mean (SD)	52.2 (9.8)
Body mass index, mean (SD)	34.0 (5.2)
Female, <i>n</i> (%)	78 (78.8)
Minority, <i>n</i> (%)	8 (8.1)
Not Hispanic, <i>n</i> (%)	90 (90.9)
Education	
No college degree	23 (23.2)
College degree	40 (40.4)
Graduate or professional degree	36 (36.4)
Marital status, <i>n</i> (%)	
Married	67 (67.7)
Divorced	18 (18.2)
Never married	4 (4.0)
Not married	6 (6.1)
Other	4 (4.0)
School age children at home, <i>n</i> (%)	32 (32.3)
Work status change, <i>n</i> (%)	
No change	32 (32.3)
Work remotely	42 (42.4)
Fewer hours	15 (15.2)
More hours	15 (15.2)
Stress over last week, ^a <i>n</i> (%)	
Not at all stressed	2 (2.0)
Slightly stressed	21 (21.2)
Moderately stressed	48 (48.5)
Extremely stressed	28 (28.3)

^aResponse options 1 = not at all; 2–3 = Slightly; 4–5 = Moderately; 6–7 = Extremely.

anyone who did not complete the survey, or completed the survey outside of a 1-week window, were excluded from the current analyses, leaving total sample of 99 individuals. Participants were asked to report on their stress over the past week using a 1–7 Likert scale (1 = not at all stressed, 7 = extremely stressed). A list of survey questions can be found in Tables 2 and 3. All study procedures were approved by the Miriam Hospital Institutional Review Board and all participants provided written informed consent prior to participation in any study procedures.

Descriptive analyses were conducted for demographic characteristics for all participants. Linear regression models were used to determine whether stress, as a continuous variable, was associated with participant characteristics, additional psychological effects from COVID-19 (e.g., anxiety, worry, concern), or weight-management behaviors (Model 1). In Model 2, analyses were adjusted for both

TABLE 2 Association between stress levels and other psychological effects of the COVID-19 pandemic

	Model 1: Unadjusted beta (95% CI)	Model 2: Model 1 + BMI + Education beta (95% CI)
How would you rate your overall level of concern regarding COVID-19?	0.39** (0.19, 0.54)	0.38** (0.17, 0.54)
How would you rate the degree to which your life has been impacted by COVID-19?	0.42** (0.14, 0.36)	0.42** (0.13, 0.37)
Over the past week, how would you rate your level of nervousness or anxiety?	0.71** (0.73, 1.09)	0.72** (0.73, 1.11)
I feel that COVID-19 has negatively impacted my mental well-being	0.57** (0.46, 0.86)	0.54** (0.42, 0.83)
Over the past week, I have not been able to stop or control my worrying	0.69** (0.71, 1.08)	0.71** (0.72, 1.12)
As a result of COVID-19, I have been worried about family members, colleagues, and close friends	0.37** (0.16, 0.47)	0.37* (0.14, 0.48)
Compared to one month ago, my stress levels are significantly greater now	0.68** (0.58, 0.91)	0.67** (0.56, 0.90)

Note: Model 2 adjusted for BMI and education level.

Abbreviations: BMI, body mass index; CI, confidence interval.

* $p < 0.05$; ** $p < 0.001$.

education level and BMI.¹³ Statistical significance was set at $p < 0.05$. All analyses were conducted using SPSS Version 26 (Chicago, IL).

3 | RESULTS

A total of 99 participants completed the additional study survey between 14 April 2020 and 21 April 2020. Participants were primarily female (79%) and white (91%) with a mean age of 52.2 ± 9.8 years and BMI at baseline of 34.0 ± 5.2 kg/m² (Table 1). Using stress levels reported over the last week, 48% reported feeling moderately stressed and 28% reported feeling extremely stressed. Stress levels were positively associated with BMI ($F [1, 97] = 4.40, p = 0.04$) and education ($F [1197] = 4.2, p = 0.04$). Greater stress levels were also related to working more hours ($F [1, 98] = 9.27, p = 0.003$) and having school-age children at home ($F [1197] = 9.7, p = 0.002$).

The majority of participants (60.1%) of participants were "very" to "extremely" concerned about COVID-19 and reported that their life was "moderately" (38.4%) or "extremely" (40.4%) impacted by COVID-19. Furthermore, 55.6% of participants reported feeling moderately to extremely nervous and anxious. Both adjusted and unadjusted models indicate that stress was positively associated with higher levels of concern for COVID-19, higher ratings of nervousness or anxiety, greater worry for family, colleagues, and close friends, greater belief that life has been impacted by COVID-19, and that COVID-19 has negatively impacted one's mental well-being (p 's < 0.001 , Table 2).

Most participants (76%) reported that their weight-loss goals were still moderately to extremely important compared to other life demands, with 73% and 70% agreeing that it was harder to stay on track with eating and exercise habits, respectively. However, 43% of participants disagreed with having more time now to dedicate to weight-loss efforts compared to one month ago. The majority of

participants (63%) also agreed that they are less physically active throughout the day as compared to before COVID-19.

Linear regression was used to examine the association between stress levels and weight-loss behaviors (Table 3). Stress was associated with having less time to dedicate to weight-loss efforts, even after controlling for education and BMI ($F [3, 97] = 3.49, p = 0.02$). Stress also was related to more difficulties staying on track with eating habits ($F [1, 97] = 5.15, p = 0.03$); however, after controlling for education and BMI, the overall model was no longer significant ($F [3, 97] = 1.98, p = 0.12$). Stress was not associated with any other weight-loss behavior (e.g., weight-loss importance, exercise habits, sitting behaviors, participation in DIALNow program).

4 | DISCUSSION

The results of this study suggest that the majority of individuals with overweight and obesity enrolled in a weight-loss program are experiencing high levels of stress as a result of the COVID-19 pandemic, with many of the participants experiencing a change in their work situation. Greater stress was associated with more deleterious effects on mental health (e.g., worry, anxiety, concern over COVID-19) and more difficulties finding time for weight-management efforts. Higher stress was also associated with more difficulty staying on track with eating habits; however, this was no longer significant after adjusting for BMI and education. Interestingly, stress was also associated with having school age children at home.

Elevated stress levels are known to hinder weight-control efforts.^{3,14} Moreover, the associations between stress and other psychological outcomes, such as those observed in this study (e.g., anxiety and worry regarding COVID-19), raise further concern among a population that may already be at increased risk for poor COVID-19 outcomes. Current findings are in agreement with those by Cardel et al.¹⁵ which demonstrates the negative impact of

TABLE 3 Associations between stress and weight-loss behaviors during COVID-19 pandemic

	Model 1: Unadjusted beta (95% CI)	Model 2: Model 1 + BMI + Education beta (95% CI)
Weight loss goals and efforts		
Compared to other demands in your life, how important is it for you to stay on track with your weight goals over the upcoming month?	−0.006 (−0.23, 0.22)	0.02 (−0.22, 0.26)
Compared to one month ago, I have more time now to dedicate to my weight loss efforts ^a	−0.30* (−0.65, −0.14)	−0.27 (−0.63, −0.09)*
I believe that my enrollment in the DialNow study will help me to stay on track with my weight during the COVID-19 outbreak	−0.12 (−0.35, 0.83)	−0.09 (−0.33, 0.13)
Diet		
Compared to one month ago, it is harder to stay on track with my eating habits ^a	0.23* (0.04, 0.54)	0.21 (−0.01, 0.53)
Staying on track with my dietary goals is very important to me right now	−0.04 (−0.24, 0.16)	−0.01 (−0.22, 0.21)
I eat in response to my emotions, and not necessarily when I am hungry	0.13 (−0.08, 0.42)	0.16 (−0.07, 0.47)
Physical activity and sedentary behavior		
Compared to one month ago, it is harder to stay on track with my exercise habits ^a	0.11 (−0.12, 0.41)	0.98 (−0.15, 0.41)
Staying on track with my exercise habits is very important to me right now	−0.04 (−0.24, 0.15)	−0.03 (−0.23, 0.18)
Compared to before the COVID-19 outbreak hit, I am less physically active throughout the day	−0.07 (−0.37, 0.17)	−0.09 (−0.40, 0.17)
Compared to before the COVID-19 outbreak hit, I sit more throughout the day than before	−0.14 (−0.47, 0.09)	−0.18 (−0.55, 0.04)

Note: Model 2 adjusted for BMI and education level.

Abbreviations: BMI, body mass index; CI, confidence interval.

^a*n* = 98.

**p* < 0.05.

COVID-19 on mental health among those enrolled in behavioral interventions, including increased reports of anxiety, depression, and distress. Changes in mental health, such as increases in stress can affect eating behaviors by increasing caloric intake,¹⁶ snacking,¹⁷ and consumption of high-fat/sugar foods.¹⁸ Consistent with this literature, stress in the current study was associated with more difficulty staying on track with eating habits, until adjusting for BMI and education. While our sample may not have been large enough to detect significant associations, BMI, and in particular, having obesity, appears to be associated with reductions in lifestyle behaviors, protective of weight gain, during the COVID-19 lockdown,¹¹ and should be considered in future studies.

Current stress levels were also associated with having less time to dedicate to weight-management efforts, even after controlling for BMI and education. These results are consistent with previous literature suggesting challenges adhering to behavioral intervention recommendations, especially when facing moderate to severe distress.¹⁵ Many evidence-based behavioral strategies for weight management are time consuming, such as self-monitoring and meal planning; thus, alternative strategies that could help with maintaining healthy eating behaviors (e.g., simplifying meals, use of meal replacements), particularly among those with overweight and obesity, may need to be explored during periods of high stress to

promote positive-weight-related behaviors and to prevent weight gain.

Participants were in agreement that exercise was still important during the pandemic, and stress was not associated with difficulties staying on track with exercise habits. Physical activity is known to reduce stress¹⁹ and may play a role with stress management during high-stress situations. Furthermore, with the closing of gyms, fitness centers, and parks, individuals may be engaging in more home-based physical activities and exercise programs.²⁰ Likewise, the study was completed in the springtime (April) in New England when the weather was transitioning to warmer outdoor temperatures and more daylight hours, both of which have been associated with greater physical activity.²¹ Thus, individuals in the current study may have also been able to participate in more physical activity outdoors.

Stress levels were also associated with having school age children at home, suggesting potential difficulties dealing with school closings, moving to alternative virtual options, and changes with work routines, such as working remotely or more hours during the pandemic. In China, having children at home was shown to negatively impact the mental health of parents during the pandemic.²² Future studies may be necessary to explore how parental stress influences psychosocial outcomes and weight-loss behaviors of the family, particularly if virtual learning and working from home continue.

While this study was timely and provided a unique opportunity to examine the effect of a common stressor (COVID-19) on weight-management efforts among individuals enrolled in an ongoing internet-delivered weight-loss program, the study is not without limitations. This was a small convenience sample ($n = 99$), and it is likely that those not attempting to lose weight or those not enrolled in a program may have different perspectives of the influence of the COVID-19 pandemic on their weight-loss behaviors. Although the survey was administered at an ideal time to assess current stress levels during the COVID-19 pandemic, the survey questions were created for this study and participants were asked to recall their stress levels prior to the pandemic, possibly introducing memory recall bias. Nonetheless, it is interesting to see how current stress levels relate to mental health and weight-loss behaviors among motivated, weight-loss seeking individuals, particularly as it is estimated that 42% of adults in the general population are trying to lose weight.²³ Additionally, while this study provides some insights on the relationship between stress and weight-loss behaviors, the study was not powered adequately to detect significant associations. Finally, this study was unable to examine weight, objectively measured physical activity, and dietary behaviors to see the true effects of the pandemic on weight-loss efforts and behaviors in this population.

In conclusion, many adults enrolled in weight-loss treatment have experienced high stress during the COVID-19 pandemic, possibly due to changes in work status, having school-age children at home, or other disrupted routines. Current findings indicated that high stress during this time was associated with greater levels of anxiety, worry, and concern for oneself and others. Of additional concern, stress levels were associated with less time for weight-management efforts, among individuals for whom weight loss is recommended.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

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