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Association between Food Worry and Self-Rated Mental Health during the COVID-19 Pandemic

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Abstract: This study aimed to assess the association between food worry and self-rated anxiety and depression during the early phase of COVID-19. We recruited a cross-sectional proportional quota sample of 415 respondents from 15 May through July 2020 in New York State. A validated food access survey instrument was administered to the respondents, capturing demographic information and data on food access issues and self-rated mental health. Multiple logistic regression models were fitted to examine the relationship between food worry, anxiety, and depressive symptoms. Of the respondents included in the study, 43.4% were male, and 55.4% were female. Forty-three percent reported high food worry, and 39.5% and 41.2% reported symptoms suggestive of anxiety and depression, respectively. Respondents with high food worry were more likely than respondents with low or no food worry to experience anxiety symptoms (adjusted odds ratio (aOR) = 4.80; 95% CI: 3.02, 7.62). Likewise, respondents with high food worry had higher odds of reporting depressive symptoms than respondents with low or no food worry (aOR = 3.89; 95% CI: 2.45, 6.18). Identifying the personal and contextual drivers of food worry and mental health outcomes would guide public mental health intervention efforts.

Keywords: food insecurity; anxiety; depression; mental health; United States; New York

Citation: Karaye, I.M.; Koyratty, N.; Rogus, S.; Clay, L. Association between Food Worry and Self-Rated Mental Health during the COVID-19 Pandemic. *World* **2022**, *3*, 928–937. https://doi.org/10.3390/world3040052

Academic Editor: Mario D'Amico

Received: 19 July 2022
Accepted: 16 November 2022
Published: 18 November 2022

1. Introduction

The COVID-19 pandemic has resulted in close to 1 million deaths in the United States (US), as of 13 March 2022 [1]. The disease was first diagnosed in the US early in 2020 and shortly thereafter, contributed to widespread disruptions in the economy, health, and supply chains throughout the US and abroad [1]. Many non-essential workers who could not transition to working from home, saw a reduction in their hours, were furloughed, or lost their jobs, causing unemployment in the US to rise from 6.2 million in February 2020 to 20.5 million in May 2020 [2].

The uncertainty surrounding SARS-CoV-2 disrupted social systems and caused widespread anxiety, which precluded many Americans from seeking help from their informal social networks [3]. Emotional distress related to the risk of an individual contracting the virus, or family members or friends contracting the virus, and the social isolation brought on by stay-at-home orders resulted in higher reports of loneliness and depression during the pandemic [4–7]. Those particularly likely to experience depression and anxiety were those with concerns about financial security and employment disruption, those who contracted the virus, and those at higher risk of contracting the disease, such as essential workers [8–10]. The loss of income for many households, supply chain disruptions across the food system, and changes in food purchasing behaviors like stockpiling early in the pandemic, increased general anxiety about food procurement as well as food insecurity [11]. Over 40% of US adults reported experiencing food insecurity in a nationally representative survey from April 2020 [12].

Food insecurity and food worry are closely related. Food insecurity refers to the lack of access to food due to financial constraints [13]; whereas food worry is the psychological response to perceived food scarcity [14]. Growing evidence suggests that food worry is a determinant of poor health [15]. Concerns about an impending lack of access to food-, e.g., from financial constraints or disruptions in the supply chain- are associated with an increased risk of anxiety and depression [15]. During the early phase of the COVID-19 pandemic, there was an increase in sales of non-perishable items, yet an increased worry about perceived scarcity, which resulted in panic shopping and hoarding [16]. Speculations about a fractured supply chain or a possible transmission of SARS-CoV2 from food or food packaging, also exacerbated anxiety and mental health challenges in the US population [16].

Since the COVID-19 pandemic, studies have examined the physical and mental health impacts of food insecurity in the US population [17–19], but limited research has assessed the relationship between food worry and mental health in the context of the pandemic. This study aims to determine the association between food worry and self-rated anxiety and depression during COVID-19 in a sample of New York State adults.

2. Methods

2.1. Data Collection

We collaborated with Qualtrics® (Provo, UT, USA) to recruit a cross-sectional proportional quota sample of 415 respondents from 15 May through 20 July 2020. The instrument was based on a validated food access survey developed by the National Food Access and COVID-19 Research Team (NFACT) [20]. NFACT is a multi-site and multi-state collaborative of researchers examining food access and food security during COVID-19 in the United States [20]. The survey included information about food access, food sources, food security, food assistance, mental health, purchasing behavior, social determinants of health, perceptions, social support, COVID-19 impact, and COVID-19 risk factors, amongst other factors [20]. The quota sample was 50% Black or African American, 50% Hispanic, and 50% low-income residents, to over-represent persons with increased social vulnerability to the pandemic [20]. Factor analysis and Cronbach's alpha on the pilot data revealed an internal consistency of 0.70 for the food worry scale [17]. Respondents were eligible for the survey if they were at least 18 years of age and were residents of New York State, excluding New York City [17,20,21].

It is worth noting that Qualtrics® does not provide the counts of individuals invited to participate in quota-based surveys, such as in the current study. Therefore, the survey response rate was not available.

2.2. Measurements

Food worry: We assessed food worry by asking respondents if they worried about food-access issues since the beginning of the COVID-19 pandemic. A total of six questions were administered that captured respondents' concerns, including food becoming expensive or unsafe for handling, respondents not being able to afford enough food, not having enough food stocked at home, losing access to food assistance programs, and not having enough food in grocery stores. For example, one of the questions read: "Since the coronavirus outbreak began in New York (1 March 2020), how worried are you regarding food becoming more expensive? Choose one answer per statement, where 1 is 'not at all worried' and 6 is 'extremely worried'". For each respondent, affirmative responses to the six questions were aggregated into a worry scale with a minimum value of 6 and a maximum of 36. We dichotomized food worry to ease the interpretation of our results. A participant was classified as having high food worry when their score fell above the average value of 20, otherwise identified as having low or no food worry.

Mental health: Depression was assessed using a public health questionnaire (PHQ-2), a scientifically validated instrument used to screen and diagnose self-rated depression [22,23]. Anxiety was assessed using the generalized anxiety disorder questionnaire (GAD-2), an equally validated psychometric instrument [24]. Both anxiety and depression were di-

chotomized for ease of interpretation. The range of possible values for GAD-2/PHQ-2 is 0 to 6 [22–24]. Respondents were classified as likely to suffer from anxiety or depression when their GAD-2 or PHQ-2 score was between 3 and 6, otherwise identified as less likely [22–24].

2.3. Statistical Analysis

A multiple logistic regression model was fitted with anxiety or depression as an outcome and food-related worry as the predictor, adjusting for the potential confounding effects of age, sex, education, race/ethnicity, respondent diagnosis of COVID-19, family diagnosis of COVID-19, friend diagnosis of COVID-19, death of a family member from COVID-19, death of a friend from COVID-19, respondent hospitalization from COVID-19, family hospitalization from COVID-19, annual income, and respondent loss of job since COVID-19. The covariates were adjusted for in the model based on prior knowledge of the subject matter or if they were included in a previous similar study [11,14,16,25]. Multicollinearity was assessed using the Variance Inflation Factor. All values were found to be less than 10 and greater than 0.1, implying no multicollinearity. Results were expressed as crude and adjusted odds ratios (aOR) and 95% confidence intervals (CI).

All statistical analyses were conducted using Stata (College Station, TX, USA).

2.4. Informed Consent for Study Participation

Potential respondents were informed that the survey was being conducted to advance the knowledge of food insecurity in the United States, participation was voluntary, and that they would be allowed to withdraw from the survey anytime. Only adults aged 18 years and above were eligible to participate. Respondents that consented were then administered the survey questions.

2.5. Ethical Approval

This study was reviewed and approved by the institutional review board of [omitted for peer review].

3. Results

The sample included 415 adults from New York State, among which 42.6% were Black, 36.6% were White, and 5.8% were of more than one race. The median age of the respondents was 34 years (mean = 38 years; Range = 19–79 years), and the sample was approximately 55.4% female and 43.4% male. Four percent (16 of 415) of the respondents were diagnosed with COVID-19, 3.4% (14 of 415) were hospitalized for the disease, and 5.8% (24 of 415) lost a family member to the disease. There were 39.5% (164 of 415) of respondents with self-rated generalized anxiety disorder and 41.2% (171 of 415) with self-rated depression (Table 1).

Table 1. Descriptive characteristics of study participants, New York, United States.

Variable	N (%)
Age	
18–24	128 (30.8)
25–34	80 (19.3)
35–44	75 (18.1)
45–54	49 (11.8)
55–64	39 (9.4)
65+	44 (10.6)
Race	
Black/African American	170 (42.6)
White	146 (36.6)
More than one race	23 (5.8)
Other	60 (15.0)

Table 1. *Cont.*

Variable	N (%)
Hispanic Ethnicity	
Yes	182 (43.9)
No	233 (56.1)
Sex	
Male	180 (43.4)
Female	230 (55.4)
Income	
<$12,999	74 (17.8)
$13,000–$24,999	74 (17.8)
$25,000–$49,999	106 (25.5)
$50,000–$74,999	63 (15.2)
>$75,000	98 (23.6)
Highest Educational Level	
High School	131 (31.6)
Some College	97 (23.4)
Associate's degree/Technical School	61 (14.7)
Bachelor's/Postgraduate degree	126 (30.4)
Lost Job Since COVID-19	
Yes	62 (14.9)
No	353 (85.1)
Diagnosed of COVID-19	
Self	16 (3.9)
Family	84 (20.2)
Friend	94 (22.7)
Other	221 (53.3)
Hospitalized from COVID-19	
Self	14 (3.4)
Family	43 (10.4)
Friend	69 (16.6)
Other	289 (69.6)
Death from COVID-19	
Family	24 (5.8)
Friend	60 (14.5)
Other	331 (79.8)
Self-rated Generalized Anxiety Disorder	
Yes	164 (39.5)
No	251 (60.5)
Self-rated Major Depressive Disorder	
Yes	171 (41.2)
No	244 (58.8)
FoodWorry	
High	179 (43.1)
Low/None	236 (56.9)

Less than 20% of respondents reported not being worried at all for most of the food worry tested, except for worry over losing food assistance (36.6%) and being unable to afford food (24.8%). Eighty percent of the respondents reported being worried, at varying levels, about food prices (86.0%), food safety (81.7%), food supply in stores (83.6%), and

food stock at home (80.5%). Finally, based on the worry-scale, 43.1% of the respondents had high food worry and 56.9% had low or no worry (Table 2).

Table 2. Food-related worry among respondents during COVID-19 in New York, United States.

Variable	N (%)
Worried about food becoming expensive	
Not at all worried	58 (14.0)
A little	81 (19.5)
A moderate amount	87 (21.0)
A lot	61 (14.7)
A great deal	53 (12.8)
Extremely worried	75 (18.1)
Worried about food becoming unsafe to handle	
Not at all worried	76 (18.3)
A little	89 (21.5)
A moderate amount	74 (17.8)
A lot	53 (12.8)
A great deal	58 (14.0)
Extremely worried	65 (15.7)
Worried about losing access to assistance programs	
Not at all worried	152 (36.6)
A little	74 (17.8)
A moderate amount	62 (14.9)
A lot	33 (8.0)
A great deal	42 (10.1)
Extremely worried	52 (12.5)
Worried not being able to afford enough	
Not at all worried	103 (24.8)
A little	73 (17.6)
A moderate amount	67 (16.1)
A lot	51 (12.3)
A great deal	48 (11.6)
Extremely worried	73 (17.6)
Worried not having enough in food stores	
Not at all worried	68 (16.4)
A little	77 (18.6)
A moderate amount	65 (15.7)
A lot	70 (16.9)
A great deal	60 (14.5)
Extremely worried	75 (18.1)
Worried not having enough stocked at home	
Not at all worried	81 (19.5)
A little	71 (17.1)
A moderate amount	78 (18.8)
A lot	49 (11.8)
A great deal	62 (14.9)
Extremely worried	74 (17.8)
[a] Food-Related Worry	
High	179 (43.1)
Low/None	236 (56.9)

[a] respondents were classified as having high food- worry when their score fell above the average value of 20, otherwise identified as having low or no food worry.

Association between Food Worry and Mental Health

There was a positive association between level of food worry and self-rated mental health. Respondents with high food worry were more likely to be classified as having generalized anxiety disorder than respondents with low or no food worry (aOR = 4.80; 95% CI: 3.02, 7.62). Additionally, respondents with high food worry had a higher odds of reporting depressive symptoms than respondents with low or no food worry (aOR = 3.89; 95% CI: 2.45, 6.18) (Table 3).

Table 3. Crude and adjusted associations between food worry and mental health outcomes during COVID-19, New York, United States.

	Self-Rated Anxiety Odds Ratio (95% CI)		**Self-Rated Depression Odds Ratio (95% CI)**	
	[a] Model 1	[b] Model 2	[a] Model 1	[b] Model 2
Food Worry (Ref. = Low/None)				
High	* 4.46 (2.93, 6.78)	* 4.80 (3.02, 7.62)	* 3.50 (2.32, 5.27)	* 3.89 (2.45, 6.18)
Sex (Ref. = Female)				
Male	* 0.63 (0.44, 0.90)	0.83 (0.57, 1.19)	* 0.63 (0.44, 0.90)	0.81 (0.56, 1.16)
Age	* 0.98 (0.96, 0.99)	* 0.98 (0.97, 0.99)	* 0.96 (0.95, 0.98)	* 0.96 (0.95, 0.98)
Respondent Positive for COVID-19 (Ref. = 'No')				
Yes	1.56 (0.57, 4.24)	3.40 (0.94, 12.3)	2.46 (0.88, 6.91)	3.30 (0.91, 12.02)
Family Positive for COVID-19 (Ref. = 'No')				
Yes	1.26 (0.78, 2.05)	0.86 (0.44, 1.68)	* 1.66 (1.03, 2.69)	1.00 (0.51, 1.96)
Friend Positive for COVID-19 (Ref. = 'No')				
Yes	1.18 (0.74, 1.88)	1.03 (0.56, 1.90)	1.14 (0.71, 1.81)	1.00 (0.54, 1.85)
Family Died from COVID-19 (Ref. = 'No')				
Yes	0.91 (0.39, 2.14)	0.38 (0.10, 1.50)	0.85 (0.36, 1.99)	* 0.23 (0.06, 0.97)
Friend Died from COVID-19 (Ref. = 'No')				
Yes	0.87 (0.49, 1.53)	0.62 (0.29, 1.34)	1.11 (0.64, 1.92)	1.05 (0.48, 2.30)
Respondent Hospitalized with COVID-19 (Ref. = 'No')				
Yes	1.55 (0.53, 4.51)	2.88 (0.66, 12.50)	1.45 (0.50, 4.20)	0.84 (0.19, 3.72)
Family Hospitalized with COVID-19 (Ref. = 'No')				
Yes	1.53 (0.81, 2.88)	1.91 (0.72, 5.10)	* 2.67 (1.39, 5.13)	* 4.34 (1.38, 13.62)

* p-value < 0.05. [a] crude (unadjusted) model, [b] adjusted model. Additional covariates included in the model (not shown): education, race, ethnicity, income, and lost job since COVID-19.

4. Discussion

We found food worry to be associated with poor self-rated mental health during the early phase of the COVID-19 pandemic. Respondents with high food worry were 4.8 times as likely to experience anxiety symptoms as respondents with low or no food worry. Additionally, we found that high food worry- as compared to low or no food worry- was associated with greater odds of depressive symptoms among New York State adults.

Previous studies have examined the association between food insecurity and poor mental health outcomes before and since the COVID-19 pandemic in the United States [1,25–27]. Our study adds to this literature by further considering food worry. Prior to the COVID-19 pandemic, a cross-sectional survey of 2870 mothers across 18 cities in the United States from 2001–2003 found that greater food insecurity was associated with higher rates of anxiety and depression [28]. During the early days of the COVID-19 pandemic, a large US-based nationally representative web-based survey of 2840 adults found that adults with very low food security were more likely to screen positive for anxiety, depression, and high perceived stress [11].

This study suggests that food worry- the psychological response to perceived food scarcity- is also associated with poor mental health outcomes during the COVID-19 pandemic. Our findings are consistent with a large body of literature showing a positive association between worry and poor mental health [14,29–32]. Excessive and uncontrollable worry induces psychological stress, which in turn increases the risk for and vulnerability to mental health outcomes, including Generalized Anxiety Disorder (GAD) and Major Depressive Disorder (MDD) [30,32]. Several studies have reported an increased incidence of food worry during the COVID-19 pandemic [14,33,34]. This might reflect the pandemic's disruption of the socioeconomic landscape, especially in the vulnerable- loss of income, supply chain disruptions, changes in food purchasing behavior, e.g., stockpiling, emotional distress from perceived fear of food shortage, emotional distress associated with viral transmission via food handling, and disruption in social networks [4,33,35–37]. Further studies should examine the association between food worry and physician diagnosis of GAD and MDD, which are more precise measures of mental health than the self-rated symptoms estimated in this study. A study conducted using a large nationally representative US sample of 1450 adults found that not being able to get food due to supply shortages was associated with GAD prevalence during the COVID-19 pandemic between 31 March and 13 April 2020 [38].

During the early phase of COVID-19, the US congress enacted the Families First Coronavirus Act to expand the federal nutrition assistance program [39]. Eligible households, with children that receive free school meals, were given pandemic Electronic Benefit Transfer (P-EBT) that amounted to $114 per child [39]. Public schools were permitted to expand summer meal programs to provide for families during school closures. States were also allowed to increase Supplemental Nutrition Assistance Program (SNAP) allotment to the maximum limit possible, for emergency reasons [39]. Evidence suggests that Women, Infants, and Children (WIC) and SNAP have effectively reduced food insecurity in the United States prior to the COVID-19 pandemic. A survey of 6500 US households found that SNAP was associated with a 12–19% food insecurity reduction in US households [40].

Besides federal interventions, New York implemented statewide initiatives to improve food security during COVID-19 [41,42]. For example, NYS liability protection law was enacted to extend the Bill Emerson Good Samaritan Food Donation Act in New York [41]. As part of the law, Nourish New York Initiative provided tax incentives and liability protections to food donor organizations [42].

We recommend food-related policy directions for New York, ahead of a future pandemic. Businesses should be encouraged to donate food, and to leverage tax incentives; several do not apply because they do not know about, or think the process is complicated. Second, New York does not protect non-profit donors from liability [43]. Considerations should be made to shield this category of donors. Third, liability and tax incentives should apply to businesses that donate food directly to individuals or organizations that charge for food. Other recommendations include: Expand WIC and SNAP eligibility requirements to include more low income households; address the root causes of food insecurity- the social determinants of health- by promoting equitable education, and reducing poverty and unemployment rates. Finally, food insecure children in New York will benefit from meal support programs, including summer meal, school back pack programs, universal breakfast, and lunch reach. These programs are not universally available across school districts, counties, and cities in New York, and can benefit from expansion [43].

This study has several limitations. The survey instrument was administered online and in English only, which could selectively exclude persons with no internet access and those who do not speak English, from the study. The study was also cross-sectional by design, so we could not demonstrate temporality in the association between food worry and anxiety or depression symptoms, precluding any causal inference. Another limitation relates to how food concerns were operationalized in this study. They were described as worry. Worry is a central clinical feature of generalized anxiety disorder, and is also closely related to rumination, which is a central feature of depression [44]. Therefore, the results may be recursive, reflecting an association between symptoms, rather than between an exposure and an outcome. The food worry scale employed in this study was validated by factor analysis, which revealed a Cronbach's alpha of 0.7. However, there are no additional data- evidence for criterion, convergent, or discriminant validity- to support the validity of the scale. Finally, we assessed anxiety and depression symptoms using psychometric instruments- GAD-2 and PHQ-2, rather than physician diagnosis. However, previous studies have found GAD-2 and PHQ-2 to be valid and reliable in estimating mental health outcomes [22–24].

5. Conclusions

Food worry is associated with greater odds of anxiety and depression symptoms among New York State adults. This study was conducted at the beginning of COVID-19 and likely reflects the socioeconomic and health impacts of the early pandemic on the adult population. Further studies should explore the personal and contextual drivers of food worry and mental health outcomes to guide public mental health intervention efforts.

Author Contributions: I.M.K., N.K., S.R., L.C.: Conceptualization, Methodology, Writing; I.M.K., N.K., L.C.: Data curation; I.M.K., N.K.: Formal analysis; S.R., L.C.: Supervision; N.K., S.R., L.C.: Validation; I.M.K., N.K., S.R., L.C.: Roles/Writing—original draft; I.M.K., N.K., S.R., L.C.: Writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of D'Youville College on 5 May 2020.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical restrictions.

Conflicts of Interest: The authors declare no conflict of interest.

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