Preventive Medicine Reports 28 (2022) 101830

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Short communication

Disparities in dietary practices during the COVID-19 pandemic by food security status

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ARTICLE INFO

Keywords:
Nutrition
Diet
COVID-19
Health disparities
Food security

ABSTRACT

Little is known about the differences in dietary practices among food secure and food insecure populations during the early COVID-19 pandemic restrictions. The purpose of this study was to examine differences in dietary practices the early COVID-19 pandemic restrictions between adults reporting food security versus food insecurity. An online cross-sectional survey using validated measures was administered between April and September 2020 to explore both dietary patterns and practices and food security status among persons residing in five U.S. states from different regions of the country during the COVID-19 pandemic. Between-group differences (food secure versus food insecure) were examined for dietary practice outcomes using Pearson's Chi-Square test statistic, with Fisher's Exact test for cell counts less than five. There were 3,213 adult respondents. Food insecurity increased among the survey sample from 15.9% before the COVID-19 pandemic to 23.1% during the onset of the COVID-19 pandemic ($p < 0.01$). Compared to food secure respondents, those experiencing food insecurity reported more group gatherings for meals during the pandemic, decreased fruit and vegetable intake, and a need for more nutrition support resources than food secure respondents ($p < 0.05$). Food secure individuals reported increasing alcohol consumption, more frequent take-out or delivery ordering from fast food or restaurants, and more interest in supporting the local food system ($p < 0.05$). Results indicate a clear risk of disparities in dietary practices based on food security status during the early COVID-19 pandemic restrictions. Public health research, practice, and policy efforts should tailor specific efforts towards both food secure and food insecure groups.

1. Introduction

Food insecurity, or lacking "access by all people at all times to enough food for an active, healthy life," is tied to poor dietary quality, low perceived overall health, and increased risk for diet-related non-communicable disease (Coleman-Jensen et al., 2020; Gundersen and Ziliak, 2015; US Department of Agriculture and US Department of Health and Human Services, 2020). Estimates of food insecurity during the early months of the COVID-19 pandemic in 2020 were high, with as much as 38.3% of American households lacking access to sufficient food (Fitzpatrick et al., 2020). This period was marked by a declaration of a national emergency, with lockdowns and restrictions leading to economic distress and nationwide food retail closures. The United States (U.S.) Department of Agriculture estimated food security to be at 10.5% for data collected across the entire year of 2020, yet food insecurity was higher than 15% for subpopulations including Black, non-Hispanic households, households with children and adults, or that experienced higher rates of poverty (Coleman-Jensen et al., 2020). This data suggests that the COVID-19 pandemic played a role in deepening nutrition and health disparities.

An emergent body of research has explored the impact of COVID-19 pandemic and related restrictions on dietary practices among the

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https://doi.org/10.1016/j.pmedr.2022.101830
Received 15 December 2021; Received in revised form 9 May 2022; Accepted 15 May 2022
Available online 18 May 2022

general population. For example, Chenarides' et al. (2021) research among a general metropolitan population in the U.S. found that consumers adopted shopping practices that limit going to the grocery store and food consumption patterns largely remained the same. Survey participants cooked from home more during the pandemic to reduce the amount of time and risk of going out (Filimonau et al., 2021; Bender et al., 2021).

However, limited studies have assessed the impact of COVID-19 on dietary practices by food security status. One study conducted among residents of Los Angeles County found individuals reporting food insecurity were significantly more likely to report healthy and unhealthy dietary changes than other populations (Miller et al., 2021). In a statewide survey in Vermont, participants that experienced household food insecurity had higher odds of facing access challenges and utilizing coping strategies, such as cutting meals or going hungry (Niles et al., 2020).

Little is known about the differential impacts of the COVID-19 pandemic on dietary practices among food secure and insecure people across the U.S. The objective of this study was to examine differences in dietary practices by food security status among American households across five diverse U.S. states during the early COVID-19 pandemic restrictions. Differences in dietary practices between food secure and insecure respondents during this critical time are analyzed to inform future public health responses for food and nutrition security (Shanks et al., 2020).

2. Methods

A cross-sectional online survey was developed to explore changes to food security in response to the national declaration of emergency in March 2020 due to the COVID-19 pandemic (Trump, 2020). The survey was distributed online using Qualtrics between April and September 2020 to a convenience sample across five states that vary by geographic location, racial/ethnic breakdown, and percent poverty: Louisiana, Montana, North Carolina, Oregon, and West Virginia (Grocke-Dewey et al., 2021; University of Wisconsin Population Health Institute, 2020). Adult participants aged 18 and over were recruited using a snowball sampling technique, drawing upon partnerships that researchers had previously established with organizations with wide reach, including Cooperative Extension, public health departments, local and state listservs, and social media. The survey was closed after a 6 month data collection period. The survey took an average of 32 min to complete. Louisiana State University Agricultural Center, Montana State University, North Carolina State University, Western Oregon University, and West Virginia University Institutional Review Boards approved the study protocol.

2.1. Measures

Measures included (Supplement 1): sociodemographics; economic security; household composition; public service support; health conditions that are related to nutrition or increase complications with COVID-19; and food (food security status, food behaviors, and food supply resources). A majority of questions were adapted from validated surveys developed from O'Meara et al. (2022), Calloway et al. (2019), and Bickel et al. (2000). One question about changing income during COVID-19 was developed internally as no similar questions existed time. The survey was reviewed by academic researchers and individuals from community, state, and federal agencies to inform a final instrument.

Household food security was measured using the USDA's Household Food Security Survey Module Six-Item Short Form (Bickel et al., 2000). Food security questions were modified for the context of the emergency (e.g., "For the 12 months before the COVID pandemic the food that my household bought just didn't last and I/we didn't have money to get more" and "Since the COVID pandemic began in [state name] during March, I ate less than I felt I should because there wasn't enough money for food").

Dietary outcomes of interest included eating out, eat at someone else's place, eating frozen fruits and vegetables, cooking ready to eat frozen meals, relying on others to get groceries, buying food out of fear or anxiety, eating food out of fear or anxiety, stockpiling food, wasting food, drinking alcohol, snacking, baking, gaining weight, leaving the house for groceries, ordering take-out/pick up or delivery foods from fast food/restaurants, cooking at home, eating fresh fruits and/or vegetables, eating canned fruits and/or vegetables, and food availability when shopping.

2.2. Analysis

All questions were analyzed quantitatively. Food security status was determined using USDA Household Food Security Survey Module scoring procedures (Bickel et al., 2000). Mean, standard deviation, and frequency statistics were used to describe characteristics of respondents. Between-group differences (food secure versus food insecure) were examined for dietary practice outcomes using Pearson's Chi-Square test statistic, with Fisher's Exact test for cell counts less than five. Analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC, U.S.).

3. Results

In total, 3213 individuals participated (response rates by state include: Louisiana, 20.7%; Montana, 50.2%; North Carolina, 9.4%; Oregon, 7.3%; West Virginia, 12.4%). Across these states, food insecurity rose from 15.9% to 23.1% pre- to post-onset of the COVID-19 pandemic ($p < 0.01$). Those experiencing food insecurity reported more economic hardship compared to food secure respondents, for example missing bill or credit card payments (26.1% vs. 2.7%; $p < 0.01$) or having been laid off (11.6% vs. 4.3%; $p < 0.01$). Individuals experiencing food insecurity also reported more children on average than food-secure households (1.1 ± 1.4 vs. 0.7 ± 1.2, respectively; $p < 0.01$). See Table 1.

Significant disparities in dietary practices existed between persons reporting food security versus food insecurity (Table 2). Compared to food secure respondents, those reporting food insecurity decreased fresh fruit and vegetable consumption and reported gathering in groups for meals. Those reporting food security utilized take-out or delivery services at restaurants/fast food establishments and increased alcohol consumption in comparison to food insecure individuals.

Regarding resources needed during the COVID-19 pandemic, food insecure respondents reported needing support resources, whereas food secure respondents more often noted an interest in knowing how to support local food systems (data not shown). Food insecure respondents reported more frequently than food secure respondents that information about food availability in their area, federal food assistance, and charitable food organizations would be helpful ($p < 0.05$). Food insecure respondents reported that advice about what to eat, food safety, reduce or prevent food waste, food preservation, or home gardening and online tools to help access food or improve diet would be helpful when compared to food secure respondents ($p < 0.05$).

4. Discussion

Results from a survey administered across five states in response to the COVID-19 pandemic identified important disparities in dietary practices between food secure and insecure respondents during the early COVID-19 pandemic restrictions. Individuals experiencing food insecurity reported more group gatherings for meals during the pandemic, decreased fruit and vegetable intake, and a need for more nutrition support resources than food secure respondents, while individuals experiencing food security reported increased alcohol consumption, more frequent take-out or delivery ordering from fast food or restaurants, and more interest in supporting the local food system. Findings

Table 1
Characteristics of Survey Respondents Reported by Food Security Status Across Five U.S. States During the COVID-19 Pandemic.

Sociodemographic Characteristics	Food Insecure		Food Secure		*P*
	%	n	%	n	
Total	23.08	732	76.92	2,439	
Age					
18 to 24	**14.78**	106	7.63	183	0.01
25 to 34	**23.99**	172	19.15	459	
35 to 44	**29.71**	213	23.57	565	
45 to 54	15.20	109	**17.73**	425	
55 to 64	12.69	91	**18.15**	435	
65+	3.63	26	**13.77**	330	
Sex/Gender					
Female	**88.8**	650	86.10	2,100	0.01
Male	10.11	74	**13.45**	328	
Other identity	**0.82**	6	0.24	6	
Prefer not to answer	0.00	0	**0.12**	3	
Race/Ethnicity					
White	72.54	531	**89.38**	2,180	<0.01
Black	**9.70**	71	4.35	106	<0.01
Hispanic	**7.65**	56	2.95	72	<0.01
Asian	**4.64**	34	1.64	40	<0.01
American Indian/Alaskan Native	**3.42**	25	1.52	37	<0.01
Middle Eastern	**0.68**	5	0.37	9	0.26
Hawaiian/Pacific Islander	0.00	0	**0.12**	3	0.45
Multi-racial	**2.60**	19	1.15	28	<0.01
Other race	**0.82**	6	0.70	17	0.73
Prefer not to answer	**1.23**	9	0.29	7	<0.01
Education					
Less than high school or less than high school equivalent (GED)	**1.78**	13	0.16	4	<0.01
Completed high school or high school equivalent (GED)	**9.84**	72	5.21	127	
Some college, but no degree	**27.87**	204	13.74	335	
Completed 2-year junior or community college or trade school	**15.30**	112	10.21	249	
Completed 4-year college or university or higher	44.40	325	**70.40**	1,717	
Prefer not to answer	**0.82**	6	0.29	7	
Children in Household					
Yes	**53.57**	360	38.31	875	<0.01
No	46.43	312	**61.69**	1,409	

Food Security	**Before COVID-19**		**After COVID-19**		***P***
	%	**n**	**%**	**n**	
Food Secure	84.10	2,702	76.92	2,439	<0.01
0 – High food security	**74.07**	2,380	65.97	2,092	
1 – Marginal food security	10.02	322	**10.94**	347	
Food Insecure	15.90	511	**23.08**	732	
2 – Low food security	4.54	146	**5.55**	176	
3 – Low food security	2.77	89	**4.45**	141	
4 – Low food security	1.84	59	**2.52**	80	
5 – Very low food security	2.02	65	**2.84**	90	
6 – Very low food security	4.73	152	**7.73**	245	

Economic Hardship During COVID-19	**Food Insecure**		**Food Secure**		***P***
	%	**n**	**%**	**n**	
Participation in Social Services During COVID-19					
Supplemental Nutrition Assistance Program (SNAP)	**19.67**	144	2.95	72	<0.01
Special Supplemental Nutrition Program for Women, Infants and Children (WIC)	**9.70**	71	1.27	31	<0.01
Disability Payments or Social Security Disability Insurance (SSDI)	**4.92**	36	1.89	46	<0.01
Temporary Assistance to Needy Families (TANF)	**1.23**	9	0.12	3	<0.01
Supplemental Security Income (SSI)	**4.78**	35	1.97	48	<0.01
Free or reduced price school breakfast or lunch	**12.02**	88	4.02	98	<0.01
After school or summer meals program	**5.33**	39	1.35	33	<0.01
Food from food banks or food pantries	**17.08**	125	2.05	50	<0.01
Food gifts from relatives or friends	**16.94**	124	3.98	97	<0.01
Farmers market or Community Supported Agriculture (CSA)	3.42	25	4.02	98	0.46
Relying on alternative sources of food	**13.66**	100	7.50	183	<0.01
Household Income During COVID-19					
$5,000 or less per year (or less than $417 per month)	**6.42**	47	1.23	30	<0.01
$5,001–15,000 per year (or $417 – 1,250 per month)	**14.07**	103	3.40	83	
$15,001–25,000 per year (or $1,251 – 2,084 per month)	**13.80**	101	5.13	125	
$25,001–35,000 per year (or $2,085–2,917 per month)	**14.21**	104	7.34	179	
$35,001–45,000 per year (or $2,918–3,750 per month)	**12.84**	94	8.16	199	
$45,001–50,000 per year (or $3,751–4,167 per month)	**9.84**	72	7.75	189	
More than $50,000 per year (or more than $4,167 per month)	24.45	179	**61.17**	1,492	
Prefer not to answer	4.37	32	**5.82**	142	
Employment Status During COVID-19					
Not employed- not looking for work	4.23	31	**4.72**	115	<0.01
Not employed- looking for work	**4.37**	32	1.39	34	
Not employed- retired, disabled, a full-time homemaker/stay-at-home parent, or a full-time student	7.24	53	**9.80**	239	
Yes- employed in a temporary or seasonal job.	**5.33**	39	3.57	87	
Yes- employed year-round in a job for 1–10 h per week.	**5.87**	43	3.12	76	
Yes- employed year-round in a job for 11–29 h per week.	**14.75**	108	10.33	252	
Yes- employed year-round in a job for more than 30 h per week.	52.60	385	**61.42**	1,498	
Other employment status	5.05	37	**5.41**	132	
Prefer not to answer	**0.55**	4	0.25	6	

Health Conditions Reported During COVID-19	**Food Insecure**		**Food Secure**		***P***
	%	**n**	**%**	**n**	
Overweight or obese	**44.93**	328	31.35	764	<0.01
High blood pressure or hypertension	23.29	170	21.99	536	0.46
Prediabetes	**10.41**	76	6.81	166	<0.01
High blood sugar, Type 1 diabetes, Type II diabetes	**7.67**	56	4.72	115	<0.01
Gestational diabetes / diabetes during pregnancy	**3.56**	26	2.05	50	0.02
Metabolic syndrome	**2.88**	21	1.68	41	0.04
	3.97	29	2.01	49	<0.01

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Table 1 (*continued*)

Sociodemographic Characteristics	Food Insecure		Food Secure		*P*
	%	n	%	n	
Heart condition such as a heart attack, angina, or congestive heart failure					
Chronic lung disease or moderate to severe asthma	**9.18**	67	5.95	145	<0.01
Chronic kidney disease	**1.10**	8	0.53	13	0.10
Chronic liver disease	0.68	5	0.37	9	0.26
Immunocompromised	**7.81**	57	4.60	112	<0.01
Other health condition	**10.14**	74	6.48	158	<0.01
No health conditions	37.12	271	**48.46**	1181	<0.01
Prefer not to answer	2.05	15	1.44	35	0.24

warrant the need to tailor public health nutrition responses for food and nutrition security (Mozaffarian et al., 2021) among both food secure and food insecure Americans during crisis situations.

Reported food insecurity during the COVID-19 pandemic in this study was slightly lower than some national estimates (Fitzpatrick et al., 2020) and somewhat higher than the pre-pandemic prevalence of food insecurity (Coleman-Jensen et al., 2020). We found food insecurity increased during the COVID-19 pandemic, especially among younger females and those identifying with a racial and ethnic minority group. As these populations were at higher risk of experiencing food insecurity prior to the pandemic, household food insufficiency brought on by the COVID-19 pandemic may persist (Lee et al., 2021).

Our findings also highlight dietary changes misaligned with public health guidance among both food secure and food insecure groups during the COVID-19 pandemic. Among those reporting food security, lower fruit and vegetable intake is problematic given the associated risk for diet-related chronic disease and gathering for meals increases risk for virus transmission. However, social networks have been indicated as a protective factor against food insecurity (Jayashankar and Raju, 2020). Among food secure groups, increased consumption of food away from home is concerning given these meals are typically high in saturated fat, added sugar, and sodium – nutrients associated with diet-related chronic disease if consumed in excess. Additionally, higher reported alcohol use among food secure persons is worrying. Recent evidence suggests alcohol increases risk for all-cause mortality and cancer and specifies no safe level of consumption (Global Burden of Disease (GBD) Alcohol Collaborators, 2018).

4.1. Limitations

This study's strengths included the high number of responses, sample representing various regions of the U.S., a diverse sample, and use of validated questions. Limitations include its cross-sectional design, which limit its ability to show how food security and dietary practices may have varied across the data collection period. Data collection occurred when in-person recruitment was neither possible nor ethical; however, individuals without access to the Internet would not have been able to access the survey. Given the nature of the convenience sample, the response rate is unknown. In addition, the difference in the sample within and across states may impact the generalizability of the findings. Survey findings cannot be widely generalized as responses were mostly from females (87.45%). Lastly, the survey was administered during a tumultuous time and federal nutrition benefits were changing rapidly. Thus, food security status and dietary practices likely changed for survey participants.

5. Conclusion

This research illuminates how dietary changes among both food insecure and food secure groups during the COVID-19 pandemic could be detrimental to health. Risky dietary changes resulting from structural

Table 2
Dietary Practices During the COVID-19 Pandemic Reported by Food Security Status.

Dietary Changes During COVID-19	Food Insecure		Food Secure		*P*
	%	n	%	n	
Eating out					
Decrease	89.69	322	90.50	791	0.34
Increase	6.13	22	4.35	38	
No Changes	4.18	15	5.15	45	
Eating at someone else's place					
Decrease	87.15	312	**90.63**	793	<0.01
Increase	**4.75**	17	1.26	11	
No Changes	8.10	29	8.11	71	
Eating frozen fruits and vegetables					
Decrease	**14.21**	51	3.89	34	<0.01
Increase	**40.95**	147	27.49	240	
No Changes	44.85	161	**68.61**	599	
Cooking ready to eat frozen meals					
Decrease	**16.01**	57	15.52	135	<0.01
Increase	**33.43**	119	16.9	147	
No Changes	50.56	180	**67.59**	588	
Relying on others to get groceries for you					
Decrease	**9.58**	34	5.07	44	<0.01
Increase	**28.73**	102	18.11	157	
No Changes	61.69	219	**76.82**	666	
Buying food out of fear or anxiety					
Decrease	**7.06**	25	3.33	29	<0.01
Increase	**60.45**	214	52.41	456	
No Changes	32.49	115	**44.25**	385	
Eating food out of fear or anxiety					
Decrease	**8.15**	29	5.06	44	<0.01
Increase	**47.75**	170	31.15	271	
No Changes	44.10	157	**63.79**	555	
Stockpiling food					
Decrease	**7.54**	27	3.56	31	<0.01
Increase	**52.23**	187	49.66	432	
No Changes	40.22	144	**46.78**	407	
Wasting food					
Decrease	**47.19**	168	32.88	287	<0.01
Increase	**8.15**	29	4.93	43	
No Changes	44.66	159	**62.20**	543	
Drinking alcohol					
Decrease	**15.14**	53	6.09	53	<0.01
Increase	30.57	107	**34.71**	302	
No Changes	54.29	190	**59.2**	515	
Snacking					
Decrease	**15.32**	55	5.03	44	<0.01
Increase	**62.40**	224	57.44	502	
No Changes	22.28	80	**37.53**	328	
Baking					
Decrease	**8.36**	30	2.63	23	<0.01
Increase	60.72	218	**63.20**	553	
No Changes	30.92	111	**34.17**	299	
Gaining weight					
Decrease	**15.08**	54	7.89	69	<0.01
Increase	**53.35**	191	46.91	410	
No Changes	31.56	113	**45.19**	395	

(*continued on next page*)

Table 2 (*continued*)

Dietary Changes During COVID-19	Food Insecure		Food Secure		*P*
	%	n	%	n	
Leaving the house for groceries					
Decrease	81.51	291	**83.43**	730	0.02
Increase	**12.89**	46	8.46	74	
No change	5.60	20	**8.11**	71	
Ordering take-out/pick up or delivery foods from fast food/ restaurants					
Decrease	67.41	242	59.66	522	0.04
Increase	21.73	78	**27.77**	243	
No change	**67.41**	39	**12.57**	110	
Cooking at home					
Decrease	**5.85**	21	1.60	14	<0.01
Increase	**83.29**	299	79.27	692	
No change	10.86	39	**19.13**	167	
Eating fresh fruits and/or vegetables					
Decrease	**40.39**	145	15.66	137	<0.01
Increase	**33.70**	121	30.06	263	
No change	25.91	93	**54.29**	475	
Eating canned fruits and/or vegetables					
Decrease	**14.29**	51	4.12	36	<0.01
Increase	**45.94**	164	26.69	233	
No change	39.78	142	**69.19**	604	
Were all foods you needed available when you shopped?					
No	**87.69**	641	74.50	1,817	<0.01
Yes	11.90	87	**25.38**	619	

changes and psychosocial coping mechanisms during the COVID-19 pandemic likely increased risks for early death and disability and COVID-19-related complications. Public health efforts should tailor initiatives to the unique and urgent needs of both food insecure and food secure Americans.

CRediT authorship contribution statement

Carmen Byker Shanks: Funding acquisition, Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Bailey Houghtaling:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Justin Shanks:** Conceptualization, Methodology, Writing – review & editing. **Michelle Grocke-Dewey:** Funding acquisition, Conceptualization, Methodology, Writing – review & editing. **Eliza Webber:** Formal analysis, Writing – review & editing. **Lauri Andress:** Methodology, Writing – review & editing. **Annie Hardison-Moody:** Methodology, Writing – review & editing. **Megan Patton-Lopez:** Methodology, Writing – review & editing. **Lindsey Haynes-Maslow:** Methodology, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

National Institute of General Medical Sciences of the National Institutes of Health under Award Number 5P20GM104417 (C. Byker Shanks). United States Department of Agriculture, National Institute of Food and Agriculture, Hatch project 1024670 (B. Houghtaling). The content presented here is solely the responsibility of the authors and does not represent the official views of the National Institutes of Health or United States Department of Agriculture.

Funding National Institute of General Medical Sciences of the National Institutes of Health under Award Number 5P20GM104417 (C. Byker Shanks). United States Department of Agriculture, National Institute of Food and Agriculture, Hatch project 1024670 (B. Houghtaling). The content presented here is solely the responsibility of the authors and does not represent the official views of the National Institutes of Health or United States Department of Agriculture.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2022.101830.

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