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Association between nutrition assistance programs and household produce waste during the COVID-19 pandemic

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Abstract

Fresh produce is the most wasted food, accounting for about 45% of household food waste in the United States. The literature is inconclusive about whether nutrition assistance programs aimed at increasing access to healthy food affect household food waste, particularly during the COVID-19 pandemic. To address this knowledge gap, we investigated the association between participation in nutrition assistance programs (food pantries and the Supplemental Nutrition Assistance Program, or SNAP) and changes in household produce waste since the beginning of the COVID-19 pandemic. Given that more fresh produce was distributed to

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food pantries during the pandemic, we examined whether the perceived quality of fresh produce at food pantries may influence household food waste behavior. We conducted an online survey for adults residing in the Capital Region of New York state from October to December 2021. Among 504 respondents, 27% reported throwing away less produce than usual since the COVID-19 pandemic began, 22% used food pantries, and about half perceived the quality of fresh produce at those pantries as poor. Approximately one-third of respondents were SNAP participants, including the Pandemic Electronic Benefit Transfer (P-EBT). We found that food pantry users who rated produce quality as acceptable had 2.4 times the odds of wasting less produce since the COVID-19 pandemic began compared to non-users of food pantries. Similarly, SNAP/P-EBT users were more likely to report less household produce waste compared to non-SNAP/P-EBT users. Our findings highlight that participation in food assistance programs may help reduce household food waste and underscore the importance of maintaining fresh produce quality at a level clients perceive as acceptable. We suggest greater collaboration among public health nutrition, food waste research, and food systems stakeholders to work toward the common goals of efficiently distributing healthy food, reducing food waste, and eliminating hunger.

Keywords
household food waste, fresh produce, fruit and vegetables, COVID-19, pandemic, food pantries, SNAP, perceived food quality, nutrition assistance program, New York State

Introduction

In the U.S., over one-third of the food produced is never eaten (U.S. Environmental Protection Agency [US EPA], 2023a). Food waste occurs at various stages of the food's life cycle. According to the US EPA, the largest share of food waste is generated by the food retail, food service, and residential sectors, with approximately 40% coming from individual households (2023b). The literature confirms that food wasted at the final consumption stage is the most significant source of food loss (Bellemare et al., 2017; Buzby et al., 2014; Yu & Jaenicke, 2020). Furthermore, fresh produce is the most wasted food in U.S. households. A ReFED (2025) study indicated that in 2024, fresh produce accounted for 45.2% of household food waste, three times the amount of the second-most-wasted food, dry goods (14.9%). A 2023 survey of 9,259 American consumers found that vegetables were the most-wasted food group, with an average of 1.3 cups wasted per week, closely followed by fruits, with 1.2 cups wasted per week (MITRE & Gallup, 2023).

For several decades, the U.S. public health community has focused on promoting fruit and vegetable consumption. Most Americans, particularly low-income and food-insecure individuals, are not meeting the recommended levels of fruit and vegetable intake, putting them at risk of various nu-

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trition-related diseases (2025 Dietary Guidelines Advisory Committee, 2024; Havas et al., 1994; Lee et al., 2022). High costs, limited access to grocery stores, and perceived constraints on convenience are major barriers to low-income individuals' regular consumption of fresh fruits and vegetables (Haynes-Maslow et al., 2015). Nutrition safety-net programs, such as the Supplemental Nutrition Assistance Program (SNAP) and food pantries, play an integral role in increasing access to fresh produce, promoting its consumption, and reducing hunger (Eicher-Miller, 2020; Engel & Ruder, 2020). However, little is known about how much food from nutrition assistance programs is wasted at home. Some studies demonstrate that low-income and food-insecure households waste less food (Daniel, 2016; Ghafoorifard et al., 2022; Yu & Jaenicke, 2020), while other studies report no associations between income level and food waste, suggesting that food waste behavior is complex and cannot be explained by a single factor (Schanes et al., 2018).

The COVID-19 pandemic introduced additional challenges for nutrition assistance programs. Due to disruptions in the food supply chain and employment, the number of food-insecure households increased significantly across the U.S. (Niles et al., 2021; Pryor & Dietz, 2022). To combat this phenomenon, SNAP expanded eligibility and benefits (Restrepo, 2023), and food pantries increased the collection of fresh produce through their own networks and special government programs (Huang et al., 2023; Larison et al., 2021; Winkler et al., 2023). As a result, more fresh produce was collected and distributed than usual (Huang et al., 2023; Larison et al., 2021). Studies reported that utilization of nutrition assistance programs was associated with increased fruit and vegetable consumption during the pandemic (Bertmann et al., 2021; Lee et al., 2023; Woo Baidal et al., 2024). However, researchers also note that the increased availability of fresh produce can lead to greater household food waste, particularly when the produce clients receive is of poor quality or otherwise undesirable (Kihlstrom et al., 2019; Pruden et al., 2020). Did participation in nutrition assistance programs affect household produce waste during the COVID-19 pandemic? To answer this question, we analyzed survey data collected in the last quarter of 2021 to investigate the association between participation in nutrition assistance programs and changes in household produce waste since the onset of the COVID-19 pandemic. We incorporated the perceived quality of fresh produce at food pantries in the analysis. Findings from this study can help public health professionals better understand the levers of household food waste and, in turn, safeguard fruit and vegetable consumption and reduce hunger during the pandemic.

Data Source

We used the COVID-19 Food Access Survey III (FAS3), which aimed to understand and track adults' experiences, attitudes, perceptions, and needs related to food security and access. We adapted the questionnaire developed by the National Food Access and COVID research Team (NFACT), a consortium that assessed COVID-related food access across multiple U.S. study sites (Niles et al., 2021). The study community was the Capital Region of New York state. This region is home to 1.24 million people living throughout 11 counties and includes the Albany-Schenectady-Troy Metropolitan Statistical Area. During the first 10 months of the COVID-19 pandemic, 40% of residents in this region reported experiencing food insecurity at some point (Feingold et al., 2021). We administered FAS3 via a Qualtrics online panel from October 20, 2021, to December 13, 2021, or approximately 19 to 21 months since the beginning of the COVID-19 outbreak. The eligibility criteria were adults aged 18 or older who lived in the study region and who were able to consent and take a self-administered survey in English or Spanish. Qualtrics sent the sociodemographic screener to potential participants to ensure half of the respondents were from low-income households (i.e., annual household income less than $50,000[1]). As an incentive, participants received "points" based on the length and complexity of the Qualtrics survey, which they could redeem for monetary rewards later.

[1] All currency in this article is in U.S. dollars.

Measures

The outcome of interest is whether less fresh produce was wasted at the household level since the beginning of the COVID-19 pandemic. The binary variable ("Yes" for wasted less fresh produce) was derived from the question "Has your household done any of the following in the past year?" and the response option "Throw away less fresh produce than normal." The exposure variables were self-reported household participation in the food pantry and in SNAP during the COVID-19 pandemic. To incorporate the perceived quality of the food pantry's produce into the food pantry variable, we examined how food pantry users had responded to the statement "the food pantry has good quality of fruits and vegetables" in the section on their experience of food pantry usage in the past year. Those who strongly disagreed or disagreed with this item were considered to have rated the quality of fresh produce as "poor," while those who strongly agreed, agreed, or had no opinion were considered to have rated it as "acceptable." We then created a three-category variable to indicate whether respondents were food pantry users who rated the quality of fresh produce as poor or acceptable, or were non-users of food pantries. The SNAP variable was binary; "Yes" indicated SNAP or Pandemic Electronic Benefit Transfer (P-EBT) enrollment.

Additionally, we measured changes in fruit and vegetable consumption and cooking behavior because the literature suggests these behaviors are related to food waste (Ghafoorifard et al., 2022; Grier-Welch et al., 2021; Rodgers et al., 2021). The fruit and vegetable consumption variable was derived from a question asking respondents whether they have been eating more, less, or about the same amounts of fresh fruits and vegetables per day since the COVID-19 pandemic began. Similarly, the cooking variable assessed whether the respondent spent more time cooking than prior to the COVID-19 pandemic. We assessed the following sociodemographic characteristics as potential covariates: age (18–34, 35–54, and 55+), gender (male, female, and other), race/ethnicity (Hispanic, Non-Hispanic White, Non-Hispanic Black, and other or multiple), annual household income (less than $10,000, $10,000–24,999, $25,000–49,999, $50,000–74,999, $75,000–99,999, and $100,000+), educational attainment (high school or less, some college, or college degree or higher), and political affiliation (liberal, moderate, conservative, or don't know/prefer not to answer) .

Data Analysis

First, we conducted descriptive analyses of all the variables to be included in the model and evaluated their distributions, intercorrelations, and associations with the outcome variable. To provide additional context on the sample, we also conducted descriptive analysis of a subset of food pantry users' characteristics. Next, we conducted a logistic regression analysis of the outcome, with higher odds ratios (ORs) indicating a greater likelihood of reporting that they were wasting less fresh produce than usual since the COVID-19 pandemic began. After we constructed the baseline model, which included all exposure variables and covariates described earlier, we identified the final model using a stepwise backward-elimination approach. At each step, we removed the variable with the largest Wald test p-value, then performed a likelihood ratio test (LRT) to confirm that its removal did not significantly worsen model fit. Variables were dropped if the LRT p-value exceeded 0.05, and this process was repeated until all remaining variables met the retention threshold. We assessed the final model's fit and sensitivity using the Hosmer-Lemeshow test and evaluated its discriminative ability using the C-statistic (Hosmer et al., 1991). We also made some adjustments to certain variables to facilitate ease of interpretation. The fruit and vegetable consumption variable was initially coded as a three-category variable with levels "less," "same," and "more." When "same" was the reference level, the OR for "less" was close to 1.00 and did not alter significantly after adjustment. Therefore, we coded this variable as binary, with "less/same" and "more." We excluded income from the model due to high multicollinearity with the SNAP variable. We completed all analyses using SAS Studio OnDemand.

Results

There were 504 respondents in the analysis dataset. Table 1 summarizes the results of the descriptive analysis. Twenty-seven percent (27.0%) of re-

Table 1. Characteristics of the FAS3 Participants (*N* = 504)

Characteristic	*N*	%
Throwing away less produce		
Yes	136	27.0
No	368	73.0
Food pantry use and produce quality		
Produce quality at food pantry is poor	58	11.5
Produce quality at food pantry is acceptable	55	10.9
Do not use a food pantry	391	77.6
SNAP/P-EBT user		
Yes	147	29.2
No	357	70.8
Spending more time cooking		
Yes	283	56.2
No	221	43.8
Eating more fruits and vegetables		
Yes	70	13.9
No	424	84.1
Unknown	10	2.0
Age		
18–34	168	33.3
35–54	158	31.4
55+	178	35.3
Gender		
Male	131	26.0
Female	364	72.2
Other	9	1.8
Race/Ethnicity		
Hispanic	40	7.9
Non-Hispanic White	380	75.4
Non-Hispanic Black	48	9.5
Other/Multiple	36	7.1
Household Income		
Less than $10,000	43	8.5
$10,000–24,999	68	13.5
$25,000–49,999	146	29.0
$50,000–74,999	95	18.9
$75,000–99,999	61	12.1
$100,000+	91	18.1
Education		
High school or less	146	29.0
Some college	194	38.5
College degree or higher	164	32.5
Political Affiliation		
Liberal	129	25.6
Moderate	168	33.3
Conservative	110	21.8
Don't know or prefer not to say	97	19.3

spondents reported throwing away less fresh produce since the COVID-19 pandemic began, and 22.4% of respondents used food pantries. Out of 113 food pantry users 58 (51.3%) perceived the quality of fresh produce at food pantries as poor. Approximately one-third of respondents (29.2%) were SNAP or P-EBT participants. While more than half of all respondents (56.2%) reported cooking more frequently, only 13.9% reported eating more fruits and vegetables. In terms of sociodemographic characteristics, women, adults aged 35 to 54, low-income individuals, and people of Hispanic and non-Hispanic Black race/ethnicity were overrepresented relative to the Capital Region's overall population (New York State Department of Labor, 2026).

Table 2 describes characteristics of food pantry users (n = 113). Typical food pantry users were those who became clients after the COVID-19 pandemic began (55.8%) and used one or two different food pantries (75.0%), with visits occurring once a month or less (62.2%). A majority (71.4%) consumed at least 75% of the fruits and vegetables they obtained from food pantries, with a mean consumption of 81.9%. They reported that it took an average of 3.8 days for fruits and vegetables from the food pantry to go bad.

Table 3 presents the results of the baseline and final logistic regression models for wasting less produce since the COVID-19 pandemic began (n = 494). None of the sociodemographic variables, except for the 35–54 age group, was significantly associated with the outcome variable. In the final model, food pantry users who rated produce quality as acceptable had 2.38 times the odds of wasting less produce compared with non-users of food pantries (95% CI, 1.14–4.92). SNAP/P-EBT participation (OR 1.88, 95% CI 1.16–3.28), increased cooking frequency (OR 5.79, 95% CI 3.49–9.97), increased fresh fruit and vegetable intake (OR 2.20, 95% CI 1.23–3.93), and the 35–54 age group (OR 1.81, 95% CI 1.05–3.15) were also significantly associated with wasting less produce compared to their respective reference groups. The Hosmer-Lemeshow test indicates a good model fit (p=0.7593), and the c-statistic indicates an acceptable model fit (c=0.763) (data not shown).

Discussion

Our motivation for conducting this study was to investigate whether participation in existing nutrition assistance programs during the COVID-19 pandemic had a positive or negative impact on household food waste. Through analysis of FAS3, a survey conducted in New York state's Capital Region in the last quarter of 2021, we found that since the COVID-19 pandemic, food pantry users who perceived the quality of fresh produce as acceptable were significantly more likely to report less produce waste than usual compared to non-users of food pantries. Similarly, SNAP/P-EBT participants were more likely to report less produce waste compared with non-SNAP/EBT participants. These are encouraging findings for both the public health and environmental science communities. Approximately 60% of household food waste is landfilled; therefore, any measures that reduce household food waste can potentially lessen soil and water contamination and reduce methane and carbon dioxide emissions (US EPA, 2023b).

Table 2. Characteristics of FAS3 Food Pantry Users (*n* = 113, % is for valid cases only)

Characteristic	*n*	%
Food pantry use history		
Start using it before the COVID-19 pandemic	50	44.2
Start using it since the COVID-19 pandemic	63	55.8
Number of different food pantries used		
One	56	50.0
Two	28	25.0
Three	18	16.1
Four	10	8.9
Frequency of food pantry use		
Once a month or less	69	62.2
2–3 times a month	28	25.2
Once a week or more	14	12.6
Percent of fruit and vegetables from food pantries that are eaten [a]		
0–49%	5	4.8
50–74%	25	23.8
75–99%	50	47.6
100%	25	23.8
Number of days before pantry fruits and vegetables went bad [b]		
0 day (already bad)	11	15.3
1 day	6	8.3
2 days	11	15.3
3 days	14	19.4
4 days	10	13.9
5 days or more	20	27.8

[a] The mean is 81.9% with a standard deviation of 18.9%.
[b] The mean is 3.8 days with a standard deviation of 4.4 days

Food Pantry Implications

For food pantries, our findings highlight the importance of maintaining the quality of fresh produce at the level their clients perceive as acceptable. Food pantry clients desire higher-quality food, including nutritious items and food that is not close to expiration (Long et al., 2023). A food item not being "good enough" in consumers' assessment has been identified as the primary reason for food waste (Aschemann-Witzel et al., 2019). During the pandemic, the New York State government implemented "Nourish New York," a program to redistribute surplus fresh produce and other farm products to food pantries (New York State Department of Agriculture and Markets, n.d.). The program increased the volume of donated fresh produce; however, it is very likely that some food pantries were not fully prepared to keep them in good quality, mainly due to staff/volunteer shortage and a lack of refrigeration equipment and cold storage (Huang et al., 2023; Wetherill et al., 2019; Winkler et al., 2023). In our study, slightly more than half of food pantry clients rated their food pantry's fresh produce as "poor quality," and nearly a quarter of clients reported that fresh produce went bad within a day. It is also noteworthy that most food pantries in the study area operated with the client-choice model before the pandemic (Winkler et al., 2023). However, public health measures to reduce community transmission of COVID-19 forced food pantries to switch to the fixed-bundle model (also known as the prepackaged-bag model) (Larison et al., 2021; Winkler et al., 2023). The fixed-bundle model has been associated with greater household

food waste (Pruden et al., 2020). Despite reduced client choices, our study provides evidence that food pantries can help reduce produce waste, provided they maintain fresh produce quality at or above acceptable levels.

Table 3. Results of the Logistic Regression Analysis for Throwing Away Less Produce Since the COVID-19 Pandemic: FAS3 data (*N* = 494)

Variable	Baseline Model OR95% CI	Final Model OR95% CI
Food pantry produce quality		
Produce quality at food pantry is poor	1.960.99–3.91	1.960.99–3.92
Produce quality at food pantry is acceptable	2.241.06–4.74	2.381.14–4.92
Do not use a food pantry	1.00REF	1.00REF
SNAP User		
Yes	1.721.00–2.96	1.881.16–3.28
No	1.00REF	1.00REF
Spending more time cooking		
Yes	6.263.65–10.72	5.793.49–9.97
No	1.00REF	1.00REF
Eating more fruits and vegetables		
Yes	2.261.26–4.06	2.201.23–3.93
No	1.00REF	1.00REF
Age		
18–34	1.00REF	1.00REF
35–54	1.961.10–3.51	1.811.05–3.15
55+	1.630.87–3.05	1.550.86–2.66
Gender		
Male	1.00REF	
Female	0.930.53–1.62	
Other	0.520.07–3.67	
Race/Ethnicity		
Hispanic	1.00REF	
Non-Hispanic White	1.130.49–2.63	
Non-Hispanic Black	1.470.52–4.16	
Other/Multiple	1.390.45–4.27	
Education		
High school or less	1.00REF	
Some college	0.830.48–1.46	
College degree or higher	0.620.33–1.19	
Political Affiliation		
Liberal	1.00REF	
Moderate	1.080.6–1.97	
Conservative	0.800.4–1.59	
Don't know or prefer not to say	1.030.51–2.09	

OR: Odds Ratio, CI: Confidence Interval, REF: Referent

SNAP Implications

Literature that focuses on SNAP and household food waste is limited and inconsistent. A study that employed mathematical models estimated that SNAP would substantially increase food purchases, leading to greater food waste (Yu & Fan, 2023). In contrast, another study that used a different modeling technique estimated that SNAP would significantly reduce household food waste (Yu & Jaenicke, 2020). These existing studies used pre-pandemic data and did not factor in the expansion of SNAP during the pandemic, which enrolled more higher-income individuals and provided greater benefits (Restrepo, 2023). Moreover, New York state was one of five states that introduced an online SNAP food purchase program before the COVID-19 pandemic and continued it during the pandemic (Kinsey et al., 2020). Our study's association between SNAP/P-EBT and reduced produce waste might have been influenced by pandemic-specific SNAP provisions that enabled participants to purchase desirable, high-quality fresh produce. In addition, our study's findings on the relationships between increased fruit and vegetable consumption, increased home cooking, and less food waste are consistent with the literature (Ghafoorifard et al., 2022; Grier-Welch et al., 2021; Rodgers et al., 2021).

Strengths and Limitations

This study has several strengths. The dataset included approximately 500 respondents, with oversampling of low-income individuals, enabling us to conduct analyses with adequate statistical

power and adjust for sociodemographic covariates. The questionnaire we used was pilot-tested, and its key construct domains had reasonably high internal validity (Niles et al., 2021). The outcome and some independent variables were assessed retrospectively; thus, we were able to account for temporality in the analysis. Finally, this study is among the few that directly evaluated the association between nutrition assistance programs and household food waste.

This study also has limitations. The oversampling of low-income individuals limits the generalizability of the results to the study population. FAS3 was administered online via Qualtrics, which may have limited participation among those without digital literacy skills or regular internet access. Those without regular internet access tend to be older, less educated, rural adults (Hargittai et al., 2019). All behavioral variables used in this study were based on self-report and may be subject to recall and social desirability biases (Fadnes et al., 2008). Moreover, these variables were relative measures (e.g., less or more, increased or decreased), and no absolute quantities, volumes, or frequencies were obtained. Nonetheless, these measures were obtained with minimal respondent burden and are appropriate for an exploratory study.

Conclusion

In conclusion, this study suggests that nutrition assistance programs during the COVID-19 pandemic may have led to beneficial outcomes despite increased food insecurity: they not only swiftly expanded access to fresh fruit and vegetables but also likely reduced household waste of these items among participants. For food pantries, this was achieved when the fresh produce provided was of acceptable quality to their clients. Improving the quality of fresh produce in food pantries remains an ongoing issue that requires attention. Several studies provide valuable "lessons learned" and insights about this subject (Huang et al., 2023; Larison et al., 2021; Long et al., 2023; Pruden et al., 2020; Wetherill et al., 2019; Winkler et al., 2023). Additionally, educating food pantry staff and clients on the meaning of food date labels on pre-cut fruits and vegetables can prevent discarding those that are still safe to consume (Neff, et al., 2019)

Moving forward, recognizing that participation in nutrition assistance programs is associated with reduced household waste of nutritious food during times of distress may help promote transdisciplinary research collaboration. Food waste research, where the major focus is on agri-food systems and their environmental impacts, and public health nutrition research have not been well integrated in the U.S. and elsewhere, even though they share the same goals of efficiently distributing healthy food, reducing food waste, and eliminating hunger (Santeramo & Lamonaca, 2021). We suggest expanding the collaboration with stakeholders from other sectors of the food system—food production, food processing, food retail, and food service—to advance this agenda through evidence-based and scenario analyses.

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