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Parent perceptions of changes in eating behavior during COVID-19 of school-aged children from Supplemental Assistance Program Education (SNAP-Ed) eligible households in California

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ABSTRACT

This cross-sectional study examined the associations between parent-reported, perceptions of changes in school-aged children's (ages 5–18) school meal participation, household cooking, fast food consumption, dietary intake, and weight during the COVID-19 pandemic. Respondents with low-income and school-aged children ($n = 1040$) were enrolled using quota sampling to approximate the distribution of low-income households and race/ethnicity among California residents who completed an on-line questionnaire developed by the authors. Adjusted multinomial models examined associations between parent-reported changes in school meal participation and time spent cooking, with parent-reported changes in child diet and body weight during COVID-19 (from before March 2020 to January-March 2021). During the pandemic, decreased school meal participation was associated with decreased child's fast food intake (OR[95 %CI] = 1.47[1.04–2.07]); conversely, increased school meal participation was associated with increased child's fast food intake (OR[95 %CI] = 1.71[1.09–2.68]). Decreased cooking at home was associated with decreased fruit and vegetable intake (OR[95 %CI] = 2.71[1.62–4.53]), increased sugar-sweetened beverage intake (OR[95 %CI] = 3.83[2.16–6.81]), and increased fast food intake (OR [95 %CI] = 4.09[2.45–6.84]); while increased cooking at home was associated with increased fruit and vegetable (OR[95 %CI] = 2.26[1.59–3.20]), sugar-sweetened beverage (OR[95 %CI] = 1.88[1.20–2.94]), sweets (OR[95 %CI] = 1.46[1.02–2.10]), and salty snack food intake (OR[95 %CI] = 1.87[1.29–2.71]). These parent-reported perceived changes in meal sources during the pandemic for children from low-income California households, and the mixed results in their associations with changes in parent-reported child dietary intake, suggest the need for strengthening policies and programs to support both access to, and healthfulness of, meals from school and home during prolonged school closures.

1. Introduction

The COVID-19 pandemic was declared on March 13, 2020 in the United States (US) (Executive Office of the President, 2020). On March 19, 2020, California, the most populous state in the US (Census Bureau, 2020), issued the first statewide shelter-in-place order requiring all school-aged children and non-essential workers to remain at home (State of California, 2020). Schools closed, instruction shifted to online, and schools provided meals for curbside pickup. California's shelter-in-place orders continued through June 15, 2021 (State of California,

2021), then became county-by-county orders through 2022. School closures impacted children and their parents, who may have lost jobs, income, and childcare (Chen et al., 2022).

Schools are important sources of nutritious food for children (Dunn et al., 2020; Kinderknecht et al., 2020; Ralston et al., 2017; Huang and Barnidge, 2016; Cullen and Chen, 2017), potentially reducing the risk of chronic disease (Van Lancker and Parolin, 2020). In the pre-pandemic 2018–2019 school year, eighty-five percent of the 800 million school meals in California were served to students who qualified for free or reduced-price, based on their family's income (California Department of

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Education and Programs, 2021). Despite waivers in March 2020 from the Food and Nutrition Service, US Department of Agriculture, to improve school meal access (Kinsey et al., 2020; United States Department of Agriculture Food and Nutrition Service, 2021), school meal participation dropped. Families with lower-incomes (\$50,000 or less/year) and children (ages 5–18) were especially vulnerable to missing food from school during pandemic closures (State of California, 2021). The US rate of unemployment and food insecurity increased for households with children, particularly among Black and Hispanic families (Schanzenbach and Pitts, 2020; Leung et al., 2014).

In addition, restaurant and convenience food purchasing away from home appeared to decrease while online grocery shopping increased during the pandemic (Ellison et al., 2021). Pre-pandemic, fast food was consumed by half of US children, based on two-day dietary recalls, possibly increasing daily total energy intake, overweight/obesity, and poor diet quality among children (Poti et al., 2014; Powell and Nguyen, 2013). Therefore, a decrease in fast food consumption could contribute to healthier diets.

Concurrent, with decreases in restaurant food and school meal participation, studies found that US households prepared food at home more often during the pandemic, a behavior associated with healthy eating patterns (Cummings et al., 2022; Bender et al., 2022). This trend may have been influenced by a perceived risk of procuring food away from home or an attempt to save money (Ellison et al., 2021).

Understanding these changes and their associations with dietary intake among populations at high risk for food/nutrition insecurity can inform nutrition related policies and programs in the aftermath of COVID-19 pandemic and during future emergencies. This study focused on households with school-aged children that were eligible for the largest nutrition education and obesity prevention program for households with low-income in California (income 185% or below the federal poverty level [FPL])—CalFresh Healthy Living (CFHL; known as the Supplemental Nutrition Assistance Program Education (SNAP-Ed) in other US states) (California Department of Social Services (CDSS), 2023).

In this study we explore parents' perceptions of changes in their children's diets during the pandemic. The study objectives are to, among CFHL-eligible households in California: 1) describe parent-reported changes in child school meal participation, household cooking, child consumption of select food/beverages, and child body weight; 2) examine associations between the reported changes in school meal participation and child food/beverage consumption and body weight; and, 3) examine associations between changes in household cooking and changes in child food/beverage consumption, school meal participation, and body weight, from before the pandemic (before March 2020) to during the pandemic (January to March 2021). For brevity, the terms *change*, *increase*, *decrease* used in this article refer to parents' self-reported perceived change.

2. Methods

2.1. Study design

This cross-sectional study examines data from online surveys administered by the California Department of Public Health (CDPH) in collaboration with the University of California Nutrition Policy Institute between April and August 2021 among California parents with school-aged children to assess changes in their food behaviors during the COVID-19 pandemic.

2.2. Sample and recruitment

Participants were recruited with assistance from the Population Research Center at California State University Sacramento, who conducted online surveys beginning in March 2019 to evaluate the CFHL social marketing campaigns (herein called media surveys), funded

through SNAP-Ed.

A marketing firm assisted CDPH recruit media survey participants through Facebook ads. Quota sampling was used to obtain respondents by race/ethnicity (African American, Latino/Latina (Latino/a), white) that reflected population distributions (14.7%, 40.7%, and 29.6%, respectively) (Tan and Danielson, 2020), or roughly equal amounts of these groups from among California's SNAP population, depending on the media survey. No quota was used for Asian/Pacific Islanders that comprise a small proportion of the SNAP population in California.

Respondents were from four designated marketing areas where media campaigns ran (Sacramento, Fresno, Los Angeles, San Diego) and five regions (Northern California, Southern California, San Francisco Bay Area, San Joaquin Valley, Greater Sacramento). These areas were chosen because they contained large populations that were SNAP-Ed eligible (incomes 185% or below FPL). Respondents were eligible to participate in a media survey if they were age 18–59 years, belonged to a SNAP-Ed-eligible household, were a parent or guardian of a child 5–17 years old (school-age) residing in the household, and preferred the survey in English or Spanish.

The 2,362 respondents who completed a media survey from January to August 2021 were invited to take an additional, 15–25 min survey between April to August 2021 for this study. A total of 1,188 respondents completed the supplemental survey; 34 were invalid (data quality issues or fraud), 94 were ineligible (did not have a school-aged child living in the household), and 20 had missing child, exposure, outcome, or covariate data, resulting in 1,040 respondents in the final sample (Fig. 1). Respondents who did not complete the survey or were excluded due to missing data ($n = 1,194$) differed significantly by parent race/ethnicity, language, education, number of children in the household, and region (data collected from the media survey). Child characteristics, only collected in the supplemental survey, did not differ significantly for child gender, race/ethnicity, grade, how child attended school, or school meal participation ($n = 20$) (Table 1).

2.3. Survey instrument

The supplemental survey (author-developed) included questions about parent-reported perceived changes in household cooking and eating behaviors of the youngest, school-aged child *before the pandemic* (defined as before March 2020) compared to *during the pandemic* (defined as January to March 2021). The *youngest school-aged child* was defined as the "youngest child currently living in the household at least part time that attends school from kindergarten through twelfth grade (K-12)," hereafter referred to as *child*. Respondents received \$40-\$75 for survey completion.

The survey asked respondents to report changes in child's consumption of selected food and beverages (fruits, vegetables, sugar-sweetened beverages, sweets, salty snacks, fast foods), overall amount of food consumed, number of school meals obtained per week for the child, perceived change in child's body weight, and change in time their household spent cooking. Responses options were *less than*, *about the same*, or *more than before the pandemic*. Respondents reported on the number of school meals obtained per week for their child during the pandemic, which were categorized as *none*, *less than one time per week* and *more than once per week*.

Race/ethnicity of respondents and their children were reported as *African American*, *Asian*, *Latino/a*, *White*, *Other* or *Multiracial*. Parent highest level of education was categorized as *high school graduate or less*, *some college*, and *college graduate or higher*. Change in parent job status was categorized as *lost job*, *kept job/reduced hours*, *kept job/didn't reduce hours*, *kept job/unknown if reduced hours*, or *not applicable (not working before COVID-19 pandemic)*. Responses to the number of children in the household were categorized as *1–2*, *3–4*, and *5 or more*. Child grade was categorized as *kindergarten*, *grade 1–5*, *grade 6–8* and *grade 9–12* and school attendance mode was categorized as *online* (classes online, distance education, home-schooled) or *in-person*.

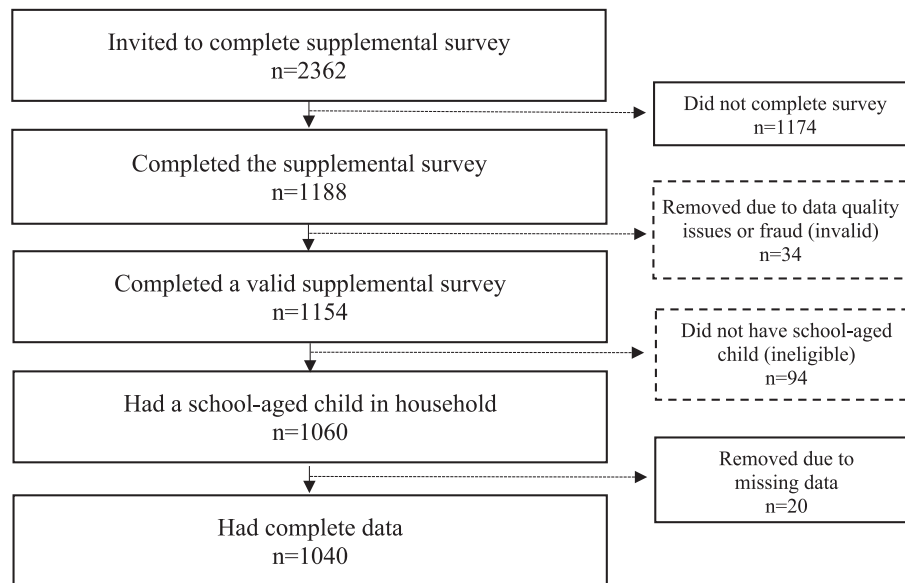


Fig. 1. Flow chart of study's analytic sample, including excluded participants.

Although adapted from previously used instruments, questions were developed by the authors for this COVID-specific project and were not validated.

2.4. Statistical analysis

Descriptive statistics were used to examine the characteristics and reported behaviors of adult respondents, their household and child. Multinomial logistic regression examined these associations: 1) change in school meal frequency and change in household time spent cooking with change in consumption of fruits and vegetables, sugar-sweetened beverages, sweets, salty snacks, fast foods, and overall amount of food; 2) change in household time spent cooking with change in school meal frequency, 3) change in school meal frequency and household time spent cooking with change in child body weight. All regression models adjusted for child race/ethnicity, gender, grade, parent highest level of education, region, and survey language. All models were also adjusted for changes in household time spent cooking, school meal frequency, and fast food consumption, except when they were already included as dependent or independent variables. P-values < 0.05 were considered statistically significant. Analyses were conducted in Rstudio, Version 1.4.1717, Posit, Public Benefit Corporation, Boston, Massachusetts, US.

This study was approved by the Committee for the Protection of Human Subjects Institutional Review Board (IRB), Center for Data Insights and Innovation, California Health and Human Services Agency.

3. Results

3.1. Household and child characteristics

Parent respondents were primarily female (84%) and Latino/a (53%); high school graduates or less (46%) or had some college (38%); lived in Southern California (38%) or San Joaquin Valley (26%) regions of California; and had lost their job or reduced work hours (45%) (Table 1). Around half (51%) of households had 1–2 children. About half of the children (youngest school-aged child in the household) were female (50%) and Latino/a (46%). Most children were in elementary school (grades K–5) (67%) and attended school online or home-schooled (87%) during the pandemic.

3.2. Child nutrition

The majority of respondents reported their child consumed about the same amount of fruits and vegetables (58%), sugar-sweetened beverages (50%), sweets (51%), and salty snacks (54%) during the pandemic (Table 2). Slightly more reported that their child increased fruit and vegetable intake (25%) than decreased (18%). More reported their child decreased consumption of sugar-sweetened beverages (34%) and fast food (43%) than increased (16% and 24%, respectively). Similar percentages reported increases and decreases in child intake of sweets (25% and 24%, respectively) and salty snacks (21% and 25%, respectively). While more than half of respondents (56%) reported the amount of food consumed by their child stayed the same, nearly one-third (30%) reported an increase compared to 14% reporting a decrease in the overall amount of food consumed during the pandemic.

Over two-thirds of respondents (67%) reported getting none or less than one school meal per week for their child during the pandemic (Table 1). Over one-third of respondents (37%) reported decreasing the number of school meals obtained per week for their child (Table 2). A similar proportion of respondents (38%) reported they got about the same number of meals per week from school for their child. One-quarter (25%) reported increasing the number of school meals obtained per week for their child. Decreases in number of school meals obtained per week during the pandemic was not associated with change in intake of selected foods and beverages intake other than fast food (OR[95 %CI] = 1.47[1.04–2.07]). Similarly, increases in number of school meals obtained per week was only associated with decreases in fast food consumption (OR[95 %CI] = 1.71[1.09–2.68]) (Table 3).

Over one-third of respondents (38%) reported that the time spent cooking at home stayed about the same. Half (50%) reported that time spent cooking at home during the pandemic increased compared to 12% reporting a decrease (Table 2). An increase in time spent cooking at home was associated with higher odds of an increase in child fruit and vegetable (OR[95 %CI] = 2.26[1.59–3.20]), sugar-sweetened beverage (OR[95 %CI] = 1.88[1.20–2.94]), sweets (OR[95 %CI] = 1.46[1.02–2.10]), and salty snack consumption (OR[95 %CI] = 1.87[1.29–2.71]). Decreases in time spent cooking at home was associated with higher odds of decreases in child fruit and vegetable (OR[95 %CI] = 2.71[1.62–4.53]), increased child sugar-sweetened beverage (OR[95 %CI] = 3.83[2.16–6.81]) and increased fast food consumption (OR[95 %CI] = 4.09[2.45–6.84]) (Table 3). Results were significant but mixed for associations between decreases in time spent cooking at home, and

Table 1

Characteristics of sampled SNAP-Ed^A eligible California households with school-aged children in 2021 (n = 1040) compared to those who were invited but did not complete the supplemental survey or had missing data (n = 1194).^B

	Sampled Participants	Participants that did not complete survey or were excluded due to missing data	p-value ^C
	n (%)	n (%) ^B	
CHARACTERISTICS OF PARENT RESPONDENTS			
Gender			
Female	877 (84.3)	1024 (85.76)	0.3421
Male	163 (15.7)	170 (14.24)	
Race/ethnicity			
African American	110 (10.6)	134 (11.22)	<0.001
Asian/Pacific Islander	68 (6.5)	56 (4.69)	
Latino/a	553 (53.2)	530 (44.39)	
White/Caucasian	309 (29.7)	474 (39.70)	
Survey language			
English	722 (69.4)	881 (73.8)	0.022
Spanish	318 (30.6)	313 (26.2)	
Highest level of education			
High school graduation or less	479 (46.1)	548 (46.3)	0.032
Some college	392 (37.7)	487 (41.1)	
College graduate or higher	169 (16.2)	149 (12.6)	
Number of children in household^D			
1–2	533 (51.25)	742 (62.20)	<0.001
3–4	421 (40.48)	375 (31.43)	
5+	86 (8.27)	76 (6.37)	
Region of California			
Greater Sacramento	123 (11.8)	184 (15.41)	<0.001
Northern California	60 (5.8)	150 (12.56)	
San Francisco Bay Area	184 (17.7)	364 (30.49)	
San Joaquin Valley	275 (26.4)	301 (25.21)	
Southern California	398 (38.3)	195 (16.33)	
Change in employment status^E			
Lost job	310 (30.8)	6 (40.0)	0.544
Kept job but reduced hours	147 (14.6)	1 (6.7)	
Kept job and did not reduce hours	349 (34.7)	4 (26.7)	
Kept job and unknown if reduced hours	27 (2.7)	1 (6.7)	
Not applicable (not working before COVID-19 pandemic)	173 (17.2)	3 (20.0)	
CHARACTERISTICS OF YOUNGEST SCHOOL-AGE CHILD IN THE HOUSEHOLD^G			
Gender			
Female	515 (49.5)	5 (33.33)	0.299
Male	525 (50.5)	10 (66.67)	
Race/ethnicity			
African American	115 (11.1)	3 (17.7)	0.396
Asian	60 (5.8)	0 (0.0)	
Latino/a	473 (45.5)	11 (64.7)	
Other/multiracial	132 (12.7)	1 (5.9)	
White	260 (25.0)	2 (11.8)	
Grade in school during 2020–21 school year			
Kindergarten	227 (21.8)	2 (10.0)	0.601
1–5	472 (45.4)	10 (50.0)	
6–8	181 (17.4)	4 (20.0)	
9–12	160 (15.4)	4 (20.0)	
How attended school during the pandemic^I			
Online, distance learning, or home-schooled	904 (87.2)	13 (100.0)	0.391
Any school in-person	133 (12.8)	0 (0.0)	
School meal participation (number of meals per week) during COVID^J			

Table 1 (continued)

	Sampled Participants	Participants that did not complete survey or were excluded due to missing data	p-value ^C
None	406 (39.2)	5 (83.33)	0.094
Less than one per week	287 (27.7)	1 (16.67)	
More than one per week	342 (33.0)	0 (0.0)	

^A Supplemental Nutrition Assistance Program – Education, a US federally funded, evidence-based program that helps people lead healthy, active lives.

^B Includes 1174 households that did not take survey and 20 with missing data.

^C P-values shown are type 3p-values derived from chi-squared tests comparing participants included in analyses to those who did not take the survey or had missing data.

^D Number of children in household; data was missing from 1 participant and was excluded from analyses.

^E Data on parental change in employment status missing for 34 sampled participants. ^F Parental change in employment status was not available for the 1174 households that did not take the supplemental survey because those questions were not asked on previous surveys. Data from those excluded due to missing is shown (n = 20). Data on parental change in employment status was missing from 5 of those respondents excluded due to missing data.

^G Defined as the youngest child currently living in the household at least part time that attends school from kindergarten through 12th grade.

^H Data on child characteristics was not available for the 1174 households that did not take the supplemental survey because those questions were not asked on previous surveys. Data on child characteristics from those excluded due to missing data is shown (n = 20). Data on child gender (n = 5), child race/ethnicity (n = 3), child attended school during the pandemic (n = 7), and on school meal participation (n = 14) was missing.

^I January to March 2021. Data on how the child attended school was missing for 3 participants.

^J Data on times child school meals obtained missing for 5 participants.

Table 2

Perceived changes in child^A school meal participation, food/beverage intake, body weight, and household cooking during the COVID-19 pandemic (January to March 2021) compared to before the COVID-19 pandemic (before March 2020) as reported by SNAP-Ed^B eligible^C parent respondents in California (n = 1040).

	Perceived change since before the pandemic		
	Decreased	About the same	Increased
School meal participation (number of meals per week)	387 (37.2)	392 (37.7)	261 (25.1)
Household time spent cooking	128 (12.3)	390 (37.5)	522 (50.2)
Child Food/beverage consumption			
Fruits and vegetables	183 (17.6)	598 (57.5)	259 (24.9)
Sugar sweetened beverages	351 (33.8)	518 (49.8)	171 (16.4)
Sweets	246 (23.7)	531 (51.1)	263 (25.3)
Salty snack foods	223 (21.4)	556 (53.5)	261 (25.1)
Fast food	445 (42.8)	346 (33.3)	249 (23.9)
Overall amount of food consumed	145 (13.9)	587 (56.4)	308 (29.6)
Child Body Weight	79 (7.6)	588 (56.5)	373 (35.9)

^A Child defined as youngest child currently living in the household at least part time that attends school from kindergarten through 12th grade.

^B Supplemental Nutrition Assistance Program – Education, a US federally funded, evidence-based program that helps people lead healthy, active lives.

^C Eligibility for SNAP-Ed defined as a household income at or lower than 185% of the US federal poverty level.

changes in salty snacks and overall food consumed; and increases in time spent cooking at home, and changes in fast food and overall food consumed. Decreases in time spent cooking at home was associated with higher odds of decreases in number of school meals obtained per week (OR[95 %CI] = 1.90[1.18–3.08]). Results were significant but mixed for associations between increases in time spent cooking at home and

Table 3 Adjusted^A odds ratios for perceived changes in child^B food/beverage consumption, school meal participation, and time household spent cooking during the COVID-19 pandemic (January to March 2021) compared to before the COVID-19 pandemic (before March 2020) from SNAP-Ed^C eligible^D California households (n = 1040).

Perceived change in Food/Beverage Consumption (ref. about the same)AOR (95 %CI) ^E											
Fruits and Vegetables		Sugar-sweetened beverages		Sweets		Salty snack foods		Ate fast food		Overall food consumed	
Decreased	Increased	Decreased	Increased	Decreased	Increased	Decreased	Increased	Decreased	Increased	Decreased	Increased
Perceived change in school meal participation (number of meals per week) (ref. about the same)											
Decreased	1.16 (0.78 – 1.74)	1.15 (0.81 – 1.65)	1.34 (0.94 – 1.90)	0.96 (0.61 – 1.49)	0.94 (0.65 – 1.37)	1.08 (0.72 – 1.62)	0.95 (0.65 – 1.39)	1.47 (1.04 – 2.07)	1.48 (0.99 – 2.21)	0.98 (0.62 – 1.55)	1.03 (0.71 – 1.50)
Increased	0.81 (0.50 – 1.29)	0.89 (0.60 – 1.33)	1.05 (0.71 – 1.56)	0.82 (0.49 – 1.36)	1.24 (0.82 – 1.88)	0.89 (0.56 – 1.42)	1.00 (0.66 – 1.53)	1.45 (1.09 – 2.68)	1.71 (1.09 – 2.68)	0.87 (0.51 – 1.47)	1.11 (0.74 – 1.66)
Perceived change in household time spent cooking (ref. about the same)											
Decreased	2.71 (1.62 – 4.53)	1.31 (0.73 – 2.35)	1.72 (0.99 – 2.98)	3.83 (2.16 – 6.81)	1.66 (1.00 – 2.75)	1.97 (1.01 – 3.84)	2.97 (1.78 – 4.95)	1.13 (0.64 – 2.00)	4.09 (2.45 – 6.84)	3.97 (2.03 – 7.78)	1.71 (1.01 – 2.91)
Increased	1.16 (0.77 – 1.72)	2.26 (1.59 – 3.20)	1.38 (0.99 – 1.91)	1.88 (1.20 – 2.94)	1.46 (1.02 – 2.10)	1.13 (0.77 – 1.67)	1.87 (1.29 – 2.71)	2.71 (1.97 – 3.73)	1.50 (1.02 – 2.19)	1.66 (1.05 – 2.61)	2.52 (1.75 – 3.62)

^A Models adjusted for child race/ethnicity, child gender, grade, parent highest level of education, region, survey language, changes in school meal participation, and changes in household time spent cooking. All models, except for those where changes in fast food consumption was the outcome, also adjusted for changes in fast food consumption.
^B Child defined as youngest child currently living in the household at least part time that attends school from kindergarten through 12th grade.
^C Supplemental Nutrition Assistance Program – Education, a US federally funded, evidence-based program that helps people lead healthy, active lives.
^D Eligibility for SNAP-Ed was defined as a household income at or lower than 185% of the US federal poverty level.
^E AOR, adjusted odds ratio. CI, confidence interval. Significant differences shown in bold (p-value less than < 0.05).

change in number of school meals obtained per week (Table 4).

3.3. Child body weight

More than one-third of the respondents (36%) reported perceiving that their child’s body weight increased, and more than half (57%) reported that their child’s body weight stayed about the same during the pandemic (Table 2). Increases in number of school meals obtained per week was not associated with changes in child body weight (Table 5). Increases in household time spent cooking was associated with increases in child body weight (OR[95 %CI] = 1.41[1.04–1.92]). Results were mixed for the association between decreases in household time spent cooking and change in child body weight.

4. Discussion

This study examined parent-reported changes in their child’s participation in the school meal program, home cooking, dietary intake, and body weight during pandemic school closures among predominately Latino/a California households with low-income. Consistent with other studies, we found that many parents reported that their child decreased school meal participation and fast food intake, and increased overall dietary intake and body weight, and had mixed changes in diet quality (Dunn et al., 2020; Hecht et al., 2022; Mayra et al., 2022; Burkart et al., 2022). These concerning trends could have implications for long-term child health, indicating the need for programs and policies supporting healthy eating among children from households with low-income during emergencies causing prolonged school closures. We are cautious about interpreting the increases in child weight as trending toward “unhealthy,” given the limitation of parent-reported perception of change in child’s weight.

The pivot from in-person to online instruction during school closures may account for the parent-reported decreases in child school meal participation. Ours and other studies found that school meal participation decreased during the COVID-19 pandemic. One study found that school meal participation decreased by 46% and the number of school meal sites decreased by 32% in California (Plank et al., 2022). Households may have experienced barriers to accessing school meals, despite USDA waivers to improve access to school meals (Cummings et al.,

Table 4

Adjusted^A odds ratios for perceived change in child^B school meal participation by perceived change in household time spent cooking during the COVID-19 pandemic (January to March 2021) compared to before the COVID-19 pandemic (before March 2020) from SNAP-Ed^C eligible^D California households (n = 1040).

Perceived change in child school meal participation (number of meals per week) (ref. about the same) AOR (95 %CI) ^E		
	Decreased	Increased
Perceived change in household time spent cooking (ref. about the same)		
Decreased	1.90 (1.18 – 3.08)	1.44 (0.81 – 2.57)
Increased	1.43 (1.04 – 1.97)	1.93 (1.35 – 2.77)

^A Models adjusted for child race/ethnicity, gender, grade, parent highest education, region, survey language, changes in fast food consumption, and changes in household time spent cooking.
^B Child defined as youngest child currently living in the household at least part time that attends school from kindergarten through 12th grade.
^C Supplemental Nutrition Assistance Program – Education, a US federally funded, evidence-based program that helps people lead healthy, active lives.
^D Eligibility for SNAP-Ed was defined as a household income at or lower than 185% of the US federal poverty level.
^E AOR, adjusted odds ratio. CI, confidence interval. Significant differences shown in bold (p-value less than < 0.05).

Table 5

Adjusted ^A odds ratios for perceived change in child ^B body weight by perceived change in school meal participation and household time spent cooking during the COVID-19 pandemic (January to March 2021) compared to before the COVID-19 pandemic (before March 2020) from SNAP-Ed ^C eligible ^D California households (n = 1040).

Perceived change in child body weight (ref. about the same) AOR (95 %CI) ^E		
	Decreased	Increased
Perceived change in child school meal participation (number of meals per week) (ref. about the same)		
Decreased	1.20 (0.67 – 2.15)	1.05 (0.76 – 1.45)
Increased	1.65 (0.87 – 3.13)	1.33 (0.93 – 1.90)
Perceived change in household time spent cooking (ref. about the same)		
Decreased	3.08 (1.43 – 6.65)	2.10 (1.32 – 3.34)
Increased	0.96 (0.55 – 1.67)	1.41 (1.04 – 1.92)

^A Models adjusted for child race/ethnicity, gender, grade, parent highest education, region, survey language, changes in fast food consumption, changes in child school meal participation, and changes in household time spent cooking.

^B Child defined as youngest child currently living in the household at least part time that attends school from kindergarten through 12th grade.

^C Supplemental Nutrition Assistance Program – Education, a US federally funded, evidence-based program that helps people lead healthy, active lives.

^D Eligibility for SNAP-Ed was defined as a household income at or lower than 185% of the US federal poverty level.

^E AOR, adjusted odds ratio. CI, confidence interval. Significant differences shown in bold (*p*-value less than < 0.05).

2022; Food Research & Action Center, 2020; Jones et al., 2022). School meals distributed curbside, reliant on families' ability to pick up meals during limited, day-time hours, may have restricted access for working parents (Chrisman and Alnaim, 2021).

The reported decreases in school meal participation may be explained by parents increased reliance on other meal sources such as home cooking or fast food outlets. This is consistent with our finding that increases in home cooking were more prevalent than decreases. However, when adjusting for fast food intake, increased household time spent cooking was associated with both increased and decreased school meal participation, and decreased household time spent cooking was associated with decreased school meal participation, suggesting there was not a clear switch between school and home-cooked meals.

Decreases in fast food intake were more prevalent than increases, suggesting fast food intake did not increase on average. Associations between changes in school meal participation and fast food intake in this study indicate that these two behaviors tended to covary in the same direction (when adjusted for change in home cooking). Perhaps families with less time or resources to prepare meals at home relied more on meals prepared outside the home, which could include both school meals and fast food. Similarly, reduced access to meals prepared outside the home due to closures during the pandemic may have increased reliance on meals prepared at home.

Similar to other studies in the US and elsewhere (Wolfson and Bleich, 2015; Ruiz-Roso et al., 2020; Tan et al., 2022), we found increased home cooking was associated with some improvements in diet quality (increased fruit and vegetable consumption) and, conversely, decreased home cooking was associated with decreased fruits and vegetables. However, we also found that increases in home cooking, even when controlling for changes in school meal participation and fast food intake, were associated with increases in some less healthy foods (sugar-sweetened beverage, sweets, and salty snacks). Similarly, another study found cooking among SNAP participants was associated with increases in both healthy and less healthy food choices (Taillie and Poti, 2017). Interpreting associations of dietary intake and home cooking is

multifaceted: time, household composition, resources, and cooking skills all can be factors (Mills et al., 2017). Home cooking may have some positive impacts on dietary intake but additional education and support may be needed to ensure home cooking does not increase intake of some unhealthy foods or lead to excessive overall intake. Programs using an evidence-based healthy cooking model (Raber et al., 2016) to support cooking at home during school closures may be warranted, emphasizing healthy feeding practices, cooking methods, and ingredients to ensure healthful outcomes (Garcia et al., 2016; McGowan et al., 2017).

This study found that parent-reported changes in child school meal participation were not associated with any of the changes in child dietary intake except fast food nor was it associated with parent-reported change in child weight. Studies have found that children participating in school lunch during normal school operations had lower intake of low-nutrient foods and beverages due to the quality nutrition standards required of school meals (Gleason et al., 2009). To our knowledge, no published studies have examined changes in the types of foods and beverages served with school meals during the pandemic. Furthermore, there could have been changes in student intake of food and beverages not measured in this study. Supply chain issues, common during the pandemic, the need for shelf-stable grab-and-go school meals and/or the relaxation of nutrition standards may have played a role in the lack of association between change in school meal participation and improved dietary intake.

The trends observed in this study of parent-reported increases in child's overall dietary intake and child weight changes during the pandemic among children already at high risk for obesity may have placed children at higher risk for complications from COVID and long term risk of chronic disease (Anderson and Butcher, 2006; Sahoo et al., 2015; Stavridou et al., 2021). These findings, plus the mixed associations of changes in home cooking with changes in child dietary intake and weight, and the lack of association of changes in school meal participation with improvements in dietary intake, suggest the need to address dietary quality in schools, home and elsewhere, during emergency situations. Examples of actions that could be taken include school food service policies, practices, and technical support to ensure nutrition standards are met for school meals; policies that remove zoning barriers for healthy food outlets; and technical support to ensure retail outlets in low-income neighborhoods offer affordable, high quality and culturally appropriate fresh food. Given the large drops in school meal participation during the pandemic, other food service models through schools or otherwise are needed to ensure access to healthy meals for those families that need them.

5. Limitations

Several limitations are worth mentioning. Cross-sectional by design, this study did not provide the ability to draw causal inferences. Parents were invited to participate in this study if they had responded to a prior survey, and surveys were only available in English/Spanish, which may have introduced selection bias and decreased the generalizability of our findings. While the survey was administered from April to August 2021, parents were asked to recall change in child and household behaviors from before March 2020 to the January to March 2021 timeframe, which may have introduced recall errors. The parent-reported perceived changes in child food behaviors and weight may be inaccurate. Some of the parent-reported child weight gain and increase in total intake may have been appropriate and within normal growth ranges. However, rates of overweight are high among Latino/a children and children from low-income households such as those in this study. Furthermore, other factors may have contributed to increased weight such as decreased physical activity, not reported in this study. We were not able to thoroughly examine how restaurant use was affected during the pandemic. One study found a drop in restaurant use and growth in quick-service outlets during 2020 (Marchesi and McLaughlin, 2022). Survey

questions were adapted from previously used instruments, but were specific to and developed quickly during the pandemic and not pre-tested or validated, potentially resulting in measurement error. The study only measured changes in select foods and beverages, other unmeasured dietary changes may have occurred. Despite these limitations, the strength of this study is its focus on an important, hard-to-reach population—mostly Latino/a parents with low-income—who may have been disproportionately affected by the pandemic (Van Dorn et al., 2020) at a critical point in time when they were experiencing dramatic changes in food access.

6. Conclusions

While this study was not a complete examination of all the factors that could have contributed to changes in dietary behaviors during the pandemic, it was, on short notice, able to capture information regarding parent-reported changes in primary sources of meals for children and the relationship of these changes to parent-reported changes in child dietary intake and weight. Diet trends identified in this study point to the need to effectively support children from families with low-income to eat healthy during school closures. The reported increases in time spent cooking at home and decreases in school meal participation present both challenges and opportunities. Increases in home cooking and decreases in the number of school meals obtained per week were associated with some dietary improvements and results were mixed for other aspects of diet. These findings suggest that increasing accessibility to healthy school meals during emergency school closures are needed to ensure child health. Increases in home cooking and decreases in fast food consumption during school closures also suggest that policies and programs may be needed to ensure that households have the access and support they need to provide healthy meals at home for their child.

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CRedit authorship contribution statement

Suzanne Rauzon: Methodology, Investigation, Project administration, Supervision, Visualization, Writing – original draft. **Sridharshi C. Hewawitharana:** Data curation, Formal analysis, Visualization, Writing – review & editing. **Erin E. Esaryk:** Software, Data curation, Formal analysis, Writing – review & editing. **Hannah R. Thompson:** Methodology, Writing – review & editing. **Lauren Whetstone:** Writing – review & editing. **Ingrid Cordon:** Project administration, Writing – review & editing. **Gail M. Woodward-Lopez:** Conceptualization, Methodology, Supervision, Writing – review & editing, Funding acquisition.

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.

Data availability

The data that has been used is confidential.

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