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The Association of Food Insecurity on Body Mass Index Change in a Pediatric Weight Management Intervention

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Abstract

Background: Childhood obesity is a critical public health concern. One potential determinant to obesity that is less understood is food insecurity.

Objective: To examine the association of food security status on body mass index (BMI) change in a Pediatric Weight Management Intervention (PWMI) consistent with national treatment recommendations.

Methods: This analysis included 201 participants from the Healthy Weight Clinic (HWC). Using linear mixed models, we compared BMI and %BMIp95 change per year between the food insecure group and food secure group, adjusting for baseline BMI, age and sex, and SNAP enrollment.

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Conflict of Interest:
All authors declare no conflict of interest.

Results: In fully adjusted models children in households with food insecurity had a 0.50 (0.26, 0.74) kg/m^2 BMI increase per year and a 2.10 (1.02, 3.19) %BMIp$_{95}$ increase per year compared to households that were food secure.

Conclusions: When comparing the BMI effect of the HWC between the food insecure group and food secure group those experiencing food insecurity in the HWC had an increase in BMI compared to those with food security. These findings suggest that food insecurity may reduce the effectiveness of PWMIs consistent with national recommendations; however, more studies should be conducted to better understand this relationship.

Keywords

Food Insecurity; Childhood Obesity; Pediatric Weight Management Intervention; SNAP; Social Determinants of Health

Background:

Childhood obesity is one of the most critical public health concerns of the twenty-first century.[1] In 2019 obesity prevalence amongst children and adolescents ages 2–19 years, was 19.3%.[2] In just one year the obesity prevalence spiked to 22.4% in the same age group and obesity rates were further exacerbated among lower-income populations.[2] Although there are several factors contributing to the inequities in obesity rates such as income, one potential determinant that is less understood is food insecurity.[3–8]

To address childhood obesity, the U.S. Preventive Services Task Force (USPSTF) and American Academy of Pediatrics (AAP) Clinical Practice Guidelines recommend 26 hours or more of a comprehensive lifestyle intervention that includes standard behavioral therapy, dietary counseling, and physical activity.[9,10] However, no studies have examined the impact food insecurity has on body mass index (BMI) change in a Pediatric Weight Management Intervention (PWMI) consistent with USPSTF and AAP recommendations while adjusting for SNAP enrollment.[9,10]

The objective of this secondary analysis is to examine the association of food security status on BMI change in a PWMI consistent with national recommendations for childhood obesity. We hypothesized that children from food secure households would have a greater BMI reduction compared to those from food insecure households.

Methods:

Study Overview

This secondary analysis includes participants from the Clinic and Community Approaches to Healthy Weight Trial.[11,12] Participants were recruited from two Federally Qualified Healthcare Centers (FQHCs) serving predominantly lower-income Hispanic communities in Massachusetts and were individually randomized to two PWMIs: The modified Healthy Weight and Your Child program at the YMCA and the Healthy Weight Clinic (HWC) embedded within primary care.[11,12] We were not able to establish non-inferiority of the

modified Healthy Weight and Your Child Program therefore this analysis only includes data from the 201 participants enrolled in the HWC which was found to reduce mean BMI.[11,12]

The HWC provided participants with 30 contact hours over one year. The HWC consists of a multidisciplinary team within primary care consisting of a pediatrician, a community health worker, and a dietitian[10,12,13]. Participants joined monthly group visits informed by a curriculum with other families and individual appointments with the multidisciplinary team during the first six months, and monthly individual appointments only in the second six months.[12] In addition, participants received health-coaching calls from a community health worker or dietitian in between visits.[12] All study activities were approved by the Institutional Review Board at the Massachusetts Department of Public Health.

Eligibility and Recruitment

Inclusion criteria included the child was between 6.0 and 12.9 years old, had a BMI at or above the 85th percentile, and had a parent or guardian who could speak English or Spanish.[12] Children were excluded if 1) they did not have at least one parent or guardian who could follow study procedures, 2) the family planned to leave the FQHC during the study period, 3) the primary care physician deemed the intervention was inappropriate (e.g., due to emotional or cognitive difficulties that would prevent them from participating), 4) children were taking medications that significantly interfered with growth (height and weight), or 5) children who had a sibling enrolled in the study.[12]

Baseline Demographics

Baseline demographics: race/ethnicity, parental education, SNAP enrollment, household income, and parental BMI were self-reported through parent telephone surveys.[14] Baseline demographics: age, sex, overweight BMI, obesity BMI, and severe obesity BMI were obtained through electronic health data. Children's baseline BMI was classified into three categories: overweight BMI (>85th percentile to less than the 95th percentile), obesity (> or = to 95th percentile or greater), and severe obesity BMI (> or = to 120% of the 95th percentile or greater).[15] Communities 1 and 2 refer to the 2 communities in Massachusetts that were included in this study.

Primary Exposure

Food Insecurity at Baseline—Parents or guardians were asked the validated Hunger Vital Signs questions at baseline via phone survey: *"Within the past 12 months we worried whether our food would run out before we got money to buy more."* and *"Within the past 12 months the food we bought just didn't last and we didn't have money to get more.*[16]*"* A positive screen for household food insecurity was confirmed when parents indicated *sometimes true* or *often true* to either or both questions.[17]

Outcome

Change in BMI—Change in BMI and percentage of the 95th percentile (%BMIp$_{95}$) per year were the primary outcomes calculated based on the Centers for Disease Control and Prevention growth curves.[15,18] We used %BMIp$_{95}$ as this is a preferred measure for children

with severe obesity.[18] At routine visits, clinical staff took height and weight measurements in accordance with their clinical standards.

Covariates—BMI at baseline, age and sex were collected from the electronic health record data. Families were asked on the baseline survey whether they were receiving Supplemental Nutrition Assistance Program (SNAP) benefits.

Statistical Analysis

We performed descriptive analysis of the exposures, outcomes, and covariates. We conducted the $\chi 2$ test and two-sample *t* test to compare baseline demographics by food security status. We then examined the change in BMI and %BMIp$_{95}$ per year comparing the food insecure group and food secure group. To do this we used indicator variables for time and used the MIXED procedure in SAS 9.4 (SAS Institute, Inc, Cary, NC) to fit mixed linear regression models with random intercepts and slopes which accounts for clustering of observations within individuals and within sites. We ran unadjusted and adjusted models, including baseline BMI category, age and sex (for BMI models only), and SNAP enrollment as the covariates. We excluded participants who had missingness in exposure, outcome, or covariates in the multivariate models (N=10; 5.0%).

Results:

Baseline Participant Characteristics

At baseline, HWC participants had a mean (SD) age of 9.57 (1.88) years, and a mean (SD) BMI of 25.09 (5.03) kg/m^2. Most participants 186 (93%) identified as Hispanic. About half of the participants reported experiencing food insecurity 93 (46%). In bivariate analyses, those who were food secure were more likely to be enrolled in SNAP 74% vs 63% (p=0.09). (Table 1).

Multivariate Results:

In unadjusted mixed linear models comparing BMI and %BMIp$_{95}$ change per year in between food insecurity vs. food security group, participants with food insecurity had a significant increase in BMI of 0.50 (0.25, 0.74) per year and an increase in %BMIp$_{95}$ of 2.03 (0.95, 3.12) per year compared to those who were food secure. In fully adjusted models, there was an increase in BMI of 0.50 (0.26, 0.74) kg/m^2 and %BMIp95 of 2.10 (1.02, 3.19) per year for those experiencing food insecurity compared to those without food insecurity. (Supplemental Table 1).

Discussion:

In this secondary analysis of children participating in a PWMI consistent with national recommendations, we found that those with food insecurity had an increase in BMI in comparison to those with food security.

Our findings align with previous literature and support that those experiencing food insecurity may not have the resources to engage in behavior change.[19–23] A prior study examined the association between food insecurity and weight trajectory of patients enrolled

in a multidisciplinary weight management clinic and found that monthly change in %BMIp$_{95}$ was significantly smaller for food insecure children compared to their food secure peers.[24] Tester et al. 's findings reinforce the outcomes of our study regarding the association between food insecurity and less improved BMI trajectory in childhood obesity treatment. Our study adds to this previous study by examining the association of food insecurity in an intervention consistent with national guidelines for obesity treatment and examining a longer duration of BMI change. In addition, we were able to adjust for SNAP enrollment.

Strengths of this study included the examination of longitudinal data with a large sample size from an evidence based PWMI. A limitation of this study is that it may not be generalizable to all populations as participants in this study had access to FQHCs and that we did not measure child-level food insecurity using the full 18-item USDA Household Food Insecurity Screener due to participant burden. Additionally, we were unable to obtain greater details pertaining to household food insecurity.

Public Health Implications:

We acknowledge more studies with differing populations should be conducted in order to better understand this relationship. However, our findings highlight the implications food insecurity could have on the success of PWMIs. Given our findings, we suggest that PWMI providers receive training on how to address food insecurity. Additionally, collaboration among community-based hunger-relief organizations could support improved effectiveness of PWMIs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Lauren Fiechtner, Meghan Perkins, and Elsie M. Taveras designed, implemented and analyzed the outcomes of the Clinic and Community Approaches to Healthy Weight Trial. Mandy Luo analyzed the data that was collected. E. Whitney Evans, Meghan Perkins, Meg Simione, Erika R. Cheng, Mandy Luo, Rachel Burgun, Elsie M. Taveras, and Lauren Fiechtner assisted with data interpretation. Alicia Persaud drafted the first version of the manuscript. All authors were involved in the manuscript revision and had final approval of the submitted version.

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Abbreviations:

BMI	Body Mass Index
PWMI	Pediatric Weight Management Intervention

USPSTF	US Preventative Services Task Force
FQHCs	Federally Qualified Healthcare Centers
HWC	Healthy Weight Clinic
SNAP	Supplemental Nutrition Assistance Program

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TABLE 1:

Baseline Demographics Among HWC Participants Stratified by Baseline Food Security Status **(N=201)**

	Overall (N=201)	Food Insecure (N=93)	Food Secure (N=108)	p-value
Age at baseline *, mean (SD), years	9.57 (1.88)	9.41 (1.89)	9.71 (1.87)	0.27
Male sex, n (%)	112 (55.72)	52 (55.91)	60 (55.56)	0.96
Race and/or ethnicity, n (%) (n=1 missing)				
White (non-Hispanic)	5 (2.50)	3 (3.26)	2 (1.85)	0.82
Hispanic	186 (93.00)	86 (93.48)	100 (92.59)	
Black (non-Hispanic)	8 (4.00)	3 (3.26)	5 (4.63)	
Asian American	1 (0.50)	0 (0.00)	1 (0.93)	
Baseline *BMI, mean (SD)	25.09 (5.03)	24.83 (4.61)	25.31 (5.37)	0.50
Baseline *%BMIp_{95}, mean (SD)	113.67 (19.60)	113.30 (17.56)	113.99 (21.28)	0.81
Baseline * Overweight BMI	54 (26.87)	23 (24.73)	31 (28.70)	0.77
Baseline * Obesity BMI	86 (42.79)	42 (45.16)	44 (40.74)	
Baseline * Severe Obesity BMI	61 (30.35)	28 (30.11)	33 (30.56)	
Community 1, n (%)	127 (63.18)	56 (60.22)	71 (65.74)	0.42
Community 2, n (%)	74 (36.82)	37 (39.78)	37 (34.26)	
Average HWC visits attended, mean (SD)	3.08 (3.62)	2.94 (3.32)	3.20 (3.88)	0.60
Parental Education levels, n (%) (n=3 missing)				
Some high school or less	84 (42.42)	41 (45.05)	43 (40.19)	0.15
High school degree	70 (35.35)	26 (28.57)	44 (41.12)	
Some college or higher	44 (22.22)	24 (26.37)	20 (18.69)	
SNAP Enrollment, n (%)				
Yes	137 (68.16)	69 (74.19)	68 (62.96)	0.09
Household Income, n (%) (n=43 missing)				
Less than or equal to $20,000	101 (63.92)	47 (70.15)	54 (59.34)	0.16
Greater than $20,000	57 (36.08)	20 (29.85)	37 (40.66)	
Parental BMI (n=19 missing)				
BMI <30	92 (50.55)	41 (50.62)	51 (50.50)	0.99
BMI≥30	90 (49.45)	40 (49.38)	50 (49.50)	

* Baseline is defined as the visit associated with enrollment date.