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Urban Latino Families' Food Built Environment and Young Children's Produce Consumption

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Abstract

This study explored the association between objective and subjective ratings of the food environment and child produce consumption for Latino preschoolers at-risk for obesity. Parental surveys (N=115) assessed perceptions of food availability, affordability, and acceptability. Comparable factors were objectively rated by a trained observer, using the Nutrition Environment Measures Survey for Stores (NEMS-S), in commonly frequented grocery stores cited by participants. There were no significant correlations between objective and subjective measures of food availability, affordability, and acceptability. Greater household income was associated with higher participant perceptions of food acceptability ($r=.33$, $p=.003$) and affordability ($r=.22$, $p=.04$). Participant-perceived affordability of food was correlated with more frequent child fruit and vegetable consumption ($r=.21$, $p=.03$). These findings support that parental subjective ratings of the food environment affects their child's eating behaviors more than objective ratings.

Keywords

Built environment; obesity; preschool children; nutrition; food consumption

In the U.S., obesity prevalence is 30% among two to five-year old Latinos compared with 21% among non-Latino Whites.¹ Nutrition is a key determinant of children's weight and is affected by the food built environment.^{2–6} The *food built environment* is both the number and type of food outlets (e.g., grocery stores, convenience stores, restaurants) and the availability, affordability, and acceptability of foods in a community's food outlets.⁷ This study considers this second part of the food built environment, measured subjectively by parent-report and objectively by observer ratings, and its influence on Latino children's produce (i.e., fruit and vegetable) consumption.

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Whereas higher fast food prices have been linked to increased fruit and vegetable consumption, decreased body mass index (BMI), and decreased probability of overweight,⁸ an increase in fruit and vegetable prices corresponded to an increase in child BMI, particularly among low-income participants.^{8,9} Moreover, children living in high-poverty neighborhoods, which have a lower density of grocery stores, consume fewer servings of fruits and vegetables.¹⁰ This literature implies lower-income neighborhoods, characterized by a higher density of unhealthy food outlets and lower density of grocery stores, are climates in which children consume fewer servings of fruits and vegetables and have higher BMI.^{11,12}

Yet research has not considered the impact of parental perceptions of the availability, affordability, and acceptability of foods on children's nutrition, despite evidence from adult populations that such perceptions affect diet.^{6,13,14} Furthermore, there is limited literature on the associations between the food built environment and produce consumption in Latino families with young children, a population with higher rates of obesity.¹ Thus, this study sought to understand the relationships between objective and subjective (i.e., parent-perceived) availability, affordability, and acceptability of food, and child produce consumption among urban, Latino families.

Methods

Data were collected from August to November 2013, prior to randomization, in a controlled trial of a parent-child intervention designed to prevent childhood obesity, which was approved by the Institutional Review Board of Vanderbilt University Medical Center.¹⁵

Study sample

Parent-child dyads were eligible to participate if they received at least one form of government assistance, spoke English or Spanish, parent was over 18 years old, child was three to five years old and normal weight or overweight (based on body mass index percentile 50th and <95th),¹⁶ and both parent and child were healthy enough to participate in physical activity. The first 115 dyads recruited constituted the sample for this study. The principle site for the trial was local community recreation centers in Nashville, Tennessee.

Measures

Subjective measure of food environment—Because there are no psychometrically tested subjective measures of food built environment, the authors developed the Built Environment Perception for Nutrition (BEP-N) survey based on prior literature and clinical judgment.¹⁴ The interviewer-administered survey included six items answered on a four-point scale. All items were translated to Spanish by the first author and checked by a native Spanish-speaking researcher with extensive experience with the target population.

Objective measure of food environment—Participants gave the name and location of the grocery store where they most frequently shopped, and the Nutrition Environment Measures Survey for Stores (NEMS-S) was conducted by a single, trained rater in the four most frequently cited grocery stores (n=70, 61% of participants, next most commonly cited

stores were different locations of the same chain) on weekdays during normal store business hours. The NEMS-S is a validated objective audit tool used to assess availability, affordability, and acceptability of healthy food in grocery stores.¹⁷

Produce consumption: Parents were asked, “How many of the last seven days did your child consume five servings of fruits and vegetables?”

Analysis

Data analysis occurred from April to August 2014. Descriptive statistics were calculated for demographic characteristics, BEP-N, NEMS-S, and parent-reported child produce consumption. Pearson correlations and two-sided Fisher’s exact tests were conducted to detect significant bivariate associations. Stata/IC 12.1 was used to conduct analyses.¹⁸

Results

Descriptive statistics

The mean age of the children was four years, with the majority in the normal weight range and about a third who were overweight, consistent with study design eligibility criteria. Two-thirds of the sample received supplemental nutrition assistance by participating in Women, Infants and Children (WIC) or the Supplemental Nutrition Assistance Program (SNAP). The majority of participating parents (97% mothers) were from Mexico and had lived in the U.S. for a mean of 10.7 years. On average, children consumed the recommended daily servings of fruits and vegetables four days per week (see Table 1). Participants reported driving an average of 3.9 miles to their primary location for food shopping.

The most commonly cited primary grocery outlets were two large, chain stores—three Walmart locations and an Aldi, and there was little variability in the NEM-S scores for availability, affordability, and acceptability. Total scores ranged from 30–31 (scale between –8 to 50) (Table 2). Parent perceptions of the food built environment are summarized in Table 3. Due to strong within-construct correlations, the two items for affordability ($r=.76$) were added together and the two items for acceptability ($r=.43$) were added together for further analysis.

How are the objective and subjective food built environment measures associated?

The objective and subjective ratings of the food built environment were not significantly correlated. Fisher’s exact tests comparing subjective scores from participants who primarily shopped at Walmart locations versus those who shopped at Aldi were not significant (results available upon request).

Socio-demographic correlates of subjective food built environment were explored based on a-priori rationale that household income and WIC/SNAP would influence perceptions of availability and affordability, and that education and years in the U.S may influence perceptions of food acceptability (Table 4). Household income ($n=82$) was positively correlated with perceived food affordability ($r=.22$, $p=.04$) and acceptability ($r=.33$, $p=.003$). Participating in WIC or SNAP ($n=114$) was significantly associated with perceptions of

greater produce availability ($p=.001$) and disagreement with the statement that fast food is more accessible than fresh produce ($p=.03$). There were no significant associations with level of education or years in the U.S.

How are the objective and subjective food built environment independently associated with children's produce consumption?

None of the objective measures of the food built environment were significantly correlated with number of days children ate the recommended servings of produce. Participant-perceived affordability of food was correlated with more frequent child fruit and vegetable consumption ($r=.21$, $p=.03$).

Discussion

Literature reviews suggest a complex relationship between subjective and objective measures of the food built environment and child nutrition.^{19–21} Thus, the current study assessed links between objective and subjective availability, affordability, and acceptability of food and child fruit/vegetable consumption among Latino families at high risk for childhood obesity.

Despite recent attention to food deserts, this study's results align with others indicating that families in low-income communities will travel outside their neighborhoods to access supermarkets with healthy food.²² Families drove an average of 3.9 miles to their grocery store of choice, which was almost always a large, chain store with NEMS-S scores indicating acceptability, affordability and accessibility of healthy foods. Participants generally rated their food built environments positively; 81.7% and 78.3% of participants "strongly agreed" with statements about the availability and acceptability of produce.

However, only 47.4% and 38.1% of participants strongly agreed that healthy food and food in general were affordable, a perception significantly associated with household income. Moreover, perception of food affordability significantly predicted more frequent child fruit and vegetable consumption. Multiple studies have linked subjective food availability and accessibility but not perceived affordability to healthy food intake;^{14,23,24} however, these studies did not examine Latino families with young children.^{13,25}

Cash transfer programs (conditional and unconditional) have been shown to improve child nutritional status in a variety of contexts, although with variable significance.^{26,27,28} Despite this variability, the fact that higher-income participants within this relatively low-income population reported more child fruit and vegetable intake suggests that cash transfers may be a promising option.

Limitations

No assessment was conducted on the frequency with which participants shopped at the stores they identified. The questions on subjective perception were newly developed, and the number of items on this instrument is intended as a brief screen rather than a comprehensive survey; further psychometric testing is needed.

Conclusions

In this sample of urban, Latino families with young children, perceived rather than objective food affordability was significantly associated with parent-reported child fruit and vegetable consumption. Strategies to overcome parents' perceived financial barriers to produce consumption could enhance obesity prevention efforts in this high-risk population.

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References

1. Ogden CL, Carroll MD, Kit BK, et al. Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA*. 2014; 311(8):806–814. [PubMed: 24570244]
2. Witkos M, Uttaburanont M, Lang CD, et al. Costs of and reasons for obesity. *J Cardiometab Syndr*. 2008; 3(3):173–176. [PubMed: 18983335]
3. Brantley PJ, Myers VH, Roy HJ. Environmental and lifestyle influences on obesity. *J La State Med Soc*. 2005 Jan; 157(1):S19–27. [PubMed: 15751906]
4. Zizza C, Siega-Riz AM, Popkin BM. Significant Increase in Young Adults' Snacking between 1977–1978 and 1994–1996 Represents a Cause for Concern. *Prev Med*. 2001; 32(4):303–310. [PubMed: 11304090]
5. Michimi A, Wimberly MC. Associations of supermarket accessibility with obesity and fruit and vegetable consumption in the conterminous United States. *Int J Health Geogr*. 2010; 9:49. [PubMed: 20932312]
6. Zenk SN, Lachance LL, Schulz AJ, et al. Neighborhood retail food environment and fruit and vegetable intake in a multiethnic urban population. *Am J Health Promot*. 2009 Mar-Apr; 23(4):255–264. [PubMed: 19288847]
7. Glanz K, Sallis JF, Saelens BE, et al. Healthy nutrition environments: concepts and measures. *Am J Health Promot*. 2005 May-Jun; 19(5):330–333. [PubMed: 15895534]
8. Powell LM, Bao Y. Food prices, access to food outlets and child weight. *Econ Hum Biol*. 2009 Mar; 7(1):64–72. [PubMed: 19231301]
9. Sturm R, Datar A. Body mass index in elementary school children, metropolitan area food prices and food outlet density. *Public Health*. 2005 Dec; 119(12):1059–1068. [PubMed: 16140349]
10. Mushi-Brunt C, Haire-Joshu D, Elliott M, et al. Fruit and Vegetable Intake and Obesity in Preadolescent Children: The Role of Neighborhood Poverty and Grocery Store Access. *American Journal of Health Education*. 2007; 38(5):258–265.
11. Morland K, Wing S, Diez Roux A. The Contextual Effect of the Local Food Environment on Residents' Diets: The Atherosclerosis Risk in Community Study. *Am J Public Health*. 2002 Nov; 92(11):1761–1768. [PubMed: 12406805]
12. Van Hulst A, Gauvin L, Kestens Y, et al. Neighborhood built and social environment characteristics: a multilevel analysis of associations with obesity among children and their parents. *Int J Obes*. 2013 Oct; 37(10):1328–35.
13. Moore LV, Diez Roux AV, Nettleton JA, et al. Associations of the local food environment with diet quality—a comparison of assessments based on surveys and geographic information systems: the multi-ethnic study of atherosclerosis. *Am J Epidemiol*. 2008; 167(8):917–924. [PubMed: 18304960]

14. Caspi CE, Sorensen G, Subramanian SV, et al. The local food environment and diet: a systematic review. *Health Place*. 2012 Sep; 18(5):1172–1187. [PubMed: 22717379]
15. Po'e EK, Heerman WJ, Mistry RS, et al. Growing Right Onto Wellness (GROW): a family-centered, community-based obesity prevention randomized controlled trial for preschool child-parent pairs. *Contemp Clin Trials*. 2013 Nov; 36(2):436–449. [PubMed: 24012890]
16. Centers for Disease Control and Prevention. BMI - Body Mass Index: About BMI for Children and Teens. Atlanta, GA: Centers for Disease Control and Prevention; 2014. Available at: http://www.cdc.gov/nccdphp/dnpa/bmi/childrens_BMI/about_childrens_BMI.htm
17. Glanz K, Sallis JF, Saelens BE, et al. Nutrition Environment Measures Survey in stores (NEMS-S): development and evaluation. *Am J Prev Med*. 2007 Apr; 32(4):282–289. [PubMed: 17383559]
18. StataCorp. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP; 2011.
19. Carter MA, Dubois L. Neighbourhoods and child adiposity: a critical appraisal of the literature. *Health Place*. 2010 May; 16(3):616–628. [PubMed: 20106712]
20. Dunton GF, Kaplan J, Wolch J, et al. Physical environmental correlates of childhood obesity: a systematic review. *Obes Rev*. 2009 Jul; 10(4):393–402. [PubMed: 19389058]
21. Feng J, Glass TA, Curriero FC, et al. The built environment and obesity: a systematic review of the epidemiologic evidence. *Health Place*. 2010 Mar; 16(2):175–190. [PubMed: 19880341]
22. Walker RE, Keane CR, Burke JG. Disparities and access to healthy food in the United States: A review of food deserts literature. *Health Place*. 2010 Sep; 16(5):876–884. [PubMed: 20462784]
23. Flint E, Cummins S, Matthews S. Do perceptions of the neighbourhood food environment predict fruit and vegetable intake in low-income neighbourhoods? *Health Place*. 2013 Nov; 24:11–15. [PubMed: 23999578]
24. Giskes K, Van Lenthe FJ, Brug J, et al. Socioeconomic inequalities in food purchasing: the contribution of respondent-perceived and actual (objectively measured) price and availability of foods. *Prev Med*. 2007 Jul; 45(1):41–48. [PubMed: 17532036]
25. Inglis V, Ball K, Crawford D. Socioeconomic variations in women's diets: what is the role of perceptions of the local food environment? *J Epidemiol Community Health*. 2008 Mar; 62(3):191–197. [PubMed: 18272732]
26. Agüero, JM., Carter, MR., Woolard, I. Southern Africa Labour and Development Research Unit Working Paper Number 06/08. Cape Town: SALDRU, University of Cape Town; 2006. The Impact of Unconditional Cash Transfers on Nutrition: The South African Child Support Grant.
27. Ruel MT, Alderman H. the Maternal and Child Nutrition Study Group. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *The Lancet*. 2013 Aug; 382(9891):536–551.
28. Ranganathan M, Largarde M. Promoting healthy behaviours and improving health outcomes in low and middle income countries: A review of the impact of conditional cash transfer programmes. *Preventive Medicine*. 2005 Nov; 55(S1):S95–105.

Table 1

Descriptive Statistics (n = 115)

Child	
BMI (mean percentile, SD)	77.4 (12.9)
Normal weight (% , n)	63.5 (73)
Overweight (% , n)	36.5 (42)
Race/Ethnicity: Hispanic/Latino (% , n)	99.1 (114)
Fruit/vegetable consumption > 5 servings/day (mean no. days/week, SD)	4.1 (2.7)
No. meals eaten outside the home/week (mean, SD)	0.6 (1.1)
Breakfast	0.4 (1.0)
Lunch	0.6 (1.1)
Dinner	0.5 (0.9)
Snacks and drinks	0.7 (1.3)
Adult	
Race/Ethnicity: Hispanic/Latino (% , n)	99.1 (114)
Country of origin	
Mexico (% , n)	73.0 (84)
Honduras (% , n)	6.1 (7)
Guatemala (% , n)	6.1 (7)
El Salvador (% , n)	5.2 (6)
Other (% , n)	9.6 (11)
Years living in U.S.A. (mean, SD)	10.7 (4.8)
Education	
Less than High School	69.6 (80)
HS or more	30.4 (35)
Employment (% , n)	42.6 (49)
Work part-time	22.6 (26)
Work full-time	20.0 (23)
Participate in WIC or SNAP (% , n)	67.8 (78)
Distance (miles) to primary food store (mean, SD)	3.9 (3.2)

BMI, Body Mass Index; HS, High School; SNAP, Supplemental Nutrition Assistance Program; U.S.A., United States of America; WIC, Women Infants and Children.

Table 2

Objective measures of common grocery stores, NEMS-S (n=70)

	Store ID*			
	1	2	3	4
Participants identifying this as primary store (%)	39 (34)	12 (10)	10 (9)	9 (8)
Availability score (0–27)	27	22	27	27
Price (i.e., Affordability) score (–8–17)	–3	3	–3	–3
Quality (i.e., Acceptability) score (0–6)	6	6	6	6
Total score (50)	30	31	30	30

* Stores are listed in descending order of popularity.

Table 3

Subjective measure of food built environment, BEP-N (n = 115)

Domain	Mean (SD)	Disagree a lot (1)	Disagree a little (2)	Agree a little (3)	Agree a lot (4)
Availability					
"I can easily find fresh fruits and vegetables in my community."	3.8 (0.5)	0.9%	2.6%	14.8%	81.7%
"It is easier to find fast food restaurants in my community than to buy fresh fruits and vegetables."	3.0 (1.2)	15.8%	20.2%	16.7%	47.4%
Affordability					
"I can buy as much food as my family needs with the money I have."	3.0 (1.0)	8.9%	17.7%	35.4%	38.1%
"I can buy as many fresh fruits and vegetables as my family needs with the money I have."	3.2 (0.9)	5.3%	19.3%	28.1%	47.4%
Acceptability					
"The fresh fruits and vegetables in my community look and taste good."	3.7 (0.7)	2.6%	2.6%	16.5%	78.3%
"I think the food I can get in my community is good enough for my family."	3.7 (0.6)	0.9%	4.4%	18.3%	76.5%

Associations with Subjective Food Built Environment and Child Produce Consumption

Table 4

	Subjective Ratings				Child Produce Consumption
	Availability of Fruits/Vegetables	Convenience of Fast Food	Affordability	Acceptability	
NEMS Availability ¹	.02	.01			-.06
NEMS Affordability ¹			-.07		.06
Household income level ¹ (n=82)	.15	-.02	.22 *	.33 ***	-.23 *
Supplemental Nutrition Assistance ²	0.001	0.03	0.33	0.49	0.18
Education > high school ²	0.07	0.12	0.07	0.07	0.89
Years in U.S. ¹	-0.03	0.13	0.17	0.01	-0.06
Child Produce Consumption ¹	-.02	-.08	.21 *	.02	

¹ Pearson correlation (*r*)² Fisher's exact test *p* values* *p*<.05** *p*<.01