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Journal of Immigrant and Minority Health

ISSN 1557-1912

J Immigrant Minority Health
DOI 10.1007/s10903-016-0344-z

Springer

J Immigrant Minority Health
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ORIGINAL PAPER

Food Hardship and Obesity in a Sample of Low-Income Immigrants

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Abstract Very little work has examined the relationship between food hardship (having inconsistent financial resources to buy food) and obesity among immigrant groups. A cross-sectional study was conducted in a low-income, multi-racial/ethnic adult sample in greater Boston, MA (n = 828). Modified Poisson regression models estimated the association between food hardship obesity (BMI ≥ 30) among adults reporting food hardship; interactions were tested by place of birth. Body mass index (BMI) was based on anthropometric height and weight. In adjusted models, those experiencing food hardship were more likely to be obese (RR 1.17, CI 1.07, 1.29) than those not experiencing food hardship. Participants from Haiti reporting food hardship were more likely to be obese than those not reporting hardship (RR 1.58, CI 1.23, 2.04); this was not the case among other groups (US born, Puerto Rican, Latin American, Other). The relationship between food hardship and weight may vary among immigrant subgroups.

Keywords Immigrant · Obesity · Hardship · Food insecurity

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Introduction

Food insecurity disproportionately affects low-income, minority, and immigrant families [1–4]. In 2013, 14.3 % of US households experienced food insecurity due to insufficient financial resources for food for their household [5]. A number of studies have linked food insecurity with low nutrient intake and poorer diet [1, 3, 6, 7]. Recent literature supports the notion that food insecurity is a risk factor for obesity among adults [3, 8, 9], although results have not always been consistent [10–12].

The association between food insecurity and obesity has, however, varied substantially between subpopulations. For example, a number of studies have found that food insecurity is associated with obesity among women, but not men [8, 13–15]. Evidence also suggests that the relationship between food insecurity and body mass index (BMI) is stronger within certain racial/ethnic subgroups [14], such as Hispanics [16–18]. One subgroup of interest is low-income immigrants, who are at an elevated risk for both food insecurity [3, 4], and obesity [19]. Dietary acculturation (changes in diet practices occurring among immigrant groups after moving to the US) tend to result in less healthful dietary choices due to an array of barriers to maintaining healthy eating habits [20]. Yet, very little research has examined the link between food insecurity and obesity among immigrant subgroups.

Published online: 12 February 2016

Food insecurity is a multidimensional construct, encompassing the physical and economic access to sufficient, safe, and nutritious foods over time [21]. In the US, food insecurity is often measured by an 18-item USDA measure [5]. While this measure is comprehensive and appropriate for surveillance, it has high participant burden, particularly for large community surveys [22]. As an alternative, other metrics have focused on single dimensions of poor food access—for example, psychological concerns about food access [9, 12], food insufficiency [6, 23] or food hardship, which occurs when households have inconsistent financial resources to buy food [24, 25].

The current study relied on a multiracial/ethnic community-based survey of adults living in low-income housing, the majority of whom were born outside the U.S., to examine the relationship between food hardship and obesity risk. The aim was to determine how the relationship between food hardship and obesity might differ across immigrant subgroups.

Methods

Study Design

Data were obtained as part of the Health in Common (HIC) study, a cross-sectional study investigating the social determinants of cancer risk in low-income housing residents. Data were collected from 828 residents in 20 low-income housing sites in Cambridge, Chelsea, and Somerville, MA. A multistage cluster design was used to sample households from housing sites and select adults within households [26]. In the smaller housing sites, a census method was used to recruit one participant per household. In the larger housing sites, a random selection of households formed the sampling frame. The response rate averaged 49 % across the sites.

All procedures involving human subjects were approved by the Institutional Review Board at *the Harvard T.H. Chan School of Public Health*. Verbal informed consent was obtained from all participants and formally recorded.

Survey Data

Resident surveys were conducted in three languages (English, Spanish, and Haitian-Creole) by trained survey assistants administering interviews in residents' homes between February 2007 and June 2009. The survey assessed an array of social and environmental factors in the home and the housing site, as well as demographic factors.

Anthropometric Data

At the time of the survey, participant height and weight were collected using standard methods (WHO 1995 Physical Status). Height without shoes was measured using a Shorr stadiometer (Shorr Productions, Olney, MD) or a wooden fold-out measurement ruler that had been calibrated to the stadiometer. Weight was assessed in light clothes using a portable electronic scale (Seca Model 770), calibrated at regular intervals with standard weights. Self-reported values of height (18 %) and weight (13 %) were used in cases where survey assistants were either unable to obtain measured weight or the participants refused the measurements.

Outcome Variable

BMI was calculated as kg/m^2. Obesity (BMI $\geq$ 30.0) was the outcome of interest rather than overweight, as 78 % of the sample had a BMI $\geq$ 25.0 [27] and obesity is a higher-risk outcome [28, 29].

Primary Explanatory Variable

Food hardship was measured with a single item: "In the past 12 months, was there ever a time when there wasn't enough money for food?" The response option was yes/no. This item is similar to other single and 2-item screener questions validated in diverse and low-income samples (e.g., "Within the past 12 months we worried whether our food would run out before we got money to buy more") which have demonstrated high sensitivity and specificity when compared with the 18-item USDA measure [22, 30].

Place of Birth (nativity)

Participants were asked their place of birth, and results were collapsed into the most common categories: US, Haiti, Puerto Rico, Latin America, or Other (most commonly from Ethiopia and Somalia or other African countries). Although those born in Puerto Rico are US citizens by birth, we followed the convention of examining them separately [31], as island-born Puerto Ricans may have experiences of language, migration and cultural identity that differ from mainland-born groups and that are relevant to health [32].

Socio-Demographic and Other Participant Characteristics

Age, race/ethnicity, gender, marital status, education, survey language, years living at the housing site, number of adults in the household working for pay, self-reported health, poverty status, and acculturation status were

obtained from the resident survey. Poverty was determined using Census Bureau 2008 poverty thresholds [33], which vary depending on the number of total individuals in the household and the number of children younger than 18 in the household. Residents were defined as being in poverty if their household income fell below the threshold based on their specific household size and number of children younger than 18 years. Acculturation categories have been described elsewhere [34] and included: (1) "very low" (non-US-born, non-English speakers who had no US schooling); (2) "low" (non-US-born, bilingual individuals who spent none/some of their schooling in the US); and (3) "moderate/high" (those born in the US, as well as non-US-born, English-only speakers who spent some/all of their school years in the US).

Statistical Analyses

Univariate and bivariable analyses evaluated the frequency of obesity by socio-demographic and a range of other participant characteristics. Multivariable regression models were run using the GENMOD procedure in SAS 9.3 with a Poisson distribution and log link function to determine the relative risk of obesity [35] with housing site controlled for as a random effect. Model building consisted of first investigating the association between BMI and food hardship (Model 1), then including nativity and other resident characteristics as covariates (Model 2). We relied on a previously developed conceptual model to determine relevant resident characteristics to include in Model 2 (age, race/ethnicity, gender, acculturation, marital status, education, and poverty). In Model 3, an interaction term (nativity*food hardship) was included in order to test whether the relationship between food hardship and obesity differed across immigrant subgroups; a statistically significant overall interaction would indicate that it would be appropriate to calculate a risk ratio and confidence interval estimating the risk of obesity by food hardship status for each group (US, Haiti, Puerto Rico, Latin America, and Other). Race/ethnicity was excluded from Model 3 because of difficulties with model convergence due to the collinearity between racial/ethnicity and nativity.

Results

In the study sample, 22 % of participants had a BMI < 25.0, 36 % had a BMI between 25.0 and 29.9, and 42 % had a BMI ≥ 30.0. Other participant characteristics and bivariate analyses are presented in Table 1. Over one-third (37 %) reported food hardship. Those reporting food hardship were more likely to be obese than those not reporting food hardship (47 vs. 39 %, $p = 0.04$). More than two-thirds of the sample (69 %) was born outside of the US. Nativity was statistically significantly associated with obesity ($p < 0.001$), and obesity was higher among more acculturated individuals ($p < 0.01$). Women were more likely to be obese than men (46 vs. 26 %, $p < 0.001$), as were residents who had lived in their housing development longer ($p < 0.01$), and individuals reporting fair/poor self-rated health compared with good/very good/excellent health (53 vs. 36 %, $p < 0.001$).

Results of the multivariable analysis are shown in Table 2. Overall, respondents reporting food hardship were 20 % more likely to be obese than respondents not reporting food hardship (RR 1.20, 95 % CI 1.08, 1.33). When other participant characteristics were included in the model (nativity, age, race/ethnicity, gender, marital status, education, poverty, and acculturation), the association was slightly attenuated, but still statistically significant (RR 1.17, 95 % CI 1.07, 1.29). Nativity was statistically significantly associated with obesity in this model ($p = 0.04$).

The interaction between food hardship and nativity was statistically significant ($p = 0.04$), indicating potential differences in the relationships between food hardship and obesity among immigrant subgroups. Table 3 presents the risk of obesity in the presence of food hardship by place of birth. Participants from Haiti reporting food hardship were more likely to be obese compared to those not reporting food hardship (RR 1.58, 95 % CI 1.23–2.04). Among other groups (US born, Puerto Rican, Latin American, Other), there was no statistically significant association between food hardship and obesity.

Discussion

This study found an association between food hardship and increased risk of obesity within a multiracial/ethnic sample of low-income housing residents. Results are consistent with other studies that have found a positive association between food insecurity and weight outcomes in adults [1, 3, 7, 9]. There are a number of plausible mechanisms for this relationship among low-income adults. For example, participation in the Supplemental Nutrition Assistance Program (SNAP) has been associated with poorer weight outcomes [36]. Some have argued that the once–a-month payment of benefits may contribute to a "feast or famine" experience of some families [8, 14, 37, 38], in which periods of limited food intake resulting from food scarcity may encourage an individual to engage in compensatory overeating later, which may contribute to weight gain over the long-term [18].

Previous research has demonstrated that, while immigrants generally arrive in the US in better health than their U.S.-born counterparts, immigrant obesity rates converge

Table 1 Participant characteristics and bivariate results by body mass index (BMI)

	Total frequency in each category n (%)	Frequency in each category with BMI ≥ 30 n (%)	Chi Square *p* value[a]
Food hardship			
No	495 (63 %)	194 (39 %)	0.04
Yes	296 (37 %)	138 (47 %)	
Nativity			
USA	251 (31 %)	118 (47 %)	<0.001
Haiti	185 (23 %)	79 (43 %)	
Puerto Rico	93 (12 %)	50 (54 %)	
Latin America	170 (21 %)	64 (38 %)	
Other	98 (12 %)	23 (23 %)	
Age			
18–29	147 (18 %)	53 (36 %)	0.12
30–39	208 (26 %)	83 (40 %)	
40–49	166 (21 %)	74 (45 %)	
50–59	139 (17 %)	70 (50 %)	
60+	137 (17 %)	54 (39 %)	
Gender			
Male	164 (20 %)	42 (26 %)	<0.001
Female	636 (80 %)	293 (46 %)	
Race/ethnicity			
Hispanic	332 (42 %)	140 (42 %)	0.25
Non-Hispanic white	88 (11 %)	44 (50 %)	
Non-Hispanic black	303 (38 %)	126 (42 %)	
Other	73 (9 %)	25 (34 %)	
Income below poverty line			
No	316 (42 %)	130 (41 %)	0.44
Yes	430 (58 %)	189 (44 %)	
Survey language			
English	432 (54 %)	176 (41 %)	0.56
Spanish	217 (27 %)	90 (41 %)	
Creole	151 (19 %)	69 (46 %)	
Acculturation status			
Very low	253 (32 %)	88 (35 %)	0.01
Low	257 (32 %)	110 (43 %)	
Moderate/high	286 (36 %)	135 (47 %)	
Education completed			
Grade school	148 (21 %)	62 (42 %)	0.08
Some high school	118 (17 %)	58 (49 %)	
High school	197 (28 %)	87 (44 %)	
More than high school	249 (35 %)	89 (36 %)	
Years living at housing site			
0–5 years	368 (48 %)	142 (39 %)	0.01
5–10 years	179 (23 %)	69 (39 %)	
More than 10 years	218 (29 %)	110 (50 %)	
Adults working for pay			
0	279 (35 %)	125 (45 %)	0.21
1	359 (46 %)	152 (42 %)	
2+	150 (19 %)	54 (36 %)	

Table 1 continued

	Total frequency in each category n (%)	Frequency in each category with BMI ≥ 30 n (%)	Chi Square *p* value[a]
Currently married			
Yes	267 (33 %)	103 (39 %)	0.18
No	531 (67 %)	231 (44 %)	
Self-reported health			
Fair–poor	276 (35 %)	146 (53 %)	<0.001
Good–very good–excellent	524 (66 %)	189 (36 %)	

[a] Chi square *p* value testing for significant differences in the frequency of obesity between categories

with US-born individuals 10–15 years after arrival [39], likely due to behavioral changes associated with the acculturative process [20, 40]. Among many immigrant groups, behavioral adaptations experienced shortly after immigrating may shape long-term dietary habits, increasing the risk for obesity [20, 41, 42]. Preserving a traditional diet may hold nutritional advantages over transitioning to a Western diet [42], but financial constraints may pose challenges to maintaining a traditional diet. Immigrant and refugee families may find culturally-specific foods to be too expensive [43–46], or, when forced to make choices, they may prioritize less healthy foods that were in scarce supply in their home countries (e.g., choosing meat over fruits and vegetables) [3]. Qualitative studies have noted other challenges in selecting healthy foods after immigration, such as language barriers, poor quality food, unfamiliar food, or increased exposure to convenience foods [44, 46–48]. In another study of low-income New Yorkers that found no association between food hardship and obesity among foreign-born residents, the authors hypothesize that access to affordable ethnic foods in the New York metropolis could avert food insecurity and "slow the acculturation process" in this unique context [9].

In the current study, Haitian immigrants reporting food hardship were more likely to be obese than those not reporting hardship, but this was not the case among other groups in our study. The diversity in the acculturative process makes it likely that the association between acculturation, low-income status, food hardship and weight outcomes varies among immigrant subgroups. Post-hoc analyses sought to characterize how Haitians may have differed from other groups in the sample; findings indicated that Haitians were more likely to have lived in low-income housing for >5 years, yet they remained the least acculturated group despite their longer tenure. While it is unclear why the observed relationship between food hardship and obesity was only present among Haitians, it is possible that the low-income housing context may have contributed to the increased risk for obesity. Indeed, the low-income housing setting can expose residents to an array of environmental risk factors that influence obesity-related behaviors, including poor access to healthy food and safety concerns [49, 50]. Including a housing tenure variable in multivariable models did not, however, substantially alter results (data not shown). Beyond these considerations, previous research supports the notion that excessive work demands and less time for food preparation may be relevant to the Haitian immigrant experience (though not unique to the Haitian experience) and may contribute to obesity-related dietary behaviors [36]. However, these factors were not measured in the current study, and further research is necessary to test specific environmental, psychosocial, or behavioral mechanisms for this relationship among Haitians. It must be noted that the data used in these analyses were collected prior to the 2010 Haitian earthquake. Therefore, the psychosocial consequences of the earthquake [51] are not manifested in these results, nor does the sample include those who arrived in the US following the earthquake.

The results of this study should be considered within its limitations. The temporal association between food hardship and obesity could not be determined in this cross-sectional study. Repeated periods of food hardship were not measured. Furthermore, although the results may be related to the time since immigration or immigration status, we were not able to explore these factors in the analysis. Our question assessing food hardship is considerably less nuanced than the 18-question USDA Household Food Security Survey. Although our measure addresses the financial constraints related to food purchasing, it does not capture food quality, psychological concerns about lack of food, or the intensity of food hardship. Additionally, self-reported height and weight values were used for some participants, which tend to slightly underestimate BMI [52]. However, this measurement error would only be relevant in cases where BMI was misclassified as normal/overweight instead of obese and vice versa. Another limitation is that we did not account for SNAP participation. SNAP eligibility and participation may have varied across our sample of immigrants based on citizenship status, household characteristics, and duration of residence in the US. Since SNAP participation has been associated with

Table 2 Modeling risk ratios and 95 % confidence intervals for obesity[a]

	Model 1: food hardship		Model 2: food hardship + participant characteristics		Model 3: food hardship + participant characteristics + food hardship*nativity	
	RR (95 % CI)	*p* value	RR (95 % CI)	*p* value	RR (95 % CI)	*p* value
Food hardship						
Yes	1.20 (1.08–1.33)	0.01	1.17 (1.07–1.29)	0.02	1.15 (0.91–1.45)	0.28
No (ref.)	1.00		1.00		1.00	
Nativity						
Haiti			1.05 (0.60–1.84)	0.04	1.29 (0.78–2.12)	0.03
Puerto Rico			1.51 (0.93–2.46)		1.30 (0.84–2.04)	
Latin America			1.01 (0.62–1.65)		0.89 (0.59–1.36)	
Other			0.50 (0.24–1.05)		0.56 (0.29–1.06)	
US (ref.)			1.00		1.00	
Age						
18–29			1.03 (0.75–1.41)	0.20	0.99 (0.71–1.39)	0.12
30–39			1.17 (0.82–1.66)		1.14 (0.82–1.60)	
40–49			1.23 (0.89–1.71)		1.21 (0.86–1.71)	
50–59			1.27 (0.96–1.70)		1.34 (1.00–1.79)	
60+ (ref.)			1.00		1.00	
Race/ethnicity						
Hispanic			0.77 (0.54–1.11)	0.37	*removed*	
Non–Hispanic black			1.08 (0.79–1.48)			
Other			0.90 (0.61–1.33)			
Non–Hispanic white (ref.)			1.00			
Gender						
Male			0.69 (0.55–0.86)	0.01	0.67 (0.52–0.87)	0.01
Female (ref.)			1.00		1.00	
Acculturation status						
Very low			0.92 (0.57–1.48)	0.88	0.84 (0.56–1.26)	0.70
Low			0.90 (0.55–1.47)		0.84 (0.54–1.29)	
Moderate/high (ref.)			1.00		1.00	
Currently married						
Yes			1.01 (0.82–1.25)	0.95	1.00 (0.82–1.22)	0.98
No (ref.)			1.00		1.00	
Education completed						
Grade school			1.15 (0.86–1.55)	0.65	1.14 (0.85–1.52)	0.63
Some high school			1.21 (0.92–1.60)		1.19 (0.87–1.61)	
High school			1.17 (0.94–1.47)		1.19 (0.94–1.51)	
More than high school			1.00		1.00	
Income below the poverty line						
Yes			1.03 (0.84–1.27)	0.78	1.05 (0.86–1.28)	0.68
No (ref)			1.00		1.00	
Food hardship*nativity						0.04

[a] Log-binomial regressions where the risk of being obese is predicted with site controlled for as a random effect

obesity [36], it could be that SNAP participation accounts to some extent for the observed results. Finally, our models focus on the role of food hardship in obesity, but do not include other known risk factors for obesity, including physical activity.

Despite these limitations, our study has a number of strengths. Our measure of height and weight used anthropometric rather than self-reported measures, reducing the potential for bias [48]. In addition, our study included a multi-racial/ethnic low-income housing sample, which

Table 3 Risk of obesity for those reporting food hardship versus those not reporting food insecurity, by place of birth

	RR	95 % CI	*p* value
US (hardship vs. no hardship)	1.22	(0.96–1.56)	0.11
Haiti (hardship vs. no hardship)	1.58	(1.23–2.04)	<0.001
Puerto Rico (hardship vs. no hardship)	0.91	(0.63–1.32)	0.62
Latin America (hardship vs. no hardship)	1.02	(0.67–1.54)	0.93
Other (hardship vs. no hardship)	1.13	(0.42–3.06)	0.78

Log-binomial regressions controlling for age, gender, marital status, acculturation, education, and poverty

allowed for an investigation of the association between BMI and food hardship across multiple social groups.

Conclusions

The results of this study add to the limited body of research investigating the effect of constrained food access among immigrant subgroups. Results suggest that the relationship between food hardship and weight may vary among immigrant subgroups. Such differences may partially explain previous inconsistent findings in cross-sectional and longitudinal studies of food hardship and obesity [3, 8–12]. These findings call for additional studies investigating the determinants and coping strategies related to food hardship across different cultural communities. In future work, it will also be important to consider the ways in which food insecurity might have a cumulative or interactive effect with other environmental, psychosocial, and socio-demographic factors that might put some groups at an elevated risk of poor obesity-related behaviors or outcomes.

Acknowledgments The authors would like to thank the research participants and the Cambridge, Somerville and Chelsea Public Housing Authorities. The authors also thank Marty Alvarez-Reeves, Ruth Lederman, Samuel Lipson, Carol Lowenstein, Brianna Wadler, May Yang and Lorraine Wallace for their contributions to the study design and implementation. This research was supported by the National Cancer Institutes, grant numbers R01 CA111310-01A (GS), R25 CA057713 (CEC), R25 CA163184 (CEC), K01 CA169041 (RTS), K05 CA108663 (GS), and by the Robert Wood Johnson Foundation Health & Society Scholars program (CAR). The National Cancer Institute and the Robert Wood Johnson Foundation had no role in the design, analysis or writing of this article.

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