

Determinants of food security and diet among rural and urban Latino/Hispanic.

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Abstract:

Rural migration and food insecurity of Latino immigrants is high. The goal of this study was to examine food insecurity among Latino immigrants in a rural region (N = 119) in comparison to urban Latinos (N = 166). The objectives were to examine, identify, and compare determinants of food security, weight status, and diet between urban and rural Latinos. Household surveys were conducted by 2 trained bilingual/bicultural interviewers. Data on food security, body mass index, self-reported weight change since US arrival, diet, and barriers to healthy eating were collected. Rural Latinos were more likely to be overweight and have low food security than urban Latinos. Difficulty eating healthy and increased time in the United States were the primary determinants of low food security and poor diet among rural Latinos. Rurality and food insecurity pose a barrier for Latino immigrants and must be addressed further.

Keywords: rural migration | latino immigrants | food insecurity | nutrition | environmental nutrition

Article:

INTRODUCTION

Food insecurity is the uncertain or limited availability of adequate supplies of nutritious and safe food. High rates of food insecurity are of concern because food insecurity has been associated with many negative diet and health consequences. Households with children, that are large, low income, headed by a low-educated adult, and do not receive food stamps are more likely to be food insecure.^{1–4} Household food insecurity is associated with poor dietary intakes among children, women and elderly, as well as adult and child obesity.^{5–7} Obesity is more prevalent among food insecure households and increases as food insecurity becomes more severe.³ Food insecure households report low energy intakes; low fruit, vegetable, milk, and dairy product

intakes; and poor health status.^{8,9} In 2005, the prevalence of food security and food insecurity in the United States was 89 and 11%, respectively.¹⁰

Many of the household characteristics associated with food insecurity can be found in newly arrived Latino/Hispanics. It is also well documented that ethnicity, specifically Latino ethnicity, is significantly associated with food insecurity.^{1–3} In 2005, 17.9% of Latino/Hispanic households in the United States were food insecure compared to the national average of 11.0%.¹⁰ Many recently arrived Latino/Hispanic immigrant households have limited incomes and financial resources and lack access to community food assistance. Many also are minimally proficient in English, which limits their ability to ask for and receive assistance, and misunderstanding of printed and verbal information likely affects how and where they shop or obtain food and the prices they pay for that food. As a result of these limited resources, many of these households are at high risk of being food insecure.

The Latino/Hispanic population is particularly vulnerable to diet-related health problems. Studies show that they have disproportionately higher rates of obesity and diet-related chronic diseases compared to Caucasians and African Americans. The incidence of obesity in the United States among Mexican Americans is 74.7% compared to non-Hispanic whites (67.4%).¹¹ Being overweight or obese is associated with most chronic diseases such as diabetes, cardiovascular disease, hypertension, coronary heart disease, and cancer.^{12–14} It is not surprising then that they are at greater risk of dying from certain cancers and heart disease than non-Hispanic whites.^{6,15}

Health risks of Latino/Hispanic immigrants frequently are compounded by low resource socioeconomic conditions. They frequently accept low-paying jobs with no health insurance, cannot afford health insurance or regular health checkups, and do not qualify for Medicaid benefits or other assistance programs due to financial or legal restrictions (such as immigration laws). An additional condition affecting Latino/Hispanic immigrant health is that the longer they stay in the United States, the more likely they are to consume poor diets, gain weight, and live in food insecure households.¹⁶

RURAL VS URBAN RESIDENCY

Rural versus urban residency may also increase the problem of food insecurity as a consequence of the availability of support systems and density of population groups. Approximately 20% of the general population resides in rural areas.¹⁷ Rural areas tend to have fewer community resources and a less developed and resourced human services infrastructure to provide for residents' basic health and food assistance. This disparity seems to be in evidence due to the fact that food insecurity rates of rural households are double the nationwide rates.¹⁸ Households located in the South and in rural regions have a higher incidence of food insecurity than metropolitan households (12.0% and 12.2% vs 8.7%).¹⁰

Currently, Latino/Hispanics are the fastest growing rural minority;¹⁹ and given the barriers this group typically encounter as new arrivals to the United States, relocation to rural areas is likely

to compound their difficulties in gaining access to health and food assistance. It is likely that Latino/Hispanic immigrants living in rural areas face additional barriers that their counterparts do not experience living in urban areas.

There have been a few studies that have examined food insecurity levels of the increasing, rural Latino/Hispanic population^{20,21} but none have addressed nutritional and body mass index (BMI) profile differences as they relate to food insecurity in these regions. Given its potential impacts on health and well-being, gaining a better understanding of factors associated with food insecurity is essential. Thus, this study is taking the additional step of looking at the nutritional and BMI profile of urban and rural immigrant Hispanics. The objectives of this project were to (1) examine food insecurity, weight status, and dietary behaviors in a rural Latino community; (2) compare nutritional and BMI profiles between rural and urban Latinos; and (3) examine determinants of food security, weight status, and diet among rural and urban Latino immigrants.

MATERIALS AND METHODS

A rural area with a high percentage of Latino/Hispanics in North Carolina served as the recruitment site for the rural sample in this study. Data from two convenience samples were used in this study. The urban sample was collected in a nearby metropolitan county for a previous study using the same data collection instruments and data collection methodology.²² Both samples were recruited from locations that had experienced similar significant increases in Latino/Hispanic migration in the past decade. Both samples included only non-US-born adult respondents.

The rural sample (N = 119) of Latino caretakers for the rural sample was recruited between August 2005 and December 2006 from a rural town (with a population less than 50000 at the time of the study) located 25 miles from a major urban area in North Carolina (where the urban sample was recruited). Participation was limited to self-identified Latino/Hispanic adults who were a primary caretaker of a child less than 12 years of age, the primary meal preparer, and living in a low-income household based on federal assistance program participation. In addition to their self-report, ethnicity was further determined by reported place of birth and where they grew up. The urban Latino/Hispanic sample (N = 166) recruited between January 2003 and December 2005 served as a comparison group.²² Identical recruitment strategies, survey, and data collection methods were used for both groups. In order to increase the likelihood of participation, respondents were recruited by an experienced, trained bilingual, bicultural community interviewer. Participants were recruited through the use of fliers inviting their participation in WIC (Supplemental Nutrition Program for Women, Infants and Children) clinics and family resource centers serving the 2 geographic areas and through referrals from study participants.

Data Collection Measures

A version of the 18-item Core Food Security/Hunger Module was used to determine food security/insecurity status. The module was translated into Spanish by the bilingual/bicultural community interviewer for this study and face validated with a small sample (N = 8) of respondent members of the target audience. Based on algorithms provided by the Economic Research Service, 10 responses to the 18-item Core Food Security/Hunger Module were used to classify respondent households into 1 of 3 food security status groups: (1) food secure (FS), (2) low food security (LFS), and (3) very low food security (VLFS).

Additional information collected from respondents included information relating to socioeconomic status, demographics, and household characteristics (age, gender, employment, education level, ethnicity, number of household members, number of children living in the house, and monthly income); acculturation status; nutrition knowledge, attitudes, behaviors, beliefs; strategies for managing food; food assistance program participation; respondent and respondent-reported child dietary intakes; and anthropometric measures (heights/weights/waist circumference) and self-reported weight change since arriving in the United States was used.

Dietary intake was assessed using a brief, pretested food frequency questionnaire (FFQ). The questionnaire was designed specifically for this study. Prior to data collection, professionals working with the target audience (N = 4) and recruited members of the target audience (N = 5) reviewed the foods included on the FFQ for appropriateness. The FFQ was then pretested with a pilot sample of respondents representing the target audience for cultural appropriateness. Based on this preliminary work, minor revisions were made to the FFQ. The final version of the FFQ included cultural foods representing all of the food groups as well as those foods that are recommended to be eaten only sparingly. Total daily consumption of 6 food groups (fruits, vegetables, dairy, meats, grains, and foods that should be eaten sparingly) was calculated, from which a diet score was computed. Participants received higher scores if they met the recommendations for consumption of each food group based on the MyPyramid guidelines. Similarly, scores decreased with higher consumption of fried foods, snacks, sweets, and artificial drinks. Diet scores could range from 0 to 12, with 12 representing the healthiest overall diet. Difficulty eating healthy was asked as a yes/no question and possible barriers associated with this difficulty were provided to the respondent. Each respondent could identify as many barriers as they felt were applicable to their situation. Examples of barriers included: eating healthy (1) takes too much time, (2) costs too much, or (3) is difficult because my family does not like healthy food. Eating behavior was assessed based on weekly consumption of away-from-home foods (eg, fast food, ethnic restaurants, and relatives' homes).

Anthropometrics (measured height/weight) and self-reported weight change since arriving in the United States were used to assess weight status. BMI was calculated as a mean and as categories (1) under/normal weight (BMI ≥ 18 and < 25), (2) overweight (BMI ≥ 25 and < 29.9), and (3) obese (BMI ≥ 30).

Data collection was conducted by a trained bilingual, bicultural interviewer in respondents' homes. All research protocols were approved by the Institutional Review Board of the university at which the study was conducted. All study participants provided written consent to participate in this study.

Data Analyses

Data were analyzed using SPSS version 14.0. Demographic and other descriptive data were used to develop profiles of respondents. These profiles provided a basis for determining relationships of demographic and other descriptive data with level of food insecurity. Relational analyses using Spearman's correlation and chi-square tests were used to assess differences between rural and urban Latino/Hispanics with regard to descriptive characteristics, food security, weight status, and diet. One-way ANOVA tests were used to assess differences in measures between food secure and food insecure Latino/Hispanics living in rural and urban regions. Binomial logistic regression controlling for socioeconomic and demographic characteristics was used to examine determinants for overweight/obesity, low/very low food security, and poor diet among rural and urban Latino immigrants. Dichotomous variables for BMI (under/normal weight vs overweight/obese), food security status (food secure vs low/very low food security), and diet score (median split score, low vs high) were used as dependent variables.

RESULTS

The rural and urban samples were representative of groups of caretakers primarily about 30 years of age, low income, with little to no education. Most lived in a house of 5 residents, with a household head that was employed full time and incomes at or below poverty. Characteristics of the two samples are presented in Table 1.

TABLE 1. Characteristics of study participants by urban/rural residence

Variable	Urban (N = 166)	Rural (N = 119)
Age (\pm SEM)	28.4 \pm 6.2 years*	31.7 \pm 7.2 years
Ethnicity, % Mexican	68.7	84.0*
Education, % \leq 8th grade	60.6	53.6
Employment, % full time	74.7	62.2*

TABLE 1. Characteristics of study participants by urban/rural residence

Variable	Urban (N = 166)	Rural (N = 119)
	16.0	26.1*
Household size (\pm S.E.M)	5.1 \pm 1.6	4.9 \pm 1.5
Food stamp participation, % participating	41.4	51.8**
Time in the United States (years \pm S.D.)	4.4 \pm 3.3	8.1 \pm 5.5**

* $p < 0.05$.

** $p < 0.001$.

Despite some general similarities, there were some differences between the 2 samples. Comparison of the 2 groups indicated that mean age, full-time employment status, food stamp usage, and monthly income were significantly greater in the rural group participants. Additionally, there was a significantly greater percentage of Mexicans living in the rural regions in comparison to the urban region. Other Latino groups represented in these samples included Puerto Ricans, Columbians, Dominicans, Cubans, and El Salvadorans. Initially, an acculturation scale for this study was developed using the following variables: amount of time participants have lived in the United States, country of birth, language proficiency in Spanish and English, and preparation and consumption of ethnic meals. With the exception of time in the United States (8.1 years vs 4.4 years, rural vs urban respondents, respectively, $p < .001$), both rural and urban groups were homogeneous with regard to ethnic food preparation and consumption frequency and language spoken in the home (Spanish).

Between Group Differences

Food Security Level

Level of food security was found to significantly differ between the two groups (Table 2). Rural Latinos were more likely to experience low food security than urban Latinos ($\chi^2 = 11.9$; $df (2)$; $p = .003$).

TABLE 2. Food security levels among urban and rural Latino immigrants

Category	Urban (N = 166)	Rural (N = 119)
Food secure	44.0	24.6
Low food security	48.2	67.8
Very low food security	7.8	7.6

Weight Status

Weight status was categorized using measured heights and weights to compute BMI. Average BMI did not significantly differ between urban and rural respondents. However, when respondents were grouped into traditional BMI categories (under/normal, overweight, obese) significant differences were observed ($\chi^2 = 7.1$; $df(2)$; $p = .029$). Rural respondents were more likely to be overweight ($BMI \geq 25.0 \text{ kg/m}^2 < 29.9 \text{ kg/m}^2$) and less likely to be at a normal weight at the time of the interview. Urban Latinos were more likely to be obese (Table 3).

TABLE 3. BMI category differences between urban and rural Latino immigrants

Category	Urban (N = 166)	Rural (N = 119)
Under/normal weight (%)	22.7	16.2
Overweight (%)	33.1	49.1
Obese (%)	44.2	34.5

Self-reported weight change since arriving in the United States among the rural group ($M = 23.3$ lbs), although not significant, was greater in comparison to the urban group (19.5 lbs). Length of stay was broken down into ≤ 2 years, 2 to 10 years and >10 years to indicate newly arrived, intermediate, and established Latinos. For rural Latinos, time in the United States was not associated with BMI; however, for urban Latinos, there was a statistical trend ($p = .079$) for those residing in the United States the longest (>10 years) to have a higher BMI (32.7 kg/m^2) than the groups that had been here less than 10 years (28.8 kg/m^2 : ≤ 2 years and 28.9 kg/m^2 : 2–10 years).

Bivariate Analyses—Rural vs Urban

Daily Food Group Consumption, Difficulty Eating Healthy, and Eating Behaviors

Daily consumption of fruits (including 100% fruit juices), vegetables, dairy products, meats, grains, fats, oils, and fried foods was calculated from food frequency questionnaire data. Mean diet scores indicated that rural Latinos consumed a healthier diet than urban Latinos. (3.2 vs 2.4; $F(1, 283) 6.49$; $p = .012$). Daily servings of grains, vegetables, and dairy were greater in the rural group than the urban group (3.3 vs 2.9; $F(1, 256) 4.52$; $p = .034$; 2.4 vs 1.5; $F(1, 278) 16.73$; $p < .000$; 2.9 vs 2.2; $F(1, 210) 17.55$; $p < .001$, respectively).

Despite having a healthier diet, the rural group reported increased difficulty eating healthy ($\chi^2(1) = 10.6$, $p = .001$). Difficulty eating healthy was associated with BMI in both the urban and rural group ($\chi^2(2) = 5.52$, $p = .063$) and ($\chi^2(2) = 7.83$, $p = .020$), respectively. Increased difficulty eating healthy corresponded with higher BMI.

Specific barriers to eating healthy food were reported among urban and rural groups, with difficulty finding healthy food being reported by nearly twice as many urban participants (9.6%) as rural (4.7%) participants. Increased time required to prepare healthy food was reported by nearly twice as many rural participants (3.0% and 7.9%, respectively). The most notable barrier to eating healthy was increased cost of healthy food reported by 6.6% urban and 21.3% rural participants.

Eating Out Behaviors

Consumption of fast foods and eating at friends' or relatives' homes were reported more frequently in the rural group ($\chi^2 = 26.8$; $df(1)$; $p < .000$; $\chi^2 = 7.7$; $df(1)$; $p = .006$, respectively). As stated before, the rural group was more likely to have low food security and these differences in eating patterns are possibly due to strategies used by food insecure households to maximize food supplies.

Urban/Rural by Food Security/Insecurity Status

Time in the United States was only associated with food security in the rural group. Food insecure rural Latinos had been in the United States a significantly less amount of time than food secure Latinos (4.5 years vs 11.1 years; $F(1, 101) 35.33$, $p = .001$). Mean BMI, BMI category, or self-reported weight change was not significantly associated with food security status for either rural or urban Latinos; however, there was a trend that among urban Latinos food insecurity was associated with being under or normal weight.

Differences in diet score and difficulty eating healthy were associated with food security among rural residing Latinos. Although scores for both urban and rural Latinos were low, food insecurity among rural Latinos was significantly associated with a lower diet score and greater difficulty eating healthy. Specifically, one-way ANOVA analyses indicated that compared to food secure households, low and very low food security were associated with decreased consumption of dairy (3.4 vs 2.7; $F(1, 92) 4.80$; $p = .031$) and tended to be associated with decreased fruit (2.7 vs 2.1; $F(1, 122) 3.00$; $p = .087$) servings and increased consumption of fried

and refined foods (2.8 vs 3.8; F(1, 109) 3.17; p = .078) among rural Latinos and increased consumption of bread and grains (2.6 vs 3.1; F (1,145) 4.22; p = .042) among urban Latinos.

Barriers to Healthy Eating

Regardless of food security status, both urban and rural Latinos reported multiple reasons why they do not eat healthy. Not knowing how to buy healthy foods (8.2%) and receiving no family support for healthy eating (8.2%) were the 2 reasons most identified for urban food secure Latinos. High cost (11.8%) and difficulty finding healthy foods their family would eat (11.8%) were the most frequently reported from food insecure urban Latinos. For food secure rural Latinos, high cost (12.1%) and inability to read food labels (9.1%) were identified as the most important barriers. High cost (27.9%) and increased time to prepare healthy foods (9.7%) were reported as the most pressing barriers to healthy eating for food insecure rural Latinos.

Determinants of Overweight/Obesity, Low/Very Low Food Security and Poor Diet

Binomial logistic regression, controlling for age, ethnicity, education, income, employment, and food stamp program participation, indicated that both time in the United States and difficulty eating healthy were determinants for overweight/obesity, low/very low food security, and poor diet for rural residing Latino immigrants (Table 4). No significant determinants were noted in either the urban or rural group for BMI; therefore, data are not presented in the table for BMI.

TABLE 4. Determinants of low/very low food security and poor diet

Determinant	Urban						Rural					
	Food Security			Diet			Food Security			Diet		
	β	OR	P Value	β	OR	P Value	β	OR	P Value	β	OR	P Value
Difficulty eating healthy (N = 166)	.520	1.68	.110	-.214	.81	.511	1.03	2.81	.033	-.385	.68	.341
Time in United States (N = 108)	-.001	.99	.733	.004	1.00	.292	-.005	.99	.047	.005	1.01	.058

OR indicates odds ratio.

For rural residing Latino immigrants, self-reported difficulty eating healthy and having lived in the United States for a shorter period of time were determinants of low/very low food security. Also, for rural Latinos the longer the period of time lived in the United States, the better the diet.

DISCUSSION

The objectives of this project were to (1) examine food insecurity, weight status, and dietary behaviors in a rural Latino community; (2) compare nutritional and BMI profiles between rural and urban Latinos; and (3) examine determinants of food security, weight status, and diet among rural and urban Latino immigrants. Regardless of rural or urban designation, all study respondents were primarily low-income, child caretakers with low education levels living in households with an average of 5 individuals. There are clear distinctions in rural and urban Latinos, however, with regard to age, employment status, participation in the food stamp program, and length of time in the United States.

Food insecurity was higher among rural Latinos than urban Latinos. Rural Latinos were significantly more likely to live in low food secure households. These findings are in contrast to other studies that report greater food insecurity among urban Latinos or no rural/urban difference in food security.^{21,23}

As supported by Jackson et al,²⁴ BMI was significantly greater in rural versus urban residing respondents. Rural respondents were less likely to be at a normal weight and more likely to be overweight than urban Latinos. Although rural respondents have resided in the United States significantly longer than their urban counterparts and reported a greater weight gain since moving to the United States, time in the United States was not significantly associated with BMI among rural Latinos. Similar results were noted by Bowie et al,²⁵ who reported that length of time in the United States was not associated with BMI among California Latino men and women. For urban Latinos, however, length of time in the United States approached significance with regard to BMI. Residence of greater than 10 years was associated with a higher BMI. These findings do support to some extent research conducted by Himmelgreen et al,¹⁶ which indicated that for Puerto Ricans, length of time in the United States is positively associated with weight gain.

It is not possible to tell from our data whether weight gain has been continuous over years of residence, occurred all at once and never lost, or began prior to moving to the United States. Respondents were asked specifically, however, how much their weight had changed since arriving in the United States. The fact that rural respondents had been in the United States longer may be attributed to the steady work available to them in the poultry industry. The urban sample was not associated with any one major employer, so their employment may have been more sporadic and seasonal and thus their stay in the United States less continuous. The fact that rural Latinos resided in the United States significantly longer than their urban counterparts may help

to explain the higher weight gain and overweight. This may be due to the fact that they had assumed unhealthy behaviors often associated with adopting the United States' culture.

With the exception of time in the United States, the urban and rural groups were homogeneous in terms of acculturation factors (language spoken at home, English fluency, and ethnic food preparation and consumption). Rural Latinos had been in the United States twice as long as urban Latinos. Using length of stay in the United States as the indicator of acculturation among these groups means that rural Latinos were more acculturated than urban Latinos. This is of particular importance because acculturation has been associated with increased risk of chronic disease and obesity.²⁶ Based on their time in the United States, rural Latinos have been reported to consume low amounts of fruits and vegetables and more high-fat foods.²⁶ This study found, however, that more fruits and vegetables were eaten by the rural participants in comparison to the urban group. Additionally, greater variety of vegetable consumption (starchy, dark green, legumes) was noted among the rural group. The sources of these vegetables, which are usually more expensive, were not recorded in this study. One study of migrant and seasonal farmworkers in North Carolina²¹ found that when provided garden space by their employers, Latino/Hispanic workers grew vegetables to supplement their household food supplies. It is possible that the rural participants were more likely to have had gardens or neighbors who supplied them with produce from their gardens.

All participants in the current study were asked to identify specific locations and frequency of food eaten outside the home during the week. The rural group consumed significantly more meals at friends or relatives houses or at fast food restaurants compared to the urban group. Our findings contrast with Duerksen et al,²⁷ who found a significant relationship between weight status and fast food consumption. These investigators concluded that among Mexican American families, higher BMI scores were associated with higher American fast food consumption. Greater frequency of eating away from home and consumption of low-cost, unhealthy foods (snacks, soda, fried foods) are commonly used coping strategies to reduce consumption of more expensive, healthier foods among rural participants.²⁰

This study also addressed the impact of food security differences on diet and weight status among rural and urban Latinos. For both urban and rural Latinos, food security was not associated with overweight or obesity or weight change since arriving in the United States. However, for the urban group, there was a trend indicating that food insecurity was associated with being under or normal weight. Our findings do not support several studies that have indicated a positive relationship between food insecurity and overweight.^{6,16,27}

Dietary behaviors and reported difficulty eating healthy were significantly associated with food insecurity among rural Latinos. Food insecure rural Latinos received a lower diet score than urban Latinos based on their decreased consumption of dairy and fruit and increased consumption of low-cost, high-fat, high-sugar foods. Dietary behaviors among food insecure urban Latinos indicated only an increased consumption of breads and grains.

One of the most reported barriers by food insecure rural Latinos, which may help to explain the greater consumption of unhealthy foods, was that healthy foods cost too much. Even if they were able to supplement their diets with home grown fruits and vegetables, food costs for families of 5 or more are likely to put considerable strain on already limited food budgets. Even with food stamp assistance, the challenge to accessing enough healthy food selections on a daily basis is likely to be quite daunting. This may in part explain the greater reliance on more fast food and low-cost, convenient food that has little nutritional value. These findings do not, however, support McArthur et al,²⁸ who found that rural and urban status was not associated with availability of high-calorie foods.

Finally, both reported difficulty eating healthy and time in the United States were determinants of food security status and diet among rural Latinos. Greater difficulty eating healthy was associated with low/very low food security and poor diet. In contrast to other studies,^{26,29,30} this study showed that for rural Latino immigrants, although their overall diet score was low, their diet was better the longer they lived in the United States. Again, this may be attributed to other means for accessing healthy foods (e.g., gardening) that were not addressed in this study.

The limitations of this study warrant caution in interpretation. Convenience sampling was used because random sampling is difficult with this population. Issues of residency and general hesitancy to provide sensitive information prevent many members of this group from participation in studies. Consequently, we recognize that the results may be more reflective of who was willing to participate and that the findings are not specifically generalizable to other Latino/Hispanic immigrant groups. However, given the modest sample sizes and the diligence with which the data were collected, we are confident that our findings warrant consideration regarding the impact of food security on this population group. Additionally, diet intake was based solely on a food frequency questionnaire (FFQ) and not corroborated by food diaries or other accepted measures. For this population and the number of participants in the 2 samples, we feel the FFQ, though limited in terms of details of nutritional intake, nonetheless provided sufficient information to draw some conclusions about dietary patterns. Finally, we recognize that we have relied solely on time in the United States as an indicator of acculturation and that this has been shown to provide only a limited picture of an individual's acculturation status.³¹ We did examine other indicators (ethnic food preparation, language spoken, country of birth) but found no difference between groups. Time in the United States was the only indicator of acculturation that provided variation between the 2 groups.

Despite the limitations, this study is unique in that it addresses dietary intake, difficulty eating healthy, as well as weight status as they relate to both food security and urban and rural status. Our findings suggest that food insecure rural Latino immigrants are at higher risk for poor diets and barriers associated with eating healthy compared to their urban counterparts. Practitioners working with Latino immigrants need to take into account the fact that food insecurity and rurality have serious implications for dietary behaviors. It should also be noted that despite food selection limitations, food stamps do not seem to be a factor limiting consumption of high-fat,

unhealthy foods. The study addresses a gap in research with Latino immigrants noted by Quandt et al,²¹ for which dietary intake and nutritional status are missing variables. Future studies should address the timing of weight change for Latino immigrants upon arrival to the United States. Regardless of household location or food security status, 80% of the total sample was overweight or obese. By pinpointing the time at which this weight gain occurs, researchers can better develop targeted interventions for Latino immigrants. As suggested by Pérez-Escamilla and Putnik,³¹ future studies need to also consider life trajectories and experiences of Latinos prior to the move to the United States. Data from such studies will provide valuable guidance in the development of effective nutrition education intervention for this target audience.

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REFERENCES

1. Kasper, J, Gupta, SK, Tran, P, Cook, JT and Meyers, AF. 2000. Hunger in legal immigrants in California, Texas, and Illinois. *Am J Public Health.*, 90: 1629–1633.
2. Rose, D. 1999. Economic determinants and dietary consequences of food insecurity in the United States. *J Nutr.*, 29(2S, suppl): 517S–520S.
3. Adams, EJ, Grummer-Strawn, L and Chavez, G. 2003. Food insecurity is associated with increased risk of obesity in California women. *J Nutr.*, 133: 1070–1074.
4. Mazur, R, Marquis, G and Jensen, H. 2003. Diet and food insufficiency among Hispanic youths; acculturation and socioeconomic factors in the third National Health and Nutrition Examination Survey. *Am J Clin Nutr.*, 7: 1120–1127.
5. Kaiser, LL, Melgar-Quinonez, HR, Lamp, CL, Johns, MC, Sutherlin, JM and Harwood, JO. 2002. Food security and nutritional outcomes of preschool-age Mexican-American children. *J Am Diet Assoc.*, 102: 924–929.
6. Drewnowski, A and Specter, SE. 2004. Poverty and obesity: the role of energy density and energy costs. *Am J Clin Nutr.*, 79: 6–16.
7. Olson, C. 1999. Nutrition and health outcomes associated with food insecurity and hunger. *J Nutr.*, 129(suppl): 521S–524S.
8. Rush, TJ, Ng, V, Irwin, JD, Stitt, LW and He, M. 2007. Food insecurity and dietary intake of immigrant food bank users. *Can J Diet Pract Res.*, 68(2): 73–78.

9. Weigel, MM, Armijos, RX, Hall, YP, Ramirez, Y and Orozco, R. 2007. The household food insecurity and health outcomes of US-Mexico border migrant and seasonal farmworkers. *J Immigr Minor Health.*, 9: 157–169.
10. Nord M, Andrews M, Carlson S. Measuring Food Security in the United States: Household Food Security in the United States, 2005. Economic Research Service, United States Department of Agriculture. Food and Nutrition Research Report Number 29. <http://www.ers.usda.gov/Publications/ERR29/ERR29fm.pdf> (Accessed: 21 June 2007).
11. Ogden, CL, Carroll, MD, Curtin, LR, McDowell, MA, Tabak, CJ and Flegal, KM. 2006. Prevalence of overweight and obesity in the United States, 1999–2004. *JAMA.*, 295: 549–555.
12. Wenten, M, Gilliland, FD, Baumgartner, K and Samet, JM. 2002. Associations of weight, weight change, and body mass with breast cancer risk in Hispanic and non-Hispanic white women. *AEP.*, 12: 435–444.
13. Ludwig, DS, Ebbeling, CB, Pereira, MA and Pawlak, DB. 2002. A physiological basis for disparities in diabetes and heart disease risk among racial and ethnic groups. *Am Soc Nutr Sci.*, 132: 2492–2493.
14. Sundquist, J and Winkleby, M. 2000. Country of birth, acculturation status and abdominal obesity in a national sample of Mexican-American women and men. *Int J Epidemiol.*, 29: 470–477.
15. Quan, T, Salomon, J, Nitzke, S and Reicks, M. 2000. Behaviors of low-income mothers related to fruit and vegetable consumption. *J Am Diet Assoc.*, 100: 567–570.
16. Himmelgreen, DA, Pérez-Escamilla, RMartinez, D. 2004. The longer you stay, the bigger you get: length of time and language use in the US are associated with obesity in Puerto Rican women. *Am J Phys Anthropol.*, 125: 90–96.
17. Gamm, LD, Hutchison, LL, Dabney, BJ and Dorsey, AM, eds. 2003. Rural Healthy People 2010: A Companion Document to Healthy People 2010, Vol. 1, College Station, Tex: The Texas A&M University System Health Science Center, School of Rural Public Health, Southwest Rural Health Research Center.
18. Stuff, JE, Horton, JABogle, ML. 2004. High prevalence of food insecurity and hunger in households in the rural Lower Mississippi Delta. *J Rural Health.*, 20: 173–180.
19. Economic Research Service, United States Department of Agriculture. Rural Income, Poverty, and Welfare: Rural Poverty. The Economics of Food, Farming, Natural Resources and Rural America. <http://www.ers.usda.gov/Briefing/incomepovertywelfare/ruralpoverty/> (Accessed: 23 May 2004).

20. Quandt, SA, Shoaf, JI, Tapia, J, Hernandez-Pelletier, M, Clark, HM and Arcury, TA. 2006. Experiences of Latino immigrant families in North Carolina help explain elevated levels of food insecurity and hunger. *J Nutr.*, 136: 2638–2644.
21. Quandt, SA, Arcury, TA, Early, J, Tapia, J and Davis, JD. 2004. Household food security among migrant and seasonal Latino farmworker in North Carolina. *Public Health Rep.*, 119: 568–576.
22. Colby, S and Haldeman, L. 2003. Eating behaviors and level of food insecurity among Latino immigrants in Guilford County, North Carolina. *American Public Health Association 131st Annual Meeting Proceedings*. November 15–19 2003, San Francisco, California. abstract no. 71646; session no. 3191.0.
23. Oberholser, CA and Tuttle, CR. 2004. Assessment of household food security among food stamp recipient families in Maryland. *Am J Public Health.*, 94: 790–795.
24. Jackson, JE, Doescher, MP, Jerant, AF and Hart, LG. 2005. A national study of obesity prevalence and trends by type of rural county. *J Rural Health.*, 21: 140–148.
25. Bowie JV, Juon H-S, Cho J, Rodriguez EM. Factors associated with overweight and obesity among Mexican Americans and Central Americans: results from the 2001 California Health Interview Survey. *Prev Chronic Dis.* [serial online]. 4(1). <http://www.cdc.gov/pcd/issues/2007/> (Accessed: 28 January 2007).
26. Neuhouser, ML, Thompson, B, Coronado, GD and Solomon, CC. 2004. Higher fat intake and lower fruit and vegetables intakes are associated with greater acculturation among Mexicans living in Washington state. *J Am Diet Assoc.*, 104: 51–57.
27. Duerksen, SC, Elder, J, Arredondo, EM. 2007. Family restaurant choices are associated with child and adult overweight status in Mexican-American families. *J Am Diet Assoc.*, 107: 849–853.
28. McArthur, LH, Anguiano, R and Gross, KH. 2004. Are household factors putting immigrant Hispanic children at risk of becoming overweight: a community-based study in eastern North Carolina. *J Community Health.*, 29: 387–404.
29. Lee, RE and Cubbin, C. 2002. Neighborhood context and youth cardiovascular health behaviors. *Am J Public Health.*, 92: 428–436.
30. Dixon, LB, Sundquist, J and Winkleby, M. 2000. Differences in energy, nutrient, and food intakes in a US sample of Mexican-American women and men: findings from the Third National Health and Nutrition Examination Survey, 1988–1994. *Am J Epidemiol.*, 152: 548–557.
31. Pérez-Escamilla, R and Putnik, P. 2007. The role of acculturation in nutrition, lifestyle, and incidence of type 2 diabetes among Latinos. *J Nutr.*, 137: 860–870.