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Racial/ethnic differences in dietary intake among WIC families prior to food package revisions

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Abstract

Objective—To compare the diets of African-American and Hispanic families in The Special Supplemental Nutrition Program for Women, Infants and Children (WIC), prior to the 2009 food package revisions.

Methods—Mother-child dyads were recruited from twelve WIC sites in Chicago, Illinois. Individuals with one valid 24-hour recall were included in the analyses (n=331 children, n=352 mothers).

Results—Diets of Hispanic mothers and children were lower ($p<0.001$) in % calories from fat, added sugars, sodium, and sweetened beverages, but higher ($p<0.001$) in vitamin A, calcium, whole grains, fruits, and total dairy, compared to their African-American counterparts. However, no groups met national recommendations for % calories from saturated fat, fiber, sodium, whole grains, vegetables, and total dairy.

Conclusions and Implications—There are racial/ethnic differences in dietary intake and future research is needed to determine if diets improve due to package revisions and whether uptake of these changes varies by race/ethnicity.

Keywords

Diet; Latino; Hispanic; African Americans; Children; Mothers

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Introduction

Substantial increases in the prevalence of overweight/obesity over the past thirty-years have brought childhood obesity prevention efforts to the top of a national research agenda (1–3). Low-income individuals, disproportionately represented among some racial/ethnic minorities, are at particular risk for overweight and obesity (2). Recent data from the National Health and Nutrition Examination Survey (NHANES) 2009–2010 showed that 23.8% of non-Hispanic White, 28.9% of non-Hispanic Black, and 33.1% of Hispanic children (2–5 years old) were overweight or obese (body mass index (BMI) 85th percentile) (3). This not only demonstrates the high prevalence of overweight/obesity in children, but the disparities that exist by race/ethnicity.

There is increasing recognition that obesity prevention efforts should involve environmental- (e.g. access to grocery stores) and policy-level (e.g. making healthy foods more affordable) strategies, to better support dietary behavior change at the individual-level (4). Consistent with this, the United States Department of Agriculture Food and Nutrition Service (USDA-FNS) commissioned the Institute of Medicine (IOM) to evaluate and provide recommendations for food package revisions provided by the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). The goal was to better align WIC food packages with the Dietary Guidelines for Americans (5, 6). Based on 2009 estimates, WIC, the third largest food and nutrition assistance program in the United States, provided supplemental foods and nutrition education to more than 9 million children (< 5 years) and women (pregnant and postpartum) (7, 8).

Following the IOM recommendations, key revisions to WIC food packages included the addition of a monthly voucher for fresh fruits and vegetables, a reduction in fat content (e.g. 2% milk fat or less in food packages for women and children > 2 years) and in quantities of milk, cheese, eggs, and fruit juice (about 4 fluid ounces per day), and an increase in whole grain offerings (e.g. whole grain breads and cereals) (7). These revisions represent the most significant changes in the program since WIC's inception in 1972 and went into effect nationally in October 2009 (7).

African-Americans and Hispanics account for more than half of all WIC participants (7, 9). Consequently, these changes have the potential to improve racial/ethnic disparities in both diet and obesity. However, it has yet to be determined if this unprecedented change in policy will improve the diets of WIC participants and whether the uptake of these revised food packages will be similar across racial/ethnic groups. Previous research suggests that the dietary intake of Hispanic children (10–12) and women (13–18) fare better in diet quality than their African-American counterparts, but this has yet to be confirmed in a WIC population. The main purposes of this study are: 1) to assess dietary differences across racial/ethnic groups (African-American vs. Hispanic) in mother-child dyads enrolled in WIC; and 2) to examine dietary intake prior to WIC package revisions.

Methods

In this cross-sectional study, dietary intake data were collected from a sample of parent-child dyads recruited from twelve WIC sites in Chicago, Illinois. These are baseline data for a longitudinal study that will examine psychosocial, behavioral, and environmental determinants of dietary practices and weight status in WIC families following the first 18-months of the food package revisions. The data for this study were collected in June-July 2009, immediately prior to implementation of revised WIC food packages in Illinois in August 2009.

Participants and Eligibility

Eligible participants were children aged 2–3.5 years enrolled in WIC and their parent or guardian. This age range ensured that children would be old enough to be consuming solid food, yet young enough to still be eligible for WIC (< 5 years) throughout the duration of the study. Only parent-child dyads that reported to be African-American or Hispanic were included in this study. The sample mainly consisted of mothers, but also included grandmothers, female guardians, and fathers. Grandmothers and female guardians were retained and fathers (n=16) were excluded from this analytic sample. Hereafter, the term “mother” will be used to refer to the female parent or guardian. All study procedures were reviewed and approved by the University of Illinois at Chicago’s Institutional Review Board and all participants provided signed informed consent.

Socio-demographic and Anthropometric data

Trained staff, fluent in Spanish and English, collected self-reported socio-demographic information from mothers about themselves and their child. The 4-item version of Marín and Marín’s Short Acculturation Scale (19) was used to assess acculturation. A score of 1 to 5 was given for each response and higher scores indicate a greater level of acculturation.

Anthropometric measurements for both parents and children were performed with a SECA 214 portable stadiometer (SECA, Hanover, MD) and Tanita BWB-800 digital scale (Tanita Corporation of America, Inc., Arlington Heights, IL), with the participant in light clothes and no shoes. Both heights and weights were measured twice, to the nearest 0.1 cm and 0.1 kg respectively, and averaged. Parents received \$35.00 for completing the demographic interview, anthropometric measurements, and 24-hour recalls. The length of time to administer all components totaled 75-minutes.

Dietary Intake

Data collectors were trained by a registered dietitian to collect 24-hour recalls using a multiple-pass approach(20). Mothers provided the recall for their child and themselves. Mothers reported all foods and beverages consumed within the previous 24-hours, including meal time and type, portions sizes, and food preparation details. A booklet of standard food measurements assisted mothers with recalling portion sizes. Recalls were entered and analyzed using Nutrition Data System for Research, version-2009 (NDSR, University of Minnesota). In instances where mothers were not with their child at meal times (e.g. daycare) and could not recall one or more main meals (ie. breakfast, lunch, or dinner), these recalls were considered incomplete (total n= 34 children; n=15 Hispanic; n=19 African-American) and excluded from the analyses. Mothers who reported values outside a plausible range of energy intake (<500 kcals and >5000 kcals)(21) were also excluded from the analyses (n=12 total; n=5 Hispanic, n= 7 African-American). Values of foods with missing amounts that could not be resolved by deferring to data-entry rules were imputed. The imputed values were based on median portions by age and gender from “Foods Commonly Eaten in the United States: Quantities Consumed Per Eating Occasion and in a Day, 1994–1996”(22).

Nutrients and food groups relevant to WIC (5) were chosen for these analyses and also compared to Dietary Reference Intakes (DRIs) (23–27) and to USDA’s MyPlate recommendations(28). Reference intakes were based on the following age groups: 1–3 years (both sexes) and 19–50 yrs for women (not breastfeeding or pregnant). Reference intakes for women ages 19–30 years and 31–50 years did not differ; therefore, we combined the two groups for ease of reporting. MyPlate recommendations are based on age and sex and included the following: 2–3 years (both sexes) and women from 19–50 years.

Statistical Analyses

Descriptive data were presented as means (SD) or proportions, as appropriate. Correlations between mothers and children's diets (e.g. nutrients and food groups) were estimated with Spearman's rho. Distributions of nutrient and food group variables were examined and many displayed non-normal distributions. Log-transformation of these variables was considered, however, back-transformation of these values to geometric means would limit the ability to interpret these values against the DRIs; therefore, medians are reported for all nutrient and food group variables and Wilcoxon rank-sum tests were used to compare differences between groups, while applying a Bonferroni correction (significance level set to .001, two-sided) to correct for multiple testing. Also, potential confounders (e.g. age, education, received public assistance) were tested and did not significantly alter values. To compare dietary intakes to reference intakes, we estimated the following for each group: 1) the proportion of intakes at or above the reference (ie. Estimated Average Requirements (EAR) or Adequate Intake (AI)) and under the Tolerable Upper Limit (UL) for vitamin C, vitamin A, folate, iron, and calcium, 2) the proportion at or below AI for sodium, 2) the proportion with intakes < 10% calories from saturated fat, and 3) the proportion within the Acceptable Macronutrient Distribution Range (AMDR) for % calories from fat. We also estimated the proportion from each group at or above MyPlate recommendations for total grains, whole grains, fruits, vegetables, and total dairy. All statistical analyses were performed using STATA version 11.1 (STATA Corp, College Station, TX, 2010).

Results

Table 1 presents demographic and anthropometric characteristics of mothers and children with a valid dietary recall (n=331 children, n=352 mothers). Both Hispanic and African-American mothers were similar in age, employment status, BMI, and in the number of household members currently receiving WIC; however, Hispanic mothers had fewer years of education ($p<0.001$), were less likely to receive benefits from the Supplemental Nutrition Assistance Program (SNAP) (29) ($p<0.01$), and were more likely to be married compared to their African-American counterparts ($p<0.001$). The majority of Hispanic mothers were born in Mexico (80%) with a median acculturation score of 1.9 (se: 0.09, range: 1–5 (highest), which suggests a less acculturated sample.

The rates of overweight/obesity in Hispanic and African-American children were 45% and 36.5%, respectively. However, no significant differences were observed in age, sex, or BMI. Also, the correlation coefficients for most nutrients and food groups between mothers and their children were predominantly low to moderate ($r_s=0.10$ to <0.50) (data not shown).

Median intakes of selected nutrients and food groups were reported for Hispanic (n=160) and African-American (n= 171) children in Tables 2 and 3, respectively. Hispanic children had significantly lower ($p<0.0001$) median intakes of % calories from fat, added sugars, sodium and significantly higher ($p<0.001$) intakes of vitamin A and calcium, compared to African-American children (Table 2). Most Hispanic and African-American children did not meet the recommendation for saturated fat intake (<10% of calories from saturated fat) (6) and group median intakes were lower than the reference value for dietary fiber and above the reference for sodium.

Median % calories from fat, % calories from saturated fat, added sugars, and sodium intake were significantly lower ($p<0.0001$) in Hispanic compared to African-American mothers (Table 2). Significantly higher median intakes of fiber ($p<0.0001$), calcium ($p<0.001$), and vitamin A ($p<0.01$) were observed in Hispanic compared to African-American mothers; however, no differences were observed in their intakes of iron, vitamin C, and folate. More than half of Hispanic and African-American mothers exceeded the recommendation for

saturated fat intake (<10% of calories from saturated fat) and group median intakes for both groups were above the reference value for sodium and below the reference values for dietary fiber, vitamin C, vitamin A, and calcium (Table 2).

Group median intakes of whole grains, total fruits, and total dairy (including total milk and reduced-fat milk intake) were significantly higher in Hispanic compared to African-American children, while intakes of total grains and sweetened beverages were significantly lower (Table 3). However, median intakes for both groups were below MyPlate recommendations for whole grains (1.5 svgs/d), total vegetables (1 svg/d), and total dairy (2 svgs/d) (Table 3).

Group median intakes of whole grains, total fruits, total dairy, total milk, and reduced-fat milk were significantly ($p<0.0001$) higher in Hispanic compared to African-American mothers, while sweetened beverage intake ($p<0.0001$) was lower (Table 3). Both groups were below recommendations for whole grains (3.0 svgs/d), vegetables (2.5 svgs/d), and total dairy (3 svgs/d) based on group median intakes.

Discussion

This study provides insight into the diet quality of Hispanic and African-American mothers and children and how it varied by race/ethnicity prior to the WIC food package revisions. Overall, the diets of Hispanic mothers and children were lower in fat, added sugars, sodium, and sweetened-beverages, but higher in vitamin A, calcium, and whole grains, fruits, and total dairy, compared to their African-American counterparts. While the diets of Hispanic mothers and children reflect a more healthful nutrition profile, the median intakes for Hispanic and African-American mothers and children failed to meet recommendations for % calories from saturated fat, dietary fiber, sodium, vegetables, whole grains and total dairy. These data lend further support for the new WIC food packages.

The reported differences between Hispanic and African-American mothers in this study are consistent with previous findings in both nationally representative samples (e.g. data from NHANES, National Health Interview Survey) and in larger cohorts of low-income women (13, 15–17). From nationally representative samples, diets of Hispanic compared to African-American women are higher in calcium(16) and lower in added sugars(17). Among cohorts of similar socioeconomic status, Hispanic women reported diets higher in fruits and vegetables(13), fiber intake(15), and milk consumption(30) compared to African-American women. The low level of acculturation in our Hispanic sample may be one explanation for why we see differences between these groups. Acculturation could play a decisive role even in our sample of very low acculturated women. For instance, we observed higher intakes of whole grains, vegetables and lower intakes of fats and added sugars in our Hispanic mothers with lower acculturation scores compared to those with higher scores (data not shown). These findings are also supported by previous studies. Among Hispanic adults in rural WA ($n=735$), less acculturated Hispanics consumed diets higher in fruits and vegetables and lower in dietary fat compared to their more acculturated counterparts(31). Also, an analysis of NHANES 1999–2004 data found that foreign-born Mexicans compared to US-born Hispanics, reported diets higher in legumes, rice, and fruit and lower in non-Mexican fast food, snacks and desserts (32). Therefore, it is reasonable to consider that being less acculturated contributed to consuming a more healthful diet.

Median nutrient intakes of vitamins A and C, folate, and iron for Hispanic and African-American children in our sample appears to be adequate relative to the DRI, which is consistent with findings from the Feeding Infant and Toddler Study (FITS) and from other nationally representative low-income populations(33–36). However, diets were also high in

sodium and % calories from saturated fat and low in fiber, servings of whole grains, vegetables, and total dairy (including milk intake). While these diets are not consistent with MyPlate recommendations, similar findings have been observed among preschoolers in FITS and in two other low-income populations (33, 34, 36). The revised WIC food package has potential to improve the diets of young children by making nutritious foods (e.g. whole grain products) more available; however, it is difficult to predict the adoption of changes and further evaluation is needed to determine this.

The recently revised WIC food package provides increased access to fruits and vegetables with the addition of the monthly fruit and vegetable voucher; \$6 in cash value for children and \$10 in cash value for pregnant and postpartum/breastfeeding mothers(37). In our sample, median intake of vegetables was less than one serving for African-American and Hispanic mothers and less than half a serving for children in both groups. While fruit and vegetable intake is expected to increase among WIC participants as a result of the revisions, it is important to assess potential changes in context. For example, a key finding from a recent report from USDA's Economic Research Service (ERS) suggests that an adult on a 2,000 calorie diet would need to spend an average of \$2/day to meet recommendations for fruit and vegetable based on 2010 Dietary Guidelines for Americans(6, 38). While WIC is a supplemental food program and not intended to meet all dietary needs, the WIC voucher only provides a fraction of what is necessary to meet national recommendations for fruit and vegetable. Nonetheless, the low consumption of vegetables for all groups in this study suggests this new policy change could lead to increased vegetable intake, particularly among children, where few (~20%) met the recommendation of 1 serving/day (data not shown).

There are some limitations to this study. This sample was collected from twelve WIC sites in a large urban setting and thus these findings may not be generalizable to African-American and Hispanic WIC families residing outside of urban settings. Additionally, the lack of a non-Hispanic White comparison group is also a limitation. Due to resource constraints, only one 24-hour recall was collected and analyzed. The use of one recall for estimating usual intake and for estimating the proportion of the population with intakes within a certain threshold is a limitation and future studies based on at least 2 days of recall are needed to further confirm these findings. Also, there was no assessment of the local food environment, which might influence fruit and vegetable consumption. For instance, Zenk et al found Hispanics compared to African-American adults consumed 2.2 times more fruits and vegetables when a large grocery store was present in their neighborhood (39).

Implications for Research and Practice

It is striking that despite similar SES, significant diet differences were observed in Hispanic and African-American mothers and children, respectively. However, even within a population receiving supplemental food benefits, both groups remain at risk for nutritional deficiencies. While the new WIC food package is intended to align the diets of WIC families with the Dietary Guidelines for Americans, targeted nutrition education may be needed to improve adoption of some of these changes.

Previous research suggests that low-income parents are not a homogenous group in their feedings styles or practices(40) and nutrition messages that acknowledge factors that influence dietary behaviors(40, 41) in these different groups should be considered. Among Hispanic parents with preschoolers, previous findings suggest that cost and preparation time are barriers to fruit and vegetable consumption(41). Therefore, nutrition messages that address these perceived barriers may help Hispanic mothers more feasibly integrate fruits and vegetables into their diets. Ritchie et al found that African-American children were more likely to consume healthier diets if their parents modeled this behavior (42);therefore,

nutrition education that strives to improve a child's consumption of a targeted food (e.g. lowfat milk) might also need to address a parent's consumption of that food as well.

In summary, significant diet differences were observed between Hispanic and African-American mothers and children, respectively, and targeted nutrition education that acknowledge these dietary differences and factors that influence dietary behaviors (40, 41) may be helpful in the adoption of targeted foods included in the revised WIC food package among these diverse groups.

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References

1. Koplan JP, Liverman CT, Kraak VI. Preventing childhood obesity: Health in the balance: Executive summary. *J Am Diet Assoc.* 2005; 105:131–138. [PubMed: 15635359]
2. Singh GK, Siahpush M, Kogan MD. Rising social inequalities in US childhood obesity, 2003–2007. *Ann Epidemiol.* 2010; 20:40–52. [PubMed: 20006275]
3. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. *JAMA.* 2012; 307:483–490. [PubMed: 22253364]
4. Khan LK, Sobush K, Keener D, Goodman K, Lowry A, Kakietek J, Zaro S. Recommended community strategies and measurements to prevent obesity in the United States. *MMWR Recomm Rep.* 2009; 58:1–26. [PubMed: 19629029]
5. Institute of Medicine. WIC food packages: Time for a change. Washington DC: National Academies Press; 2005.
6. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. Washington, DC: 2010 Dec.
7. Oliviera, V.; Frazao, E. US Department of Agriculture ERS. 2009. The WIC program: Background, trends, and economic issues, 2009 edition. ed;
8. [Accessed November 13, 2011] USDA Food and Nutrition Services: WIC Program National Level Annual Summary. <http://www.fns.usda.gov/pd/wicmain.htm>.
9. Connor, P.; Bartlett, S.; Mendelson, M.; Condon, K.; Sutcliffe, J. [Accessed November 1, 2010] WIC participant and program characteristics 2008. <http://www.fns.usda.gov/ora/menu/published/wic/FILES/pc2008.pdf>.
10. Kranz S, Siega-Riz AM. Sociodemographic determinants of added sugar intake in preschoolers 2 to 5 years old. *J Pediatr.* 2002; 140:667–672. [PubMed: 12072868]
11. Lorson BA, Melgar-Quinonez HR, Taylor CA. Correlates of fruit and vegetable intakes in US children. *J Am Diet Assoc.* 2009; 109:474–478. [PubMed: 19248865]
12. Kranz S. Meeting the dietary reference intakes for fiber: sociodemographic characteristics of preschoolers with high fiber intakes. *Am J Public Health.* 2006; 96:1538–1541. [PubMed: 16873749]
13. Hoerr S, Tsuei E, Liu Y, Franklin F, Nicklas T. Diet quality varies by race/ethnicity of Head Start mothers. *J Am Diet Assoc.* 2008; 108:651–659. [PubMed: 18375222]
14. Dubowitz T, Heron M, Bird CE, Lurie N, Finch BK, Basurto-Davila R, Hale L, Escarce JJ. Neighborhood socioeconomic status and fruit and vegetable intake among whites, blacks, and Mexican Americans in the United States. *Am J Clin Nutr.* 2008; 87:1883–1891. [PubMed: 18541581]
15. Sanchez-Johnsen LAP, Fitzgibbon ML, Martinovich Z, Stolley MR, Dyer AR, Van Horn L. Ethnic differences in correlates of obesity between Latin-American and Black women. *Obesity.* 2004; 12:652–660.

16. Arab L, Carriquiry A, Steck-Scott S, Gaudet MM. Ethnic differences in the nutrient intake adequacy of premenopausal US women: Results from the third National Health Examination Survey. *J Am Diet Assoc.* 2003; 103:1008–1014. [PubMed: 12891149]
17. Thompson FE, McNeel TS, Dowling EC, Midthune D, Morrisette M, Zeruto CA. Interrelationships of added sugars intake, socioeconomic status, and race/ethnicity in adults in the United States: National Health Interview Survey, 2005. *J Am Diet Assoc.* 2009; 109:1376–1383. [PubMed: 19631043]
18. Forshee RA, Storey ML. Demographics, not beverage consumption, is associated with diet quality. *Int J Food Sci Nutr.* 2006; 57:494–511. [PubMed: 17162328]
19. Marín, G.; Marín, BV. Research with Hispanic populations. Newbury Park: Sage Publications; 1991.
20. United States Department of Agriculture. [Accessed November 30, 2011] Procedures for collecting 24-hour food recalls. <http://www.csrees.usda.gov/nea/food/efnep/ers/documentation/24hour-recall.pdf>.
21. Stamler J, Elliott P, Dennis B, Dyer AR, Kesteloot H, Liu K, Ueshima H, Zhou BF. INTERMAP: background, aims, design, methods, and descriptive statistics (nondietary). *J Hum Hypertens.* 2003; 17:591–608. [PubMed: 13679950]
22. Smiciklas-Wright, HMD.; Mickle, SJ.; Cook, AJ.; Goldman, JD. [Accessed June 6, 2011] Foods commonly eaten in the United States: Quantities consumed per eating occasion and in a day, 1994–1996. NFS Report No 96-5. [<http://www.ars.usda.gov/sp2userfiles/place/12355000/pdf/portion.pdf>].
23. Institute of Medicine Food and Nutrition Board. Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate. Washington DC: National Academies Press; 2005.
24. Institute of Medicine Food and Nutrition Board. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients). Washington DC: National Academies Press; 2005.
25. Institute of Medicine Food and Nutrition Board. Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids. Washington DC: National Academies Press; 2000.
26. Institute of Medicine. Dietary Reference Intakes for Calcium and Vitamin D. Washington, DC: National Academies Press; 2010.
27. Institute of Medicine Food and Nutrition Board. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. The National Academies Press; 2001.
28. United States Department of Agriculture. [Accessed December 8, 2011] USDA's My Plate. Food Groups Available at: <http://www.choosemyplate.gov/foodgroups/index.html>.
29. United States Department of Agriculture. [Accessed March 14, 2012] Supplemental Nutrition Assistance Program (SNAP). <http://www.fns.usda.gov/snap/>.
30. O'Neil CE, Nicklas TA, Liu Y, Franklin FA. Impact of dairy and sweetened beverage consumption on diet and weight of a multiethnic population of Head Start mothers. *J Am Diet Assoc.* 2009; 109:874–882. [PubMed: 19394474]
31. Neuhouser ML, Thompson B, Coronado GD, Solomon CC. Higher fat intake and lower fruit and vegetables intakes are associated with greater acculturation among mexicans living in Washington state. *J Am Diet Assoc.* 2004; 104:51–57. [PubMed: 14702584]
32. Duffey KJ, Gordon-Larsen P, Ayala GX, Popkin BM. Birthplace is associated with more adverse dietary profiles for US-born than for foreign-born Latino adults. *J Nutr.* 2008; 138:2428–2435. [PubMed: 19022968]
33. Cole, N.; Fox, MK. [Accessed November 1, 2010] Diet quality of American young children by WIC participation status: Data from the National Health and Nutrition Examination Survey, 1999–2004. <http://www.fns.usda.gov/ora/menu/Published/WIC/FILES/NHANES-WIC.pdf>.
34. Butte NF, Fox MK, Briefel RR, Siega-Riz AM, Dwyer JT, Deming DM, Reidy KC. Nutrient intakes of US infants, toddlers, and preschoolers meet or exceed dietary reference intakes. *J Am Diet Assoc.* 2010; 110:S27–S37. [PubMed: 21092766]

35. Bucholz EM, Desai MM, Rosenthal MS. Dietary Intake in Head Start vs non-Head Start preschool-aged children: Results from the 1999–2004 National Health and Nutrition Examination Survey. *J Am Diet Assoc.* 2011; 111:1021–1030. [PubMed: 21703380]
36. Knol LL, Haughton B, Fitzhugh EC. Dietary patterns of young, low-income US children. *J Am Diet Assoc.* 2005; 105:1765–1773. [PubMed: 16256761]
37. [Accessed November 29, 2011] WIC food packages - maximum monthly allowances. Last modified 10/12/2011. <http://www.fns.usda.gov/wic/benefitsandservices/>.
38. Stewart, H.; Hyman, J.; Buzby, JC.; Frazão, E.; Carlson, A. How much do fruits and vegetables cost? EIB-71. U.S. Department of Agriculture, Economic Research Service; 2011 Feb.
39. Zenk SN, Lachance LL, Schulz AJ, Mentz G, Kannan S, Ridella W. Neighborhood retail food environment and fruit and vegetable intake in a multiethnic urban population. *Am J Health Promot.* 2009; 23:255–264. [PubMed: 19288847]
40. Ventura AK, Gromis JC, Lohse B. Feeding practices and styles used by a diverse sample of low-income parents of preschool-age children. *J Nutr Educ Behav.* 2010; 42:242–249. [PubMed: 20227919]
41. Shriver LH, Hildebrand D, Austin H. Determinants of fruit and vegetable availability in Hispanic Head Start families with preschool-aged children living in an urban midwestern area. *J Nutr Educ Behav.* 2010; 42:299–306. [PubMed: 20591740]
42. Ritchie LD, Raman A, Sharma S, Fitch MD, Fleming SE. Dietary intakes of urban, high body mass index, African American children: Family and child dietary attributes predict child intakes. *J Nutr Educ Behav.* 2011; 43:236–243. [PubMed: 21530411]

Table 1

Demographic and anthropometric characteristics of mothers and children by race/ethnicity (Hispanic, African-American)

Parent Characteristics	Total			Hispanic			African-American		
	Mean	sd		Mean	sd		Mean	sd	
Age at study entry (yrs) ^a	29.7	8.0		29.4	6.0		30.1	9.4	
BMI (kg/m ²) ^b	29.7	6.6		29.7	6.3		29.8	7.4	
	N	%		N	%		N	%	
High school degree/GED, % yes ^c	241	70.1%		93**	54.7%		148**	84.5%	
Full time employed, % yes ^c	60	17.1%		28	16.5%		32	17.7%	
Married/living with partner, % yes ^d	162	47.0%		124**	75.1%		38**	20.9%	
Public Assistance, N % yes ^e	277	78.7%		123*	72.4%		154*	84.6%	
Number receiving WIC N % ^f									
1 person in household	247	72.2%		116	70.0%		131	74.2%	
2 people in the household	87	25.6%		48	28.8%		39	22.5%	
>=3 people in the household	18	5.4%		6	3.5%		12	7.1%	
Child Characteristics	N	%		N	%		N	%	
Gender N % female	156	47.1%		80	50.0%		76	44.4%	
>= 85th percentile BMI % yes ^b	120	40.6%		64	45.1%		56	36.5%	
	Mean	sd		Mean	sd		Mean	sd	
Age at study entry (yrs)	2.7	0.48		2.7	0.49		2.8	0.48	

Based on sample with valid diets: n=160 Hispanic children, n=171, African-American children; n=170 Hispanic mothers, n=182 African-American mothers

^a Age (Adults) : total n=350 n=170 (Hispanic) n=180 (African-American)^b BMI (adults): total: 161; n=111 (Hispanic); n=50 (African-American); BMI(children): total n=320; n=153(Hispanic), n=167 (African American)^c Height and weight measurements were only available for a sub-sample of adults collected at 12-months after package revisions; children's anthropometric measurements were collected at baseline^d Education and Employment Status: total n=351; n=170 (Hispanic); n=181 (African-American)

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^dMarital Status: total n=351; n=169(Hispanic); n= 182 (AA)

^ePublic assistance refers to individuals receiving benefits from the Supplemental Nutrition Assistance Program

^fMay include infants (< 12 months), children (1-4), and women (pregnant, postpartum, breastfeeding)

* p value <.01;

** p<.0001; compares differences between groups (Hispanic vs. African-American)

Table 2
Comparisons of median nutrient intake of mothers and children by race/ethnicity (Hispanic, African-American)

Nutrients	Hispanic						African-American						Hispanic						African-American					
	median	25th	75th	median	25th	75th	median	25th	75th	% met ^a	% met ^b	Reference ^{a-d}	median	25th	75th	% met ^a	% met ^b	Reference ^{a-d}	median	25th	75th	% met ^a	% met ^b	Reference ^{a-d}
Mothers																								
<i>Total calories (kcal/d)</i>	1474.6	1081.5	1944.7	1609.4	1171.1	2247.4				-	-	-				-	-	-				-	-	-
<i>% calories from fat^a</i>	30.9 ^{**}	24.0	36.5	37.6 ^{**}	32.1	44.7				57.1%	35.2%	20-35% ^a												
<i>% calories from saturated fat^d</i>	10.4 ^{**}	8.1	13.1	12.5 ^{**}	9.7	15.0				43.5%	28.2%	<10% ^d												
<i>Added sugars (tsp/d)</i>	7.0 ^{**}	3.5	12.3	12.1 ^{**}	7.0	20.7				-	-	-				-	-	-				-	-	-
<i>Total dietary fiber (g/d)^b</i>	14.5 ^{**}	9.9	21.1	8.8 ^{**}	5.4	13.5				14.7%	5.5%	25g/d ^b												
<i>Vitamin C (mg/d)^c</i>	51.6	27.4	104.3	37.6	15.2	88.4				44.7%	34.6%	60 mg/d ^c												2000 mg/d
<i>Vitamin A (mcg/d RAE)^{c,e}</i>	442.1 [*]	255.6	693.5	303.5 [*]	157.2	565.5				45.3%	26.4%	500 mcg/d ^c												3000 mcg/d
<i>Folate (mcg/d DFE)^{c,f}</i>	420.4	281.5	611.3	331.6	203.0	574.6				61.8%	45.6%	320 mcg/d ^c												1000 mcg/d
<i>Iron (mg)^c</i>	12.8	8.5	16.3	10.4	7.1	16.2				75.9%	64.8%	8.1 mg/d ^c												45 mg/d
<i>Sodium (mg/d)^b</i>	2294.5 ^{**}	1530.6	3125.6	2987.9 ^{**}	2076.5	4211.9				22.4%	11.5%	1500mg/d ^b												2300 mg/d
<i>Calcium (mg/d)^c</i>	609.6 [*]	413.4	896.7	474.2 [*]	308.8	711.2				32.4%	18.1%	800 mg/d ^c												2500 mg/d
Children																								
<i>Total calories (kcal/d)</i>	1002.6	758.8	1274.2	1144.8	857.4	1519.0				-	-	-				-	-	-				-	-	-
<i>% calories from fat^a</i>	31.7 ^{**}	26.1	37.3	36.9 ^{**}	30.4	41.6				43.8%	42.7%	30-40% ^a												
<i>% calories from saturated fat^d</i>	11.7	9.5	14.9	12.6	9.5	15.1				33.1%	29.2%	<10% ^d												
<i>Added sugars (tsp/d)</i>	4.7 ^{**}	2.2	8.2	7.0 ^{**}	4.2	12.1				-	-	-				-	-	-				-	-	-
<i>Total dietary fiber (g/d)^b</i>	7.6	5.2	11.6	6.2	4.2	8.8				4.4%	1.8%	19 g/d ^b												
<i>Vitamin C (mg/d)^c</i>	45.4	19.4	79.9	40.9	13.8	78.1				80.6%	76.6%	13 mg/d ^c												400mg/d
<i>Vitamin A (mcg/d RAE)^{c,e}</i>	352.6 [*]	238.3	492.5	258.5 [*]	153.9	424.2				59.4%	50.9%	210 mcg/d ^c												600 mcg/d
<i>Folate (mcg/d DFE)^{c,f}</i>	255.8	183.7	372.9	249.8	163.6	371.4				52.5%	51.5%	120 mcg/d ^c												300 mcg/d
<i>Iron (mg)^c</i>	6.7	4.8	9.7	7.2	5.2	10.0				93.1%	95.9%	3 mg/d ^c												40 mg/d

Nutrients	Hispanic			African-American			Hispanic			African-American		
	median	25th	75th	median	25th	75th	% met ^h	% met ^h	% met ^h	Reference ^{a-d}	UL ^g	
Mothers												
Sodium (mg/d) ^b	1303.7 ^{**}	878.1	1944.3	1882.0 ^{**}	1319.3	2532.8	31.9%	11.7%	11.7%	1000 mg/d ^b	1500 mg/d	
Calcium (mg/d) ^c	592.6 [*]	396.7	830.7	450.0 [*]	262.4	639.7	63.1%	45.0%	45.0%	500 mg/d ^c	2500 mg/d	

n=160 Hispanic children, n=171, African-American children; n=170 Hispanic women, n=182 African-American women
 Wilcoxon rank-sum test compares differences between Hispanic children and Hispanic women vs. African-American children and African-American women, respectively.
 Significance level set at alpha= .001 after Bonferroni correction.

^{*} p value < .001;

^{**} p value < .0001

^a Acceptable Macronutrient Distribution Range (AMDR),

^b Adequate Intake (AI),

^c Estimated Average Requirements (EAR),

^d Dietary Guidelines for Americans

Recommendations are based on age and sex where appropriate: children 2–3 years (both sexes) and Women (not breastfeeding or pregnant between 19–50 yrs)

Recommendations for Ca and Fe differed for women >50 years, therefore, this age group (> 50 years n=9, missing age n=2) was excluded from these analyses only

^e RAE: Retinol Activity Equivalents

^f DFE: Dietary Folate Equivalents

^g Tolerable Upper Limit (UL)

^h "met" indicates % with intake at or above reference and under UL for the following nutrients: vitamin C, vitamin A, folate, iron, and calcium. For % calories from saturated fat and sodium, "met" indicates % below reference values and for % calories from fat, "met" indicates % within reference range

Table 3
Comparisons of median food group intake of mothers and children by race/ethnicity (Hispanic, African-American)

Food Categories		Hispanic			African-American			Hispanic	African-American	Recommendation	
		median	25th	75th	median	25th	75th	% met ^h	% met ^h		
Mothers											
Total grains (svgs/d) ^a		5.13	3.07	7.47	4.35	2.50	7.16	42.4%	33.5%	6 (svgs/d) ^a	
Whole grains (svgs/d)		1.94 ^{**}	0.00	3.91	0.00 ^{**}	0.00	0.99	33.5%	5.5%	3(svgs/d) ^a	
Total vegetables (svgs/d) ^b		0.99	0.41	2.20	0.84	0.14	1.70	22.4%	13.7%	2.5 (svgs/d) ^b	
Total fruits (svgs/d) ^c		1.29 ^{**}	0.00	2.58	0.00 ^{**}	0.00	1.73	40.0%	23.6%	1.5(svgs/d) ^c	
Fruit juices (svgs/d) ^d		0.00	0.00	1.88	0.00	0.00	1.25	-	-	-	
Sweetened beverages (svgs/d) ^e		0.50 ^{**}	0.00	1.50	1.50 ^{**}	0.47	2.50	-	-	-	
Total Dairy (svgs/d) ^f		1.25 ^{**}	0.50	2.00	0.67 ^{**}	0.25	1.29	13.5%	10.4%	3 (svgs/d) ^f	
Total Milk(svgs/d) ^g		0.63 ^{**}	0.13	1.30	0.11 ^{**}	0.00	0.63	-	-	-	
Whole milk (svgs/d)		0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	
Reduced fat milk (svgs/d)		0.13 ^{**}	0.00	1.13	0.00 ^{**}	0.00	0.13	-	-	-	
Lowfat/fat free (svgs/d)		0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	
Children											
		median	25th	75th	median	25th	75th				
Total grains (svgs/d) ^a		2.34 [*]	1.42	3.54	3.09 [*]	1.83	4.58	35.6%	53.8%	3 (svgs/d) ^a	
Whole grains (svgs/d)		0.50 ^{**}	0.00	1.19	0.00 ^{**}	0.00	0.73	21.3%	7.6%	1.5(svgs/d) ^a	
Total vegetables (svgs/d) ^b		0.40	0.04	1.03	0.24	0.01	0.60	28.1%	15.2%	1 (svgs/d) ^b	
Total fruits (svgs/d) ^c		1.50 [*]	0.63	2.85	1.00 [*]	0.00	2.36	66.3%	50.9%	1(svgs/d) ^c	
Fruit juices (svgs/d) ^d		0.94	0.00	1.25	0.01	0.00	1.50	-	-	-	
Sweetened beverages (svgs/d) ^e		0.00 [*]	0.00	0.47	0.31 [*]	0.00	1.00	-	-	-	
Total Dairy (svgs/d) ^f		1.56 ^{**}	1.00	2.36	1.00 ^{**}	0.38	1.73	35.0%	17.5%	2(svgs/d) ^f	
Total Milk(svgs/d) ^g		1.06 ^{**}	0.58	1.63	0.62 ^{**}	0.13	1.13	-	-	-	
Whole milk (svgs/d)		0.00	0.00	0.81	0.00	0.00	0.63	-	-	-	
Reduced fat milk (svgs/d)		0.25 [*]	0.00	1.20	0.02 [*]	0.00	0.50	-	-	-	
Lowfat/fat free (svgs/d)		0.07	0.00	0.00	0.00	0.00	0.00	-	-	-	

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n=160 Hispanic children, n=171 African-American children; n=170 Hispanic women, n=182 African-American women
 Wilcoxon rank-sum test compares median differences between Hispanic children vs. African-American children and Hispanic women vs. African-American women, respectively.
 Significance level set at $\alpha=.001$ after Bonferroni correction;

* p value <.001;

** p value <.0001

^a One serving approximates 1 ounce (e.g. 1/2 cup cereal, 1 slice of bread, 1/2 cup rice). Total grains include refined, some whole, and whole grain products; whole grains include whole grain products only

^b One serving equals 1/2 cup raw, cooked, canned, 1 cup leafy greens; minus fried potatoes and fried vegetables, and legumes

^c One serving equals 1/2 cup chopped (frozen, canned, or cooked) or 1/4 cup dried and 100% fruit juices (4 fluid ounces)

^d One serving equals 4 fluid ounces

^e One serving equals 8 fluid ounces; includes sweetened fruit drinks, sweetened teas, sweetened coffees, sweetened water

^f Total dairy includes all milk, cheeses, yogurt, pudding, frozen dairy desserts. One serving equals 8 fluid ounces of milk or yogurt, 1 1/2 ounces of natural cheese, or 2 ounces of processed cheese

^g One serving equals 8 fluid ounces; includes whole, reduced fat, low fat, non-dairy, flavored whole, flavored reduced fat milks

MyPlate recommendations are based on age and sex where appropriate: children 2-3 years (both sexes) and women (not breastfeeding or pregnant between 19-50 yrs)—fruit svgs reflects rec. for 31-50 yr olds

^h „met“ indicates % at or above recommended intake