

Description of the home food environment in Black, White, Hmong, Latino, Native American and Somali homes with 5–7-year-old children

Amanda Trofholz^{1,*}, Allan Tate², Jayne A Fulkerson³, Mary O Hearst⁴,
Dianne Neumark-Sztainer² and Jerica M Berge¹

¹Department of Family Medicine and Community Health, University of Minnesota, 717 Delaware Street SE, Minneapolis, MN 55414, USA: ²Division of Epidemiology and Community Health, University of Minnesota, Minneapolis, MN, USA: ³School of Nursing, University of Minnesota, Minneapolis, MN, USA: ⁴Henrietta Schmoll School of Health, St. Catherine University, Saint Paul, MN, USA

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Abstract

Objective: To categorize the home food environment and dietary intake of young children (5–7 years old) from racially/ethnically diverse households using objectively collected data.

Design: Cross-sectional study.

Setting: In-home observations in Minneapolis/Saint Paul, Minnesota, USA.

Subjects: Families with 5–7-year-old children who identified as Black, White, Hmong, Latino, Native American or Somali.

Results: There were many significant differences by race/ethnicity for child dietary intake and for the home food environment, with specific patterns emerging by race/ethnicity. For example, Somali children had high Healthy Eating Index-2010 (HEI-2010) scores, but low daily intakes of fruits and vegetables. Black children had low HEI-2010 scores and a pattern of low intake of healthful foods and high intake of unhealthful foods. White and Latino families had high levels of both healthful and unhealthful home food availability and children with high HEI-2010 scores.

Conclusions: Results indicate that the home food environment of young children varies across racial/ethnic group. Study findings also provide new information regarding the home food environment of young children in previously understudied racial/ethnic groups and indicate that interventions working to improve the home food environment and dietary intake of children may want to consider race/ethnicity.

Keywords

Dietary intake
Racially/ethnically diverse
Home food environment
Home food availability
Healthy Eating Index-2010

Previous research has shown positive associations between healthful home food environments (e.g. frequency of family meals, home food availability) and child and adolescent diet quality^(1,2). For example, prior studies have shown that more frequent family meals (e.g. more than three family meals per week)⁽³⁾ are associated with increased intake of fruits and vegetables^(4–8) and decreased intake of soda^(5,8,9) and fast foods⁽¹⁰⁾. Fast food for family meals has been associated with higher intake of snack foods and fast foods in adolescents⁽¹¹⁾. Furthermore, many studies have shown positive relationships between availability and accessibility of fruits and vegetables in the home and child and adolescent intake of those same foods^(12–14).

Given the importance of having a healthful home food environment for child health, it is useful to examine

whether home food environments differ by race/ethnicity, especially because race/ethnicity is often accompanied by cultural differences that are important to understand for health promotion. US Census data show a population growing in racial/ethnic diversity; more than half of children living in the USA will be from a minority race/ethnicity by 2020 and this number is only expected to grow⁽¹⁵⁾. Additionally, refugee/immigrant populations also continue to rise nationally⁽¹⁶⁾. St. Paul/Minneapolis, Minnesota, where the current study was implemented, has the largest Somali⁽¹⁷⁾ and the second largest Hmong populations in the USA⁽¹⁸⁾. The diversity and large immigrant population in St. Paul/Minneapolis provides an opportunity to determine if there are dietary intake differences between populations.

Project Eating and Activity in Teens (EAT), a population-based study of adolescents in Minnesota, USA, examined the home food environment across race/ethnicity and showed meaningful differences^(4,8,19). Specifically, one study found that most factors in the home food environment (e.g. healthful/unhealthful food availability, meal planning), with the exception of family meal frequency, varied across racial/ethnic groups (i.e. White, Black, Asian, East African (e.g. Somali), Latino and Native American)⁽¹⁹⁾. Another Project EAT study found that Asian Americans (the majority of whom were Hmong) had the highest frequency of family meals⁽⁴⁾; while a third analysis found that Hmong adolescents reported more involvement with family meal preparation than White adolescents⁽²⁰⁾.

Dietary intake patterns also differ by race/ethnicity. National Health and Nutrition Examination Survey (NHANES) data found many dietary intake differences among White, Black and Latino (i.e. Mexican American) children/adolescents. For example, compared with Whites and Blacks, Latinos had the highest intakes of fruits, vegetables, dry beans/peas and total grains, and they were more likely to meet the minimum recommendations for these foods⁽²¹⁾. An analysis of Project EAT data, including Latino, Somali, Hmong and White adolescents, found many differences in dietary intake across groups. Compared with White adolescents, Latino and Somali adolescents had higher intakes of fruits and fast foods; and Hmong adolescents had lower intakes of sugar-sweetened beverages⁽²²⁾. A study of Asian, Latino and White adolescents found that, compared with White adolescents, Asians had higher intake of vegetables and lower intake of soda; and Latino adolescents had lower intakes of vegetables and milk⁽²³⁾.

While previous research does show some evidence that the home food environment and dietary intake vary by race/ethnicity^(4,8,19–23), the amount of research is limited and the majority of analyses are from Project EAT data. More studies are needed to characterize the home food environment of different racial/ethnic groups, particularly those of young children. More research also needs to be done on other racial/ethnic groups found in St. Paul/Minneapolis, Minnesota such as urban Native Americans⁽²⁴⁾. The current study describes the home food environment and dietary intake of young children (5–7 years old) from racially/ethnically diverse households (i.e. Black, White, Hmong, Latino, Native American and Somali), which includes a large immigrant sample. The study improves upon previous research by using objectively collected home food environment data (i.e. a researcher-collected home food inventory), as well as using 24 h dietary recalls to assess child dietary intake, which is the gold standard in dietary assessment⁽²⁵⁾. An understanding of how these patterns differ by racial/ethnic group will allow for insight into how to intervene with these different groups to increase the healthfulness of children's home food environments and dietary intake with the goal of improving child health.

Methods

Data for the present study were taken from phase I of the Family Matters study, a mixed-methods, incremental 5-year study exploring risk and protective factors for childhood obesity in low-income and minority households⁽²⁶⁾. Phase I took place between 2015 and 2016. Primary care clinics in Minneapolis/St. Paul, Minnesota identified 5–7-year-old children who had recently had a well-child visit; these families were then sent a letter inviting them to participate in the Family Matters study. Families were eligible to participate if they had a 5–7-year-old child, at least one additional child living in the home full-time (i.e. sibling) and the primary parent shared at least one meal per day with the 5–7-year-old child. Study eligibility required that parents needed to speak and read English, Somali, Hmong and/or Spanish. Families (n 150) were stratified by race/ethnicity so there was an equal distribution (twenty-five families per group) of the following categories: Black, White, Hmong, Latino, Native American and Somali. Families were eligible to participate only if the parent self-identified as one of the six race/ethnicity categories. To ensure there was an equal distribution of weight status, each racial/ethnic group was stratified so there were equal numbers of non-overweight (51%) and overweight/obese (49%) 5–7-year-old children (≥ 5 th and < 85 th BMI percentile = non-overweight; ≥ 85 th BMI percentile = overweight/obese)⁽²⁷⁾. Additional demographic data can be found in Table 1. Detailed descriptions of phase I of the study have been published elsewhere⁽²⁶⁾. Families participated in two home visits over a two-week period. The current analysis uses data from the following measurements collected at the home visits: anthropometric measurements, a home food inventory (HFI), a parent-completed online survey and 24 h dietary recalls. The University of Minnesota's Institutional Review Board approved all study protocols.

Measures

All variables used in the analysis are described in detail in Table 2. The procedures used to collect the study measures are described below.

Anthropometry

Trained researchers collected the height and weight of all family members at the first home visit. Height was assessed to the nearest 0.1 cm and weight to the nearest 0.1 kg. Both measures were taken twice, and agreement of less than 0.5 cm/0.5 kg was required. BMI percentile values for the 5–7-year-old child were calculated using the Centers for Disease Control and Prevention calculator⁽²⁷⁾.

Home food inventory

An inventory with demonstrated validity⁽²⁸⁾ was adapted to produce a single instrument that captured common

Table 1 Demographic characteristics of participants: families with 5–7-year-old children, Family Matters study, Minneapolis/St. Paul, MN, USA, 2015–2016

	<i>n</i> or Mean	% or SD
Primary caregiver characteristics (<i>n</i> 150)		
Female, <i>n</i> and %	137	91
Age (years), mean and SD	34.5	7.1
BMI (kg/m ²), mean and SD	30.9	7.2
BMI category, <i>n</i> and %		
Non-overweight	35	23
Overweight	38	25
Obese	77	51
Work status, <i>n</i> and %		
Working full-time	63	42
Working part-time	32	21
Stay-at-home caregiver	25	17
Currently unemployed, seeking work	18	12
Not working for pay (e.g. retired, student)	11	7
Missing	1	1
Born in the USA, <i>n</i> and %	87	58
Immigrant time in the USA (mean years)		
Hmong (<i>n</i> 16)	22.8	–
Latino (<i>n</i> 9)	15.3	–
White (<i>n</i> 3)	22.8	–
Somali (<i>n</i> 25)	10.9	–
Household characteristics (<i>n</i> 150)		
No. of adults in home, mean and SD	2.0	1.1
No. of children in home, mean and SD	3.3	1.4
Race/ethnicity, <i>n</i> and %		
Native American	25	17
Hmong	25	17
Black	25	17
White	25	17
Somali	25	17
Latino	25	17
Household structure, <i>n</i> and %		
One parent (no other adults)	37	25
One parent (with other adults)	18	12
Two parents (no other adults)	78	52
Two parents (with other adults)	17	11
Multi-generational family	10	7
Public assistance (SNAP, WIC, TANF, SSI or MFIP), <i>n</i> and %		
Yes	99	66
No	46	31
Don't know if eligible	4	3
Missing	1	1
Annual household income, <i>n</i> and %		
Less than \$US 20 000	50	33
\$US 20 000–34 999	55	37
\$US 35 000–49 999	16	11
\$US 50 000–74 999	12	8
\$US 75 000–99 999	7	5
\$US 100 000 or more	9	6
Missing	1	1

SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; TANF, Temporary Assistance for Needy Families; SSI, Supplemental Security Income; MFIP, Minnesota Family Investment Program.

foods relevant to households of the racial/ethnic groups included in the study. The validated HFI was adapted in the following ways: (i) foods were added to the HFI that were frequently found in participants' homes in a previous study conducted by the research team, particularly ones that contributed to a less healthy environment (e.g. energy drinks, puddings, canned pasta (e.g. ravioli))⁽²⁹⁾; (ii) two other validated HFIs – one for Spanish-speaking and one for Somali-speaking families – were reviewed and

culturally specific foods were added⁽³⁰⁾; and (iii) the Family Matters team, which included representation across all racial/ethnic groups, reviewed the HFI and offered ideas for missing foods.

A trained researcher completed the HFI during the first home visit. The parent indicated the areas of the home where food was stored (e.g. refrigerator, pantry, cupboards); the researcher then examined these areas and selected 'yes' on the HFI checklist if the food was present. Foods were marked as present regardless of whether the package was open/unopen; foods also did not need a certain quantity to be considered available. For example, if apples were present at a household with two apples and a household with thirty apples, each household received a 'yes' for having apples. Fruit and vegetable categories also asked if the fruit/vegetable was fresh, canned, frozen and/or dried (fruit only). In addition to the food availability assessment, the HFI also measures the accessibility of certain foods (fruits/vegetables, sugar-sweetened beverages) in the kitchen and refrigerator. Items were considered accessible in the kitchen if they were visible and easy to reach. Accessible items in the refrigerator were ones that were visible without moving items around.

Online survey

The primary parent took an extensive online survey created by the Family Matters team at the second home visit on a study-provided iPad. Parents also had the option of completing the online survey in advance; in this case, the parent was emailed the survey the day before the second home visit. The present study uses survey questions regarding the family meal environment, including frequency of family meals, fast food at family meals and the child's participation in preparing meals. Survey questions were translated by team members into Hmong, Spanish and Somali; each translated survey was reviewed by two additional staff members fluent in the respective language to ensure the question's meaning was correctly transmitted. Details about the creation of the full online survey have been published elsewhere⁽²⁶⁾.

24 h Dietary recall interviews

Three 24 h dietary recall interviews were conducted regarding the dietary intake of the 5–7-year-old children using Nutrition Data System for Research (NDSR) software, version 2015⁽³¹⁾. Recalls were conducted with the parent of the 5–7-year-old child on three non-consecutive days (two weekdays and one weekend day). The first and third recalls were conducted during home visits; the second recall was collected via telephone in between the two home visits. As dietary recalls were conducted at and around home visits, all three recalls were scheduled. Recalls were conducted in the participant's preferred language (i.e. English, Hmong, Spanish, Somali). To assist with accuracy, participants were given a food amounts

Table 2 Description of measures used in the Family Matters study to describe the home food environment and dietary intake of racially/ethnically diverse children

Variable	Response options	Description of variable
Family meal variables (online survey)		
During the past 7 d, how many times did all, or most of your family living in your house, eat...		
Breakfast together?	0 d; 1–2 d; 3–4 d; 5–6 d; 7 d	Items were analysed as continuous random variables. Categories were recoded to the midpoint value and maximum values were recoded to 1 plus the lower category value
Lunch together?		
Dinner or supper together?		
In the past week, how many times did (child) help prepare food for dinner?	0 d; 1–2 d; 3–4 d; 5–6 d; 7 d	
In the past week, how many times was a family meal purchased from a fast-food restaurant, eaten either at the restaurant or at home?	Never; 1–2 times; 3–4 times; 5–6 times; 7 times; more than 7 times	
Dietary intake variables (24 h dietary intake data)		
HEI-2010 score	The NDSR system aggregates foods into subgroups and nutrient profiles are provided per day and per meal. The nutrient profiles of three 24 h periods are averaged to produce all measures of dietary intake	Using 24 h dietary intake data, HEI-2010 scores were created. HEI-2010 scores sum the scores of twelve categories: Total fruit; Whole fruit; Total vegetables; Greens and beans; Whole grains; Dairy; Total protein foods; Seafood and plant proteins; Fatty acids; Refined grains; Sodium; and Empty calories*. The possible HEI-2010 range is 0–100 with a higher score indicating a better diet quality
Fruit intake	Non-snack fruit categories (e.g. citrus fruits)	For all dietary intake components: three 24 h dietary recalls were collected for the 5–7-year-old child. The recalls were averaged to provide overall dietary intake. Food categories data (fruit, dairy) are presented as servings. Scores range from 0 servings or higher
Vegetable intake	Non-fried vegetable categories (e.g. dark green, tomatoes, starchy vegetables)	
100% Juice intake	100% fruit juice and 100% vegetable juice	
Dairy intake	Regular and flavoured milk and yoghurt; cheese; frozen dairy desserts and ice cream; non-dairy milk and cheese	
SSB intake	Sweetened coffee, tea and water; soft drinks; fruit drinks	
Whole grains intake	Whole-grain breads, grains (e.g. quinoa), crackers, pastas, cereals; baked goods; snacks (snack bars); popcorn	
Refined grains intake	Refined-grain breads, grains (e.g. white rice), crackers, pastas, cereals; baked goods; snacks (snack bars)	
Sodium intake	Assessed in milligrams	
Daily energy intake	Assessed in kilocalories	
Home food availability variables (HFI data)		
No. of types of fruit	Yes/No	Summed the number of types of fruits present in home (possible range: 0–30 types of fruits). If a type of fruit was present, researchers noted which form(s) the fruit was in (i.e. fresh, canned, frozen and/or dried)
No. of types of FRESH fruit	Yes/No	
No. of types of FROZEN fruit	Yes/No	
No. of types of CANNED fruit	Yes/No	
No. of types of DRIED fruit	Yes/No	
No. of types of vegetables	Yes/No	Summed the number of types of vegetables present in home (possible range: 0–24 types of vegetables). If a type of vegetable was present, researchers noted which form(s) the vegetable was in (i.e. fresh, frozen and/or canned)
No. of types of FRESH vegetables	Yes/No	
No. of types of FROZEN vegetables	Yes/No	
No. of types of CANNED vegetables	Yes/No	
No. of types of SSB	Yes/No (soft drinks; fruit drink; sports drinks; sweetened teas and water)	Summed the number of types of SSB present in home (possible range: 0–8 types of SSB)
No. of types of whole grains	Yes/No (whole-grain breads, grains (e.g. millet), pastas, crackers, cereals)	Summed the number of types of whole grains present in home (possible range: 0–12 types of whole grains)
No. of types of quick-cook foods	Yes/No (microwaveable foods (e.g. hot pockets, burritos); quick-cook meats (e.g. chicken nuggets, hot dogs); quick rice/noodle meals (e.g. canned ravioli, ramen noodles), frozen dinner meals (e.g. TV dinner))	Summed the number of types of quick-cook foods present in home (possible range: 0–21 types of quick-cook foods)

Table 2 Continued

Variable	Response options	Description of variable
No. of types of candy	Yes/No (chocolate, hard/chewy candy, fruit snacks)	Summed the number of types of candy present in home (possible range: 0–6 types of candy)
No. of types of baked goods	Yes/No (baked goods (e.g. cookies, cupcakes), pastries)	Summed the number of types of baked goods present in home (possible range: 0–8 types of baked goods)
No. of types of chips/crackers	Yes/No (crackers and chips (regular and reduced fat), pretzels, snack mixes)	Summed the number of types of chips/crackers in home (possible range: 0–16 types of chips/crackers)
Accessibility of fruits and vegetables	Yes/No (fresh/canned fruits and/or vegetables accessible in kitchen; ready-to-eat fruits and/or vegetables accessible in refrigerator)	Responses were summed; a higher score indicated more accessible fruits and vegetables (possible range: 0–5)
Accessibility of SSB	Yes/No (SSB accessible in kitchen and/or refrigerator)	Responses were summed; a higher score indicated more accessible SSB (possible range: 0–3)
Accessibility of snacks	Yes/No (snacks (e.g. chips, baked goods) accessible in kitchen)	Responses were summed; a higher score indicated more accessible snacks (possible range: 0–5)
Covariates		
Which of the following best describes your (parent) work situation?	Working full-time; Working part-time; Stay at home caregiver; Currently unemployed, but actively seeking; Not working for pay (unable to work, retired, student, etc.)	Survey questions; assessed as categorical variables
What is your yearly TOTAL HOUSEHOLD income? (i.e. income from ALL family members whose job helps support the family). This includes wages, cash assistance, Social Security, child support, etc.	Less than \$US 20 000; \$US 20 000–34 999; \$US 35 000–49 999; \$US 50 000–74 999; \$US 75 000–99 999; \$US 100 000 or more	
Does your family get public assistance (like food support/stamps, SNAP, WIC, TANF, SSI or MFIP)?	Yes; No; I don't know	
Child weight status	Non-overweight (<85th BMI percentile); Overweight (≥85th BMI percentile <95th BMI percentile); Obese (≥95th BMI percentile)	BMI percentile values were calculated using an online CDC calculator†
Number of people in home	Sum of number of adults in home and number of children in home	Reported by parent at first home visit
Household structure	One parent (no other adults); One parent with other adults; Two parents (no other adults); Two parents with other adults	Age and relationship to child of each person living in home reported by parent at first home visit

HEI-2010, Healthy Eating Index-2010; SSB, sugar-sweetened beverages; HFI, home food inventory; SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; TANF, Temporary Assistance for Needy Families; SSI, Supplemental Security Income; MFIP, Minnesota Family Investment Program; NDSR, Nutrition Data System for Research; TV, television; CDC, Centers for Disease Control and Prevention.

*University of Minnesota, Nutrition Data System for Research (2014) Guide to creating variables needed to calculate scores for each component of the Healthy Eating Index-2010 (HEI-2010). <https://drive.google.com/file/d/0B4snm2Q3-ffQQTVHUWE1NGNxUnc/view> (accessed June 2017).

†Centers for Disease Control and Prevention (2010) Growth charts. <http://www.cdc.gov/growthcharts/> (accessed June 2017).

booklet to use as a reporting aid, and parents were provided with a food diary to record the foods and drinks their child consumed the day prior to the recall. Whenever possible, school breakfast and lunch menus were used as a guide, and standard amounts were used for common school items (e.g. 4 fluid ounces of juice). Family Matters staff identified common traditional Somali and Hmong foods (e.g. *anjero*) in advance and acceptable substitutes were developed if the food was not found in the NDSR system. Staff dietitians performed detailed quality assurance reviews on 100% of recalls; this included (i) visually reviewing the recall (e.g. identifying gaps in meal occasions, unusual entries, resolving foods eaten but not found

in the NDSR system) and (ii) using NDSR reports to review food or nutrient amounts (e.g. sodium, energy) that were flagged as either too high or too low. A Healthy Eating Index-2010 (HEI-2010) score was calculated for each participant using data from the 24 h dietary recalls⁽³²⁾. The HEI-2010 scores were done using calculations provided by the Nutrition Coordinating Center at the University of Minnesota⁽³³⁾.

Statistical analysis

A series of descriptive analyses and tabulations was performed to examine sample characteristics important for

Table 3 Description of family meals variables (adjusted* mean values and 95% confidence intervals) across racial/ethnic groups for participants of the Family Matters study, Minneapolis/St. Paul, MN, USA, 2015–2016

	Racial/ethnic group										Overall race P value†				
	Total sample (n 149)†		Black (n 24)		White (n 25)		Hmong (n 25)		Latino (n 25)			Native American (n 25)		Somali (n 25)	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI		Mean	95% CI	Mean	95% CI
Number of meals together/week	3.6	3.2, 3.9	2.8	1.7, 3.8	3.9	2.7, 5.0	3.0	2.0, 4.1	3.0	2.0, 4.0	4.1	3.1, 5.1	4.5	3.5, 5.6	0.098
Breakfast	2.5	2.2, 2.8	2.2	1.4, 3.0	1.9	0.9, 2.8	2.6	1.8, 3.4	2.9	2.1, 3.6	2.6	1.8, 3.4	3.0	2.2, 3.9	0.500
Lunch	5.7	5.4, 6.0	5.3	4.4, 6.1	6.0	5.0, 6.9	5.7	4.8, 6.5	5.7	4.8, 6.5	6.2	5.4, 7.0	5.7	4.8, 6.6	0.726
Dinner	2.0	1.7, 2.2	1.8	1.0, 2.5	2.3	1.4, 3.1	2.3	1.6, 3.1	1.4	0.6, 2.1	2.3	1.6, 3.1	1.7	0.9, 2.5	0.336
Child helps prepare meal	1.8	1.6, 2.1	2.3 ^{a,b}	1.7, 3.0	1.6 ^{a,b}	0.8, 2.3	2.7 ^b	2.0, 3.3	1.3 ^a	0.7, 1.9	2.0 ^{a,b}	1.4, 2.6	1.2 ^a	0.5, 1.9	0.013
Frequency of fast food at family meals															

^{a,b}Mean values within a row with unlike superscript letters were significantly different (significance level was adjusted to 99% confidence level to account for multiple testing).

*Adjusted for parent work status, household income, child weight status, number of people in household and household structure (e.g. single parent).

†One participant did not complete the Family Matters online survey, resulting in only 149 responses.

#Bold values indicate significance ($P < 0.05$).

modelling assumptions (i.e. patterns of missingness and cell size). Multiple linear regression was used to evaluate how racial/ethnic groups differ in features of the family meal environment, child diet quality, and home food availability and accessibility. Race/ethnicity was modelled as a categorical independent variable and all study outcomes were analysed as continuous random variables. Predicted mean values by race/ethnicity (and the sample population in total, for sub-sample comparison) were examined after adjustment for covariates including parent work status, household income, child weight status, number of people living in the household and household structure (e.g. single parent). Pairwise analyses at the race/ethnicity group level were performed to examine if groups differed on the outcomes described above. To account for multiplicity, testing was conservatively adjusted to the 99% confidence level to minimize an inflated type I error rate. All data management and analysis were performed using the statistical software package Stata SE version 15.

Results

The mean age of the children in the study was 6.4 (SD 0.8) years; children were split almost evenly by child sex (47% female). The sample was primarily low-income (70% of households earned less than \$US 35 000 per annum), with about half working full-time (42%), 21% working part-time and 36% not working. Over 40% of the sample were immigrants to the USA. Additional demographic information can be found in Table 1.

Family meal environment

As shown in Table 3, racial/ethnic groups had similar family meal patterns. All racial/ethnic groups reported high numbers of family meals, with family dinners being the highest (all groups had more than five family dinners per week). Hmong families had the highest reported frequency of purchasing fast food for family meals (2.7 times/week); all racial/ethnic groups reported serving fast food for a family meal at least once weekly. Overall, the sample reported that the 5–7-year-old children helped prepare the dinner meal 2.0 times/week.

Child dietary intake

As shown in Table 4, there were significant differences in HEI-2010 scores across racial/ethnic groups, with Somali children having the highest HEI-2010 scores; their HEI-2010 scores were 15.3 points higher than those of Black children, who had the lowest HEI-2010 scores. There was at least a one serving difference between the highest and lowest intake per racial/ethnic group for fruits, vegetables, whole grains and refined grains. In addition, there was over a 1400 mg difference in sodium intake

Table 4 Description of child dietary intake variables (adjusted* daily mean values and 95 % confidence intervals) across racial/ethnic groups for participants of the Family Matters study, Minneapolis/St. Paul, MN, USA, 2015–2016

	Racial/ethnic group														Overall race <i>P</i> value†
	Total sample (<i>n</i> 150)		Black (<i>n</i> 24)		White (<i>n</i> 25)		Hmong (<i>n</i> 25)		Latino (<i>n</i> 25)		Native American (<i>n</i> 25)		Somali (<i>n</i> 25)		
	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	
HEI-2010 score	57.1	55.7, 58.5	48.9 ^a	45, 52.7	57.5 ^{b,c}	53.0, 62.0	55.0 ^{a,b}	51.1, 58.9	61.7 ^{b,c}	57.9, 65.6	55.4 ^{ab}	51.7, 59.1	64.2 ^c	60, 68.3	<0.001
Fruit intake	1.4	1.2, 1.6	1.1	0.7, 1.6	2.0	1.4, 2.6	1.0	0.5, 1.5	1.8	1.3, 2.3	1.4	1.0, 1.9	1.0	0.5, 1.5	0.058
Vegetable intake	1.2	1.0, 1.3	1.1 ^{a,b}	0.8, 1.5	1.1 ^{a,b}	0.7, 1.5	1.1 ^{a,b}	0.7, 1.4	1.4 ^b	1.0, 1.7	1.6 ^b	1.3, 2.0	0.6 ^a	0.3, 1.0	0.011
100% Juice intake	0.8	0.6, 0.9	0.9	0.6, 1.3	0.5	0.1, 0.9	0.9	0.6, 1.3	1.1	0.7, 1.4	0.4	0.1, 0.8	0.7	0.3, 1.0	0.075
Dairy intake	2.2	2.0, 2.4	2.0	1.6, 2.4	2.5	2.0, 3.0	1.7	1.3, 2.2	2.3	1.9, 2.8	2.2	1.8, 2.6	2.5	2.0, 2.9	0.145
Whole grains intake	1.3	1.1, 1.5	1.0 ^{a,b,c}	0.6, 1.5	1.8 ^{b,c}	1.3, 2.3	0.6 ^a	0.2, 1.0	1.7 ^c	1.3, 2.2	0.9 ^{a,b}	0.5, 1.3	1.7 ^c	1.3, 2.2	<0.001
SSB intake	0.5	0.4, 0.6	0.7 ^{a,b}	0.4, 1.0	0.6 ^{a,b}	0.3, 0.9	0.3 ^a	0.1, 0.6	0.5 ^{a,b}	0.3, 0.8	0.9 ^b	0.6, 1.1	0.2 ^a	-0.1, 0.5	0.009
Refined grains intake	4.6	4.3, 4.9	5.4 ^{b,c}	4.6, 6.2	3.7 ^{a,b}	2.8, 4.7	4.9 ^{a,b,c}	4.1, 5.7	3.5 ^a	2.7, 4.3	5.9 ^a	5.2, 6.7	4.1 ^{a,b}	3.2, 4.9	<0.001
Baked goods intake	0.6	0.5, 0.7	0.6	0.3, 0.9	0.5	0.2, 0.9	0.4	0.1, 0.7	0.6	0.3, 0.9	0.5	0.3, 0.8	0.6	0.3, 0.9	0.940
Chips & crackers intake	0.5	0.4, 0.6	0.9 ^b	0.6, 1.1	0.7 ^{a,b}	0.4, 1.1	0.2 ^a	0.0, 0.5	0.3 ^{a,b}	0.1, 0.6	0.7 ^{ab}	0.4, 0.9	0.2 ^a	-0.1, 0.5	0.005
Candy intake	0.1	0.1, 0.2	0.2	0.1, 0.3	0.2	0.1, 0.3	0.1	0.0, 0.2	0.2	0.1, 0.3	0.1	0.0, 0.2	0.0	-0.1, 0.1	0.212
Sodium (mg)	2414	2288, 2541	3052 ^c	2699, 3404	2450 ^{b,c}	2039, 2861	2550 ^{b,c}	2196, 2905	2012 ^{a,b}	1663, 2361	2797 ^c	2462, 3132	1627 ^a	1251, 2003	<0.001
Daily energy intake (kJ)	6615	6355, 6878	7389 ^b	6678, 8100	6782 ^{a,b}	5954, 7611	6519 ^{a,b}	5803, 7234	6443 ^{a,b}	5740, 7150	7381 ^b	6703, 8054	5184 ^a	4422, 5941	0.001
Daily energy intake (kcal)	1581	1519, 1644	1766 ^b	1596, 1936	1621 ^{a,b}	1423, 1819	1558 ^{a,b}	1387, 1729	1540 ^{a,b}	1372, 1709	1764 ^b	1602, 1925	1239 ^a	1057, 1420	0.001

HEI-2010, Healthy Eating Index-2010; SSB, sugar-sweetened beverages.

^{a,b,c}Mean values within a row with unlike superscript letters were significantly different (significance level was adjusted to 99 % confidence level to account for multiple testing).

*Adjusted for parent work status, household income, child weight status, number of people in household and household structure (e.g. single parent).

†Bold values indicate significance (*P*<0.05).

between the highest and lowest intake per racial/ethnic group and over a 2093 kJ (500 kcal) difference in daily energy intake.

While Somali children had the highest HEI-2010 scores, they had low fruit and vegetable intakes (1.0 and 0.6 average daily servings, respectively). Somali children had low sodium, chips/crackers and daily energy intakes. Latino children, who were similar to Somali children in HEI-2010 scores, also had low intakes of sodium and chips/crackers, but their vegetable intake was significantly higher than Somali children. Black children, who had the lowest HEI-2010 scores, had lower fruit, vegetable and whole grain intakes, and higher intakes of refined grains, chips/crackers, sodium and daily energy.

Home food availability/accessibility

As shown in Table 5, there were significant differences across racial/ethnic groups for most categories of home food availability/accessibility. Regarding fruits and vegetables, Black and Hmong households had the lowest number of food types available; Black households also had less accessibility of fruits and vegetables. White and Latino households had the highest number of types of fruits and vegetables available, and the most accessible fruits and vegetables.

While White households had high numbers of fruits and vegetables available and accessible, they also had higher numbers of sugar-sweetened beverages, quick-cook foods, candy and chips/crackers than most racial/ethnic groups. Native American families had the highest number of types of quick-cook foods (e.g. burritos, hot dogs), with an average of six types; this is 4.4 more types of quick-cook foods than Somali households, who had the lowest number.

Discussion

The present study described the home food environment and characterized child dietary intake in a racially/ethnically diverse sample. Results showed significant differences across many areas of the home food environment and dietary intake that may be important to consider when working with these racial/ethnic groups.

Family meal environment

Regarding the family meal environment, family meal frequency was high across all racial/ethnic groups, particularly for family dinners⁽¹⁹⁾. These are encouraging findings as previous research has shown family meals to be associated with better dietary outcomes in children and adolescents⁽⁴⁻¹⁰⁾. It appears that intervention efforts aimed at increasing family meal frequency may not need to be tailored by race/ethnicity. Instead, the focus of intervention work may need to be on family meal dietary quality and the context of the family meal^(34,35). Participants reported purchasing fast food for family meals 1.8 times per week, with Hmong families reporting the highest

amount at 2.7 times/week. Working with families to decrease fast food at family meals may be one way to encourage better family meal dietary quality⁽¹¹⁾. Additionally, families reported that their 5–7-year-old child helped prepare a dinner meal 2.0 times per week, and there were no significant differences across race/ethnicity. There is limited research about how frequently children – particularly young children – assist in meal preparation and the present study provides new information across racial/ethnic groups⁽³⁶⁾. Including young children in making family meals may be a potential target in future family meal interventions as it can increase cooking skills, confidence, attitudes and diet quality⁽³⁷⁾.

Child dietary intake

There were large and significant differences in HEI-2010 scores across racial/ethnic groups, with Somali children having the highest scores (64.2) and Black children having the lowest (48.9). The present study also confirms prior research showing that children are below recommendations for dietary intake of fruits and vegetables^(38,39). While Somali children had the highest HEI-2010 scores, they did not have a clear pattern of healthful dietary intake across food categories. For example, they had the lowest reported dietary intakes of both fruits and vegetables, which differs from previous research on Somali adolescents⁽²²⁾. It is not clear if this is a disparate finding, or if Somali adolescents happen to have higher fruit and vegetable intakes than Somali children. Somali children's high HEI-2010 scores may be partly attributed to their significantly lower daily energy intake. Because individual HEI-2010 categories (e.g. Total Fruit, Dairy) are calculated by looking at cup/ounce equivalents per 4184 kJ (1000 kcal), a lower intake of fruit would still contribute to a larger part of the daily energy intake⁽³²⁾. All Somali parents in the present study were immigrants; of the immigrant groups, they have been in the USA the shortest time (mean 10.9 years). It may be that Somali parents are maintaining a high diet quality brought with them from their home countries. Some previous research has shown that diet quality is negatively impacted upon people's immigration to the USA⁽⁴⁰⁻⁴⁴⁾; therefore, researchers may wish to intervene with Somali families to help ensure their healthier diet is not diminished the longer they are in the USA. Somali families may also be able to teach other immigrant families about balancing life as an immigrant in the USA with maintaining a healthy diet.

Conversely, Black children had the lowest HEI-2010 scores; across food categories, there was a consistent pattern where Black children had lower intake of healthful categories (e.g. fruits, vegetables, whole grains) and higher intake of unhealthful categories (e.g. refined grains, chips/crackers, sodium, daily energy). When calculating HEI-2010 scores, Somali children received an average of 6.0 more HEI points than Black children for consuming lower amounts of 'empty calories' (i.e. energy from solid fats and added sugars)⁽⁴⁵⁾. Study results provide multiple avenues for

Table 5 Description of home food availability and accessibility variables (adjusted* mean values and 95 % confidence intervals) across racial/ethnic groups for participants of the Family Matters study, Minneapolis/St. Paul, MN, USA, 2015–2016

	Racial/ethnic group														Overall race <i>P</i> value†
	Total sample (<i>n</i> 150)		Black (<i>n</i> 24)		White (<i>n</i> 25)		Hmong (<i>n</i> 25)		Latino (<i>n</i> 25)		Native American (<i>n</i> 25)		Somali (<i>n</i> 25)		
	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	
Fruit and vegetable availability															
No. of types of fruit	5.3	4.8, 5.8	3.6 ^a	2.3, 4.9	7.6 ^b	6.1, 9.1	3.4 ^a	2.1, 4.8	7.2 ^b	5.9, 8.5	5.2 ^{a,b}	3.9, 6.5	4.9 ^{a,b}	3.5, 6.4	<0.001
No. of types of FRESH fruit	3.5	3.1, 3.9	1.7 ^a	0.7, 2.8	5.0 ^b	3.8, 6.2	2.7 ^a	1.6, 3.7	5.4 ^b	4.4, 6.5	2.6 ^a	1.6, 3.6	3.5 ^{a,b}	2.4, 4.6	0.000
No. of types of CANNED fruit	1.3	1.1, 1.5	1.5 ^{a,b}	0.9, 2.1	1.4 ^{a,b}	0.7, 2.1	0.6 ^a	0.0, 1.2	1.3 ^{a,b}	0.7, 1.9	2.2 ^b	1.6, 2.7	0.8 ^a	0.1, 1.4	0.007
No. of types of FROZEN fruit	0.5	0.3, 0.6	0.1 ^a	-0.2, 0.5	1.1 ^b	0.7, 1.6	0.2 ^a	-0.2, 0.6	0.7 ^{a,b}	0.3, 1.0	0.2 ^a	-0.2, 0.5	0.4 ^{a,b}	0.0, 0.8	0.012
No. of types of DRIED fruit	0.4	0.2, 0.5	0.3	0.0, 0.7	1.0	0.6, 1.4	0.1	-0.3, 0.4	0.2	-0.1, 0.6	0.4	0.1, 0.7	0.3	-0.1, 0.7	0.050
No. of types of vegetables	7.2	6.7, 7.7	6.6 ^{a,b}	5.2, 8.0	8.6 ^b	7.0, 10.2	5.4 ^a	4.0, 6.8	8.4 ^b	7.0, 9.8	6.9 ^{a,b}	5.6, 8.2	7.3 ^{a,b}	5.8, 8.8	0.033
No. of types of FRESH vegetables	4.4	3.9, 4.8	2.6 ^a	1.4, 3.8	5.3 ^{b,c}	3.9, 6.8	3.9 ^{a,b,c}	2.7, 5.2	5.8 ^c	4.6, 7.0	3.3 ^{a,b}	2.1, 4.5	5.3 ^{b,c}	4.0, 6.6	0.002
No. of types of FROZEN vegetables	1.3	1.1, 1.5	1.2	0.6, 1.9	1.9	1.2, 2.7	0.8	0.1, 1.5	2.0	1.3, 2.6	1.1	0.5, 1.7	0.8	0.1, 1.5	0.070
No. of types of CANNED vegetables	1.9	1.6, 2.1	3.0 ^{b,c}	2.3, 3.8	1.9 ^{a,b}	1.1, 2.7	0.7 ^a	0.0, 1.4	0.8 ^a	0.1, 1.5	3.6 ^c	2.9, 4.2	1.2 ^a	0.5, 2.0	<0.001
Accessibility of fruit/vegetables score	2.0	1.8, 2.2	1.4 ^a	0.9, 2.0	2.4 ^{a,b}	1.8, 3.0	2.1 ^{a,b}	1.6, 2.6	2.7 ^b	2.2, 3.2	1.7 ^a	1.2, 2.2	1.7 ^{a,b}	1.2, 2.3	0.017
Snacks and quick-cook foods availability															
No. of types of SSB	1.4	1.2, 1.6	1.4 ^{a,b}	0.9, 1.9	1.5 ^{a,b}	0.9, 2.1	1.3 ^{a,b}	0.8, 1.8	1.9 ^b	1.4, 2.4	1.6 ^b	1.2, 2.1	0.6 ^a	0.1, 1.2	0.037
No. of types of whole grains	3.8	3.5, 4.1	3.5 ^{a,b}	2.6, 4.3	5.1 ^b	4.1, 6.1	2.6 ^a	1.7, 3.4	3.7 ^{a,b}	2.9, 4.6	4.2 ^b	3.4, 5.0	3.4 ^{a,b}	2.5, 4.3	0.008
No. of types of quick-cook foods	3.7	3.3, 4.0	5.4 ^c	4.4, 6.4	4.0 ^{b,c}	2.8, 5.2	2.6 ^{a,b}	1.6, 3.7	2.4 ^{a,b}	1.4, 3.4	6.0 ^c	5.0, 6.9	1.6 ^a	0.5, 2.7	<0.001
No. of types of candy	0.7	0.5, 0.9	0.5	0.1, 0.9	1.3	0.8, 1.8	0.8	0.3, 1.2	0.9	0.5, 1.4	0.5	0.1, 0.9	0.2	-0.3, 0.7	0.073
No. of types of baked goods	1.0	0.8, 1.1	1.1	0.7, 1.5	1.1	0.6, 1.6	0.7	0.2, 1.1	1.1	0.7, 1.5	0.7	0.3, 1.1	1.0	0.6, 1.5	0.540
No. of types of chips/crackers	1.9	1.6, 2.2	1.6 ^a	0.9, 2.4	3.3 ^b	2.5, 4.2	0.8 ^a	0.1, 1.6	2.0 ^{a,b}	1.2, 2.7	1.7 ^a	0.9, 2.4	2.0 ^{a,b}	1.2, 2.8	0.004
Accessibility of SSB score	0.9	0.8, 1.0	0.8	0.5, 1.1	0.7	0.3, 1.1	0.7	0.4, 1.0	1.1	0.8, 1.4	0.8	0.5, 1.2	1.1	0.8, 1.5	0.261
Accessibility of snacks score	0.7	0.5, 0.8	0.8	0.4, 1.1	0.6	0.1, 1.0	0.4	0.0, 0.8	1.1	0.7, 1.4	0.7	0.3, 1.0	0.6	0.2, 1.0	0.198

SSB, sugar-sweetened beverages.

^{a,b,c}Mean values within a row with unlike superscript letters were significantly different (significance level was adjusted to 99 % confidence level to account for multiple testing).

*Adjusted for parent work status, household income, child weight status, number of people in household and household structure (e.g. single parent).

†Bold values indicate significance (*P* < 0.05).

improving the dietary quality of Black children (e.g. increased fruit and vegetable intakes, lower sodium and empty calories intakes, lower daily energy intake). As Blacks are one of the largest minority groups in the USA⁽⁴⁶⁾, future interventions working to increase dietary quality for Black children could have significant public health advantages.

Home food availability and accessibility

As with dietary intake, there were many significant differences across racial/ethnic groups for home food availability and accessibility. White and Latino households were similar in that they had the most types of fruits and vegetables and highest fruit and vegetable accessibility scores, yet White and Latino households also had many types of unhealthful foods (e.g. sugar-sweetened beverages, candy, baked goods, chips/crackers). As shown earlier, compared with other racial/ethnic groups, White and Latino children had among the highest HEI-2010 scores. These findings suggest that it is not necessary to have only healthful foods in the home to have healthful child dietary intake. Future research should investigate how White and Latino children maintain high HEI-2010 scores despite having high levels of snacks in the home, and if there are recommendations that can be developed that help families balance the amount of healthful and unhealthful foods in the home.

One interesting and significant finding was regarding the amount of quick-cook foods (e.g. burritos, chicken nuggets) available in households of this diverse population. Native American, Black and White families had the highest number of types of quick-foods, while Hmong, Latino and Somali families had the lowest. As the majority of Hmong, Latino and Somali parents in the Family Matters study were immigrants⁽²⁶⁾, it may be that these groups maintain their traditional foods, which would include less quick-cook foods. Future research may want to qualitatively investigate Hmong, Latino and Somali homes to identify any helpful strategies for preparing quick family meals that do not rely on quick-cook foods to extend family meal interventions to diverse populations⁽³⁴⁾. Finally, there appear to be significant differences across race/ethnicity regarding the types (e.g. fresh, canned) of fruits and vegetables available in the home. Future research may wish to investigate further how the types of fruits and vegetables in the home are associated with dietary intake in different racial/ethnic groups.

There were many strengths to the present study, one of which includes the racially/ethnically diverse sample. Little is known about the dietary intake of some groups (e.g. urban Native Americans)⁽²⁴⁾ and less is known about the home food environment of racial/ethnic groups such as Somali and Hmong households, which the study assessed. Additionally, the mixed-methods and pre-stratified study design allowed for an equal distribution of households by race/ethnicity to examine important questions about the home food environment of diverse families. Study materials (i.e. online survey) were

translated into Hmong, Somali and Spanish, which allowed the participation of non-English-speaking participants. The present study also used dietary intake and home food availability data that are objectively measured. However, there were also limitations to the study. First, while the sample size is very diverse, the racial/ethnic subsample size is small due to the limiting nature of conducting mixed-methods studies and using in-home data collection methods; to account for this issue, more conservative statistical testing was implemented to deal with multiple comparisons. Therefore, more research is needed with larger samples. Second, home food availability assesses only the number of types of foods; for example, having limited types of fruit in the home does not necessarily mean there is limited quantity of fruits. Some racial/ethnic groups may consume larger quantities of a few types of fruits, which would not be captured by the HFI tool used. Additionally, parents were not provided a definition of meal preparation, which could lead to different survey responses regarding children's participation in meal preparation if parents' ideas about what constitutes meal preparation varied. Lastly, revisions to the HFI for the Family Matters study to increase face validity may have altered the psychometric properties of the originally validated instrument.

Conclusions

The present study examined the home food environments (i.e. family meals, dietary intake and home food availability) of children from six racial/ethnic and immigrant/refugee groups. It provides new information regarding the home food environment of young children in previously understudied racial/ethnic groups. Results show significant differences across racial/ethnic groups for many home food environment variables; results also identify aspects of racial/ethnic groups that should be explored further to develop strategies and recommendations for improving other groups' home food environments and child dietary intake. Finally, the study shows that interventions working to improve the home food environment and dietary intake of children need to consider race/ethnicity as well as other factors related to race/ethnicity, such as cultural norms, cultural assets and immigrant status.

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