# Compared to Pre-prepared Meals, Fully and Partly Home-Cooked Meals in Diverse Families with Young Children Are More Likely to Include Nutritious Ingredients

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**ABSTRACT**

**Background** Interest in initiatives that promote home cooking has been increasing, but no studies have examined whether home cooking is associated with dietary quality using longitudinal data on meals served in a diverse sample of families.

**Objective** The present study examined data on multiple meals per family in diverse households to determine whether home-cooked meals are more likely to contain nutritious ingredients than pre-prepared meals.

**Design** Data for the study came from the National Institutes of Health–funded Family Matters Study. As part of this study, between 2015 and 2016, 150 families provided ecological momentary assessment data on 3,935 meals over an 8-day observation window.

**Participants/setting** In this study, investigators followed 150 families with children aged 5 to 7 years old from six racial/ethnic groups (n=25 each non-Hispanic white, non-Hispanic black, Hispanic, Native American, Hmong, and Somali families). Recruitment occurred through primary care clinics serving low-income populations in Minnesota.

**Main outcome measures** The main outcomes were participants' self-reports of whether they served fruits, vegetables, and whole grains at a meal, and reports were made within hours of the meal.

**Statistical analyses performed** Within-group estimator methods were used to estimate the associations between meal preparation and types of food served. These models held constant time-invariant characteristics of families and adjusted for whether the meal was breakfast, lunch, dinner, or a snack and whether it was a weekend meal.

**Results** For all racial/ethnic and poverty status groups, meals that were fully or partly home-cooked were more likely to contain fruits and vegetables than pre-prepared meals ($P<0.001$). Meals that were partly home-cooked were the most likely to contain whole grains ($P<0.001$). Restaurant meals were more likely to contain vegetables than pre-prepared meals ($P<0.001$) but were equally likely to contain fruits and/or whole grains as pre-prepared meals.

**Conclusions** Interventions or initiatives that encourage fully or partly home-cooked meals may help families incorporate nutritious foods into their diets. In addition, evaluations of potential strategies to increase the likelihood of supplementing pre-prepared and restaurant meals with nutritious meal ingredients warrants further investigation.
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RESEARCHERS, NUTRITION EDUCATORS, PEDIATRICians, and parents have shown an increased interest in interventions and initiatives that promote home cooking[1-4]—meals made mostly from scratch ingredients. Home cooking declined in the late 20th century among all Americans and has remained constant among low-income households for the last 2 decades.[5-7] Research has revealed that a higher frequency of home-cooked meals is associated with higher diet quality for children and adults.[4,8-11] For example, families eating home-cooked meals five or more times per week consume significantly more fruits and vegetables than those consuming home-cooked meals less than three times per week.[9]

However, the current evidence linking home cooking with diet quality is limited in two important ways. First, because the evidence is based on cross-sectional family-level data,[11] it is not known whether increasing the frequency of home cooking in families who rarely serve home-cooked meals will improve dietary quality. No study has examined multiple meals from each family for whom some of the meals are home cooked and some are not. In particular, if families who rarely cook favor unhealthy ingredients (eg, processed meats, refined grains, saturated fats), their home-cooked meals may have the same dietary quality as meals eaten out. The second limitation of the current literature is that most studies are based on higher-income, nonminority samples,[12,13] and thus it is not known whether frequent home cooking is associated with dietary quality among low-income or minority families. In fact, one study demonstrated that a high rate of home cooking was correlated with obesity among Hispanic boys from low-education households.[12]

Because home-cooking interventions and initiatives are often targeted to families who do not frequently make homemade meals, minority families, and families from lower socioeconomic backgrounds, more research is needed to determine whether the dietary quality of home-cooked meals is higher among these populations. Thus, the objective of the present study was to determine whether fully and partly home-cooked meals were more likely to include fruits, vegetables, or whole grains than pre-prepared meals and whether the likelihood differed by race/ethnicity and socioeconomic status.

### RESEARCH SNAPSHOT

**Research Question:** Are fully and partly home-cooked meals more likely to include nutritious ingredients than pre-prepared meals?

**Key Findings:** In this observational study of 3,935 meals from 150 racially, ethnically, and socioeconomically diverse families from the Family Matters Study, fully or partly home-cooked meals were significantly more likely to contain fruits and vegetables than pre-prepared meals ($P<0.001$).

## METHODS

Data for the present study are from Family Matters, a National Institutes of Health–funded study.[14] Family Matters is a 5-year longitudinal observational study designed to identify novel risk and protective factors for childhood obesity in the home environments of racially/ethnically diverse children from primarily low-income families. Phase I of the study includes an in-depth 10-day examination of the family home environments of diverse families (n=150), including collection of both quantitative assessments and qualitative observations. Phase II is an 18-month epidemiological cohort study with diverse families (n=1,200). Data in the present study are from phase I of the Family Matters study. The University of Minnesota's Institutional Review Board Human Subjects Committee approved all protocols used in both phases of the Family Matters study. All adult participants provided written informed consent, and all children between the ages of 8 and 17 years provided assent to participate in the study. In addition, each child younger than 18 years had written parental consent in place.

### Participants

The study investigators recruited children and their families from the Minneapolis/St. Paul, Minnesota, area between 2015 and 2016 by means of a letter sent to them by their family physicians. Children were eligible to participate in the study if they were between the ages of 5 and 7 years old, had a sibling between the ages of 2 and 12 years old living in the same home, lived with their parent/primary guardian more than 50% of the time, shared at least one meal (home-cooked or otherwise) per day with the parent/primary caregiver, and were from one of six racial/ethnic categories (non-Hispanic white, non-Hispanic black, Hispanic, Native American, Hmong, or Somali). The study design intentionally stratified the sample by the race/ethnicity and weight status of the study child to identify potential weight- and/or race/ethnicity–specific home environment factors related to obesity risk. Within each race/ethnic group, half of the families recruited had a sample child with body mass index (BMI) ≥85th percentile, and the other half had a sample child with BMI >5th percentile but <85th percentile. Although income was not an eligibility criterion, recruitment occurred at clinics serving primarily low-income populations. The investigators contacted 1,500 eligible families to reach the enrollment goal of 150 families, 25 from each of the six racial/ethnic groups listed previously. In-depth details regarding recruitment and the study design are published elsewhere.[14]

### Procedures and Data Collection

Data were collected from participants over a 10-day period, which included an 8-day observational period between two home visits. The Family Matters Study collected many measures described elsewhere.[14] The measures used in this analysis (described in the section titled "Measures") come from direct measurement of height and weight of the study child and parent respondent by trained staff using a digital scale (Seca model 869) and stadiometer (Seca model 217) at the first home visit,[15] from a single online survey completed by the parent at the second home visit, and from mealtime ecological momentary assessment (EMA) surveys collected between home visits.[16] During the 8-day EMA observation period between home visits, parents filled out an EMA survey on a study-provided iPad after each meal (defined as breakfast, lunch, dinner, or snack) eaten with the study child. Parents were required to complete at least one mealtime survey per day; however, parents completed, on average, three mealtime surveys per day. The average mealtime survey took participants 3 minutes to complete. EMA survey measures were identified by examining a pre-existing, validated instrument[17] and adapting it for EMA.

**Language.** Families participated in their preferred language; all study materials were translated, and bicultural and bilingual staff interacted with families. The Somali, Hispanic, and Hmong Partnership for Health and Wellness, a group of community researchers in Minnesota, translated all materials into different languages and performed a cultural sensitivity check to ensure the translation was understandable and specific to the local culture.

## Measures

**Meal Preparation.** Although the definition of home cooking varies across the literature,[18] this study defines a fully home-cooked meal as one made at home from mostly scratch ingredients. In contrast, meals that are not home cooked are from restaurants or are pre-prepared meals, sometimes referred to as convenience foods. Partly home-cooked meals are those made from a combination of scratch ingredients, restaurant food, and/or pre-prepared foods. Each mealtime EMA survey asked parents to choose all of the following descriptors that best characterized how the meal was prepared: a) "fast food/take-out (eaten at home or at a restaurant);" b) "pre-prepared foods (eg, macaroni and cheese, frozen meals) or purchased snacks (eg, fruit snacks, chips, granola bars, cereal);" and/or c) "homemade/freshly prepared foods (include fresh fruits or vegetables here)."[19,20] From this question, each meal was classified into one of four mutually exclusive categories as follows:

1. fully home-cooked meals (respondent chose home-cooked foods only);
2. partly home-cooked meals (respondent chose home-cooked foods plus pre-prepared and/or restaurant foods);
3. restaurant meals (respondent chose fast food/take-out only, or fast food/take-out and pre-prepared foods); or
4. pre-prepared meals (respondent chose pre-prepared foods only).

**Ingredients Served.** Immediately following the meal preparation question on the mealtime EMA survey was a question asking whether any of the following foods were served at the meal that just occurred: "fruit; vegetables; whole grains (eg, whole-wheat bread or cereals, brown rice, oatmeal, corn tortillas); refined grains (eg, white bread or cereals, flour tortillas, white rice); dairy (eg, milk, cheese, yogurt, milk alternative such as soy milk, ice cream); meat protein (eg, chicken, beef, seafood/fish); beans, eggs, seeds, nuts, tofu; sugary drinks (eg, pop, Kool-Aid, Capri Sun, Sunny Delight, sports drinks)[*]; cake/cupcake/cookies or other baked goods; and candy (eg, sweets, chocolate, Gushers, fruit snacks)[†]."[17] This study focused on whether parents served and whether children ate fruits, vegetables, or whole grains at the meal because consumption of fruits, vegetables, and whole grains has been found to be associated with reduced risk of obesity, diabetes, heart disease, and certain types of cancer.[21-28]

**Ingredients Eaten.** After the respondent identified all of the ingredients served in a meal, he or she reported whether the child ate any of the served ingredients.[17] Analysis also included whether the sample child ate the served fruits, vegetables, or whole grains as a check that serving a nutritious ingredient translated into dietary intake of that ingredient.

**Other Meal Characteristics.** Indicators for whether the meal was a breakfast (n=975), lunch (n=644), or snack (n=1,103) and whether the meal occurred on a weekend day (n=1,205) were also created. The reference categories were dinner meals (n=1,213) and weekday meals (n=2,730).

**Race/Ethnicity and Poverty Status.** Determination of race/ethnicity depends on the primary caregiver's report of the race/ethnicity of the sample child at the time of recruitment. Because the online survey collected annual household income in brackets, the household's poverty status cannot be determined precisely; instead, analysis included an estimated poverty status based on income bracket and household composition. Because all families in the sample included at least one adult and two children, all families with annual incomes below $20,000 in the sample fall below the poverty level (n=50) according to the 2016 federal poverty guidelines.[29] Among families with annual incomes between $20,000 and $34,999, families with six people or more were classified as falling below the poverty level (n=22), according to the 2016 federal poverty guidelines.[29]

## Statistical Analysis

Descriptive analyses included two-sample unpaired *t* tests to determine whether there were significant differences in: a) average family characteristics across racial/ethnic groups, b) the proportion of meals that are home-cooked across racial/ethnic groups and across groups defined by poverty status, and c) the proportion of meals that included fruits, vegetables, and whole grains across racial/ethnic groups and across poverty status groups.

Then, within-group estimator methods were employed to estimate the relationship between meal preparation and ingredients served (or eaten) at the meal within each family, adjusting for meal-level characteristics. The model identifies the relationship from variation within families, not across families. As a result, family-level characteristics were not included in the regression specification because the model adjusts for all meal-invariant characteristics, whether observable (such as race/ethnicity, income, or any of the family characteristics listed in Table 1) or unobservable (such as a family's taste or distaste for nutritious ingredients). The specific model is a within-group logistic regression, and it estimates the relationship between whether a meal was fully or partly home-cooked or from a restaurant (reference was pre-prepared) and whether a meal contained fruits, vegetables, or whole grains (or whether the sample child ate those ingredients). The models adjusted for whether the meal was breakfast, lunch, or a snack (reference was dinner) and whether the meal occurred on a weekend day. Multiple tests of this model were conducted (ie, collinearity tests, link tests, and likelihood ratio $\chi^2$ tests) to ensure that it is not affected by specification problems. Pre-prepared meals were chosen to be the reference group because, after home-cooking, they were the most prevalent category of meal preparation. Likewise, dinner was chosen to be the reference because it was the most prevalent meal type.

[*] *Kool-Aid (Kraft Foods); Capri Sun (Kraft Heinz); Sunny Delight (Sunny Delight Beverages).*
[†] *Gushers (General Mills).*

**Table 1.** Distribution of sociodemographic characteristics of a diverse sample of Minnesota families with young children in 2015–2016, by race/ethnicity

| | Non-Hispanic white families[a] (n=25) | Non-Hispanic black families (n=25) | Hispanic families (n=25) | Native American families (n=25) | Hmong families (n=25) | Somali families (n=25) |
|---|---|---|---|---|---|---|
| **Household characteristics** | | | | | | |
| Annual household income (%) | | | | | | |
| Less than \$20,000 | 8 | 48** | 36* | 56*** | 20 | 32 |
| \$20,000-\$34,999 | 16 | 36 | 52** | 32 | 44* | 40 |
| \$35,000-\$49,999 | 8 | 0 | 4 | 8 | 20 | 24* |
| \$50,000 or more | 68 | 16*** | 8*** | 4*** | 16*** | 4*** |
| Household receives public assistance (%) | 24 | 84*** | 52* | 80*** | 68*** | 88*** |
| Number of children (including study child) (%) | | | | | | |
| Two | 60 | 32* | 48 | 52 | 12*** | 8*** |
| Three | 24 | 28 | 32 | 16 | 32 | 24 |
| Four | 8 | 28 | 20 | 20 | 28 | 20 |
| Five or more | 8 | 12 | 0 | 12 | 28* | 48*** |
| **Primary caregiver characteristics** | | | | | | |
| Age in years (mean) | 39 | 30*** | 36 | 35* | 31*** | 36 |
| Highest level of education (%) | | | | | | |
| Less than high school | 0 | 20 | 48*** | 8 | 16 | 40*** |
| High school diploma | 16 | 56** | 20 | 48* | 56** | 44* |
| Some college | 16 | 20 | 20 | 40* | 8 | 8 |
| Bachelor's degree or more | 68 | 4*** | 12*** | 4*** | 20*** | 8*** |
| Currently working (%) | 76 | 52 | 56 | 48* | 68 | 80 |
| Married (%) | 92 | 8*** | 72 | 8*** | 64* | 68* |
| Foreign born (%) | 12 | 0 | 76*** | 0 | 64*** | 100*** |
| Obese (BMI[b]≥30) (%) | 32 | 76*** | 48 | 68** | 24 | 60* |
| **Child characteristics** | | | | | | |
| Female (%) | 40 | 60 | 40 | 48 | 44 | 52 |
| Obese (BMI≥95th percentile) (%) | 16 | 36 | 32 | 32 | 32 | 32 |

[a]Significance test results from two-sample unpaired *t* tests are relative to the non-Hispanic white subgroup.
[b]BMI=body mass index.
*$P<0.05$.
**$P<0.01$.
***$P<0.001$.

Statistical significance was reported as $P<0.001$, $P<0.01$, and $P<0.05$; and clinically meaningful results are discussed. Because multiple outcomes are examined, significant results may occur in some small percentage of the models by chance (eg, false-positive results). For transparency and to avoid a high rate of false-negative results, significance tests were not adjusted to reduce the false-positive rate (eg, Bonferroni correction).[30-32]

A separate regression estimates the relationship for each racial/ethnic group and poverty status group. For ease of interpretation, results are displayed as average predicted probabilities, or the mean of each meal's probability that the outcome is true (eg, fruit is served) if the key independent variable is set to true (eg, the meal is home cooked). The average predicted probabilities are calculated from the estimated logistic model results using within-estimator methods. For each average predicted probability, 95% CIs (the range of predicted probabilities within which the true parameter lies with 95% confidence) are presented. All analyses were conducted in Stata 15.1 SE,[33] including computing average predicted probabilities and 95% CIs using the commands "xtlogit, fe" and "margins."

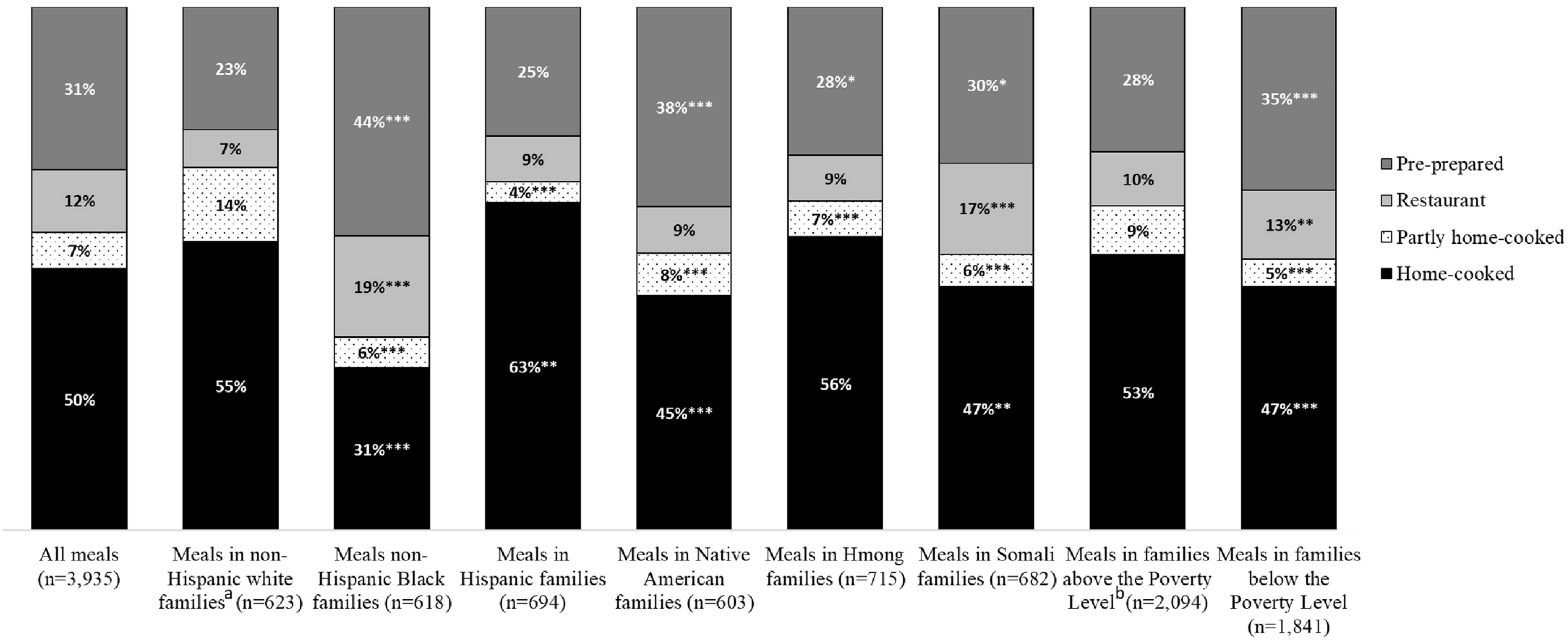


**Figure 1.** Distribution of meal preparation types in a longitudinal sample of meals served by 150 diverse Minnesota families with young children, by race/ethnicity and poverty level. [a]Significance test results for racial/ethnic subgroups are relative to those for the non-Hispanic white subgroup. [b]Significance test result for meals in the subgroup of families below the poverty level is relative to that for meals in families above the poverty level subgroup. *$P<0.05$; **$P<0.01$; ***$P<0.001$.

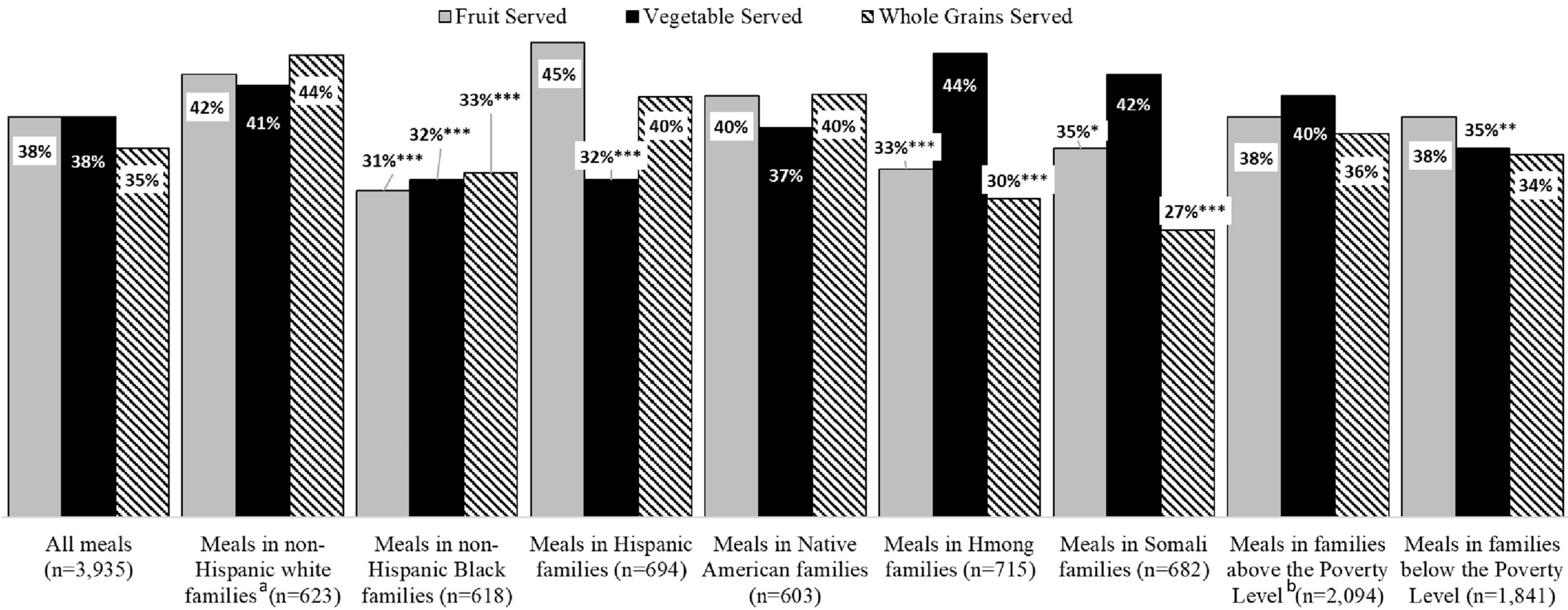


**Figure 2.** Distribution of meals including fruits, vegetables, and whole grains in a longitudinal sample of meals served by 150 diverse Minnesota families with young children, by race/ethnicity and poverty level. [a]Significance test results for racial/ethnic subgroups are relative to those for the non-Hispanic white subgroup. [b]Significance test on Meals in families below the Poverty Level subgroup is relative to Meals in families above the Poverty Level subgroup. *$P<0.05$; **$P<0.01$; ***$P<0.001$.

**Table 2.** Associations between home-cooked meals and the average predicted probability of serving healthy ingredients in a longitudinal sample of meals served by 150 diverse Minnesota families with young children, by race/ethnicity and poverty level

| | All meals[a] (n=3,935) | Meals in non-Hispanic white families (n=623) | Meals in non-Hispanic black families (n=618) | Meals in Hispanic families (n=694) | Meals in Native American families (n=588) | Meals in Hmong families (n=715) | Meals in Somali families (n=640) | Meals in families above the poverty level (n=2,094) | Meals in families below the poverty level (n=1,841) |
|---|---|---|---|---|---|---|---|---|---|
| **Meal preparation** | **Average predicted probability (%) of meal containing *fruits* (95% CI)[b]** | | | | | | | | |
| Fully home-cooked | 84.9*** | 92.3*** | 92.0*** | 81.1*** | 92.4*** | 67.3 | 69.6* | 85.4*** | 84.4*** |
| (95% CI) | (81.7-88.1) | (87.7-96.9) | (87.4-96.7) | (72.0-90.3) | (88.5-96.2) | (52.8-81.7) | (56.1-83.1) | (81.0-89.8) | (79.6-89.1) |
| Partly home-cooked | 91.6*** | 95.9*** | 93.6*** | 86.2** | 96.4*** | 79.3** | 86.7*** | 92.7*** | 89.4*** |
| (95% CI) | (88.8-94.4) | (92.9-99.0) | (87.8-99.4) | (74.6-97.7) | (92.8-100) | (64.7-94.0) | (75.2-98.2) | (89.5-95.8) | (83.8-95.1) |
| From restaurant | 68.0 | 83.6 | 72.0 | 66.1 | 62.2 | 41.0 | 70.0 | 69.5 | 66.6 |
| (95% CI) | (60.8-75.3) | (70.6-96.5) | (57.7-86.3) | (48.9-83.4) | (42.0-82.5) | (18.7-63.4) | (53.3-86.8) | (58.9-80.0) | (56.5-76.6) |
| Pre-prepared (reference)[c] | 65.3 | 69.6 | 71.9 | 58.9 | 75.1 | 55.6 | 55.4 | 64.5 | 66.3 |
| (95% CI) | (62.7-68.0) | (64.3-74.9) | (66.8-76.9) | (52.2-65.6) | (71.1-79.2) | (48.1-63.2) | (47.0-63.8) | (60.8-68.3) | (62.5-70.1) |
| **Meal preparation** | **Average predicted probability (%) of meal containing *vegetables* (95% CI)** | | | | | | | | |
| Fully home-cooked | 47.8*** | 40.2*** | 49.4*** | 41.8*** | 41.4*** | 62.6*** | 63.9*** | 42.0*** | 54.8*** |
| (95% CI) | (42.4-53.2) | (31.1-49.4) | (35.9-62.9) | (29.4-54.3) | (31.2-51.6) | (48.9-76.4) | (47.5-80.3) | (35.1-48.9) | (46.5-63.1) |
| Partly home-cooked | 50.1*** | 40.3*** | 50.7** | 58.5*** | 32.0 | 70.0*** | 67.2** | 43.5*** | 60.1*** |
| (95% CI) | (42.7-57.4) | (30.3-50.4) | (30.5-71.0) | (39.0-78.0) | (16.3-47.8) | (52.0-88.0) | (46.6-87.8) | (34.7-52.2) | (47.3-72.8) |
| From restaurant | 33.9*** | 25.7 | 24.8 | 38.4* | 27.0 | 40.5 | 67.3*** | 31.1* | 37.3** |
| (95% CI) | (27.9-40.0) | (11.8-39.7) | (13.0-36.6) | (23.5-53.2) | (14.7-39.3) | (23.6-57.5) | (48.2-86.3) | (23.1-39.2) | (28.1-46.6) |
| Pre-prepared (reference) | 24.2 | 19.0 | 26.0 | 22.2 | 21.2 | 30.5 | 37.4 | 22.5 | 26.5 |
| (95% CI) | (22.8-25.7) | (16.6-21.3) | (22.4-29.6) | (19.0-25.3) | (18.7-23.6) | (25.7-35.3) | (30.3-44.4) | (20.6-24.3) | (24.1-29.0) |
| **Meal preparation** | **Average predicted probability (%) of meal containing *whole grains* (95% CI)** | | | | | | | | |
| Fully home-cooked | 46.2 | 47.6 | 42.6 | 48.5 | 54.6 | 32.9** | 51.6 | 48.9 | 43.6 |
| (95% CI) | (40.4-52.1) | (32.6-62.6) | (28.3-57.0) | (35.0-62.0) | (41.0-68.1) | (19.2-46.5) | (36.3-66.9) | (40.7-57.2) | (35.3-51.9) |
| Partly home-cooked | 61.5*** | 67.9* | 55.3 | 67.5* | 62.3 | 54.2 | 56.4 | 68.3*** | 48.6 |
| (95% CI) | (53.4-69.6) | (52.3-83.5) | (33.2-77.3) | (45.7-89.4) | (41.6-83.0) | (33.2-75.1) | (32.0-80.7) | (58.7-78.0) | (34.5-62.7) |

(*continued on next page*)

**Table 2.** Associations between home-cooked meals and the average predicted probability of serving healthy ingredients in a longitudinal sample of meals served by 150 diverse Minnesota families with young children, by race/ethnicity and poverty level (*continued*)

| | All meals[a] (n=3,935) | Meals in non-Hispanic white families (n=623) | Meals in non-Hispanic black families (n=618) | Meals in Hispanic families (n=694) | Meals in Native American families (n=588) | Meals in Hmong families (n=715) | Meals in Somali families (n=640) | Meals in families above the poverty level (n=2,094) | Meals in families below the poverty level (n=1,841) |
|---|---|---|---|---|---|---|---|---|---|
| From restaurant | 41.5 | 44.6 | 38.9 | 31.1 | 57.3 | 35.2 | 45.1 | 43.5 | 39.6 |
| (95% CI) | (33.8-49.2) | (23.5-65.8) | (22.7-55.2) | (14.2-48.0) | (38.0-76.6) | (16.9-53.6) | (23.9-66.3) | (32.2-54.8) | (29.1-50.2) |
| Pre-prepared (reference) | 47.9 | 48.5 | 48.7 | 42.0 | 45.1 | 48.2 | 56.1 | 48.6 | 47.2 |
| (95% CI) | (45.2-50.6) | (42.3-54.8) | (42.6-54.7) | (36.1-47.9) | (38.7-51.5) | (40.8-55.6) | (48.1-64.2) | (44.9-52.3) | (43.3-51.1) |

[a]For all regression results reported in this table, the likelihood ratio $\chi^2$ test indicates that there is a statistically significant relationship between the independent variables and the outcome ($P<0.001$).
[b]Average predicted probabilities and 95% CIs were calculated from results of a logistic regression model using within-estimator methods.
[c]Significance test results are relative to pre-prepared meals (the reference group) holding all else constant (whether meal was breakfast, lunch, or snack [reference is dinner] and whether the meal occurred on the weekend).
*$P<0.05$.
**$P<0.01$.
***$P<0.001$.

# RESULTS

## Description of the Families Included in the Study

Table 1 provides summary statistics describing the six racial/ethnic samples. Although 68% of non-Hispanic white families had annual incomes of $50,000 or more, families from the other five racial/ethnic groups had lower incomes on average, with only between 4% and 16% of these families earning more than $50,000 per year. The average age of the primary caregivers was 34.5 years (standard deviation=7.1), and most were working at the time of the interview. Fewer than half of the non-Hispanic white (32%), Hispanic (48%), and Hmong (24%) caregivers were obese (BMI≥30), whereas most non-Hispanic black (76%), Native American (68%), and Somali (60%) caregivers were obese. The study design required that half of the sample children be overweight (BMI≥85th percentile); measurement indicated that just under a third of the sample children were obese (BMI≥95th percentile).

## Distribution of Meal Preparations and Ingredients by Race/Ethnicity and Poverty Status

The analysis in the present study included data on 3,935 meals, or 26.2 meals per family on average, which translates to about three meals per day per family. Across all families, half of all meals (including breakfasts, lunches, dinners, and snacks) were home cooked, but there was substantial variation across families by race/ethnicity and poverty status (Figure 1). Only 31% of meals consumed by non-Hispanic black families were home cooked, whereas 63% of meals consumed by Hispanic families were home cooked. In non-Hispanic black families, 44% of meals were pre-prepared and 19% were from restaurants; in non-Hispanic white families, 23% of meals were pre-prepared and 7% of meals were from restaurants. Non-Hispanic white families mix home cooking with pre-prepared and/or restaurant foods in a greater proportion of meals (14%) than families from the other racial/ethnic groups (4% to 8%). Finally, compared with families above the poverty level, families below the poverty level had significantly fewer fully home-cooked (47% vs 53%) and partly home-cooked meals (5% vs 9%) and more pre-prepared (35% vs 28%) and restaurant meals (13% vs 10%).

About 38% of all meals contained fruits, 38% contained vegetables, and 35% contained whole grains (Figure 2). Only 31% of meals consumed by non-Hispanic black families contained fruits, whereas 45% of meals consumed by Hispanic families contained fruits. Thirty-two percent of meals consumed by non-Hispanic black and Hispanic families contained vegetables, whereas 44% of meals consumed by Hmong families contained vegetables. Somali families only served whole grains at 27% of meals, whereas non-Hispanic white families served whole grains at 44% of meals. There were no statistically significant differences in the percentage of meals that contained fruits or whole grains by poverty status, but families below the poverty level served vegetables at a smaller percentage of meals than families above the poverty level (35% vs 40%).

## Associations Between Meal Preparation and Ingredients Served and Eaten at the Meal

Meals that were fully or partly home cooked had a significantly higher average predicted probability of including fruits and vegetables than meals that were pre-prepared (the reference

**Table 3.** Associations between home-cooked meals and the average predicted probability of the sample child eating healthy foods in a longitudinal sample of meals served by 150 diverse Minnesota families with young children, by race/ethnicity and poverty level

| | All meals[a] (n=3,935) | Meals in non-Hispanic white families (n=623) | Meals in non-Hispanic black families (n=618) | Meals in Hispanic families (n=694) | Meals in Native American families (n=588) | Meals in Hmong families (n=715) | Meals in Somali families (n=640) | Meals in families above the poverty level (n=2,094) | Meals in families below the poverty level (n=1,841) |
|---|---|---|---|---|---|---|---|---|---|
| **Meal preparation** | **Average predicted probability (%) of child eating *fruits* at meal (95% CI)[b]** | | | | | | | | |
| Fully home-cooked | 84.8*** | 92.5*** | 91.8*** | 80.2*** | 92.0*** | 65.2 | 69.9* | 86.4*** | 82.9*** |
| (95% CI) | (81.5-88.1) | (88.0-97.1) | (87.0-96.7) | (70.6-89.8) | (88.1-96.0) | (49.8-80.5) | (55.3-84.4) | (82.2-90.7) | (77.7-88.0) |
| Partly home-cooked | 89.8*** | 95.2*** | 93.8*** | 85.8** | 96.7*** | 72.0 | 74.6* | 91.3*** | 87.5*** |
| (95% CI) | (86.5-93.0) | (91.8-98.7) | (88.2-99.4) | (74.1-97.5) | (93.3-100) | (53.7-90.3) | (57.2-92.0) | (87.6-94.9) | (81.1-93.9) |
| From restaurant | 64.7 | 83.5 | 86.5 | 53.2 | 62.9 | 42.1 | 68.2 | 66.9 | 62.5 |
| (95% CI) | (56.7-72.7) | (70.5-96.6) | (52.7-84.3) | (32.5-73.8) | (43.0-82.9) | (19.5-64.7) | (49.5-87.0) | (55.4-78.5) | (51.6-73.5) |
| Pre-prepared (reference)[c] | 65.2 | 69.8 | 71.7 | 59.3 | 75.4 | 54.0 | 53.7 | 65.3 | 65.2 |
| (95% CI) | (62.5-68.0) | (64.5-75.2) | (66.5-76.9) | (52.5-66.0) | (71.4-79.4) | (46.1-61.8) | (44.8-62.7) | (61.6-69.0) | (61.3-69.1) |
| **Meal preparation** | **Average predicted probability (%) of child eating *vegetables* at meal (95% CI)** | | | | | | | | |
| Fully home-cooked | 44.3*** | 40.1*** | 44.2*** | 43.7*** | 32.7** | 69.6*** | 51.9* | 42.4*** | 47.1*** |
| (95% CI) | (38.9-49.7) | (29.6-50.6) | (31.1-57.4) | (30.1-57.3) | (23.4-41.9) | (55.4-83.7) | (34.9-68.9) | (34.9-49.6) | (38.9-55.3) |
| Partly home-cooked | 45.5*** | 38.4*** | 50.0** | 57.6*** | 29.0 | 74.7*** | 44.1 | 41.9*** | 52.7*** |
| (95% CI) | (38.2-52.9) | (26.7-50.2) | (29.9-70.1) | (37.2-78.0) | (12.9-45.0) | (57.9-91.4) | (22.1-66.1) | (32.9-51.0) | (39.7-65.7) |
| From restaurant | 30.1* | 25.8 | 23.3 | 42.3** | 22.9 | 45.7 | 40.4 | 31.4* | 29.5 |
| (95% CI) | (24.2-36.0) | (11.6-40.1) | (11.8-34.9) | (26.1-58.4) | (11.2-34.6) | (25.8-65.5) | (22.0-58.7) | (22.8-39.9) | (21.1-37.9) |
| Pre-prepared (reference) | 24.5 | 18.9 | 26.1 | 22.6 | 21.8 | 34.4 | 35.3 | 23.0 | 26.6 |
| (95% CI) | (23.0-26.1) | (16.6-21.1) | (22.5-29.6) | (19.3-25.8) | (19.2-24.4) | (28.9-39.8) | (28.2 -42.4) | (21.1-24.9) | (24.1-29.0) |
| **Meal preparation** | **Average predicted probability (%) of child eating *whole grains* at meal (95% CI)** | | | | | | | | |
| Fully home-cooked | 45.6 | 49.4 | 41.4 | 44.7 | 55.2 | 35.8* | 46.5 | 50.5 | 40.6 |
| (95% CI) | (39.6-51.6) | (34.3-64.5) | (27.0-55.8) | (30.8-58.6) | (41.6-68.8) | (21.0-50.6) | (30.1-62.9) | (42.0-58.9) | (32.2-49.0) |
| Partly home-cooked | 60.0** | 70.1* | 62.5 | 72.0** | 60.0 | 40.2 | 50.8 | 69.0*** | 44.7 |
| (95% CI) | (51.8-68.3) | (54.8-85.3) | (41.5-83.5) | (51.2-92.9) | (39.0-80.9) | (18.4-62.0) | (24.8-76.8) | (59.3-78.8) | (30.6-58.8) |

(*continued on next page*)

**Table 3.** Associations between home-cooked meals and the average predicted probability of the sample child eating healthy foods in a longitudinal sample of meals served by 150 diverse Minnesota families with young children, by race/ethnicity and poverty level (*continued*)

| | All meals[a] (n=3,935) | Meals in non-Hispanic white families (n=623) | Meals in non-Hispanic black families (n=618) | Meals in Hispanic families (n=694) | Meals in Native American families (n=588) | Meals in Hmong families (n=715) | Meals in Somali families (n=640) | Meals in families above the poverty level (n=2,094) | Meals in families below the poverty level (n=1,841) |
|---|---|---|---|---|---|---|---|---|---|
| From restaurant | 40.4* | 49.6 | 38.2 | 27.6 | 54.2 | 36.2 | 38.5 | 45.4 | 35.5* |
| (95% CI) | (32.4-48.3) | (28.0-71.1) | (21.9-54.6) | (10.4-44.8) | (34.2-74.1) | (17.1-55.3) | (15.5-61.6) | (33.7-57.0) | (24.9-46.2) |
| Pre-prepared (reference) | 48.5 | 51.2 | 49.8 | 41.6 | 45.6 | 49.8 | 53.6 | 50.3 | 46.4 |
| (95% CI) | (45.7-51.2) | (44.9-57.4) | (43.7-56.0) | (35.4-47.7) | (39.1-52.0) | (42.0-57.6) | (45.0-62.2) | (46.5-54.1) | (42.4-50.4) |

[a]For all regression results reported in this table, the likelihood ratio $\chi^2$ test indicates that there is a statistically significant relationship between the independent variables and the outcome ($P$<0.001).
[b]Average predicted probabilities and 95% CIs were calculated from results of a logistic regression model using within-estimator methods.
[c]Significance test results are relative to pre-prepared meals (the reference group) holding all else constant (whether meal was breakfast, lunch, or snack [reference is dinner] and whether the meal occurred on the weekend).
*$P$<0.05.
**$P$<0.01.
***$P$<0.001.

category), adjusting for whether the meal was breakfast, lunch, or snack and whether the meal occurred over the weekend (see Table 2). For every racial/ethnic and poverty status subgroup, the average predicted probability that the meal contained fruits if the meal involved any home cooking was between 67% and 96%, whereas if the meal was pre-prepared, the probability that fruits were served was between 55% and 75%. Similarly, the probability that the meal contained vegetables if the meal involved any home cooking was between 32% and 70%, whereas the probability that a pre-prepared meal contained vegetables was between 19% and 37%.

The benefits of home cooking were not as consistent for whole grains; compared with pre-prepared meals, partly home-cooked meals were more likely to include whole grains for non-Hispanic white and Hispanic families, as well as families above the poverty level. However, fully home-cooked meals were *less* likely to include whole grains for Hmong families. Overall, the predicted probability of inclusion of whole grains if the meal involved any home cooking was between 33% and 68%, whereas if the meal was pre-prepared, the probability that whole grains were served was between 42% and 56%.

Meals from restaurants were not significantly different from pre-prepared meals with respect to fruits and whole grains; however, restaurant meals were significantly more likely to include vegetables for the full sample and both poverty status samples, as well as two of the racial/ethnic subgroups. The predicted probabilities suggest that restaurant meals contain fruits 68% of the time, contain vegetables 34% of the time, and contain whole grains 42% of the time for the full sample.

The associations between meal preparation and actual consumption of nutritious foods by the child (Table 3) generally followed the patterns described previously. There was a significantly higher probability of children eating fruits and/or vegetables if the meal was fully or partly home cooked in comparison with meals that were pre-prepared (the reference category) for all subgroups examined. As in Table 2, the associations between eating whole grains and home cooking were mixed. Finally, consistent with the information provided in Table 2, in a few subgroups, children were more likely to consume vegetables in restaurant meals than in pre-prepared meals (Table 3).

## DISCUSSION

In the present study, EMA data on about two dozen meals from each family over an 8-day period were used to examine whether meal preparation is associated with dietary quality of food served at meals (ie, inclusion of fruits, vegetables, and whole grains). The families in the sample were racially, ethnically, and socioeconomically diverse and included young children. Thus, this study contributes to the literature in two important ways: the measure of home cooking is at the meal level (eg, was this meal home-cooked?) instead of at the family level (eg, how many times per week do you have home-cooked meals?), and this sample was drawn from a lower-income setting and stratified such that it included large proportions of racially/ethnically diverse families.

Findings from the present study indicate that both *fully* and *partly* home-cooked meals are significantly more likely to include fruits and vegetables than pre-prepared meals. Similarly, children are more likely to *eat* fruits and vegetables at both *fully* and *partly* home-cooked meals compared with pre-prepared meals. The average predicted probability that fruit is served is about 20 percentage points, or roughly 30%, higher if the meal was either fully or partly home cooked rather than being pre-prepared. The predicted probability that vegetables are served is about 25 percentage points, or about 100%, higher if the meal was either fully or partly home cooked rather than being pre-prepared. This finding was equally true for all racial/ethnic and poverty status groups examined.

Study results also show that there is little difference in the dietary quality of foods served at restaurant meals and pre-prepared meals when fruits or whole grains are considered. However, pre-prepared meals were significantly less likely to contain vegetables than restaurant meals in the full aggregated sample and in the subsamples of Hispanic and Somali families. These findings extend the current literature, which has not previously given much attention to pre-prepared meals. Families report limited time, lack of cooking skills, and high perishability of fresh foods as barriers to frequent engagement in home cooking.[5,7,34] For many families, the rise in availability and accessibility of pre-prepared meals appears to offer a solution to these common barriers by providing quick, easy, and shelf-stable meals that can be eaten at home.[35] Unfortunately, the findings of the present study provide evidence that despite the many benefits of pre-prepared meals, their lack of nutritious ingredients makes them comparable, and perhaps even inferior with respect to vegetables, to restaurant meals. Thus, healthy outcomes may be achieved through collaboration between clinicians/public health professionals and families regarding home cooking to identify potential barriers and generate possible ways to overcome these barriers with the goal of increasing the frequency of home cooking among families.

At the same time, study findings offer support for a practical solution for families. Specifically, the findings suggest that supplementing restaurant meals or pre-prepared meals with home-cooked mix-ins/combinations or sides (eg, takeout pizza and a tossed salad or boxed macaroni and cheese with steamed broccoli or frozen peas mixed in) increases the likelihood of including nutritious meal ingredients as much as fully home-cooked meals. Thus an evaluation of potential strategies to increase the likelihood of supplementing pre-prepared and restaurant meals with nutritious meal ingredients is needed.

Although the study findings indicate that all families would benefit from more home-cooked meals, fewer pre-prepared meals, and fewer meals from restaurants, the findings indicate that certain groups may benefit from additional focused research to identify barriers to home cooking and evaluate potential strategies to overcome barriers specific to these subgroups. In particular, in this sample, non-Hispanic black, Native American, and Somali families, as well as families below the poverty level, serve home-cooked meals less than 50% of the time. Similarly, non-Hispanic black, Hispanic, and Native American families, as well as families below the poverty level, serve vegetables at fewer than 40% of meals. Finally, non-Hispanic black, Hmong, and Somali families, as well as families below the poverty level, serve whole grains at fewer than 35% of meals.

This study has both strengths and limitations. A marked strength of the study is the diversity of the sample population, which included racially/ethnically and socioeconomically diverse participants, as well as immigrant populations; diversity within the sample allowed for an exploration of the impact of home cooking on dietary intake within demographic subgroups. The use of EMA to measure dietary intake is both a strength and a limitation of the present study design. EMA allowed for the assessment of meal-level behaviors at multiple time points within and across days over an 8-day period; EMA methodology reduces retrospective recall bias and improves recall accuracy.[36] It is important to note that although more traditional dietary intake assessments (eg, 24-hour dietary recall) are able to determine what, when, and how much individuals are eating, assessment of dietary intake using EMA only allows for the capture of some of these dimensions. In particular, the present study was focused on three types of foods (fruits, vegetables, and whole grains) offered by parents and consumed by children at meals. In addition, EMA survey measures on meal ingredients and dietary intake lack validation, although an evaluation is currently in progress. As a result, EMA responses may not capture dietary quality as well as other validated dietary intake assessments (eg, 24-hour dietary intake). However, EMA is a commonly used methodology,[37] and there is evidence for the validity of EMA measures in similar areas of research (eg, eating disorders[38]).

Another limitation is the small number of families included in the study (n=150). This study also involved only families with young children and families living in the Twin Cities in Minnesota. Thus although repeated meal measurements increased the number of observations, and both clinically meaningful and statistically significant results were found, it is important to use caution in generalizing study findings to other family types and regions. Future research with larger samples covering a larger geographical area and other types of family compositions is needed.

## CONCLUSIONS

Overall, the study findings indicate that for all racial/ethnic and poverty status groups, meals that were fully or partly home cooked are more likely to contain fruits and vegetables than meals that do not involve home cooking. Pre-prepared meals and restaurant meals are equally likely to contain fruits and whole grains, but restaurant meals are more likely to contain vegetables than pre-prepared meals. Taken together, these findings suggest that interventions that reduce barriers to home cooking, through the promotion of cooking and easy meal planning strategies (eg, how to choose mix-ins/combinations with maximum health benefits), warrant further consideration.

### References

1. Condrasky MD, Griffin SG, Michaud Catalano P, Clark C. A formative evaluation of the cooking with a chef program. *J Extension*. 2010;48(2):2FEA1.
2. Lichtenstein AH, Ludwig DS. Bring back home economics education. *JAMA*. 2010;303(18):1857-1858.
3. Virudachalam S, Chung PJ, Faerber JA, Pian TM, Thomas K, Feudtner C. Quantifying parental preferences for interventions designed to improve home food preparation and home food

environments during early childhood. *Appetite*. 2016;98(Mar):115-124.
4. Taillie LS, Poti JM. Associations of cooking with dietary intake and obesity among Supplemental Nutrition Assistance Program participants. *Am J Prev Med*. 2017;52(2):S151-S160.
5. Smith LP, Ng SW, Popkin BM. Trends in US home food preparation and consumption: Analysis of national nutrition surveys and time use studies from 1965–1966 to 2007–2008. *Nutr J*. 2013;12(45):45.
6. Virudachalam S, Long JA, Harhay MO, Polsky DE, Feudtner C. Prevalence and patterns of cooking dinner at home in the USA: National Health and Nutrition Examination Survey (NHANES) 2007–2008. *Public Health Nutr*. 2014;17(05):1022-1030.
7. Taillie LS. Who's cooking? Trends in US home food preparation by gender, education, and race/ethnicity from 2003 to 2016. *Nutr J*. 2018;17(1):1-9.
8. Tiwari A, Aggarwal A, Tang W, Drewnowski A. Cooking at home: A strategy to comply with U.S. dietary guidelines at no extra cost. *Am J Prev Med*. 2017;52(5):616-624.
9. Mills S, Brown H, Wrieden W, White M, Adams J. Frequency of eating home cooked meals and potential benefits for diet and health: cross-sectional analysis of a population- based cohort study. *Int J Behav Nutr Phys Act*. 2017;14:1-11.
10. Wolfson JA, Bleich SN. Is cooking at home associated with better diet quality or weight-loss intention? *Public Health Nutr*. 2015;18(8):1397-1406.
11. Mills S, White M, Brown H, et al. Health and social determinants and outcomes of home cooking: A systematic review of observational studies. *Appetite*. 2017;111(Apr):116-134.
12. Rollins BY, BeLue RZ, Francis LA. The beneficial effect of family meals on obesity differs by race, gender, and household education: The National Survey of Children's Health, 2003-2004. *J Am Diet Assoc*. 2010;110(9):1335-1339.
13. Kramer RF, Coutinho AJ, Vaeth E, Christiansen K, Suratkar S, Gittelsohn J. Healthier home food preparation methods and youth and caregiver psychosocial factors are associated with lower BMI in African American youth. *J Nutr*. 2012;142(5):948-954.
14. Berge JM, Trofholz A, Tate AD, et al. Examining unanswered questions about the home environment and childhood obesity disparities using an incremental, mixed-methods, longitudinal study design: The Family Matters study. *Contemp Clin Trials*. 2017;62(Nov):61-76.
15. Lohman T, Roche AF, Martorell R. *Anthropometric Standardization Reference Manual*. Champaign, IL: Human Kinetics Books; 1988.
16. Shiffman S, Stone AA, Hufford MR. Ecological momentary assessment. *Annu Rev Clin Psychol*. 2008;4(1):1-32.
17. Guenther PM, Casavale KO, Reedy J, et al. Update of the Healthy Eating Index: HEI-2010. *J Acad Nutr Diet*. 2013;113(4):569-580.
18. Wolfson JA, Bleich SN, Smith KC, Frattaroli S. What does cooking mean to you?: Perceptions of cooking and factors related to cooking behavior. *Appetite*. 2016;97(Feb):146-154.
19. Berge JM, Jin SW, Hannan P, Neumark-Sztainer D. Structural and interpersonal characteristics of family meals: Associations with adolescent body mass index and dietary patterns. *J Acad Nutr Diet*. 2013;113(6):816-822.
20. Berge JM, Rowley S, Trofholz A, et al. Childhood obesity and interpersonal dynamics during family meals. *Pediatrics*. 2014;134(5):923-932.
21. Steinmetz KA, Potter JD. Vegetables, fruit, and cancer prevention. *J Am Diet Assoc*. 1996;96(10):1027-1039.
22. Slavin JL, Lloyd B. Health benefits of fruits and vegetables. *Adv Nutr*. 2012;3(4):506-516.
23. Ness AR, Powles JW. Fruit and vegetables, and cardiovascular disease: A review. *Int J Epidemiol*. 1997;26(1):1-13.
24. Dauchet L, Amouyel P, Hercberg S, Dallongeville J. Fruit and vegetable consumption and risk of coronary heart disease: A meta-analysis of cohort studies. *J Nutr*. 2006;136(10):2588-2593.
25. Fulton SL, McKinley MC, Young IS, Cardwell CR, Woodside JV. The effect of increasing fruit and vegetable consumption on overall diet: A systematic review and meta-analysis. *Crit Rev Food Sci Nutr*. 2016;56(5):802-816.
26. Aune D, Chan DSM, Lau R, et al. Dietary fibre, whole grains, and risk of colorectal cancer: Systematic review and dose-response meta-analysis of prospective studies. *BMJ*. 2011;343(nov10 1):d6617-d6617.
27. Slavin J. Whole grains and human health. *Nutr Res Rev*. 2004;17(01):99.
28. Ye E, Chacko S, Chou E, Kugizaki M, Liu S. Greater whole-grain intake is associated with lower risk of type 2 diabetes, cardiovascular disease, and weight gain. *J Nutr*. 2012;142(7):1304-1313.
29. The Department of Health and Human Services. Poverty Guidelines. Federal Register. https://aspe.hhs.gov/poverty-guidelines. Published 2016. Accessed July 20, 2018.
30. Rothman KJ. No adjustments are needed for multiple comparisons. *Epidemiology*. 1990;1(1):43-46.
31. Perneger TV. What's wrong with Bonferroni adjustments. *BMJ*. 1998;316(7139):1236-1238.
32. Streiner DL, Norman GR. Correction for multiple testing: Is there a resolution? 2011;2:1-3.
33. *STATA Statistical Software [computer program]. Release 15*. College Station, TX: StataCorp; 2017.
34. Wolfson JA, Frattaroli S, Bleich SN, Smith KC, Teret SP. Perspectives on learning to cook and public support for cooking education policies in the United States: A mixed methods study. *Appetite*. 2017;108(Jan):226-237.
35. Okrent AM, Kumcu A. US households' demand for convenience foods. Washington, DC: US Department of Agriculture, Economic Research Service. 2016;ERR-211:1-40.
36. Smyth JM, Heron KE. Ecological momentary assessment (EMA) in family research. In: McHale SM, Amato P, Booth A, eds. *National Symposium on Family Issues: Vol. 4. Emerging Methods in Family Research*. Cham, Switzerland: Springer International Publishing; 2014:145-161.
37. Engel SG, Crosby RD, Thomas G, et al. Ecological momentary assessment in eating disorder and obesity research: A review of the recent literature. *Curr Psychiatry Rep*. 2016;18(4):37.
38. Wonderlich JA, Lavender JM, Wonderlich SA, et al. Examining convergence of retrospective and ecological momentary assessment measures of negative affect and eating disorder behaviors. *Int J Eat Disord*. 2015;48(3):305-311.

**For more information on the subject discussed in this article, see Sites in Review on page 881.**

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### STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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J. M. Berge and A. C. Trofholz collected the data. A. D. Tate prepared the data for analysis. A. R. Fertig conducted the analysis with technical feedback from A. D. Tate and M. Miner. A. R. Fertig wrote the first draft with contributions from K. A. Loth and J. M. Berge. D. Neumark-Sztainer provided substantial guidance regarding the scope and content of the manuscript. All authors reviewed and commented on subsequent drafts of the manuscript.