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DIETARY CONTRIBUTORS TO FOOD GROUP INTAKE IN PRESCHOOL CHILDREN ATTENDING FAMILY CHILDCARE HOMES

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DIETARY CONTRIBUTORS TO FOOD GROUP INTAKE
IN PRESCHOOL CHILDREN ATTENDING FAMILY
CHILDCARE HOMES

BY
ANDREA RAMIREZ-SANABRIA

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
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IN
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UNIVERSITY OF RHODE ISLAND

2020

MASTER OF SCIENCE THESIS

OF

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2020

ABSTRACT

Statement of the Problem: Exposing preschool aged children to a variety of healthy food is essential for the development of healthy eating patterns. Therefore, ensuring healthy environments are necessary. This includes Family Childcare Homes (FCCH), a specific type of childcare in which non-relative providers care for the children in their own home. Unfortunately, during childcare, children are not meeting recommendations for fruits, vegetables, whole grains and low-fat milk; and on the contrary, are consuming too many sugar-sweetened beverages, fruit juice and energy-dense snacks. Most studies have been conducted in childcare centers, and even though FCCH provide care for nearly 2 million preschoolers, studies exploring what children are consuming in FCCH are limited. In addition, FCCH providers are often ethnically diverse; including Latino providers, which are expected to increase due to demographic changes. Previous studies have shown that the providers' Latino culture influences the foods they serve; however, differences in foods offered by Latino and non-Latino providers in the FCCH have been unexplored. The aim of this study was to identify and describe the food sources that contribute to food group intake in preschool children attending FCCH in Rhode Island, and to examine differences by provider ethnicity. **Methods:** Baseline data (n=120 FCCH and n=370 children) from Healthy Start, a cluster-randomized trial, were used. Providers were classified as Latino or non-Latino according to their answer to the question referent to ethnicity on the demographics survey completed. Information about foods and beverages consumed by the children was collected using the Dietary Observation in Child Care technique; observations were done twice, either on consecutive or non-consecutive days. The

Nutrition Data System for Research food group classification was used to define food groups and sources. A home-level analysis was conducted to determine the children's food group intake, this was then averaged overall and by the provider's ethnicity. The contribution of each food source to its respective major food group was calculated as a proportion, using ratio of means. Differences in mean ratios between Latino and non-Latino providers were tested with ANOVA and ANCOVA ($p < 0.05$) and Bonferroni adjustments were made for multiple comparisons. **Summary of results:** The analysis included 120 FCCH providers, all female, 67.5% were Latino, with mean age of 48.9 ± 9.0 years; and 370 preschool children, 57.6% were Latino, mean age of 3.4 ± 0.9 years. There is room for improvement in the foods consumed at the FCCH, specifically regarding fruit juice, refined grains and dark-green vegetables. Juice contributed the highest proportion of fruits consumed (0.85 ± 0.24) across all FCCH, and most vegetables consumed were non-starchy (0.61 ± 0.34). Of the total dairy consumed, nearly, three-fourths was low-fat (0.71 ± 0.30), and most milk/yogurt was unsweetened (0.85 ± 0.20). Of the total grains, three fourths of the servings consumed were refined (0.75 ± 0.22). The major contributor to the fats group were vegetable oils (0.89 ± 0.20). Syrup and jelly contributed more than half (0.50 ± 0.41) to the total sweets consumed. Foods sources differed by the provider ethnicity. Children in non-Latino vs Latino FCCH consumed a significantly higher proportion of fruit juice (0.90 ± 0.16 vs 0.82 ± 0.26 , $p < 0.0001$), animal fats (0.37 ± 0.36 vs 0.11 ± 0.20 , $p < 0.0001$) and a lower proportion of legumes (0.05 ± 0.19 vs 0.33 ± 0.31 , $p < 0.0001$). Children attending Latino vs. non-Latino FCCH consumed a lower proportion of non-starchy vegetables (0.52 ± 0.34 vs 0.82 ± 0.24 , $p < 0.0001$), low-fat dairy (0.68 ± 0.31 vs $0.77 \pm$

0.24, $p < 0.0001$), and nuts and seeds (0.05 ± 0.13 vs 0.21 ± 0.34 , $p = 0.0020$). These differences suggest that Latino and non-Latino FCCH could benefit from tailored recommendations. Findings support that the ethnicity of the provider influences the foods offered in the FCCH and highlight the importance of addressing cultural differences.

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PREFACE

This thesis was prepared in manuscript format following the author guidelines for *Public Health Nutrition*. After submitting this thesis, the manuscript may be submitted for publication.

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MANUSCRIPT

**Dietary Contributors to Food Group Intake in Preschool Children Attending
Family Childcare Homes**

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ABSTRACT

Objective: To identify and describe the food sources that contribute to food group intake in preschool-aged children attending Family Childcare Homes (FCCH) and to examine differences by provider ethnicity.

Design: Cross-sectional, secondary data analysis using baseline data from Healthy Start/Comienzos Sanos study, an ongoing cluster-randomized trial.

Setting: FCCH in Rhode Island, USA.

Participants: Providers (n=120) and preschool aged children enrolled in the FCCH (n=370).

Results: All providers were female, 67.5% were Latino, with a mean age of 48.9 ± 9.0 years; 57.6% of the children were Latino, with mean age of 3.4 ± 0.9 years. There was room for improvement in the foods consumed at the FCCH, specifically regarding fruit juice, refined grains, and dark-green vegetables. Juice contributed the highest proportion of fruits consumed (0.85 ± 0.24) across all FCCH, and most vegetables consumed were non-starchy (0.61 ± 0.34). Of the total dairy consumed, nearly, three-fourths was low-fat (0.71 ± 0.30), and most milk/yogurt was unsweetened (0.85 ± 0.20). Of the total grains, three fourths of the servings consumed were refined (0.75 ± 0.22). The major contributor to the fats major group were vegetable oils (0.89 ± 0.20). Syrup/honey/jelly contributed more than half (0.50 ± 0.41) to the total sweets consumed. Foods sources differed by the provider ethnicity. Children in non-Latino vs Latino FCCH consumed a significantly higher proportion of fruit juice (0.90 ± 0.16 vs 0.82 ± 0.26 , $p < 0.0001$), animal fats (0.37 ± 0.36 vs 0.11 ± 0.20 , $p < 0.0001$) and a lower proportion of legumes (0.05 ± 0.19 vs 0.33 ± 0.31 , $p < 0.0001$). Children attending

Latino vs. non-Latino FCCH consumed a lower proportion of non-starchy vegetables (0.52 ± 0.34 vs 0.82 ± 0.24 , $p<0.0001$), low-fat dairy (0.68 ± 0.31 vs 0.77 ± 0.24 , $p<0.0001$), and nuts and seeds (0.05 ± 0.13 vs 0.21 ± 0.34 , $p=0.0020$).

Conclusions: FCCH providers should be encouraged to offer more whole fruits, whole grains, fish and a greater variety of vegetables; however, the differences in the food sources found in this study suggest that Latino and non-Latino FCCH could benefit from tailored recommendations.

Keywords: Family Childcare Homes, providers, ethnicity, food sources, food groups

INTRODUCTION

The preschool years are considered a critical period in the development of food preferences and food eating patterns¹⁻³. Exposing children to a variety of healthy food and limiting less healthy dietary components is essential for the development and reinforcement of healthy eating patterns⁴. Research shows that the eating patterns formed during these early years can extend into adolescence and adulthood¹⁻³. Thus, developing early healthy eating habits and ensuring healthy environments where children spend most of the time represents an opportunity to improve health and prevent chronic diseases later in life⁵⁻⁸.

In the United States (US), three quarters of preschool age children are enrolled in some type of childcare⁹, where they spend on average 33 hours per week¹⁰. This includes Family Childcare Homes (FCCH), a specific type of childcare in which non-relative providers care for the children in their own home instead of a separate facility¹¹. Nearly 2 million children in the US are enrolled in FCCH¹⁰, which have become a primary resource for low-income and ethnically-diverse families¹². FCCH are social settings that can influence the development of a child's dietary habits^{10,13-15}. Providers can help shape food preferences by exposing children to a wide variety of high-quality, nutrient-dense foods, and limit consumption of low-nutrient, energy-dense foods and beverages^{16,17}.

Unfortunately, while in childcare, children are not meeting recommendations for fruits, vegetables, whole grains and low-fat milk; and on the contrary, are consuming too many sugar-sweetened beverages (SSBs), fruit juice and energy-dense snacks, with excess added sugars, saturated fat and sodium¹⁸⁻²⁴. Most of these studies have

been conducted in childcare centers (CC); and even though FCCH provide care of a substantial number of preschoolers, studies exploring what children are consuming in FCCH are limited²⁵. While some studies have been conducted in FCCH, these have provided an overall insight of diet quality and major food groups^{12,25–29}, and have not examined in detail the specific food sources that contribute to these major food groups.

Several factors influence the providers' food selection, including participation in the Child and Adult Care Food Program (CACFP)^{30,31}. This is a federal reimbursement program for meals and snacks to eligible CC and FCCH^{13,31,32}, in which childcare providers must follow the CACFP meal patterns guidelines to get reimbursed³³. Although not all childcare settings are eligible to participate in the CACFP, all foods served in childcare should be nutritionally adequate and consistent with the Dietary Guidelines for Americans (DGA), by including a variety of healthy foods such as fruits, vegetables, whole grains and low-fat dairy³⁴.

FCCH providers are ethnically diverse²⁸, which is expected to increase due to the demographics changes the US is facing³⁵. The ethnicity of the FCCH providers has been related to different dietary practices in childcare settings, and research suggests that cultural and social differences play a role in the type of food offered to the children^{28,36,37}. Lindsay et al.¹⁶ explored Latino FCCH providers' beliefs and practices related to nutrition using focus groups with 44 FCCH providers in Massachusetts, and found that most providers recognized that their Latino culture influenced the foods they serve at the FCCH. In order to develop more effective, tailored interventions¹⁶, there is a need to better understand the cultural dietary patterns in FCCH, including

information regarding the types of foods offered to the children during childcare. Training and education aimed to providers must contemplate cultural and linguistic differences²⁸; however, research examining the differences in foods between FCCH Latino and non-Latino providers is limited. Therefore, the aim of this study was to identify and describe the food sources that contribute to food group intake in preschool age children attending FCCH, and to examine differences by provider ethnicity.

METHODS

This study is a cross-sectional, secondary analysis using baseline data from *Healthy Start/Comienzos Sanos*: a cluster-randomized controlled trial designed to evaluate the impact of a multicomponent intervention on nutrition and physical activity in English and Spanish speaking FCCH. In Healthy Start, FCCH were randomized in matched pairs into the intervention (nutrition and physical activity) or the comparison group (reading readiness), according to the language spoken by the provider and the number of eligible children³⁸. The Healthy Start study included 120 providers and 370 children between 2-5 years of age.

FCCH providers were eligible for the study if their location was within 60 miles of Providence, Rhode Island; in operation for at least 6 months; with at least one child taken care of for a minimum of 10 hours per week; and serving one meal and snack. Informed consent was obtained from the parents of children in eligible FCCH³⁸.

Trained study staff members used a variety of strategies for the recruitment of the FCCH providers, such as direct contact through emails, information sessions at community organizations and conferences organized for FCCH providers, meetings

with the coordinators of FCCH systems, and word of mouth referrals. Interested providers were contacted to complete a telephone eligibility survey³⁸.

A more detailed description of the study has been previously described. The Healthy Start study protocol was approved by the institutional review boards at the University of Rhode Island, Brown University and University of Connecticut³⁸.

Measures

All baseline data from the 120 FCCH and 370 children was used for this analysis. This information was collected from January 2016 to June 2018.

Provider and children demographics.

Trained study staff collected the providers demographic information during the baseline surveys, which were conducted on the telephone and during an in-person visit. These surveys also included information about the FCCH characteristics, such as hours of operation, number of children and average number of hours children spent daily at the FCCH³⁸. The providers were classified as Latino or non-Latino according to their answer to the question referent to ethnicity (*“Do you consider yourself to be a Latino/Latina/Hispanic?”*) on the demographics survey completed³⁸. Subsequently, two groups were created: children under the care of Latino and non-Latino providers. Parents provided their child’s information, including age, sex, ethnicity and hours spent in childcare, by completing a short demographic survey.

Child Dietary Intake. Dietary intake of each child was collected according to the Dietary Observation in Child Care (DOCC), a reliable and valid observation technique for this population³⁹. Each certified field staff member watched up to three children, avoiding interfering with the daily routine. They visually estimated the amount and

type of foods and beverages served and eaten, as well as any additional or remaining servings. Amount consumed was calculated using the following equation: amount consumed = (amount served $\pm$ amount added or wasted) – amount remaining. Information about recipes and mixed dishes were collected from the provider³⁸. All foods and beverages (except water) consumed by the children were recorded. Only foods offered by the provider and consumed by the children were included in this analysis. Observations were done twice, either on consecutive or non-consecutive days, and were previously scheduled with the provider. At baseline, 317 children had dietary observations for two days in the FCCH. The records were entered into the nutrition analysis software Nutrition Data System for Research (NDSR) software versions 2015-2018⁴⁰.

Food Groups and Food Sources

The food groups and food sources used for this analysis were based on the Nutrition Coordinating Center (NCC) food group classification and the NCC Food Group Serving Count System, which is the database NDSR uses. This database classifies foods into 168 subgroups, which belong to one of the 9 major food groups.

In order to determine the food groups and sources relevant for this study, a descriptive analysis was first run with the raw data. Of the 168 NCC food subgroups, 83 were not consumed by children on either observation day and were excluded from the analysis. NCC food subgroups consumed (n=85) were aggregated to create the food sources, using the DGA 2015 as a reference⁴¹. Figure 1 summarizes the aggregation process and the food groups and sources included. This resulted in 25 food sources distributed across 7 main food groups (fruits, vegetables, dairy and non-

alternatives, protein, grains, fats and sweets). Fruits were grouped according to the way fruit was consumed (juice, whole fruit). Vegetables were grouped as starchy, non-starchy and legumes. Dairy and non-dairy alternatives were grouped according to fat and added sugar content. For the protein group, NCC food subgroups representing similar foods/same type of meat were grouped; for example, poultry, lean poultry and fried chicken were aggregated to determine the contribution of poultry. Grains were grouped as whole grain and refined; “some whole grains” products were considered refined. Fats sources were grouped as vegetable and animal fats. For sweets, the NCC food subgroups representing similar foods were grouped. The beverage and the miscellaneous groups were not included in this analysis, given the focus on foods for this study.

In order to analyze individual food items, additional grouping was conducted for vegetables (red and yellow, dark-green, starchy, legumes and other vegetables); dairy and non-dairy alternatives (milk, cheese, yogurt, non-dairy, desserts); grains (grains/flour/dry mixes, crackers, ready-to-eat cereals, bread, other breads, cakes/cookies, pasta, snacks); and fats groups (oils, butter/another animal fats, salad dressings, margarine, shortening, cream).

Statistical analysis

Food group intake in Latino and non-Latino FCCH

Food intake was calculated as servings. Serving sizes (numbers of cups, ounces, and teaspoon equivalents) used by the NCC Food Serving Count System, are based on the DGA 2000. For food items that are not included in these recommendations, NCC uses the Food and Drug Administration (FDA) serving sizes⁴⁰.

A home-level analysis was conducted to determine the children's food group intake: for each major food group, a mean serving intake per FCCH was calculated by averaging the intake of all the children in the FCCH. This was then averaged overall and by the provider's ethnicity⁴².

Contribution of Food Sources to Major Food Groups

The contribution of each food source to its respective major food group was calculated as a proportion, using ratio of means⁴². A home-level analysis was conducted: mean proportions for each food source were calculated in each FCCH; then the proportions were averaged overall and by provider's ethnicity.

Differences between Latino and non-Latino providers

The differences in mean food group intakes and ratios between Latino and non-Latino providers were tested with Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA) models ($p < 0.05$). Bonferroni adjustments were made for multiple comparisons. Variables that were possible confounders and had a statistically significant association with the outcome ($p < 0.1$), were included in the adjusted model. The covariates considered for inclusion in the adjusted model were CACFP participation, provider's age, education and income, number of children in the home, and the children's age. These variables have been used as confounders in previous studies or have been related to the foods offered and consumed by preschool children in FCCH^{12,31}. The mean serving food group intake was included in the adjusted models as a covariate if the Pearson correlation coefficient between the mean serving food group intake and the ratio of each food source was < 0.7 . SAS studio (SAS Institute, Inc., Cary, NC) was used to carry out the analyses included in this study.

RESULTS

Demographics

The characteristics of the providers and the children are shown in table 1. All providers were female, with a mean age of 48.9 ± 9.0 years, and the majority (67.5%) identified themselves as Latino. Almost half of the sample (49.1%) reported an annual household income between \$25,001-\$50,000. On average, providers cared for 7.7 ± 3.1 children in each home and spent 62.4 ± 13.8 hours per week working as FCCH providers. Most of them (82.5%) participated in CACFP; however, only 7.5% participated in other programs like Special Supplemental Nutrition Assistance Program (SNAP) and/or Women, Infants and children (WIC). More than half of the children were female (51.4%) and Latino (57.6%), with a mean age of 3.4 ± 0.9 years. On average, they were taken care of 4.8 ± 0.8 days per week in the FCCH and spent 7.6 ± 0.9 hours per day in childcare.

Food group intake in Latino and non-Latino FCCH

Table 2 shows the mean servings of food groups consumed by children in FCCH, overall and by the provider's ethnicity. In comparison to non-Latino providers, children taken care of by a Latino provider had a significantly lower intake of total grains (0.60 ± 0.27 vs 0.70 ± 0.32 , $p = 0.0006$). Significant differences were not observed for any of the other food groups.

Contribution of Food Sources to Major Food Groups

Table 3 shows the contribution of food sources, as mean proportions, to their major food group. Overall, among fruit, the majority was consumed as juice (0.85 ± 0.24). More than half of the vegetables consumed were non-starchy (0.61 ± 0.34),

followed by legumes (0.24 ± 0.31), and starchy vegetables (0.15 ± 0.23). Dark-green vegetables represented approximately 7% of the vegetables consumed by children (table 4). When analyzing dairy according to fat content, low-fat dairy made up the highest proportion of the total dairy consumed (0.71 ± 0.30). Most of the milk and yogurt consumed by the children was unsweetened (0.85 ± 0.20). In addition, it is worth noting that milk was the main contributor to dairy. In the protein food group, poultry (0.44 ± 0.36) was the major contributor; and fish (0.05 ± 0.16) and pork (0.05 ± 0.14) were the most uncommon food contributors. Three quarters of the total grain group were refined (0.75 ± 0.22); grains, flour, dry mixes (0.28 ± 0.23), crackers (0.17 ± 0.16) and bread (0.15 ± 0.15) were the most common food sources overall.

Vegetable fats (0.81 ± 0.28) made up the highest proportion of the fats consumed. Half of the sweets consumed in the FCCH were syrup/honey/jelly (0.50 ± 0.41), followed by sugar (0.32 ± 0.20) and SSBs (0.12 ± 0.27).

Differences between Latino and non-Latino providers

There were differences by ethnicity in contributions of food sources to food groups (tables 3 and 4). Children attending Latino FCCH vs those enrolled in non-Latino FCCH, had a higher proportion of legumes (0.33 ± 0.31 vs 0.05 ± 0.19 , $p < 0.002$), poultry (0.48 ± 0.36 vs 0.34 ± 0.35 , $p < 0.002$), grains, flour and dry mixes (0.34 ± 0.21 vs 0.13 ± 0.13 , $p = 0.0002$), vegetable fats (0.89 ± 0.20 vs 0.37 ± 0.36 , $p < 0.0001$) and oils (0.73 ± 0.32 vs 0.27 ± 0.37 , $p < 0.0001$). On the other hand, Latino FCCH vs. non-Latino had a lower proportion of fruit juice (0.82 ± 0.26 vs 0.90 ± 0.16 , $p < 0.0001$), non-starchy vegetables (0.52 ± 0.34 vs 0.82 ± 0.24 , $p < 0.002$), red and yellow vegetables (0.23 ± 0.24 vs 0.29 ± 0.32 , $p < 0.0001$), other vegetables (0.23 ± 0.24 vs 0.45

± 0.34 , $p < .0001$), low-fat dairy (0.68 ± 0.31 vs 0.77 ± 0.24 , $p < 0.002$), nuts and seeds (0.05 ± 0.13 vs 0.21 ± 0.34 , $p < 0.002$), snacks (0.02 ± 0.07 vs 0.08 ± 0.11 , $p = 0.0002$), butter and other animal fats (0.11 ± 0.20 vs 0.26 ± 0.32 , $p < .0001$), salad dressings (0.06 ± 0.15 vs 0.12 ± 0.26 , $p < .0001$), margarine (0.04 ± 0.15 vs 0.18 ± 0.28 , $p = 0.0008$) and cream (0.01 ± 0.03 vs 0.11 ± 0.27 , $p = 0.0008$).

DISCUSSION

This study provided a more detailed insight of the food sources that contributed to food group intake in preschool aged children attending FCCH, and found differences in the contribution of food sources, such as fruit juice, non-starchy vegetables, red and yellow vegetables, other vegetables, legumes, low-fat dairy, grains, snacks, poultry, nuts and seeds, oils, butter, margarine, salad dressings, vegetables and animal fats, between Latino and non-Latino providers. These findings suggest that there is room for improvement in the foods consumed, specifically regarding fruit juice, refined grains and dark-green vegetables; however, the differences in the food sources found in this study suggest that Latino and non-Latino FCCH could benefit from tailored recommendations. These findings support that the ethnicity of the provider influences the foods offered in the childcare settings and highlight the importance of addressing cultural differences. To our knowledge, this is the first study to explore such differences in the foods provided between FCCH Latino and non-Latino providers.

The DGA and the CACFP recommend prioritizing whole fruit intake, however, the results from this study show that the major contributor to fruit consumed was juice. This is in line with previous studies that have found a problematic high contribution of juice in both CC^{19,24,43} and FCCH^{25,44}, where fruit juice is served, 3-4 times per week

or more⁴⁴. Furthermore, vegetables have been identified as a food group of concern in preschool age populations and childcare settings, due to insufficient variety and intake^{19,23,24}, low intakes of non-starchy vegetables and high intakes of starchy vegetables, especially fried potatoes⁴⁵. However, in the current study, starchy vegetables were not the main source of vegetables, and instead, other vegetables and red/deep-yellow vegetables represented an important proportion. Dark-green vegetables contributed the least to their food group, as also shown in other studies^{14,19,45}. CACFP guidelines encourage childcare settings to serve more than 1 serving/day of whole grains⁴⁶, and the DGA advises that at least half of the grains should be whole⁴¹; however, only one quarter of the grains were whole grains. This is consistent with previous studies in CC^{14,19,47} and FCCH²⁶, underscoring that these diets exceed refined grain recommendations.

Cost has been identified as a common barrier to purchasing healthy food, specifically, whole fruits, vegetables and whole grains in childcare^{27,48}, which can explain the results regarding these food sources. Cost of healthy food is related to CACFP participation: studies have found that childcare settings that participate in CACFP offer more healthy foods than settings that do not join CACFP, which indicate that reimbursement might enable higher nutritional value^{33,49}. However, the majority of the providers in this study were participating in CACFP, suggesting that other factors may be at play. For example, children preferences and allergies have also been identified as a factor that affect the providers' food choices³¹, which may be related to the low intakes of fish and seafood found in this study. This is important to consider, since high intakes of fried and high-fat meats, including cold cuts, have been reported

in childcare¹⁹. Future studies and programs may consider focusing specifically on recommendations to increase nuts and seeds, fish and poultry. This would improve the quality of the fats consumed by the children, since high intakes of saturated fats have been described previously^{18,19}. Along with this, CACFP guidelines state that unflavored low-fat (1% fat) or fat-free milk must be served⁴⁶, which is especially important when considering that high-fat milk is the major contributor of saturated fats in preschool-aged children^{50,51}. While most dairy this study was low-fat (1% fat), dairy with higher fat content was still being consumed. Offering low-fat milk this is a feasible and priority area for ongoing improvement in FCCH considering that it is an important source of various nutrients⁵¹ and that there is no cost difference between low and whole-fat milk.

In addition, in order to increase unsaturated fats, DGA recommendations promote the use of vegetable fats for cooking. Studies in CC have reported the need to decrease animal fats¹⁴; although butter/another animal fats, was the second contributor of the fats group, this study also found that most of the fats came from vegetable fats, mainly oils. Nonetheless, future trainings should continue to decrease the use of animal fats.

This study did not analyze beverages as a major food group, however, SSBs were included in the food group sweets. SSBs have been identified as an area to improve upon in childcare⁵²⁻⁵⁵; however, this was not the main food source contributing to sweets. This is promising given that early SSB consumption displaces more nutrient dense foods and increases the likelihood of consuming them later in life⁵⁶.

Recommendations could be also aimed to reduce syrup and jellies, which can be

important sources of added sugars. This is important considering that excess added sugars has been identified as a problem in general preschool-aged children^{51,57}.

The current study found that the foods provided in FCCH differ by the provider ethnicity and by the composition of the foods included within each major food group. Even though there were no significant differences within the major food groups, except for grains, there were differences in the food sources that composed those major food groups: fruit juice, non-starchy vegetables, legumes, poultry, nuts and seeds, vegetable and animal fats. These findings highlighted the importance of exploring specific food sources and supported the influence of ethnicity in the foods offered in the childcare setting^{28,36} and reinforce the need to describe food environment, while addressing cultural differences⁵⁸. These results support the influence of ethnicity in the foods offered in childcare^{28,36} and reinforce the need to describe food environment, while addressing cultural differences⁵⁸.

Differences in the attitudes and practices between Latino and non-Latino providers have been reported previously²⁸. A study that explored the beliefs and perceptions about dietary behaviors of Latino FCCH providers, found that providers felt a sense of responsibility to provide healthy foods to the children³⁷. This was consistent with another study that showed that Latino providers believed that they were influential figures in promoting healthy eating, and that it was their role to offer healthy foods and to educate children under their care¹⁶. Regulations, including those from the CACFP, were also important factors influencing Latino FCCH providers practices related to nutrition¹⁶. These factors might explain the lower proportion of fruit juice and animal fat found in the Latino FCCH, since the opposite has been described in the

overall Latino population, in comparison to White population⁵⁸⁻⁶². In addition, SSBs have been described to be higher in the overall Latino children⁶³; However, in the current study, no differences in sweets were found between the ethnicity of the provider.

Even though Latino providers seemed to follow guidelines more than non-Latino providers for these food sources, this was not the case for dairy. Even though the CACFP guidelines state that low-fat dairy must be provided, a lower proportion of low-fat was served in the Latino FCCH. Lower intakes of low-fat dairy in overall Latino children have been described before. For example, Hoog et al.⁶³ found that Latino children had lower intake of skim or 1% dairy as compared to white children. It is important to highlight that these differences were present even though analyses were adjusted for CACFP participation.

Latino providers engage more in the preparation of home-cooked meals and mixed dishes³⁷. This might reflect some of the differences found in the vegetable, and grain groups. Even though previous studies⁶¹ have shown that green-leafy vegetables are less consumed in the Latino community, no differences between the Latino and non-Latino FCCH were found. Legumes have been identified as an important area for improvement for diet quality in childcare¹⁴. Nonetheless, the current study suggests that efforts should be aimed more specifically at the non-Latino providers. The higher proportion of legumes in the Latino FCCH was expected since previous studies have shown that the Latino population have a greater intake of legumes when compared to other ethnicities^{58,61}.

In relation to grains, efforts to improve the intake of whole grains could be focused on the main food sources. Overall, grains/flour/dry mixes, crackers and bread were identified as the main food sources in this study. However, when analyzed by the ethnicity of the provider, the main food contributors for Latino and non-Latino FCCH providers were different. Tailored interventions to improve the food patterns and diet quality might benefit from understanding these differences, so that efforts can be focused on these specific food sources. This is particularly important considering that grains in childcare have been characterized as refined, energy-dense and high in fat and sodium^{23,24}. Lastly, results from this study might also reflect cultural preferences, for example, the lower proportion of nuts and seeds in the Latino FCCH.

Taken together, the results suggest that Latino providers could be encouraged to provide more low-fat dairy, nuts and seeds; and on the other hand, the non-Latino FCCH, increasing more whole fruits, legumes, nuts and seeds, vegetable fats, as well as reducing animal fats such as butter and cream intake.

Findings from this study can become inform future research in FCCH. Information regarding the providers food choices can serve as guidance for dietary screenings and contribute to the creation of creative and innovative programs. This is especially important when considering that education sessions or trainings should also be actionable, simple, practical, by emphasizing suggestions for specific foods^{16,45,64}. By identifying the differences in the food contributors between Latino and non-Latino FCCH, more tailored recommendations can be developed. Materials should also be culturally appropriate, since needs, values and beliefs can affect the way they interpret the messages given⁶⁵. In general, providers may have trouble translating

recommendations into more specific foods that children commonly consume⁴⁵. This can become a more important limitation for the Latino providers; since it has been shown that racial/ethnic minorities and non-native speakers of English are more likely to experience low literacy⁶⁵.

Some limitations must be noticed. The sample included providers that were interested in participating in the study, from a specific area in the US, which may lead to selection bias and non-generalizability of the findings. Scheduling the visits beforehand with the providers could have influenced the food served during the observation day, which is related to social desirability bias. The results of the analysis were influenced by the food classification used and the decisions regarding how to aggregate NCC subgroups to create the food sources. The NCC food classification is slightly different from the one used by other studies; therefore, these differences should be addressed when comparing these data. Water intake information was not collected, which could have been important to address to understand the main sources of liquid during childcare, especially when considering that fruit juice is largely consumed in FCCH. Lastly, it is important to consider that there might be additional variations within more specific ethnic groups in the non-Latino providers and different Latino backgrounds.

There were several strengths to this study. It extends the literature in FCCH by providing a more detailed insight of the types of foods consumed by the children in these settings, which can complement previous studies conducted in FCCH and help better understand the nutrition environments in FCCH. Along with this, the information presented can inform future interventions in FCCH, which is particularly

important since most studies in childcare have been conducted in CC. Differences between FCCH and CC, including economic and personnel resources, explain why in some cases, the interventions developed for CC are not adaptable to FCCH. Another study strength was the use of the DOCC for the dietary data collection, which has been tested for validity and reliability in childcare settings³⁹. Data were collected by trained personnel, therefore, did not rely on self-reported data, which has been a limitation in other studies^{23–25}, including ones conducted on FCCH^{44,66,67}. Self-reported data can introduce self-report bias: it has been reported previously that when caregivers report what the children consumed, they may tend to overestimate the quality of their child's diet and underreport foods considered unhealthy⁶⁸.

Conclusions

The findings from this study reinforce the need to identify strategies to improve foods consumed while at FCCH and support previous studies that the ethnicity of the provider is related to the food sources provided to the children. Latino and non-Latino FCCH should decrease fruit juice, refined grains, include more fish and a higher variety of vegetables. According to the differences identified, non- Latino FCCH should aim to decrease the frequency of legumes and animal fat. Latino FCCH could benefit from the inclusion of more low-fat dairy, nuts and seeds, and more non-starchy vegetables. Cultural differences should be addressed to provide more tailored recommendations, considering the areas they need to improve.

TABLES

Table 1: Descriptive characteristics of the Family Childcare Home (FCCH) providers (n = 120) and the children (n = 370) enrolled in the Healthy Start/Comienzos Sanos study at baseline.

Characteristics	Providers Mean (SD) or n (%)	Children Mean (SD) or n (%)
Sex, n (%)		
- Female	120 (100%)	180 (48.7%)
Age, mean (SD)	48.9 (9.0)	3.43 (0.9)
Ethnicity, n (%)		
- Latino	81 (67.5%)	208 (57.6%)
- Non-Latino	39 (32.5%)	153 (42.4%)
Race, n (%)		
- American Indian/ Alaska Native	4 (3.3%)	3 (0.8%)
- Black/African American	20 (16.6%)	3 (0.8%)
- Native Hawaiian/ Pacific Islanders	3 (2.5%)	35 (9.8%)
- White/ Caucasian	52 (43.3%)	3 (0.8%)
- Other	28 (23.3%)	168 (46.8%)
- Don't know/ Refused	13 (11.0%)	147 (41.0%)
Marital status, n (%)		
- Single, never married	11 (9.2%)	
- Married or living with partner	90 (75.0%)	
- Divorced	10 (8.3%)	
- Separated/Widowed	9 (7.5%)	
Education level, n (%)		
- Less than high school diploma or GED	13 (10.9%)	
- High school diploma or GED	39 (32.5%)	
- More than high school	68 (56.6%)	
Annual Household Income, n (%)		
- Less than \$25,000	16 (13.8%)	
- Between \$25,001 - \$50,000	57 (49.2%)	
- Between \$50,000 - \$75,000	24 (20.7%)	
- More than \$75,001 - \$100,000	19 (16.3%)	
Hours spent FCCH as a provider per week, mean (SD)	62.4 (± 13.8)	
Number of children enrolled per home, mean (SD)	7.7 (± 3.1)	
CACFP Participation, n (%)		
- Yes	99 (82.5%)	
Program participation, n (%)		
- SNAP	4 (3.3%)	
- WIC	4 (3.3%)	
- WIC + SNAP	1 (0.9%)	
- None	111 (92.5%)	
Hours spent in childcare, mean (SD)		7.6 (0.9)
Days per week in the FCCH, mean (SD)		4.8 (0.8)

GED, General Education Diploma

Table 2: Mean servings of food groups consumed by preschool children while attending childcare at Family Childcare Homes (FCCH) according to the ethnicity of the provider.

Food group	Mean serving intake						
	Overall (n=120)		Latino provider (n=81)		Non-Latino provider (n=39)		Adjusted <i>p</i> value ^a
	Mean	SD	Mean	SD	Mean	SD	
Fruit	0.37	0.23	0.40	0.30	0.35	0.23	0.3091
Vegetables	0.17	0.14	0.18	0.14	0.14	0.14	0.1653
Dairy/alternatives	0.35	0.18	0.33	0.16	0.38	0.21	0.0089*
Grains	0.63	0.29	0.60	0.27	0.70	0.32	0.0006**
Protein	0.31	0.25	0.31	0.24	0.32	0.26	0.1762
Fats	0.19	0.17	0.19	0.15	0.18	0.21	0.2664
Sweets	0.07	0.18	0.07	0.20	0.06	0.14	0.0650

A serving equals to: **Fruits** - medium unit; ½ cup fresh, frozen, cooked, canned fruit; ¼ cup dried fruit; 4 fluid ounces of juice. **Vegetables** – 1 cup raw leafy vegetables; ½ cup other raw/cooked vegetables; 4 fluid ounces of juice. **Grains** – 1 slice of bread; 1 ounce ready-to-eat cereal; ½ cup cooked cereal/rice/pasta. **Protein** – 1-ounce cooked meat/fish/poultry; 1 egg; 1 TB peanut butter; ½ ounce nuts/seeds. **Dairy and non-dairy alternatives** – 1 cup milk/yogurt; 1 ½ ounces natural cheese; 2 ounces processed cheese. **Fats** – 1 tsp margarine/oil/other animal fats; 30g salad dressing; 30 g mayonnaise type dressing. **Sweets**- 4g sugar, 1 TB honey/ jam; 15g hard candies; 40g all other candies.

^a Covariates included in the models: providers' education, income, age, CACFP participation, number of children in the FCCH, and children age.

* Significant before multiple comparison adjustment (p<0.05).

** Significant after multiple comparison adjustment (p<0.007).

Table 3: Contribution of food sources to the main food groups in Family Childcare Homes (FCCH) and differences according to the ethnicity of the provider.

Food group/Food source	Mean ratio						
	Overall (n=120)		Latino (n=81)		Non-Latino (n=39)		Adjusted p value ^a
	Mean	SD	Mean	SD	Mean	SD	
Fruit							
- Whole fruit	0.15	0.24	0.18	0.26	0.10	0.16	0.0513
- Fruit juice	0.85	0.24	0.82	0.26	0.90	0.16	<.0001**
Vegetables							
- Non-starchy ^b	0.61	0.34	0.52	0.34	0.82	0.24	<.0001**
- Starchy ^c	0.15	0.23	0.15	0.24	0.13	0.19	0.1589
- Legumes	0.24	0.31	0.33	0.31	0.05	0.19	<.0001**
Dairy/Alternatives							
According to fat content^d							
- Low-fat	0.71	0.30	0.68	0.31	0.77	0.24	<.0001**
- Reduced-fat	0.10	0.19	0.11	0.21	0.08	0.15	0.1250
- Whole-fat	0.19	0.24	0.21	0.26	0.15	0.20	0.1636
According to added sugar^e							
- Sweetened	0.15	0.20	0.14	0.16	0.17	0.27	0.6430
- Unsweetened	0.85	0.20	0.86	0.16	0.83	0.27	0.5309
Protein							
- Poultry	0.44	0.36	0.48	0.36	0.34	0.35	<.0001**
- Beef	0.14	0.25	0.15	0.24	0.12	0.26	0.8368
- Eggs	0.10	0.18	0.10	0.19	0.09	0.16	0.7913
- Cold cuts	0.12	0.22	0.10	0.19	0.16	0.27	0.2169
- Fish	0.05	0.16	0.06	0.17	0.04	0.13	0.8681
- Pork	0.05	0.14	0.05	0.15	0.04	0.12	0.3504
- Nuts and seeds	0.10	0.23	0.05	0.13	0.21	0.34	0.0020**
Grains							
- Whole grain	0.25	0.22	0.26	0.22	0.24	0.22	0.5540
- Refined grain	0.75	0.22	0.74	0.22	0.76	0.22	0.5540
Fats							
- Vegetable	0.81	0.28	0.89	0.20	0.63	0.36	<.0001**
- Animal	0.19	0.28	0.11	0.20	0.37	0.36	<.0001**
Sweets							
- Syrup, honey, jelly	0.50	0.41	0.54	0.40	0.44	0.42	0.6586
- Sugar	0.32	0.20	0.30	0.37	0.37	0.45	0.0942
- SSBs	0.12	0.27	0.15	0.22	0.08	0.22	0.4525
- Chocolate/candy	0.05	0.13	0.02	0.05	0.06	0.22	0.0274*

SSBs, sugar sweetened beverages

^aCovariates included in the models: providers' education, income, age, CACFP participation, # children in the FCCH, and children age, food group serving amount.

^bIncluded dark-green, deep-yellow, tomato and other vegetables.

^cIncluded white potatoes, fried potatoes and other starchy vegetables.

^dAnalysis included milk, yogurt, cheese.

^eAnalysis included milk and yogurt.

* Significant before multiple comparison adjustment (p<0.05).

** Significant after multiple comparison adjustment (p<0.002).

Table 4: Additional description: contribution of food sources to vegetables, dairy and non-dairy alternatives, grains and fats in Family Childcare Homes (FCCH) and differences according to the ethnicity of the provider.

Food group/Food source	Mean ratio						Adjusted <i>p</i> value ^a
	Overall (n=120)		Latino (n=81)		Non-Latino (n=39)		
	Mean	SD	Mean	SD	Mean	SD	
Vegetables							
- Red and yellow	0.24	0.27	0.23	0.24	0.29	0.32	<.0001**
- Dark-green	0.07	0.13	0.07	0.12	0.07	0.16	0.8461
- Starchy ^b	0.15	0.23	0.16	0.24	0.14	0.19	0.1589
- Legumes	0.24	0.31	0.33	0.31	0.05	0.19	<.0001**
- Other vegetables ^c	0.29	0.30	0.23	0.24	0.45	0.34	<.0001**
Dairy/Alternatives							
- Milk	0.71	0.24	0.72	0.22	0.69	0.28	0.1305
- Cheese	0.14	0.18	0.13	0.18	0.16	0.19	0.3619
- Yogurt	0.11	0.15	0.12	0.15	0.09	0.14	0.6514
- Non-dairy	0.01	0.06	0.01	0.05	0.02	0.07	0.1161
- Desserts ^d	0.02	0.07	0.01	0.03	0.04	0.11	0.6211
Grains							
- Grains, flour, dry mixes ^e	0.28	0.23	0.34	0.21	0.13	0.13	0.0002**
- Crackers	0.17	0.16	0.15	0.14	0.20	0.19	0.4687
- Ready-to-eat cereals	0.11	0.13	0.13	0.12	0.07	0.13	0.1674
- Bread	0.15	0.15	0.12	0.14	0.20	0.15	0.0054*
- Other breads ^f	0.12	0.14	0.09	0.12	0.16	0.18	0.0493*
- Cakes/cookies ^g	0.07	0.12	0.07	0.11	0.06	0.13	0.6959
- Pasta	0.07	0.10	0.06	0.10	0.08	0.11	0.6068
- Snacks ^h	0.04	0.09	0.02	0.07	0.08	0.11	0.0004**
Fats							
- Oils	0.59	0.40	0.73	0.32	0.27	0.37	<.0001**
- Butter/another animal fats	0.16	0.25	0.11	0.20	0.26	0.32	<.0001**
- Salad dressings	0.07	0.19	0.06	0.15	0.12	0.26	<.0001**
- Margarine	0.08	0.20	0.04	0.15	0.18	0.28	0.0008**
- Shortening	0.05	0.15	0.05	0.14	0.06	0.16	0.1482
- Cream	0.05	0.16	0.01	0.03	0.11	0.27	0.0014**

^a Covariates included in the models: providers' education, income, age, CACFP participation, # children in the FCCH, and children age.

^b Included white potatoes, fried potatoes and other starchy vegetables.

^c Includes raw, cooked and canned, stews, soups, pickles and pickled vegetables, relishes, salsas, mixed vegetables from other categories.

^d Includes frozen dairy desserts, pudding and other dairy desserts and frozen non-dairy desserts.

^e Includes cooked grain/cereal, flour, cornmeal, bran or wheat germ, rice.

^f Includes quick breads, corn muffins, tortillas, French toast, waffles, pancakes, biscuits.

^g Includes cakes, cookies, pies, pastries, Danish, doughnuts and cobblers.

^h Includes snack chips, snack bars and popcorn.

* Significant before multiple comparison adjustment (p<0.05).

** Significant after multiple comparison adjustment (p<0.002).

FIGURES

Figure 1: Aggregation process of the Nutrition Coordinating Center (NCC) food subgroups to determine food groups and sources.

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APPENDICES

A. REVIEW OF LITERATURE

Dietary habits during childhood and importance for chronic disease prevention

During the preschool years, energy and nutrient intake are fundamental to achieve an adequate growth and development in children¹. Preschool age is a critical period where food preferences are developed². During these early years, children's preferences are shaped by their experiences with food, including type and quantity, eating occasions, and the social environment in which these experiences occur³. Children learn about types of food that are usually consumed at meals and snacks by direct contact with food and by observing the environment⁴. This is particularly important since research has shown that food preferences influence eating behaviors and food eating patterns^{3,5}. Therefore, the types of foods offered to the children and the use of strategies, such as repeated exposure, are key ways to encourage the acceptance of certain foods, especially new or disliked ones^{3,4}. Exposing children to a variety of healthy food and limiting less healthy dietary components is essential for the development and reinforcement of healthy eating habits⁶.

Evidence suggests that the eating habits formed during early childhood can extend into adolescence and adulthood⁷. Consequently, there is a clear connection between early eating patterns and health status later in life^{1,4}. During childhood, a healthy diet that includes a variety of fruits and vegetables, whole grain products, and unsaturated fats is associated with lower risk to develop chronic diseases⁸. Unhealthy

eating patterns during childhood, that incorporate high intakes of added sugars, saturated fat and sodium, have been linked to the development of diseases such as type 2 diabetes, hypertension, cardiovascular diseases, sleeping problems, glucose intolerance, and some types of cancer^{9,10}. Some of these cardiovascular and metabolic complications can even appear during these early years, including other adverse effects such as early puberty, asthma, liver disease, orthopedic abnormalities and psychosocial disorders^{11,12}. Childhood obesity is also an outcome of unhealthy eating patterns, and is one of the most serious public health challenges at this time¹³. The early onset of obesity, especially between the ages of 2-6 years, is a predictor of future obesity^{13,14}; children who are overweight or obese by age five are four times more likely to become obese as adults¹⁵. These diseases and health conditions increase morbidity and mortality, generating an important health burden, due to hospitalization, treatment expenses¹⁶ and negative effects on social and economic outcomes^{11,17}. Therefore, ensuring that preschoolers are exposed to and consuming healthy foods is an opportunity to improve dietary behaviors and health in the overall population¹⁸⁻²⁰.

Diet of preschool children in the United States (US)

The Dietary Guidelines for Americans (DGA), along with the American Academy of Pediatrics (AAP) and the American Dietetic Association (ADA), encourage healthy eating patterns during childhood²¹. The DGA recommends including fruits, particularly whole fruits; a variety of vegetables from all subgroups (dark green, red and orange, legumes, starchy); grains, of which at least half are whole grain; fat-free or low-fat dairy; a variety of protein foods, including seafood, lean meats and poultry, eggs, legumes, nuts and seeds; and healthy oils²². Healthy eating

patterns for children aged 2 or older also include limiting fruit juice, sugar sweetened beverages (SSBs) and foods high in sodium and saturated fats²¹. These recommendations are based on evidence establishing that calcium and vitamin D intake are necessary for optimal health; fiber to promote healthy lipid profile, glucose blood levels, and gastrointestinal functions; sodium and potassium to promote healthy blood pressure; saturated fatty acid and cholesterol intake for cardiovascular health; and minimal added sugar intake to balance energy consumption and promote the intake of other nutrients²³.

However, research shows that preschool-aged children do not have healthy eating patterns: they are not consuming the types and amounts of foods that are consistent with these recommendations. Specifically, they are not meeting dietary recommendations for fruits, vegetables, whole grains and low-fat milk; and on the contrary, are consuming too many energy-dense snacks and SSBs²⁴⁻²⁷. Along with this, the portion sizes of foods such as soft drinks, salty snacks, desserts and fast foods have increased during the last years²⁸; as well as the number of daily eating occasions^{28,29}.

A study that included five nationally representative surveys of dietary intakes (Continuing Survey of Food Intake in Individuals, What We Eat in America, National Health and Nutrition Examination Surveys) among 10,647 children aged 2-6 years, found that between 1989 and 2008, the intake of savory snacks, pizza/calzones, sweet snacks and candy, mixed Mexican dishes and fruit juice increased significantly²⁴. The only identified positive change was a small increase in fruit intake (+24 kcal/day)²⁴.

Similar results were found in the Feeding Infants and Toddlers Study (FITS) 2008, which is a cross-sectional, descriptive survey of a national random sample of US children from birth through age 3 years³⁰. Fox et al.³⁰ used this data to describe the food consumption patterns of preschoolers between the ages of 2-3 years. The results showed that 59% consumed 100% juice and 73% ate at least one fruit on the day of the recall. Unfortunately, 86% of the children consumed some type of SSBs, desserts, sweets or salty snacks in a day; these percentages were higher for 3-year-olds than for 2-year-olds. They also found that whole milk was frequently consumed, which has been identified by other studies as a major contributor of saturated fat³¹. Flavored milk was consumed by 10% of 2-year-olds and 14% of 3-year-olds. More than 25% of the children did not eat a distinct portion of vegetables in a day; and French fries/fried potatoes were the most commonly consumed vegetables, while dark-green and deep-yellow vegetable intake was low³⁰. The study also identified that whole grains intake was low, which has been reported by other studies².

Alarming, in a more recent study using data from FITS 2016, these patterns continued³². In children aged 2-4 years, low-fat and dairy consumption was low: even fewer children consumed skim milk in 2016 than in 2008. One third of the children ate hotdogs, cold cuts, bacon, or sausage. These results complement the research that indicates that most children are meeting or exceeding the recommended intake of protein; but preferred protein sources such as seafood, nuts and seeds are not the main sources³³. Almost 90% of the children ate a dessert, SSBs or sweets; and 36% consumed a savory snack during the day of the recall³². Around 75% of the children ate a distinct portion of fruit and only 27% consumed a portion of vegetables.

However, one of the limitations of the FITS studies is the lack of inclusion of vegetables and fruits in mixed dishes into the analyses; therefore, fruit and vegetable intake might be underreported^{30,32}. Also, when the parent or caregiver self-report what their child consumed, they may tend to overestimate the quality of their child's diet and underreport foods considered unhealthy³².

An analysis of food sources and their contribution to energy and nutrients, using data from National Health and Nutrition Examination Surveys (NHANES) 2003-2006, showed that the top five sources of energy in 2 to 18 year-old children were milk, cake/cookies/quick bread/pastry/pie, breads/rolls, crackers/popcorn/pretzels, chips, and soft drinks/soda³⁴. Except for milk, all the other food sources contributed to fat and added sugar intake and few important nutrients. Milk was identified as an important source of vitamin D, calcium and potassium, and also, as one of the main sources of protein, along with poultry. Even though fish intake is recommended, it was the protein source least consumed. Unfortunately, soft drinks and soda were the main sources of carbohydrates, total and added sugars; and fruit was the main source of fiber, however, most children did not eat the recommended amount³⁴.

These studies show a high intake of processed foods. Approximately, 66% to 84% of total daily energy, saturated fat, cholesterol, total sugar, added sugars, and sodium intake are contributed by processed foods²³. Some of these foods, such as cookies, chips and desserts, are being offered during snacks; therefore, snacks have been identified as an area for improvement³⁵. The nutrient requirements of preschoolers are high with relatively low energy requirements. Consequently, these energy-dense foods can replace others with a higher nutritional content³⁰, resulting in

insufficient intake of critical micronutrients, such as calcium, fiber, potassium and vitamin D²².

Overall, literature shows that the eating patterns of the US children are concerning. Given the impact of the diet in preschool ages in immediate and long-term health outcomes, major changes to improve diet quality and eating patterns are needed to ensure children a healthy lifestyle.

Ethnic disparities in preschool children diet

Ethnic and racial disparities in diet quality³⁶ and eating patterns²¹ have been reported before in preschool-aged children and still persist. In the US, a greater prevalence of unhealthy eating habits, in low-income and ethnic minority children, are due to several social factors, such as food preferences, community and environmental status, family factors, and socioeconomic status³⁷. This includes the Latino community; studies have shown that Latino children's diet quality is lower as compared to children of other ethnic backgrounds^{38,39}. For example, Latino children consume fewer fruits and vegetables and have a greater intake of salty snacks and calorie dense foods^{39,40}.

Hoog et al.⁴¹ analyzed associations of race and ethnicity with food intake among 723 White, 128 Black and 47 Hispanic 3-year-old children. They found that Latino children had higher intakes of SSBs, fast food, red and processed meats, and fiber; and a lower intake of skim or 1% dairy, snack foods and calcium as compared to White children.

Along with differences in eating patterns, Latino children experience other health risk factors, such as the acculturation to the obesogenic US environment, parental

obesity and access to medical care³⁷. These environmental and diet characteristics position them into a vulnerable situation. Therefore, understanding the foods children consume while taking into account the context of Latino families, is essential and important for the development of successful interventions and educational programs⁴².

Childcare as settings to improve eating habits

Given that eating habits develop in early childhood, ensuring healthy environments where children spend time is fundamental to promote the development of healthy eating habits. This includes childcare settings; in the US, three quarters of preschool-age children are enrolled in some type of childcare⁴³. Since more parents rely on childcare, the amount of hours children are taken care of has increased in recent years; on average, they spend 33 hours per week in these settings⁴⁴. This growing demand for different types of childcare responds to demographic, economic and social changes, including a higher percentage of women employed in the labor force⁴⁴.

Most parents generally choose among several types of child-care arrangements; however, most children attend childcare centers (CC) or are cared for by relatives^{43,44}. However, the number of children enrolled in Family Childcare Homes (FCCH) has been increasing, and nearly 2 million children in the US are enrolled⁴⁴. FCCH are a specific type of childcare in which non-relative providers care for the children in their own home instead of a separate facility^{45,46}. In comparison to CC, FCCH are smaller, have lower enrollment fees, offer more flexible hours and, usually, only one provider takes care of the children⁴⁷. These characteristics might be more appealing to low-income families and parents who work longer shifts⁴⁷. In addition, FCCH serve ethnic

minorities and they are usually run by ethnically diverse providers. For example, in Rhode Island, more than 40% of FCCH providers speak Spanish⁴⁸.

As a result of the increased time spent in childcare, children consume several meals and snacks in these settings^{49,50}. On average, they are served between 2-3 meals during childcare⁵¹; which can provide up to 75% of the children's daily energy and nutrient intake^{52,53}. However, children from low-income backgrounds might be consuming up to 100% of their Recommended Dietary Allowances (RDA) in these settings⁵⁴. Therefore, childcare has been recognized as an important setting to promote healthy behaviors, including eating habits⁵², which raises concern about the types and quality of foods and beverages offered to the children.

To ensure that children receive their daily nutritional requirements during childcare, national authorities have developed recommendations and nutrition standards that can be used to evaluate the foods offered. For example, the Child and Adult Care Food Program (CACFP) is a federal reimbursement program for meals and snacks to eligible childcare centers and homes⁵⁵. It offers meal planning guidance and nutritional training for the providers to guarantee that children receive healthy meals and snacks while in childcare⁵⁵. Reimbursement for FCCH are targeted to low-income children and programs located in lower income areas⁵⁶ and it is based on the number of meals served to children⁵⁷. The participating childcares can claim up to 2 reimbursable meals (breakfast, lunch, supper) and 1 snack, or 2 snacks and 1 meal per day and child⁵⁷. In order to get reimbursed, childcare providers must meet State Licensing requirements and need to follow the CACFP meal patterns guidelines, which includes recommendations for components such as milk, fruits, vegetables and

grains⁵⁸. Within these guidelines, foods and beverages with high amounts of added sugars and fats are discouraged⁵⁹.

Although CACFP guidelines are consistent with the Dietary Guidelines for Americans (DGA), not all childcare settings are eligible to be reimbursed. Despite this, all foods served in childcare should be nutritionally adequate and consistent with the DGA, and include a variety of healthy foods such as fruits, vegetables, whole grains and low-fat dairy⁵².

Foods served and consumed in childcare settings

Unfortunately, the situation in childcare is very similar to that of the general preschool population; the food served often do not meet DGA and many studies have shown an inadequacy in the foods served in these settings⁶⁰. Most studies assessing what children are consuming in childcare have been conducted in CC^{61–65}. Children are consuming high amounts of added sugars, saturated fat^{60,66}, sodium^{65,66}, protein⁶⁴, mainly from animal sources⁶⁷; and on the contrary, insufficient fiber^{65,66}, iron^{64,66}, zinc^{64,66}, vitamin D and E^{64–66}, calcium and folate⁶⁴. The poor quality of these foods is found primarily in the snacks being served; these are energy-dense, high in sugar, fat and sodium, and are offered more often than fruits and vegetables^{62,63}. These studies also report that children have low intakes of vegetables, fruits, whole grains and milk^{60,62,63}. Providers in CC are also offering whole-fat milk, high-fat or fried meat and refined grains⁶⁰.

Additionally, research suggests that the foods served do not match the menus. A study in 84 CC in North Carolina compared menus to the actual foods and beverages. They found that only 52% of the meals and snacks matched with the menu. Whole

grains, juice and vegetables were served less often; and on the other hand, milk, foods high in protein, fruits, and foods of low nutritional value were served more often than indicated in the menu. Cookies, chips, and juices were commonly served during snack time⁶⁸.

Even though FCCH provide care of a substantial number of preschoolers, studies exploring what children are consuming in FCCH are limited⁶⁹. These have found that similar to centers, children are not meeting recommendations⁷⁰. For example, Tovar et al.⁷⁰ described the nutritional quality of the food served to children among 166 participating in the Keys to Healthy Family Child Care Homes study. Even though the providers were serving some healthy food, such as fruit and dairy, children were not meeting dietary guidelines, specifically for greens, beans, seafood, plant proteins, whole grains, total vegetables, dairy, whole and total fruit; and amounts exceeding recommendations for sodium and refined grains. The analysis included food groups, but not the specific food items⁷⁰. The study highlighted the need to improve the diet quality in FCCH.

Trost et al., described policies and practices related to nutrition and physical activity in 297 FCCHs in Kansas⁶⁹. The results showed that providers had limited training in nutrition. More than 50% of the FCCH served 100% juice in a daily manner, less than 14% served low-fat milk regularly, and there was a frequent use of unhealthy foods for celebrations, which has been reported by other authors⁶⁹. On the other hand, providers served adequate servings of fruit and vegetables; and low quantities of sweets, high-fat meats, sugary drinks and high-salt foods as snacks⁷¹. Interestingly, FCCH providers serve more servings of fruit and vegetables and limit

more foods with high contents of fat and saturated fat, as compared to CC^{69,72}.

However, another study showed that one third of snacks and breakfast did not include any fruit or vegetable, and that the meals and snacks offered exceeded the recommended limit of saturated fat ⁷³. Although Trost et al., included a large sample of FCCH, it is important to note that the data were self-reported by the providers, and social desirability bias is of concern⁷⁴. Self-reported data has been a limitation in other studies completed in FCCHs^{71,75,76}.

Cuadrado-Soto et al.⁷⁷ described the micronutrient adequacy in preschoolers attending 118 FCCH in Rhode Island. They found high percentages of children with inadequate intake density for vitamin D (86.1%), vitamin E (89.1%), vitamin K (99.2%) and potassium (99.2%). Meals and snacks provided in childcare might be deficient in important and critical nutrients for children's growth, physical and cognitive development, which points out that the food environment needs to be improved in these settings^{59,74,78}.

Although studies conducted in FCCH have provided important information regarding the diet of children while attending childcare, more studies exploring what children are consuming in FCCHs are needed, especially when considering that there is room to improve their diets.

Factors that influence the foods served by providers

While attending childcare, the providers are responsible for the foods provided to the children. Research has shown that different factors can influence food purchases and that there are differences in the type and nutritional quality of the foods offered by the providers.

Otten et al.⁵⁵ explored the factors that influence early care and food purchasing decisions. They found that among the providers from 12 CC and six FCCH in Washington, one of the main factors that influenced providers' choices was State Licensing requirements and participation in the CACFP⁵⁵. Studies have found that childcare settings that participate in CACF offer more healthy foods and beverages in comparison to the ones that do not join CACFP^{58,79}. These results have been explained by the fact that CACFP providers receive nutritional education and that this reimbursement might also allow providers to purchase more foods with a higher nutritional quality^{58,80}. Therefore, reimbursement can affect child food intake since nutritious diets tend to be more costly. This was found in a study conducted by Monsivais & Johnson in 60 FCCH participating in CACFP in Washington. They determined that higher nutritional quality, based on servings of whole grains, fresh whole fruits and vegetables, energy density and mean nutrient adequacy (mainly fiber, magnesium and vitamin E), was associated with higher food expenditures⁵⁹. However, Otten et al.⁵⁵ also found that some providers did not consider that the CACFP regulations supported children's health, that the reimbursement was insufficient, and that they needed more preparation in order to follow guidelines.

Besides the CACFP, other factors that might influence foods offered in childcare include: suppliers and vendors; which involves a balance between price, convenience and quality; physical environment, including the child-care facility itself in terms of kitchen and storage; social environment, such as professional networks (training and support received and the influence of the parents); and individual characteristics of the provider and children⁵⁵. This last factor includes the children's physical needs for

health and growth, preferences and allergies, and the providers' values, skills, behaviors, motivations, attitudes, knowledge, preferences, and their cultural background⁵⁵.

FCCHs' providers cultural background and dietary practices

Dietary patterns are influenced by several factors, including lifestyle, demographic and sociocultural elements, including ethnicity⁸¹. Ethnicity is based on cultural characteristics such as shared language, ancestry, religion, traditions, history and dietary preferences⁸². The types of foods, preparation methods and frequency of consumption reflect cultural practices⁸³; therefore, food patterns vary among ethnicities^{41,81,84}. For example, in the Latino culture, psychosocial and environmental factors influence diet behaviors, including a preference for traditional, home-prepared foods during certain meal times, and beliefs about gender roles relating to food⁸⁵. Certain environmental factors also influence their dietary intake, including food access and availability, cooking skills, social interactions living structure, schedules, and available time⁸⁵. Latinos are more likely than others to spend more money on food, prepare and serve meals at home, and use fresh and traditional fruits and vegetables⁸⁶.

As mentioned before, the ethnicity of the FCCH providers has also been related to different dietary practices in childcare settings, in which culture may play a role in the type of foods offered to the children^{48,55,87}. For Latino providers, CACFP regulations influence knowledge and practices related to child nutrition, which have been associated with positive beliefs related to child nutrition⁸⁸. Tovar et al.⁴⁸ explored practices and attitudes of providers in 105 FCCH in Rhode Island and determined that the providers' ethnicity was a predictor of certain nutrition practices, suggesting a

possible cultural influence among these providers. For example, Latino providers reported receiving more nutrition education; however, they were more likely to encourage children to finish food in their plate⁴⁸.

Lindsay et al.⁸⁸ explored Latino FCCH providers' beliefs and practices related to nutrition using focus groups with 44 FCCH providers in Massachusetts. They found that most providers recognized that their Latino culture influenced the foods they serve at the FCCH and that their culture did not negatively impact the food selection that the children made⁸⁸.

This information should be considered in the design of interventions to improve the nutritional quality of foods served in childcare settings⁵⁵. Racial and ethnic minorities generally engage in less healthy dietary behaviors than White people, which has a public health impact since they have higher risk to develop chronic diseases related to lifestyle factors⁸⁹. FCCH are usually run by ethnically diverse providers, which is expected to increase due to the demographics changes the US is facing⁸⁶.

Consequently, it is important to understand the context of Latino FCCH providers and to address these differences in order to better tailor interventions, including information regarding the types of foods offered to the children during childcare. Training and education aimed to providers must contemplate cultural and linguistic differences⁴⁸; however, the information regarding food choices between the ethnicity of the provider is limited.

FCCH and providers as opportunities to improve children's diet

A greater understanding of the environment in which children spend the majority of time is imperative⁵¹. Childcare has been identified as an important environmental

and social setting that can influence the development of early dietary habits^{26,44,56}.

Given the increased parents reliance on childcare and the number of daily meals children consume while in care, the improvement of diet and the creation of healthy environments in childcare settings constitutes an opportunity to improve dietary behaviors in the overall population⁵².

During childcare, preschoolers depend on the food provided by the caregivers²⁶; consequently, providers are responsible for offering healthy food⁹⁰ that will promote optimal health, growth and development²¹. They have the opportunity to create healthy childcare environments, with appropriate feeding practices and attitudes⁹⁰, and to help establish and reinforce early healthy eating habits⁸⁸. Hence, providers should offer preschool children a wide variety of high-quality, nutrient-dense foods, and limit consumption of low-nutrient, energy-dense foods and beverages. More specifically, providers should be encouraged to expose children to fruits and vegetables, whole-grain products, low-fat or fat-free milk, healthy sources of unsaturated fats, lean and unprocessed meats, chicken, and fish; and they should limit sources of sodium and saturated fat (including cheese and butter)³⁰.

Research has shown that Latino FCCH providers and parents develop a close relationship⁹¹. Latino parents also believe that FCCH providers are important in shaping their children's eating habits⁹², suggesting that providers can become an important influence in the Latino community⁸⁸. This is an opportunity to engage families in discussions about the importance of healthy eating patterns in children, showing that the providers' impact can expand beyond the FCCH⁹¹. This can be truly beneficial, especially in households with lower incomes and education⁹³. This

highlights the importance of the providers' knowledge and perceptions about nutrition, the selection of foods and meals, and their influence on the foods children are exposed to⁹⁴. Nevertheless, most FCCHs providers do not participate frequently in nutrition training⁴⁸. Considering that there is a need to improve the quality of foods and beverages offered to children during childcare, more education to the childcare providers is needed, including information about policies and recommendations about the foods that can and should be served^{51,95–97}. Fortunately, it has been shown that in-person trainings are well received by providers and that they are willing to improve⁸⁸.

Educational sessions and trainings that are simple and practical have been shown to be effective in increasing childcare providers' knowledge⁸⁸. Guidance should be actionable, include daily plans for meals and snacks that meet children's nutrient needs, and emphasize suggestions for specific foods³⁰. Studies have found that interventions that target foods and beverages are effective to improve diet quality⁷⁸. However, providers may have trouble translating recommendations into more specific foods³⁰. Therefore, understanding what children are eating while in childcare, and the type and variety of foods to which they are exposed, are necessary in order to provide targeted guidance to improve eating habits in FCCH³⁰. Strategies implemented must be low cost, easy to implement and to maintain over time⁹⁵, as well as culturally appropriate⁴⁸.

FCCH characteristics make them an ideal setting to implement programs⁵⁶. FCCH are a primary resource for many families, especially low-income and ethnically-diverse⁷⁸. However, most studies, and the majority of childcare-based interventions, have been conducted in CC^{51,95}. These settings have several differences, for example,

FCCH are small businesses, with low profit margins and are less regulated than CC⁹⁵.

These differences in economic and personnel resources explain why in some cases, the interventions developed for CC are not adaptable to FCCH⁹⁵. Therefore, more information about the environment and the types of foods available in FCCH are necessary to create more effective interventions⁹⁵.

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B. EXTENDED METHODOLOGY

Study Design

This study is a secondary analysis using baseline data from Healthy Start/Comienzos Sanos: a cluster-randomized controlled trial designed to evaluate the impact of a multicomponent intervention on nutrition and physical activity in English and Spanish speaking FCCH in Rhode Island¹.

Healthy Start/Comienzos Sanos Study

Healthy Start included 120 FCCH, which were randomized in matched pairs into the intervention or comparison group, according to the language spoken by the provider and the number of eligible children. The study data manager randomized the FCCH providers using a Microsoft Excel randomization function. FCCH providers received an 8-month intervention targeting nutrition and physical activity (intervention group) or reading readiness (comparison group)¹.

A variety of strategies were used for recruitment, such as direct contact through emails, information sessions at community organizations and at conferences organized for FCCH providers, meetings with the coordinators of FCCH systems, and word of mouth referrals from FCCH already participating¹.

Surveys were conducted in either English or Spanish by trained research staff interviewers. Evaluations before and after the intervention included phone and in-person surveys with the provider, as well as observations of the FCCH physical and social environment. Data collection also included two-day observations of the

children's food intake during childcare. A more detailed description of the study population and methods has been previously described¹.

The Healthy Start study protocol was approved by the institutional review boards at the University of Rhode Island, Brown University and the University of Connecticut.

Participants

Inclusion criteria included being a provider within 60 miles of Providence, Rhode Island; operating a FCCH for at least 6 months; talk English or Spanish; with at least one child taken care of for a minimum of 10 hours per week; and serving one meal and snack in the FCCH. Informed consent was obtained from the parents of children in eligible FCCH. The Healthy Start study included 120 providers and 370 children between 2-5 years old.

All baseline data from the 120 FCCH and 370 children were used for this analysis. This information was collected from January 2016 to June 2018.

Measures

Children and provider demographics. Children and provider demographic characteristics, including ethnicity, gender, race, age, education and household size, were collected at baseline¹.

Provider and FCCH information were collected through a telephone survey and during the first visit to the FCCH by the field coordinator. This survey also included characteristics of the FCCH, such as hours of operation, number of children, average number of daily hours children spent in the FCCH, and participation in the Child and

Adult Care Food Program (CACFP). Parents provided their child's information by completing a demographic survey¹.

The FCCH providers were classified as Latino or non-Latino according to their answer to the question referent to ethnicity (*"Do you consider yourself to be a Latino/Latina/Hispanic?"*) on the demographics survey completed¹. Subsequently, two groups of children were created: children under the care of a Latino provider and under the care of a non-Latino provider.

Child Dietary Intake. Dietary intake of each child was collected using the Dietary Observation in Child Care (DOCC), a reliable and valid observation technique for this population². The observations were done twice, either on consecutive or non-consecutive days, depending on the schedule of the provider¹. At baseline, 317 children completed two days of dietary observations.

The information was collected by trained and certified field staff members, which arrived before the children ate their first meal or snack in the FCCH. Each observer watched up to three children, avoiding interfering with the daily routine. They visually estimated the amount and type of foods and beverages served, as well as any additional or remaining servings. The amount consumed was calculated using the following equation: $\text{amount consumed} = (\text{amount served} \pm \text{amount added or wasted}) - \text{amount remaining}$. When possible, information about recipes was collected from the provider, especially for mixed dishes; other information related to the foods provided was clarified with the provider. All foods and beverages (except water) consumed by the children, including foods from home, were observed and collected. However, only those food items offered by the provider were analyzed¹.

The food records were entered into Nutrition Data System for Research (NDSR), software versions 2015-2018, a nutrition analysis software developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN. The different versions were used to reflect updates in the marketplace food industry throughout the study³. The foods and beverages consumed were reviewed and entered into NDSR by the Community Nutrition and Child Obesity Prevention Research Group (CNCOP), from the Department of Nutrition and Food Sciences of the University of Rhode Island. This process, including quality control, was performed according to the Data Management Manual created for the Healthy Start study. Any questions related to amounts and types of foods were addressed by the project manager to ensure the accuracy of the data. Outputs generated by NDSR were used for the data analysis of this study³.

Statistical analysis

Food Groups and Food Sources

The food groups and food sources used for this analysis were based on the Nutrition Coordinating Center (NCC) food group classification and the NCC Food Group Serving Count System, which is the database used by NDSR. This database classifies foods into 168 subgroups, which belong to one of the 9 major food groups: 1) Fruits, 2) Vegetables, 3) Grains (bread, cereal, pasta, rice), 4) Dairy and non-dairy alternatives, 5) Meat, Fish, Poultry, Eggs, Nuts, Seeds, 6) Fats, 7) Sweets 8) Beverages and 9) Miscellaneous Foods.

To determine the food groups and sources for the study, the NCC food subgroups consumed by children were identified by conducting descriptive statistics on the raw

data set from NDSR output file 9. This file also contains foods at the ingredient level, which means that recipes and mixed/assembled dishes are listed as ingredients, which are then allocated by the program into either of the subgroups. Food subgroups consumed (n=85) were aggregated to create the food sources for the study, using as reference the key recommendations from the Dietary Guidelines for Americans (DGA) 2015⁴. The NCC food subgroups not consumed by the children on either of the days observed, were included in the miscellaneous group. The beverage and the miscellaneous groups were not included in the analysis, due to the objectives of the study.

1. *Fruits*: The NCC subgroups were aggregated according to the way the fruit was consumed: as juice or whole piece. Recommendations emphasize the consumption of whole fruit, mainly for its fiber content⁵.
2. *Vegetables*: The NCC vegetable subgroups were aggregated into non-starchy, starchy vegetables and legumes.
3. *Dairy and non-dairy alternatives*: Dairy was described according to its fat and added sugar content. Subgroups were categorized according to its fat content as low-fat/fat free, reduced fat and whole fat. This is important since childcare settings are serving high-fat dairy, which is high in saturated fats⁶. Added sugars has also been identified as a problem in the general preschool population^{7,8}.
4. *Meat, Fish, Poultry, Eggs, Nuts, Seeds (Protein)*: NCC food subgroups representing similar foods/same type of meat were grouped. For example, poultry, lean poultry and fried chicken were aggregated to determine the contribution of poultry. After the aggregation process, protein sources included: poultry, beef,

eggs, cold cuts, fish, pork, and, nuts and seeds. Providers should offer healthy sources of unsaturated fats, lean and unprocessed meats, chicken, and fish; and they should limit meats with high content of saturated fats⁹.

5. *Grains*: Grains were described as whole or refined. “Some whole grain” products were included in refined grains, since the whole grain ingredient is not the first ingredient in the food label of the food. One of the main recommendations is to offer whole grain products; however, studies have shown this is an area to improve⁶.
6. *Fats*: The NCC food subgroups were aggregated according to their vegetable and animal nature. It has been reported that children are consuming high amounts of saturated fats during childcare; therefore, animal fats should be limited^{6,10}.
7. *Sweets*: The NCC food subgroups representing similar foods were grouped. After the aggregation process, sweets sources included: syrup/honey/jelly, sugar, SSBs chocolate/candy. SSBs were included in the sweets food group since beverages were not analyzed as a major food group

Appendix 3 shows the detailed aggregation of NCC food subgroups into the food sources used for this study. This aggregation resulted in 25 food sources distributed across 7 major food groups (fruits, vegetables, dairy and non-alternatives, protein, grains, fats and sweets).

Food group intake in Latino and non-Latino FCCH

Food intake was calculated as servings. Serving sizes (numbers of cups, ounces, and teaspoon equivalents) used by the NCC Food Serving Count System, are based on the Dietary Guidelines for Americans 2000 (DGA 2000). For the food items not

included in these recommendations, the NCC Food Serving Count System uses the Food and Drug Administration (FDA) serving sizes. These are detailed in the Serving Count 2018 File in the NDSR manual³.

A home-level analysis was conducted to determine the children's food group intake. For each major food group, the mean serving intake in each FCCH was calculated; this was then averaged overall and by provider's ethnicity ¹¹.

Contribution of Food Sources to Major Food Groups

A home-level analysis was conducted to determine the contribution of each food source to its respective major food group. The mean proportion for each food source was calculated using ratio of means¹¹. This was determined for each FCCH and then averaged overall and by provider's ethnicity.

For the vegetables, dairy and non-dairy alternatives, grains, and fat food groups, additional descriptions were conducted, in order to analyze individual food items. Based on the DGA 2015, more specific information about the types of vegetables (red and deep yellow, dark green) was included. This provided insight to vegetable variety, given that recommendations emphasize this due to the differences in micronutrient content⁹. For dairy, grains and fats, more description about the food items were included. Appendix 4 shows the detailed aggregation.

Differences between Latino and non-Latino provider

The differences between the mean food group intake and food source ratios between Latino and non-Latino providers were tested with ANOVA and ANCOVA models ($p < 0.05$). Bonferroni adjustments were made for multiple comparisons. The dependent, continuous variables were the food group mean intakes and the food source

ratios; and the independent variable was the provider ethnicity. Before creating the models, the distributions of the dependent continuous variables were checked, which had deviations from normality. Therefore, these variables were logarithmically transformed. The heteroscedasticity assumption was examined through the plots; and maximum values were analyzed through visual identification in histograms or scatterplots.

Variables that were possible confounders and had a statistically significant association with the outcome ($p < 0.1$), were included in the adjusted model. The covariates considered for inclusion in the adjusted model were CACFP participation, provider's age, education and income, number of children in the home and the children's age. These variables have been used as confounders in previous studies or have been related to the foods consumed by preschool children in FCCH^{12,13}. In the adjusted models for the proportions, the mean serving intake was included as a covariate if the Pearson correlation coefficient between serving intake and the ratio of each food source was < 0.7 . SAS studio (SAS Institute, Inc., Cary, NC) was used to carry out the analyses.

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C. AGGREGATION OF NCC FOOD SUBGROUPS INTO THE STUDY

FOOD SOURCES

Food group	Food sources	Code	NCC food group
Fruit	Fruit juice	FRU0100	Citrus juice
		FRU0200	Fruit juice excluding citrus juice
	Whole fruit	FRU0300	Citrus fruit
		FRU0400	Fruit excluding citrus fruit
		FRU0500	Avocado and similar
Vegetables	Non- starchy vegetables	VEG0100	Dark-green vegetables
		VEG0200	Deep-yellow vegetables
		VEG0300	Tomato
		VEG0600	Other vegetables
	Starchy vegetables	VEG0400	White Potatoes
		VEG0450	Other Starchy Vegetables
		VEG0800	Fried potatoes
	Legumes	VEG0700	Legumes (cooked dried beans)
Dairy and non-dairy alternatives	Low-fat dairy	DYR0100	Yogurt - Sweetened Low Fat
		DYL0100	Yogurt - Sweetened Fat Free
		DYR0200	Yogurt - Artificially Sweetened Low Fat
		DYL0200	Yogurt - Artificially Sweetened Fat Free
		DMR0100	Milk - Low Fat and Fat Free
		DML0200	Ready-to-drink Flavored Milk - Low Fat and Fat Free
		SWT0600	Sweetened Flavored Milk Beverage Powder without Non-fat Dry Milk
		DMN0100	Milk – Nondairy
		DOT0200	Frozen Nondairy Dessert
	Reduced dairy	DMR0100	Milk - Reduced Fat
		DCR0100	Cheese - Reduced Fat
	Whole	DYF0100	Yogurt - Sweetened Whole Milk

		DMF0100	Milk – Whole
		DCF0100	Cheese - Full Fat
		DOT0100	Frozen Dairy Dessert
		DOT0300	Pudding and Other Dairy Dessert
Protein (Meat, Fish, Poultry, Eggs, Nuts, Seeds)	Eggs	MOF0300	Eggs
	Nuts and seeds	MOF0500	Nuts and Seeds
		MOF0600	Nut and Seed Butters
	Beef	MRL0100	Lean Beef
		MRF0100	Beef
	Pork	MRF0400	Fresh Pork
		MCL0200	Lean Cured Pork
		MCF0200	Cured Pork
	Poultry	MPF0100	Poultry
		MPL0100	Lean Poultry
		MPF0200	Fried Chicken - Commercial Entrée and Fast Food
	Fish	MFL0100	Lean Fish - Fresh and Smoked
		MFF0200	Fried Fish - Commercial Entrée and Fast Food
	Cold cuts and sausages	MCL0100	Lean Cold Cuts and Sausage
		MCF0100	Cold Cuts and Sausage
Grains	Refined grains	GRR0100	Grains, Flour and Dry Mixes - Refined
		GRR0200	Loaf-type Bread and Plain Rolls - Refined Grain
		GRS0200	Loaf-type Bread and Plain Rolls - Some Whole Grain
		GRR0300	Other Breads (quick breads, corn muffins, tortillas) - Refined Grain
		GRS0300	Other Breads (quick breads, corn muffins, tortillas) - Some Whole Grain
		GRR0500	Pasta - Refined Grain
		GRR0400	Crackers - Refined Grain
		GRS0400	Crackers - Some Whole Grain

		GRR0600	Ready-to-eat Cereal (not presweetened) - Refined Grain
		GRR0700	Ready-to-eat Cereal (presweetened) - Refined Grain
		GRS0700	Ready-to-eat Cereal (presweetened) - Some Whole Grain
		GRR0800	Cakes, Cookies, Pies, Pastries, Danish, Doughnuts and Cobblers - Refined Grain
		GRS0800	Cakes, Cookies, Pies, Pastries, Danish, Doughnuts and Cobblers - Some Whole Grain
		GRR0900	Snack Chips - Refined Grain
		GRS0900	Snack Chips - Some Whole Grain
	Whole grains	GRW0100	Grains, Flour and Dry Mixes - Whole Grain
		GRW0200	Loaf-type Bread and Plain Rolls - Whole Grain
		GRW0300	Other Breads (quick breads, corn muffins, tortillas) - Whole Grain
		GRW0400	Crackers - Whole Grain
		GRW0500	Pasta - Whole Grain
		GRW0600	Ready-to-eat Cereal (not presweetened) - Whole Grain
		GRW0700	Ready-to-eat Cereal (presweetened) - Whole Grain
		GRW0800	Cakes, Cookies, Pies, Pastries, Danish, Doughnuts and Cobblers - Whole Grain
		GRW0900	Snack Chips - Whole Grain
		GRW1000	Snack Bars - Whole Grain
		GRW1100	Popcorn
		FAF0100	Butter and Other Animal
Fats	Animal		

			Fats – Regular
		FCF0100	Cream
		FCN0100	Cream - Nondairy
		FCR0100	Cream - Reduced Fat
	Vegetal	FDF0100	Salad Dressing – Regular
		FDR0100	Salad Dressing - Reduced Fat/Reduced Calorie/Fat Free
		FMR0100	Margarine - Reduced Fat
		FOF0100	Oil
Sweets	Sugar sweetened-beverages	BVA0500	Artificially Sweetened Tea
		BVS0300	Sweetened Fruit Drinks
	Sugar	SWT0400	Sugar
	Chocolate/ candy	SWT0100	Chocolate Candy
		SWT0200	Non-chocolate Candy
	Syrup, Honey, Jam, Jelly, Preserves	SWT0500	Syrup, Honey, Jam, Jelly, Preserves
Miscellaneous	Miscellaneous	MSC0300	Sauces and Condiments – Regular
		MSC0400	Sauces and Condiments - Reduced Fat
		MSC0500	Pickled Foods
		MSC0600	Miscellaneous Dessert
		MSC0800	Soup Broth
		MSC0900	Baby Food Dessert
		MSC1000	Miscellaneous Baby Food Mixtures
		SWT0800	Sauces, Sweet - Reduced Fat/Reduced Calorie/Fat Free
		BVS0700	Nondairy-based Sweetened Meal Replacement/Supplement
		BVU0500	Unsweetened Water
		MSC0500	Pickled Foods
		BVE0200	Wine
		BVA0100	Artificially Sweetened Coffee
		BVA0200	Artificially Sweetened Coffee Substitutes
		BVA0300	Artificially Sweetened Fruit Drinks
		BVA0400	Artificially Sweetened Soft Drinks

		BVA0600	Artificially Sweetened Water
		BVA0700	Non-dairy based Artificially Sweetened Meal Replacement/Supplement
		BVE0100	Beer and Ales
		BVE0300	Distilled Liquor
		BVE0400	Cordial and Liqueur
		BVO0100	Non-alcoholic Beer
		BVO0200	Non-alcoholic Light Beer
		BVS0100	Sweetened Coffee
		BVS0200	Sweetened Coffee Substitutes
		BVS0400	Sweetened Soft Drinks
		BVS0500	Sweetened Tea
		BVS0600	Sweetened Water
		BVU0100	Non-alcoholic Beer
		BVU0200	Unsweetened Coffee Substitutes
		BVU0300	Unsweetened Soft Drinks
		BVU0400	Unsweetened Tea
		BVU0600	Nondairy-based Unsweetened Meal Replacement/Supplement
		DCL010	Cheese - Low Fat and Fat Free
		DCN0100	Cheese – Nondairy
		DMF0200	Ready-to-drink Flavored Milk - Whole
		DML0300	Sweetened Flavored Milk Beverage Powder with Non-fat Dry Milk
		DML0400	Artificially Sweetened Flavored Milk Beverage Powder with Non-fat Dry Milk
		DMR0200	Ready-to-drink Flavored Milk - Reduced Fat
		DOT0400	Artificially Sweetened Pudding and Other Dairy Dessert
		DOT0500	Dairy-based Sweetened Meal Replacement/Supplement

		DOT0600	Dairy-based Artificially Sweetened Meal Replacement/Supplement
		DYF0200	Yogurt - Artificially Sweetened Whole Milk
		DYN0100	Yogurt – Nondairy
		FAR0100	Butter and Other Animal Fats - Reduced Fat
		FCL0100	Cream - Low Fat and Fat Free
		FMC0200	Meat-based Savory Snack
		FMF0100	Margarine – Regular
		FRU0600	Fried Fruits
		FRU0700	Fruit-based Savory Snack
		GRR1000	Snack Bars - Refined Grain
		GRR1300	Baby Food Grain Mixtures – Refined Grain
		GRS0100	Grains, Flour and Dry Mixes - Some Whole Grain
		GRS0500	Pasta - Some Whole Grain
		GRS0600	Ready-to-eat Cereal (not presweetened) - Some Whole Grain
		GRS1000	Snack Bars - Some Whole Grain
		GRS1300	Baby Food Grain Mixtures – Some Whole Grain
		GRW1200	Flavored Popcorn
		GRW1300	Baby Food Grain Mixtures – Whole Grain
		MFF0100	Fish - Fresh and Smoked
		MOF010	Organ Meats
		MOF0200	Baby Food Meat Mixtures
		MOF0400	Egg Substitute
		MOF0700	Meat Alternatives
		MRF0200	Veal
		MRF0300	Lamb
		MRF0500	Game
		MRL0200	Lean Veal
		MRL0300	Lean Lamb

		MRL0400	Lean Fresh Pork
		MSC0100	Gravy – Regular
		MSC0200	Gravy - Reduced Fat/Fat Free
		MSC0700	Non-grain Flour and Similar
		MSC1100	Artificially Sweetened Flavored Milk Beverage Powder without Non-fat Dry Milk
		MSC1200	Sugar Substitute
		MSF0100	Fried Shellfish - Commercial Entrée and Fast Food
		MSL0100	Shellfish
		SWT0300	Frosting or Glaze
		SWT0700	Sauces, Sweet – Regular
		FMC0100	Vegetable-based savory snack
		DOT0700	Infant Formula
		DOT0800	Infant Formula – Nondairy
		VEG0900	Fried vegetables
		VEG0500	Vegetable juice

D. AGGREGATION OF NCC FOOD SUBGROUPS FOR ADDITIONAL
DESCRIPTIONS FOR VEGETABLES, DAIRY AND NON-ALTERNATIVES,
GRAINS AND FATS

Food group	Food sources	Code	NCC food group
Vegetables	Dark green vegetables	VEG0100	Dark green vegetables
	Red and deep-yellow vegetables	VEG0200	Deep yellow vegetables
		VEG0300	Tomato
	Starchy vegetables	VEG0400	White Potatoes
		VEG0450	Other Starchy Vegetables
		VEG0800	Fried potatoes
	Other Vegetables	VEG0600	Other vegetables
	Legumes	VEG0700	Legumes (cooked dried beans)
Dairy and Non-dairy alternatives	Yogurt	DYR0100	Yogurt - Sweetened Low Fat
		DYL0100	Yogurt - Sweetened Fat Free
		DYR0200	Yogurt - Artificially Sweetened Low Fat
		DYL0200	Yogurt - Artificially Sweetened Fat Free
		DYF0100	Yogurt - Sweetened Whole Milk
	Milk	DMR0100	Milk - Low Fat and Fat Free
		DML0200	Ready-to-drink Flavored Milk - Low Fat and Fat Free
		SWT0600	Sweetened Flavored Milk Beverage Powder without Non-fat Dry Milk
		DMR0100	Milk - Reduced Fat
		DMF0100	Milk – Whole
		DCR0100	Cheese - Reduced Fat
		DCF0100	Cheese - Full Fat
	Non-dairy	DMN0100	Milk – Nondairy
	Desserts	DOT0100	Frozen Dairy Dessert
		DOT0300	Pudding and Other Dairy Dessert
		DOT0200	Frozen Nondairy Dessert

Grains	Grains, Flour and Dry Mixes	GRR0100	Grains, Flour and Dry Mixes - Refined Grain
		GRW0100	Grains, Flour and Dry Mixes - Whole Grain
	Bread	GRR0200	Loaf-type Bread and Plain Rolls - Refined Grain
		GRS0200	Loaf-type Bread and Plain Rolls - Some Whole Grain
		GRW0200	Loaf-type Bread and Plain Rolls - Whole Grain
	Other Breads (quick breads, corn muffins, tortillas)	GRR0300	Other Breads (quick breads, corn muffins, tortillas) - Refined Grain
		GRS0300	Other Breads (quick breads, corn muffins, tortillas) - Some Whole Grain
		GRW0300	Other Breads (quick breads, corn muffins, tortillas) - Whole Grain
	Pasta	GRR0500	Pasta - Refined Grain
		GRW0500	Pasta - Whole Grain
	Crackers	GRR0400	Crackers - Refined Grain
		GRS0400	Crackers - Some Whole Grain
		GRW0400	Crackers - Whole Grain
	Ready-to-eat cereals	GRR0600	Ready-to-eat Cereal (not presweetened) - Refined Grain
		GRR0700	Ready-to-eat Cereal (presweetened) - Refined Grain
		GRS0700	Ready-to-eat Cereal (presweetened) - Some Whole Grain
		GRW0600	Ready-to-eat Cereal (not presweetened) - Whole Grain
		GRW0700	Ready-to-eat Cereal (presweetened) - Whole Grain
	Cakes, Cookies, Pies, Pastries, Danish, Doughnuts and	GRR0800	Cakes, Cookies, Pies, Pastries, Danish, Doughnuts and Cobblers

	Cobblers		- Refined Grain
		GRS0800	Cakes, Cookies, Pies, Pastries, Danish, Doughnuts and Cobblers - Some Whole Grain
		GRW0800	Cakes, Cookies, Pies, Pastries, Danish, Doughnuts and Cobblers - Whole Grain
	Snacks	GRR0900	Snack Chips - Refined Grain
		GRS0900	Snack Chips - Some Whole Grain
		GRW0900	Snack Chips - Whole Grain
		GRW1000	Snack Bars - Whole Grain
		GRW1100	Popcorn
Fats	Butter and other animal fats	FAF0100	Butter and Other Animal Fats – Regular
	Cream	FCF0100	Cream
		FCN0100	Cream - Nondairy
		FCR0100	Cream - Reduced Fat
	Salad dressing	FDF0100	Salad Dressing – Regular
		FDR0100	Salad Dressing - Reduced Fat/Reduced Calorie/Fat Free
	Margarine	FMR0100	Margarine - Reduced Fat
	Oil	FOF0100	Oil
	Shortenin	FSF0100	Shortening