HHS Public Access

Author manuscript

J Acad Nutr Diet. Author manuscript; available in PMC 2019 December 01.

Published in final edited form as:

J Acad Nutr Diet. 2018 December ; 118(12): 2280–2286. doi:10.1016/j.jand.2018.08.154.

Nutritional quality of meals and snacks served and consumed in family child care

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Abstract

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Author Contributions:

All the authors contributed to the various stages of this study. AT contributed to the study design, performed all of the statistical analysis, and drafted the manuscript. AV, SBN contributed to the study design and helped draft the manuscript. TO, MS participated in discussion of the design of the study and revised manuscript. RB helped manage data collection and read manuscript. DW conceived of the initial idea of the study, contributed to design of the study, revised the manuscript and contributed especially to the intellectual content. All the authors read and commented on the drafts and approved of the final version for submission.

None of the authors have any conflict of interest to disclose

Background.—Improving the nutritional quality of food, including beverages, served in early care and education settings should enhance children's diet quality. However, few studies have explored the relationship between what is served and consumed in family child care homes (FCCH).

Objective.—To describe the nutritional quality of food served to children in FCCH and to assess the extent to which children eat what is served.

Design.—This study was a cross-sectional analysis using baseline data (n=166) from a cluster-randomized-controlled trial (2013 to 2016).

Participants/setting.—Eligible FCCH's in central North Carolina had to have at least two children between 18-months-four years, have been in business for at least two years, and serve at least one meal and one snack.

Main outcome measures.—Food was captured using the Diet Observation at Child Care protocol.

Statistical analyses.—Frequencies, means, and multivariate analysis were used to examine the relationship between food served and consumed by food groups, and by Healthy Eating Index (HEI-2010).

Results.—Children consumed between 61–80% of what was served, with vegetables, having the lowest percent consumed (61.0%). Total HEI-2010 score for food served was 63.6 (10.4) and for food consumed was 61.7 (11.5), out of a 100-point maximum. With regards to food served, FCCH providers came close to meeting HEI-2010 standards for dairy, whole fruit, total fruit and empty calories. However, providers appeared to fall short when it came to green and beans, seafood/plant proteins, total vegetables, whole grains, and fatty acids. They also exceeded recommended limits for sodium, and refined grains.

Conclusions.—While FCCH's are serving some healthy food, mainly fruit, dairy and few empty calories, there is room for improvement with regards to vegetables, grains, seafood and plant protein, fatty acids, and sodium. Future trainings should help providers find ways to increase the serving and consumption of these foods.

Keywords

Foods consumed; Foods Served; Child-Care; Diet quality

Background

Early care and education (ECE) programs are ideal settings to support the development of healthy habits in young children. In the United States, 60% of children under five years of age receive non-parental care,[1] spending, on average, over 26 hours a week in this setting.[2] Recommendations suggest that children enrolled in full-time child care obtain two-thirds of their daily nutrients while in care from meals and snacks consistent with the Dietary Guidelines for Americans (DGA).[3–5] Inclusion of these recommendations in state ECE program licensing vary[4]; however, ECE programs that participate in federally-funded programs, such as the Child and Adult Care Food Program (CACFP),[6] are subject to nutrition regulations and policies.

Despite these recommendations and federal programs encouraging ECE programs to provide nutritious food and beverages, studies suggest that there are several opportunities for improvement.[7] Findings appear consistent whether studies have examined what is being served[8–14] or what is being consumed.[15–17] However, few studies have measured and evaluated the differences between the amounts and quality of food and beverages served to and consumed by children. Furthermore, most studies have focused on child care centers,[18] but overlooked family child care homes, a form of ECE typically operated from the provider's own home. Family child care homes are much smaller programs that generally offer flexible child care hours and lower enrollment fees compared to child care centers[19,20] – characteristics that are particularly appealing to parents employed in shift work or low-income families. Regulations for family child care homes are often less stringent, including those around the promotion of healthy foods.[21] In this type of setting, understanding children's compliance with nutritional guidelines, and the extent to which children are consuming what is being offered can help inform future interventions. This study describes the nutritional quality of food served and consumed by children in family child care homes, assessing the extent to which the children consume what they are served, and assessing the association between the nutritional value of food served and consumed.

Methods

This cross-sectional analysis used baseline data from the Keys to Healthy Family Child Care Homes (Keys) study, which was conducted from 2013 to 2016 with family child care homes across central North Carolina (NC).[22] Keys was a cluster-randomized controlled trial that evaluated the efficacy of a childhood obesity prevention intervention designed to help providers become healthy role models, improve nutrition and physical activity environments, and implement effective business practices in their family child care homes. The study enrolled and measured 166 family child care homes and providers and 496 children ages 18 months to 4 years (approximately 3 children per home). Family child care homes were recruited in multiple waves from counties across central NC.[22] To target areas with the greatest need, recruitment efforts prioritized counties where childhood overweight and obesity prevalence was above the state average and median household income was below the state median (using US Census data).[23] When recruitment extended into higher income counties (i.e., above the state median), efforts were directed at low-income census tracts and family child care homes accepting child care subsidies. Within each county, community partners helped distribute study information via their existing communication channels with family child care homes (newsletters, emails, partner website, trainings, group meetings). In addition, an invitation to participate in the study and a study flyer were emailed and/or mailed directly to licensed family child care homes in each county. Interest and eligibility were assessed during follow-up telephone calls. To be eligible for the study, family child care homes had to have at least two children between the ages of 18 months and four years in their care, have been in business for at least two years with no plans of closing in the coming year, and serve at least one meal (breakfast, lunch, or dinner) and one snack (morning or afternoon snack) to children in their care. Child care providers and parents of children in care provided written informed consent to participate in the Keys study. Measures were collected by trained and blinded data collectors during two-day onsite

observations, including observation of children's dietary intake. For diet observations to be considered valid and to be included in the data analysis for this study, observations for each child had to capture lunch and at least one additional meal or snack (i.e., breakfast, morning or afternoon snack, dinner). Detailed information about the Keys study design and protocols have been reported in full elsewhere,[22,24] but aspects relevant to this analysis are described briefly below. All study protocols were approved by the Institutional Review Boards of the University of North Carolina at Chapel Hill and Duke University Medical Center.

Data Collection and Measures

Child dietary intake in the family child care home

Children's dietary intake while in child care was assessed with the Diet Observation at Child Care (DOCC) protocol.[24, 25] The DOCC protocol has demonstrated good validity and reliability for capturing dietary intake of children in child care.[24] For this project, trained data collectors observed and recorded all meals and snacks served to participating children across two full days of child care. According to DOCC protocol, one observer can accurately observe and record a maximum of three children. Typically, this included breakfast/morning snack, lunch, and an afternoon snack.

Data collectors estimated the quantity of food and beverages served, added (i.e., second helpings), exchanged, wasted, and remaining following the end of each meal and snack to calculate the total quantity served to and consumed by children. If additional detail was needed about food or beverages served (e.g., preparation of mixed dishes), the data collector would request this information from the family child care home provider. As noted above, valid diet observation days had to capture lunch and at least one additional meal or snack, thus setting a minimum level of data required for each day given that number of meals and snacks served can vary by family child care home and child (depending on the hours they are enrolled in care). If a child was absent or left early (before sufficient diet data could be collected), an additional visit was conducted to repeat the diet observation for that child. DOCC protocol allows observation of up to three children at a time. Typically, the family child care homes required only one observer, but a second was present whenever a home had four or more children participating.

DOCC data were analyzed using the Nutrition Data System for Research (NDSR) software (Nutrition Coordinating Center, University of Minnesota, Minnesota).[26] Data were entered separately for food served and food consumed. Specific variables from the NDSR output that were examined for food served and consumed included energy (kcal/day), total vegetables (cups/day), total vegetables w/out potatoes (cups/day), whole fruit (cups/day), 100% fruit juice (ounces/day), whole grains (ounces/day), refined grains (ounces/day), dairy (cups/day), and total protein (grams/day). These specific variables were selected because they allow comparison with nutrition recommendations in the DGA's as well as the nutrition standards of the CACFP. In addition, the NDSR output was used to calculate Healthy Eating Index (HEI-2010) scores for both food served and consumed (based on all meals and snacks observed) using the HEI-2010 scoring rubric[27] and the SAS macro provided by NDSR.[28] As per protocol, diet data for each child were first summed across the two observation days and then HEI-2010 scores were calculated from these sums. HEI-2010 was designed to measure

diet quality in terms of how well diets conform to the 2010 Dietary Guidelines for Americans.[29] The total HEI-2010 score represents the sum of 12 components scores (maximum component score shown in parentheses), including total fruit (5), whole fruit (5), total vegetables (5), green and beans (includes dark green vegetables and cooked, dried beans and peas because intakes of these types of vegetables are furthest from the amounts recommended in the USDA Food Patterns*)* (5), whole grain (10), dairy (10), total protein food (5), seafood and plant proteins (5), fatty acids (10), refined grains (10), sodium (10) and empty calories (20). Total HEI-2010 scores can have a maximum value of 100 which indicates high diet quality.[27]

Other variables

Demographic information from family child care home providers and parents of participating children were collected via self-administered questionnaires. Provider surveys captured characteristics of the family child care home, including years of operation, number of children enrolled, participation in subsidy programs such as CACFP and North Carolina's quality improvement rating system (where ECE programs are rated on a scale of one to five stars based on staff education, program standards, and compliance history; a rating of one star means that an ECE program meets North Carolina's minimum licensing standards) and personal demographics, including sex, age, race (Black/African American, White, Asian/Asian American, multiple race or other), and education (high school degree, associate degree, college degree, or graduate degree). Parent surveys captured the child's sex, age, and race. During site visits, data collectors also measured child and provider height and weight using standardized protocols described elsewhere.[22]

Statistical Analysis

Frequencies, percentages, means, and standard deviations were calculated from the demographic data to describe characteristics of children and providers. Means and standard deviations were calculated for the food served and consumed, specifically, energy (kcal/day), total vegetables (cups/day), total vegetables w/out potatoes (cups/day), whole fruit (cups/day), 100% fruit juice (cups/day), grains (ounces/day), whole grains (ounces/day), refined grains (ounces/day), dairy (cups/day), protein (grams/day), as well as HEI-2010 total and component scores. To assess children's consumption of food served, the percent of served that was consumed was calculated (i.e., consumed/served × 100) for all energy and food group variables. Multi-level mixed effects models were used to examine the association between HEI-2010 of food served (independent variable) and HEI-2010 score of food consumed (dependent variable). Models included a random intercept to account for nesting of children within family child care homes. Child level (child sex, age and BMI) and home level covariates (provider race, education, BMI, child care quality star rating and CACFP participation) were included. Covariates that did not contribute significantly to the model (p-value <0.10) were removed in a final reduced model. All analyses were conducted in SAS 9.3, 2013 (SAS Institute, Inc).[30]

Results

Data were available on 166 family child care homes and 495 children (diet data was missing for 1 child). Family child care homes had a mean (standard deviation, SD) of 7.2 (3.6) children enrolled and 91.0% of homes participated in CACFP (Table 1). All providers were women with a mean (SD) age of 49.4 (9.1) years. Providers were predominately Black/African American (74.1%) and either overweight (24.1%) or obese (65.7%). Among the children, there were similar numbers of boys and girls, with a mean (SD) age of 35.7 (11.4) months old. Children were predominantly Black/African American (63.3%). Their mean (SD) body mass index (BMI) *z*-score was 0.8 (1.2), and 17.4% were overweight and 16.0% were obese.

Child diet data was available for all 495 children, capturing 990 separate observation days. All 495 children had at least one valid day (lunch plus at least one additional meal or snack). There were 19 cases of non-valid observation days (3 completely missing, 5 missing lunch, and 11 lunch only), so a total of 971 valid observation days were utilized. In other words, there were 19 children with only one day of observation and the remaining 476 had two days.

None of the family child care home providers served meals and snacks “family style, meaning that children could serve themselves and decide what portion of food to take. Instead, 97% of providers served the food to children and decided children’s portions. Only 1.2% served food but allowed children to decide portions, and 1.8% allowed children to serve themselves but provider decided the portions.

A comparison of different food groups served versus consumed is presented in Table 2. Children were served on average 738 (212) kcals per day and consumed 545 (191) kcals, or 74% of what was served. Across the different food groups, children consumed between 61–80% of the amount served. Percent of food served that was consumed varied slightly between food groups, with children consuming a slightly lower percentage of vegetables compared to other food groups.

A comparison of the HEI-2010 total and component scores for food served and consumed is presented in Table 3. The food served and consumed in child care was not meeting dietary guidelines.[28] The average total HEI-2010 score of food served was 63.6 (10.4) and for food consumed was 61.7 (11.5). With regards to food served, family child care home providers came close to meeting HEI-2010 standards for dairy (9.6 (1.3) out of 10), whole fruit (4.8 (0.9) out of 5), total fruit (4.5 (1.0) out of 5) and empty calories (16.9 (3.7) out of 20). However, providers appeared to fall short when it came to green and beans (1.4 (2.0) out of 5), seafood/plant proteins (1.8 (2.3) out of 5), whole grains (3.9 (3.3) out of 10), total vegetables (2.3 (1.1) out of 5), and fatty acids (4.3 (3.2) out of 10). They also appeared to exceed recommended limits for sodium (4.9 (2.9) out of 10), and refined grains (5.4 (3.3) out of 10).

Multi-level mixed effects models found that the HEI-2010 score of what children were served was significantly associated with the HEI-2010 score of what they consumed, even

after adjusting for child and home level covariates. A 1-unit increase in HEI-2010 served was associated with a 0.97-unit increase in HEI-2010 consumed (Table 4).

Discussion

The goal of this study was to describe what children are being served and what they are consuming in family child care homes, a unique type of ECE setting. Findings from this study indicate that there is great room for improvement in the quality of food and beverages served to and consumed by children while in family child care homes, particularly with regards to greens and beans and total vegetables, seafood/plant proteins, whole and refined grains, fatty acids, and sodium. Also, children may selectively eat more of some food and less of others (e.g., vegetables). While children do not eat everything served to them, the overall quality of food served appears to predict the quality of food consumed. These findings, therefore, reiterate the importance of programmatic and policy efforts to improve the quality of food served to children. In addition, efforts to help providers introduce and encourage the consumption of healthy foods is clearly warranted.

This study found that overall quality of food served and consumed in this setting did not meet dietary guidelines assessed by the HEI-2010, which is consistent with the literature. In the Keys sample, the total HEI-2010 score for food served was only 63.6 and for foods consumed was only 61.7.[29] These findings are similar to what others have found about the quality of food served in child care settings whereby vegetables and whole grains are limited.[10,30–32,14] These results are also comparable to HEI-2010 scores for young children's total daily intakes estimated from in the National Health and Nutrition Examination Survey (NHANES). Meals and snacks consumed in child care homes by children in the Keys study sample had a slightly higher score for empty calorie (better diet quality) and a slightly lower score for total protein food and for seafood/plant proteins compared to children in the NHANES sample.[37] Together these studies reinforce the need to improve the quality of food served in child care as a means to support healthier dietary intakes in children. Furthermore, ECE providers would also likely benefit from strategies and resources on ways to serve more vegetables as well as practices they can use to encourage children to consume them. For example, repeated exposure of vegetables,[36] incorporating sensory learning activities,[36] sitting with children during meals,[37] being enthusiastic role models,[38–40] involving children in meal preparation,[41] serving meals and snacks "family style",[4] and talking with children about healthy foods[42,43] has been associated with healthier eating habits.

These findings highlight the importance of having strong nutrition guidelines, such as CACFP, for food and beverages served at child care. While results for this study were collected prior to the 2017 CACFP revisions, recent updates to these program guidelines should help address several of these inadequacies as they have a greater emphasis on providing healthy meat options (including seafood and plant proteins), vegetables, and whole grains, while avoiding added sugars (e.g., flavored milk, grain-based desserts).[44] Future studies should assess the impact of these rule changes.

This study also found that the diet quality of food served and consumed in this setting were highly associated, even after adjusting for child and home level factors. While serving nutritious food is clearly important, ECE providers view child preference as a barrier.[45] Their concerns appear at least in part to be substantiated by these results. Percent of food served that was consumed was similar across food groups; however, children appeared to consume slightly less of the vegetables than they were served. Similar findings were reported in a plate waste study conducted with preschool-aged children in Head Start showing that vegetables contributed to 61% of plate waste, indicating that children were consuming less of the vegetables being served.[46] Food waste is a real concern for ECE providers, especially family child care home providers, as resources are very limited.[47] Together, these findings speak to the importance of providing high quality food in ECE settings and helping providers encourage and support healthy eating habits in children, so that when healthy food is served, children are willing and excited to eat it. Future studies should continue to explore ways to increase child acceptance of certain food especially vegetables.

There were several strengths to this study including detailed observation of both food being served and consumed by trained observers, examination of the understudied setting of family child care homes, and a large sample size. This study however was limited in that observed food and beverages served to and consumed by children were captured over two days of care only. Data on feeding practices of the childcare providers was not included in this analysis and may be an important factor to consider for future studies. Finally, the results of this may not be generalizable to other family child care homes, to other ECE settings such as child care centers, or to other regions of the country beyond North Carolina. It is important to note that recruitment targeted low-income areas, and as a result, the majority of the homes in this study received CACFP reimbursements. Hence, results may not be generalizable to family child care homes that do not participate in CACFP. In addition, this study cannot predict how the relationship between food served and consumed might change if the quality of the food served improves. Caution must also be taken to avoid possible unintended consequences, such as creating a larger disparity between food served and consumed when healthier foods are introduced, emphasizing the need for ECE provider training and education on effective feeding strategies.

Conclusions

The findings from this study suggest that while family child care homes are serving some healthy food, mainly fruit, dairy and few empty calories, there is much room for improvement with regards to vegetables, whole and refined grains, seafood and plant protein, fatty acids, and sodium. The new CACFP rules are a step in the right direction to improve what is provided. Continued efforts are needed in less studied environments, such as family child care homes. Future trainings and support should offer child care providers strategies to help increase the amount of vegetables that are served and those that are consumed by children.

Acknowledgments

Financial Support

This research was funded by the National Heart, Lung, And Blood Institute of the National Institutes of Health under Award Number R01HL108390 and funds for Dr. Tovar were provided by early career diversity grant funds, 3R01HL108390-03S1. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The sponsor had no role in the study design; collection, analysis, or interpretation of the data; writing of the article; or decision to publish this article. This journal article was also supported by Cooperative Agreement Number U48-DP001944 from the Centers for Disease Control and Prevention. The findings and conclusions in this journal article are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention. Support was also received from the Nutrition Obesity Research Center at the University of North Carolina at Chapel Hill (NIH DK056350).

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Research Snapshot

Research Questions:

What food is being served to children attending family child care homes, and to what extent do children consume this food? What is the nutritional quality of the food served and consumed?

Key Findings:

Children consumed 60–80% of the food served; for vegetables, dairy, and whole grains, children ate 60–71% of what was served. The Healthy Eating Index-2010 total score for food served was 63.6 and for food consumed was 61.7. The nutritional quality of the food served could be improved by offering more vegetables and lean protein foods and replacing refined grains with whole grains.

Table 1.

Baseline characteristics of the family child care homes and providers (n=166) and children (n=495) in the Keys to Healthy Family Child Care Homes study

Family child care home characteristics	
Number of children enrolled, mean(SD)	7.2 (3.6)
CACFP[a] participation, n (%)	151 (91.0)
Provider characteristics	
Sex, female, n (%)	166 (100.0)
Age in years, mean (SD)	49.4 (9.1)
Race, n (%)	
Black/African American	123 (74.1)
White	30 (18.1)
Asian/Asian American	2 (1.2)
Multiple race/other race	11 (6.6)
Education, n (%)	
High school diploma	40 (24.5)
Associates degree or equivalent college credits	81 (41.7)
College degree	37 (22.7)
Graduate degree	5 (3.1)
BMI[b], mean (SD)	33.2 (7.7)
Child characteristics	
Sex, female, n (%)	250 (50.4)
Age in months, mean (SD)	35.7 (11.4)
Race, n (%)	
Black/African American	314 (63.3)
White	135 (27.2)
Asian/Asian American	4 (0.8)
Multiple race/other race[c]	43 (8.7)
BMI[b] z-score, mean (SD)	0.8 (1.2)

[a]CACFP = Child and Adult Care Food Program

[b]BMI = body mass index

[c]American Indian/Alaskan Native or Native Hawaiian/Pacific Islander

Table 2.

Foods served to and consumed by children ages 2 to 5 years (n=495) attending family child care homes (n=166) in North Carolina[a]

	Foods Served Mean (SD)		Foods Consumed Mean (SD)		Percent (%) of food served that was consumed
Energy (kcal/day)	738.2	(211.50)	545.0	(190.86)	73.8
Food groups					
Total vegetables (cups/day)	0.4	(0.2)	0.2	(0.2)	63.2
Total vegetables w/out potatoes (cups/day)	0.3	(0.2)	0.2	(0.2)	61.0
Whole fruit (cups/day)	0.6	(0.3)	0.5	(0.3)	79.7
100% Fruit juice (ounces/day)	1.6	(2.5)	1.2	(2.0)	75.0
Whole grains (ounces/day)	0.5	(0.5)	0.3	(0.4)	70.8
Refined grains (ounces/day)	2.2	(10)	1.6	(0.9)	75.0
Dairy (cups/day)	1.5	(0.6)	1.0	(0.6)	70.0
Protein (grams/day)	1.7	(0.9)	1.3	(0.9)	76.4
Added sugars (grams/day)	32.7	(20.8)	25.2	(16.9)	77.1

[a]Food was captured using the Diet Observation at Child Care protocol across two full days.

Table 3:

Mean Healthy Eating Index (HEI-2010) total and component scores of foods served to and consumed by children of children ages 2 to 5 years (n=495) attending family child care homes (n=166) in North Carolina[a]

HEI-2010 Component (maximum score)	Foods Served Mean (SD)	Foods Consumed Mean (SD)
Total Fruit (5)	4.5 (1.0)	4.5 (1.1)
Whole Fruit (5)	4.8 (0.9)	4.7 (1.0)
Total Vegetables (5)	2.3 (1.1)	1.9 (1.3)
Greens/Beans (5)	1.4 (2.0)	1.1 (1.9)
Whole Grain (10)	3.9 (3.3)	3.6 (3.4)
Dairy (10)	9.6 (1.3)	9.1 (2.0)
Total Protein Foods (5)	3.8 (1.4)	3.6 (1.6)
Seafood and Plant Proteins (5)	1.8 (2.3)	1.7 (2.2)
Fatty Acids (10)	4.3 (3.2)	4.6 (3.4)
Refined Grains (10)	5.4 (3.3)	5.3 (3.5)
Sodium (10)	4.9 (2.9)	5.0 (3.0)
Empty Calories (20)	16.9 (3.7)	16.6 (4.2)
Total HEI (100)	63.6 (10.4)	61.7 (11.5)

[a]Food was captured using the Diet Observation at Child Care protocol across two full days.

Table 4:

Multi-Variable Regression Results Examining the Association between Healthy Eating Index (HEI-2010) of Foods Served and Child Healthy Eating Index Score of Foods Consumed

	Estimate	95% CI	p-value
Model 1: Unadjusted			
HEI-2010 of foods served	0.97	0.92–1.02	<0.0001
Model 2: Adjusted for Child Level Variables			
HEI-2010 of foods served	0.97	0.92–1.02	<0.0001
Child sex (female vs. male)	−0.09	−0.9–0.7	0.83
Child age (months)	0.02	−0.01–0.05	0.27
Child BMI[a]	0.16	−0.06–0.39	0.16
Model 3: Adjusted for Home Level Variables			
HEI-2010 of foods served	0.96	0.9–1.01	<0.0001
Provider race (African-American vs. all other)	0.11	−1.4–1.6	0.87
Provider education (>Bachelor degree vs. higher)	−0.65	−2.1–0.77	0.37
CACFP[b] (no vs. yes)	−1.5	−4.0–0.96	0.22
Star rating (≥2 vs. < 2 stars)[c]	2.2	−0.69–4.7	0.14
Provider BMI	−0.02	−0.10-.07	0.65
Model 4: Fully Adjusted Model[d]			
HEI-2010 of foods served	0.96	0.91–1.02	<0.0001
Star rating (≥2 vs. < 2 stars)	1.4	−0.98–3.7	0.25
Child BMI	0.15	−0.07–0.38	0.19

[a]Body Mass Index

[b]Child and Adult Care Food Program

[c]Star Rating is the North Carolina's quality improvement rating system where higher number of stars is equivalent to higher child care quality as it relates to staff education, program standards and compliance history.

[d]Included variables that were significant in model 2 and model 3