Resemblance of Dinner Meal Consumption among Mother and Preschool-Aged Child Dyads from Families with Limited Incomes

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Abstract: Parents' eating habits are associated with food and nutrient intake of their children; yet, the associations have not always been very strong. The objective of this study was to expand the current literature to include an examination of resemblance in intakes of foods, within the context of a meal, among mother and preschool-aged child dyads from families of limited incomes. Mother-child dyads (n=112; 41% Hispanic and 59% African-American) participated in the study. During the two home observations of each mother-child dyad, a digital photography method plus actual weighing of plate waste was used to assess the amount of food served and consumed by the mothers and children. There were significant correlations between the mother-child dyad intakes of food/beverages consumed at the dinner meal; ranging from 0.298 (total beverages, $p<0.01$) to 0.687 (100% fruit juice or milk, $p<0.01$). There was a significant linear association between the amount of total food/beverages served and the amount consumed for both the mothers ($R^2=0.72$, $p<0.0001$) and the children ($R^2=0.55$, $p<0.0001$). Mothers-children who were served larger amounts of total food/beverages consumed more. There was a positive association ($p<0.05$) between the amount of total energy consumed in the mother-child dyads. Portion sizes may be an important strategy that can be used by parents to promote intake of fruits and vegetables and to decrease intake of energy-dense foods. It is important that food and nutrition professionals provide the guidance needed that encourages intake of major food groups in mothers so they can model healthier food consumption behaviors for their children.

Keywords: Preschoolers diets, dinner meal, low-income families, parental influence.

INTRODUCTION

Family dietary practices have been shown to be an important determinant of the quality of children's diets. Parents are gatekeepers and can serve as role models for their children's health-related behaviors [1-6], including diet. Parental food preferences [7] and dietary intake [4, 8-10] have been shown to influence children's eating behaviors. The majority of studies have documented the impact of maternal influences on young children's dietary intakes.

Young children imitate the diets of their parents [3, 4, 10]; for example, preschool children have been shown to choose healthy foods they've seen their parents purchase [11, 12]. Children, 3-5 years of age (y), had a stronger positive correlation to the diets of their parents than older children or adolescents [4]. Stronger positive correlations have been shown between the diets of parents and daughters [4, 13] than for parents and sons [4, 9]. Although there is a widespread perception of a strong resemblance in parent-child dietary intakes [14-17], surprisingly, some studies show that the association is weak [4]. This is likely because eating patterns in children are influenced by a variety of factors [5], and the family environment is just one of those factors.

Evidence suggests correlations of nutrient intakes among family members [9, 18]. More recently, studies have focused on familial resemblance in dietary patterns, such as consumption of dairy [9, 19, 20], sweetened beverages [9, 20], fruits and vegetables [6, 9, 18], and snacks/sweets [6, 9]. Parent-child resemblance varied by food group [9]. This is not surprising given that the majority of studies looked at single foods or food groups in isolation and not within the context of a meal. The objective of this study was to expand the current literature to include an examination of resemblance in intakes of foods, within the context of a meal, among mother-child dyads from families of limited incomes.

SUBJECTS AND METHODS

Participants

Mother and preschool-aged child dyads (subsequently referred to as mother-child dyads) were recruited from Head Start (HS) centers in Houston, Texas, which are predominately African-Americans (AA) and Hispanic-Americans (HA). Mothers were recruited to participate in the study during drop off and

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pick up at the HS centers, during parent meetings, and through the registration process at HS. Mothers were asked if they would like to participate in a study involving two home observations of their dinner meal. Research members explained that the purpose of the study was to understand better the family environment around dinner meals. The parent who was primarily involved in feeding the HS child was designated as the target parent (the population was 96% mothers, thus the word "mother" is used for "parent" throughout this manuscript). The investigators excluded children following specific dietary regimes, those with food restrictions based on religion, or those with food allergies that may affect food consumption. Parents and children with chronic medical problems were also excluded. Consent forms were signed by the mother at the beginning of the first home observation and confidentiality was assured. During the two home observations, mothers and children were observed during dinner by staff members. The total sample size in the parent study was 214 mothers and their preschool children; however, only 52% of the mothers consumed dinner with their child; thus the mother-child dyad analysis in this study was limited to a sample of 112. At the end of the first observation, a packet of mother-report questionnaires (available in English and Spanish) was left for the mother to complete. The completed packet was collected by staff members at the second observation. Mothers received a monetary incentive at the end of each of the two observations. The study was reviewed and approved by the Institutional Review Board at Baylor College of Medicine.

Food Intake

A digital photography method was used to measure the amount of food placed on the dinner plates [21-23]. Standard plates, bowls, and cups were provided to the families in order to standardize photographs. Foods were photographed using digital cameras (Sony Digital Handy Cam DCR-VX1000; Sony Corporation of America, New York, NY). Staff members were trained and certified to take photos of the plates at 2 feet above and 2 feet away from the center of the plate with an angle of approximately 45 degrees. Within each digital camera there were four corner brackets. If the meal plate was outside the brackets, the research staff immediately knew that they did not have the correct position for taking one photograph of the meal plate. Second and third servings were estimated relative to the original portion size. Staff estimated whether the second or third servings were one-fourth, one-half, three-fourths or the same as the original portion size. Once the family finished their meal, trained staff measured the plate waste unobtrusively in the kitchen (away from the family). Individual foods were separated and weighed one at a time with a food scale. Gram amounts were documented on a plate waste form.

Detailed information on menus, recipes and preparation method was collected from the mother prior to each eating occasion. Additionally, descriptive information such as brand names and form of ingredients such as fresh, frozen, or canned was collected as well as food labels when appropriate. The documented recipes were recreated by trained staff in the kitchen at the Children's Nutrition Research Center (CNRC). Most of the time the recipe was followed as described by the participant with exact ingredients and preparation methods. On occasion certain ingredients (very few) were unattainable and comparable substitutions were made. For each food recreated in the CNRC kitchen, reference pictures were taken in 10 gram increments using the digital photography method. Foods were photographed one at a time and at four positions on the plate.

Trained staff used these multiple reference pictures to estimate the gram amounts of food documented in the digital photos taken in the homes. A computer application was used to simultaneously display the digital photographs of the reference portions and the participant meal plate showing food selection. Trained research staff estimated the percent of the reference portion of the food selection and these estimates were entered into a computer application [24, 25]. The Digital Photography of Foods Method has been used in a number of settings and its reliability and validity (accuracy) has been established in adults [21, 26-28], children [24], and preschool children [23, 29]. Portion size estimates correlated highly with weighed portion size [27, 29] and mean differences between directly weighed foods and digital photography estimates were minimal (< 6 g), with no systematic bias over levels of food intake [27, 29]. The average correlation between estimated weights and actual weights was 0.96 ($p < 0.0001$). The average mean difference between the estimated and actual amounts was 10.6 grams or 105 kilojoule (Kj) (25 kilocalories [kcal]) Digital photography estimates were only 5% lower than the actual weights.

To determine the energy and nutrient content for each food served and consumed in the home, foods were coded using the Nutrition Data System-Research (NDS-R) (NDS version 2006, Nutrition Coordinating

Center, University of Minnesota). The food group categories generated by NDS-R were also used in the analyses. The families provided recipes and preparation of food items. For mixed dishes, an attempt was made to match the food to a similar food item in NDS-R. The components of the recipe were coded when no match was available. For each food item, the nutrient content was expressed per gram and was multiplied by the gram weight for food selection, plate waste, and food intake for each child. Results for macronutrients in each food were downloaded and merged with other variables in the master database. The actual amount of a particular food consumed by the participant was determined by subtracting the amount of plate waste minus non-edible refuse from the starting amounts of various foods. Eight major food groups were created and included fruit and juice, vegetables, grains, meats, dairy, fats and oils, sweets, and beverages.

Body Mass Index (BMI)

Height and weight measurements were obtained by trained staff members following standardized procedures [30]. Parents and children were dressed in light clothing and asked to remove their shoes. Height and weight were measured in duplicate to assure accuracy. Height and weight scores for children were converted to age- and gender- specific BMI z-scores using the revised 2000 growth charts from the Centers for Disease Control and Prevention [31]. Mean height and weight scores for parents were converted to BMI.

Statistical Analyses

All statistical analyses were conducted using the Statistical Analysis Software (SAS) (version 9.2, SAS Institute Inc Cary, NC, 2008). Means and standard deviations, as well as frequency distribution of participant characteristics, the amount and coefficient of variation (CV) of food served, plate waste, and the amount of food consumed were calculated and summarized (mean) for each food group category and overall for all foods. Energy density was defined two ways: 1) as mean total food energy (in kJ) consumed/mean total gram amount of food (excluding beverages) consumed at the dinner meal; and, 2) mean total food energy consumed/mean total gram amount of food and beverages consumed at the dinner meal. To measure the relationship between BMI and the amount of food served and consumed, linear regressions were computed controlling for age, race/ethnicity, and mothers' age. The regression models were generated separately for each food group. Plots and histograms of residuals were used to investigate homogeneity of variance and normal distribution of variables. A $p<0.05$ was considered statistically significant. Small ($r \leq 0.10$), medium ($r > 0.10$ and $r < 0.30$) and large ($r \geq 0.30$) correlations were determined using published criteria [32].

Table 1: Demographic Characteristics for Children and Mothers (n=112)

Children	**n (%)**
Ethnicity	
Hispanic-American	46 (41.44)
African-American	65 (58.56)
Gender	
Boys	49 (44.14)
Girls	62 (55.86)
Body Mass Index (BMI)	
Normal (< 85th percentile)	67 (62.62)
Overweight (≥ 85th and < 95th percentile)	16 (14.95)
Obese (≥ 95th percentile)	24 (22.43)
Age (yrs.)	
≤ 4	33 (30.28)
> 4 & ≤ 5	55 (50.46)
> 5+	21 (19.27)
Age (yrs.) (mean (SE))	4.41 (0.06)
BMI z-score (mean (SE))	0.72 (0.11)
Mothers	**n (%)**
Ethnicity/Race	
Hispanic-American	48 (43.24)
African-American	63 (56.76)
Education Completed	
High School or less	52 (48.60)
Some College/Technical	45 (42.06)
College Graduate and Higher	10 (9.35)
Weight Status	
Normal/Underweight (<25.0) Kg/m^2	23 (20.72)
Overweight (≥25.0- <30.0) Kg/m^2	23 (20.72)
Obese (≥30.0) Kg/m^2	65 (58.56)
Marital Status	
Married	43 (43.00)
Divorced/Widowed/Separated	23 (23.00)
Never Married	29 (29.00)
Other	5 (5.00)
Employment status	
Yes	57 (50.89)
No	55 (49.11)
Work Hours/week if Employed (mean (SE))	15.93 (1.71)
Age (yrs.) (mean (SE))	32.35 (0.71)
BMI (Kg/m^2) (mean (SE))	31.74 (0.78)
# of People living in home (mean (SE))	4.58 (0.16)

RESULTS

Characteristics of the Mother-Child Dyad Sample (Table 1)

The study included 112 mother-child dyads recruited from HS centers in Houston, Texas. Preschool children participating in the study ranged from 3 to 5 y with a mean age of 4.4 ± 0.1 y (44% boys; 59% AA and 41% HA). The mean age of the mothers was 31.7 ± 0.8 y. Thirty-seven percent of the children and 80% of the mothers were overweight or obese. Mothers showed a wide range of education, with 49% having less than a high school diploma and 42% having some college. Forty-three percent of mothers were married and 51% were employed.

Table 2a: Food Intake at Dinner Meals for Children

Food Groups (Servings)	Intake by Children				
	% Served*	Mean (SE)†	Min--Max‡	CV%‡‡	Mean % Intake§
Fruits and Juices	42.86	0.36 (0.06)	0.00 - 4.21	180.50	81.82
Vegetables	97.32	0.55 (0.04)	0.00 - 2.28	79.00	68.75
Grains	100.00	1.14 (0.08)	0.02 - 4.89	73.55	74.51
Meats	98.21	1.31 (0.10)	0.00 - 6.18	82.20	68.95
Dairy	71.43	0.21 (0.03)	0.00 - 1.61	138.19	77.78
Fats and Oils	91.07	0.77 (0.09)	0.00 - 6.69	121.55	68.14
Sweets	42.86	0.08 (0.02)	0.00 - 1.82	322.60	44.44
Beverages	86.61	0.47 (0.03)	0.00 - 1.24	74.64	74.60
Total Grams	----	337 (9.32)	101 - 589	29.24	71.96
Total Grams (Food Only)	----	191 (8.53)	56.59 - 468	47.21	----
Total Energy Density£	----	4.48 (0.17)	1.26 – -9.84	36.87	----
Total Energy Density (Food Only)££	----	8.50 (0.29)	2.39 – 19.13	36.46	----

*% Served=Mean percent of children served.
†Mean (SE) = Mean (Standard Error); ‡ Min-Max =Minimum and maximum intake in servings of the indicated food group.
‡‡CV% = Coefficient of Variation =(standard deviation/mean x 100%) for intake of each food group in servings.
§Intake of indicated food group in servings/Amount served in servings x 100%.
£Energy Density = Energy kilojoule per grams of food/beverage consumed (kj/g).
££Energy Density = Energy kilojoule per grams of food (without beverage) consumed (kj/g).

Table 2b: Food Intake at Dinner Meals for Mothers

Food Groups (Servings)	Intake by Mothers				
	% Served*	Mean (SE)†	Min--Max‡	CV%‡‡	Mean % Intake§
Fruits and Juices	27.68	0.30 (0.07)	0.00 - 4.39	228.48	78.95
Vegetables	93.75	0.88 (0.06)	0.00 - 2.73	70.02	85.44
Grains	97.32	1.43 (0.09)	0.00 - 4.08	66.61	88.82
Meats	94.64	1.95 (0.13)	0.00 - 6.07	70.42	75.58
Dairy	62.50	0.26 (0.03)	0.00 - 1.71	136.18	86.67
Fats and Oils	84.82	0.99 (0.10)	0.00 - 5.12	102.69	84.62
Sweets	40.18	0.14 (0.04)	0.00 - 2.90	341.61	73.68
Beverages	78.57	0.79 (0.06)	0.00 - 2.19	81.04	83.16
Total Grams	----	471 (16.71)	79.55 - 974	37.57	83.56
Total Grams (Food Only)	----	254 (10.36)	1.60 - 643	43.23	----
Total Energy Density£	----	4.44 (0.21)	0.71 – 14.91	48.99	----
Total Energy Density (Food Only)££	----	8.79 (0.75)	1.17 – 84.45	89.75	----

*% Served=Mean percent of mothers served.
†Mean (SE) = Mean (Standard Error); ‡ Min-Max =Minimum and maximum intake in servings of the indicated food group.
‡‡CV% = Coefficient of Variation =(standard deviation/mean x 100%) for intake of each food group in servings.
§Intake of indicated food group in servings/Amount served in servings x 100%.
£Energy Density = Energy kilojoule per grams of food/beverage consumed (kj/g).
££Energy Density = Energy kilojoule per grams of food (without beverage) consumed (kj/g).

Food Intake at Dinner Meals (Table 2)

There was very little variation in the total amount (grams) and energy density of food/beverage consumed for both the children and the mothers. Mean amount of food groups consumed was a little more than one serving for meats and grains; ranging from 0.08 servings (sweets) to 0.77 servings (fats and oils) for the other food groups. The coefficient of variation was lowest for intakes of total grains (74% and 67%), total meats (82% and 70%), total beverages (75% and 81%), and total vegetables (79% and 70%) for the children and mothers respectively. The mean % intake indicated the amount of food/beverages actually consumed. The mean % intake was highest for fruits and juices (82%) and lowest for sweets (44%); ranging from 68% (fats and oils) to 78% (grains) for the other food groups. For the major food groups consumed at the dinner meal, the average plate waste was 32% for children and 21% for mothers.

Association between Total Amount Food/Beverage Served and the Total Amount Food Consumed (Figures 1 and 2)

There was a significant linear association between the amount of total food/beverage served and the amount consumed for both the mothers (Std β = 0.83, $p<0.0001$) and the children (Std β = 0.45, $p<0.0001$). Mothers and children who were served larger amounts of total food/beverages consumed more.

Correlation between Child and Mother Consumption (Table 3)

There were significantly medium-to-large correlations between what the child and mother consumed at the dinner meals. The correlation between the total gram amount of food/beverage consumed for the mother-child dyads was $r=0.34$ ($p<0.01$). For food groups, the correlations ranged from 0.30 (total beverages, $p<0.01$) to 0.69 (100% fruit juice and milk, $p<0.01$) for the mother-child dyads. There was a significant negative correlation between sweetened beverage consumption and 100% fruit juice ($r = -0.30$ and -0.36; $p<0.01$) for both the mothers and the children respectively; however, there was no association with milk consumption ($r = -0.12$, $p>0.05$) (data not shown).

Association between Total Food and Beverage Intake

There were no significant associations between the amounts of foods/beverage consumed for the mother-child dyads, after controlling for the amount of food/beverage served at the dinner meals. However, there was a significant positive association (Std β=0.13; $p<0.05$) between the amount of total energy consumed in the mother-child dyads (controlling for the amount of energy served) (data not shown).

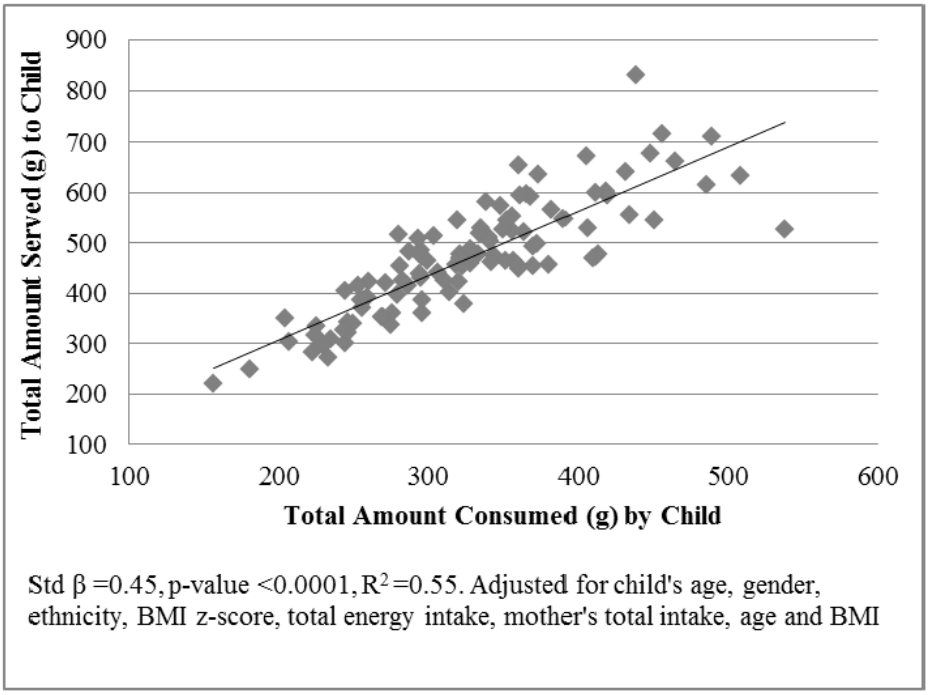

Figure 1: Relationship Between Total Amount of Foods/Beverages Served and Total Amount Consumed by Children.

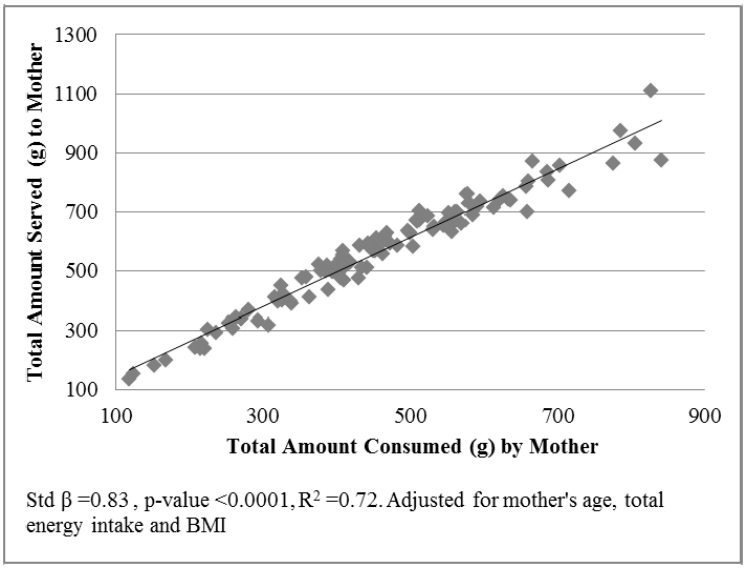

Figure 2: Relationship Between Total Amount of Foods/Beverages Served and Total Amount Consumed by Mothers.

Table 3: Pairwise Correlations Between Amount of Food/Beverages Consumed by Mother-Child Dyads (n=112)

Food Groups (Servings)	Correlations Between Intakes for Mother-Child Dyads
Fruits and Juices	0.69**
Vegetables	0.51**
Grains	0.57**
Meats	0.44**
Dairy	0.62**
Fats and Oils	0.59**
Sweets	0.89**
Beverages	0.30**
Total Grams	0.34**

**Correlation is significant at the 0.01 level (2-tailed).

Predictors of Child Consumption (Tables 4a to 4b)

The food groups that the mother served themselves were a significant predictor of the type and amounts of foods that the child was served. However, when the amount of the foods that the child was served was controlled for, the association between the mothers' intake and child's intake was negated, with the exception of total food consumed, milk, and sugar-sweetened beverages.

Additional regression analyses (data not shown) showed that for child's total energy from total amount to be served and consumed just revealed that the heavier children were served more energy (p = 0.032) than lighter ones, so did their total energy consumed (p = 0.025). African-American children were more likely to consume more energy than Hispanic-American children (p = 0.040). Although there were no gender,

Table 4a: Predictors of Amount of Food/Beverages Served to Children

Amount Served to Children	Amount Served to Mothers
Food Groups	**Std β[1]**
Fruits and Juices	0.76***
Vegetables	0.54***
Grains	0.42***
Meats	0.44***
Dairy	0.66***
Fats and Oils	0.57***
Beverages	0.34**
Total Grams	0.26**

Table 4b: Predictors of Amount of Food/Beverages Consumed by Children

Intake by Children	Intake by Mothers
Food Groups	**Std β[2]**
Fruits and Juices	0.03
Vegetables	0.06
Grains	0.03
Meats	-0.03
Dairy	0.02
Fats and Oils	-0.02
Beverages	-0.03
Total Grams	0.05

Abbreviation: Standardized beta coefficient (Std β)
1: Regression models were Adjusted for gender, age, BMIZ, ethnicity/race, total energy intake, and mother's age, and BMI.
2: Regression models were adjusted for amount served to the children, gender, age, BMIZ, ethnicity/race, total energy intake, and mother's age, and BMI.
The sweets food group was not assessed because children consumed all sweets that they were served.
*p<.05, **p<.01, *** p<.001.

ethnicity, age, and BMI z-score related differences in the total amount consumptions, African-American children wee more likely to be served less foods than Hispanic-American children ($p = 0.024$), and the older children were likely to get a big amount ($p = 0.032$) from their mother. The results also suggest that the older mothers were likely to serve more food to children ($p = 0.010$). Moreover, the results showed that the older mothers were more likely to consume big amounts of food ($p = 0.038$) than younger mothers, if they served themselves.

DISCUSSION

Family meals have been an honored ritual for sharing food and an opportunity for parents to model healthy eating behaviors [33-35]. The latter is supported by the finding that parental fruit and vegetable consumption predicts child fruit and vegetable consumption and this relationship becomes stronger when more family meals were eaten together [36]. Children who eat family meals also consume more vegetables, grains, milk, and fiber and less fried foods, soft drinks, and saturated fatty acids [37-42] and have better overall diet quality [37] than those not consuming them. Neumark-Sztainer [38] reported greater nutrient intake (vitamins A, C, E, and B_6; folate; fiber; calcium; and iron) among adolescents who reported more frequent family meals. Very few studies have looked at resemblance in dietary intake among mother-child dyads.

On average, approximately 50% of American families reported eating family meals three to five times a week, with younger children participating in family mealtimes more regularly than older children and families having a lower socioeconomic status reporting less fewer family mealtimes [43, 44]. In our study, only 52% of mothers with limited income consumed dinner with their preschool child.

Recent research has focused on family dinner meals as an opportunity to improve diet and health of children. Family dinner has been identified as a foundation of healthful food choices, possibly because of the higher quality of food served or the opportunity of parents to model healthy eating behavior [45]. Despite the importance placed on the family dinner by parents, the proportion of children eating dinner with their families is not high and the frequency of family mealtime is decreasing [46]. In 1991, a telephone survey of parents of children 12 to 17 y found that 27% consumed family dinner together every day, 47% consumed family dinner together 4 to 6 days per week, 27% consumed family dinner 1 to 3 days per week, and only 2% never ate family dinner together [47]. In 1995, another telephone study of children 9 to 15 y found that 5% fewer children had dinners with their family than in the 1991 study [48]. In a 1997 survey of women, 80% stated they had dinner with their family sometime during the week [49]. In another study of children 10 y, dietary intake data showed that consuming a home dinner decreased from 89.2% to 75.9% and eating a dinner prepared outside the home increased from 5.4% to 19.0% over a 21-year period (1973-1994). Data suggest that there appears to be a decline in the family dinner meal in the home with a concomitant increase in meals consumed outside the home [46].

Parents influence the development of children's dietary patterns through structured mealtimes, determining availability of different foods, and modeling of eating behaviors [40, 47-49]. There is a growing body of evidence suggesting that dietary intake and food patterns among children moderately resemble that of their parents [9, 18]. A major finding of this study was the positive correlations between the mother-child dyad intakes of food consumed at the dinner meal. The strong correlations were not surprising given that the sample was limited to mothers who consumed dinner with their child. The correlations found in this study were strong compared to moderate or weak associations found in total dietary intake of parents and their children [4]. A systematic review on child-parent resemblance in dietary intakes concluded that the resemblance was weak and the correlations varied by parent-child pairs, dietary assessment, foods, nutrients and across studies [4]. Comparing mother-child dyad intakes at the dinner meal may not be a fair comparison when looking at total dietary intake. Approximately 27% of total energy intake by preschool children is consumed outside the home [50], predominantly in day care centers. Thus, if this study looked at the resemblance in child and parental dietary intake, one can expect the correlations in total intake to be much lower than what was found for a single meal, given that most dinner meals are consumed within the family context.

Typically, the dinner meal consisted of a food from the meat, vegetable, grain, and dairy food groups. A small percentage of the mothers and children were served a fruit at the dinner meal and sweetened beverages were the beverage of choice that was served rather than milk. Plate waste was 20-30% for the mothers and children, respectively. Similar to other

studies [51-55], there was a significant positive correlation between the amount of food served and the amount of food consumed for both the children and the mothers. Mothers' consumption was a significant predictor of what the child consumed for all food groups studied. Similarly, the food groups the mother served themselves were a significant predictor of the foods the child was served. However, when we controlled for the amount of the foods that the child was served, the association between the intakes of the mothers and the children disappeared, with the exception of total food consumed, milk, and sugar-sweetened beverages. There also was a significant positive association between the amounts of total energy consumed at the dinner meal in the mother-child dyads. Despite this association, the children's BMI z-score was not predictive of what was served to or consumed by the child at the dinner meal. Since children imitate the diets of their parents, teaching mothers about portion sizes may be beneficial in controlling energy intake, particularly at the dinner meal which is consumed by 96% of young children [56]. Studies have shown that variations in portions sizes can be used strategically to increase fruit and vegetable intake and potentially decrease intake of energy-dense foods [57].

Further research is needed to better understand: 1) the impact of family resemblance of dietary intake at the dinner meal on overall dietary intake of young children; 2) factors influencing the amount of food served and consumed by children within the home environment; and, 3) the relationship between the volume of food intake and energy intake and body weight, not only with specific meals but also within the context of the total diet.

STUDY LIMITATIONS

This was a cross-sectional study, thus causal inferences cannot be drawn. This study was conducted with a small convenience sample of low-income AA and HA, mother-child dyads in Head Start programs in a southern state, and findings cannot be generalized to other populations. This also applies to the use of research staff in the home to assess dinner meal consumption using digital photography. Although this may appear to be an intrusive dietary assessment method, this method has been validated with children [23, 24] and adults [26-28] for assessing single meals in the home [22], school cafeterias [26], and HS centers [29].

The two home-based dinner meals were not standardized within and between families. Therefore, the meals differed in a number of characteristics including, but not limited to, the types of foods served (e.g. entrées, number and type of side dishes), preparation methods, timing, and other family members present during the dinner meal. The lack of standardization limits the interpretability of the findings. However, this study was not a controlled experiment but rather a study conducted in a naturalistic environment.

There is also the possibility that the amount of food served to the children may have been influenced by the paper plates that were provided to the mothers for use in this study; especially if the mothers typically used smaller dinner plates. The use of digital photography could have influenced the types and amounts of foods served and consumed. However, the average macronutrient and energy content of the dinner meal provided reasonable estimates of the nutrient content of dinner meals consumed by preschoolers [58]. The digital diet estimation method [23] was modified in this study. Second and third servings were estimated relative to the original portion size and plate waste was weighed. These modifications were made to minimize disruption and the intrusive nature of taking more pictures during the dinner meal. There were very few occasions when the child received seconds and it has been shown that at least 30% of the dinner meal is not consumed [58]. The macronutrient and energy content of the dinner meal served and consumed in this study were comparable to what was estimated in the validity and feasibility study of this method [23]. It can be argued that using different types of assessments may increase measurement error. Yet, actual weighing of plate waste is intuitively more accurate than human estimation. However, the average correlation between estimated weights and actual weights was 0.96 ($p< 0.001$) and the average mean difference was 10.6 grams [23]. This small mean difference resulted in very small differences in the energy and macronutrient content between the two methods. A further limitation of this study is that observation data, with its many advantages, also hold potential risks. One such risk is that the presence of a researcher may have altered the families' behavior to some degree, potentially compromising the results. However, a review [59] suggested that the presence of an observer does not necessarily distort the nature of interactions. Yet, it is unknown if this is true for the types and amounts of foods served in more natural conditions of the home when an observer and recording device (*i.e.* camera) are present. A final limitation is that this study focused

just on dinner meals consumed by mother-child dyads; thus, the results may not apply to other meals or overall 24-hour dietary intakes.

CONCLUSIONS

A large percentage of mothers did not consume dinner with their child, suggesting that there may be personal or family needs that mothers perceived as being more important. Examples include eating at a later time or waiting for older children or husband to come home. However, for those mothers who did consume dinner with their child, there were moderate-to-strong correlations between the mother-child dyad intakes of food consumed at the dinner meal. Mothers and children who were served larger amounts of total food/beverages consumed more. There was a positive association between the amounts of total energy consumed in the mother-child dyads; BMI of the mother or child was not a significant predictor. These findings support other studies on resemblance in dietary intakes among mother-child dyads and that larger portion sizes of foods served was related to higher amounts of those foods consumed. It is important the food and nutrition professionals provide the guidance needed that encourages intake of major food groups in mothers so they can model healthier food consumption behaviors for their children.

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AUTHOR DISCLOSURE STATEMENT

There are no conflicts of interest for any of the authors. All authors have fully read and have approved this revised manuscript. They have all contributed to the conception, design, analysis and interpretation of the data as well as the drafting and revising of the manuscript. No portion of this manuscript is currently under consideration for publication elsewhere and no portion of the manuscript other than the abstract has been published or posted on the Internet.

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