Published in final edited form as:
J Acad Nutr Diet. 2013 November ; 113(11): 1476–1483. doi:10.1016/j.jand.2013.05.018.

Diet Quality of Overweight and Obese Mothers and Their Preschool Children

Leigh Ellen R. Laster, BA,
Affiliation at time of research: Masters candidate and dietetic intern, Department of Nutrition, The University of North Carolina at Greensboro, Greensboro, NC, PO Box 26170, Greensboro, NC 27402-6170, Telephone: 704-451-7401, Fax: NA, leighellen.laster@gmail.com

Cheryl A. Lovelady, PhD, MPH, RD, FADA, LDN,
Professor, Department of Nutrition, The University of North Carolina at Greensboro, Greensboro, NC, PO Box 26170, Greensboro, NC 27402-6170, Telephone: 336-256-0310, Fax: 336-334-4129, cheryl_lovelady@uncg.edu

Deborah G. West, MS, RD, LDN,
Affiliation at time of research: Study Coordinator, Department of Nutrition, The University of North Carolina at Greensboro, Greensboro, NC, PO Box 26170, Greensboro, NC 27402-6170

Gina A. Wiltheiss, MS, RD, LD,
Affiliation at time of research: Masters candidate, Department of Nutrition, The University of North Carolina at Greensboro, Greensboro, NC, PO Box 26170, Greensboro, NC 27402-6170

Rebecca J. N. Brouwer, MS,
Affiliation at time of research: Clinical Research Coordinator, Duke University Medical Center, Department of Community and Family Medicine, Durham, NC, Box 104006, Duke University Medical Center, Durham, NC 27710

Marissa Stroo, BS, and
Research Analyst, Duke University Medical Center, Department of Community and Family Medicine, Durham, NC, Box 104006, Duke University Medical Center, Durham, NC 27710, Telephone: 919-684-6189, Fax: 919-684-8675, marissa.stroo@duke.edu

Truls Østbye, PhD, MD
Professor, Duke University Medical Center, Department of Community and Family Medicine, Durham, NC, Box 104006, Duke University Medical Center, Durham, NC 27710, Telephone: 919-660-0331, Fax: 919-684-5108, truls.ostbye@duke.edu

Abstract

Corresponding author (will also handle requests for reprint): Cheryl A. Lovelady, PhD, MPH, RD, FADA, LDN.
Current affiliation: Consulting Dietitian, Greensboro, NC, Telephone: 336-312-2665, Fax: NA, debbiewest2002@hotmail.com
Current affiliation: Nutritionist, Special Supplemental Nutrition Program for Women, Infants and Children, Urbana, OH, 1512 South US 68, Urbana, OH 43078, Telephone: 614-634-0397, Fax: NA, gmoening@gmail.com
Current affiliation: Research Project Manager, Duke Global Health Institute, Box 90519, Duke University, Durham, NC 27708, Telephone: 919-681-0858, Fax: 919-684-8675, rebecca.brouwer@duke.edu

Background—Children of obese parents are more likely to become obese than children of normal weight parents. However, there is little information regarding diet intake of children of obese parents.

Objectives—To determine diet quality of preschoolers and their overweight/obese mothers; if maternal and child diet quality were correlated; and predictors of child's diet quality.

Design—Results are from baseline measurements from a randomized controlled behavioral intervention.

Participants—Participants were English-literate, postpartum mothers and their preschoolers (n = 177 mother-child dyads) in North Carolina. Visits took place in the Triangle and Triad regions of North Carolina between September 2007 and November 2009.

Main outcome measures—Diet quality of mothers and preschoolers using the Healthy Eating Index (HEI)-2005.

Statistical analyses performed—Descriptive statistics, χ^2, analysis of variance, Pearson correlations, and stepwise regression models were used.

Results—Only 11% of children and 7% of mothers had HEI-2005 scores ≥ 80. Most children did not meet recommendations for fruits, vegetables, whole grains, meat and beans, sodium, saturated fat, and energy from solid fat and added sugars. Child diet quality was correlated with maternal diet quality (r = 0.44, p <0.001). However, children and mothers differed in the proportion that met food group recommendations. Children versus mothers: total fruit (50% vs. 14%), whole fruit (46% vs. 28%), total vegetables (6% vs. 18%), dark green and orange vegetables and legumes (7% vs. 19%), total grains (57% vs. 71%), milk (63% vs. 22%), and meat and beans (33% vs. 60%). Maternal diet quality and household income were positively correlated with child diet quality.

Conclusion—Diets of children of overweight/obese mothers need improvement in several areas. Mother's diet quality and household income are important contributors to child's diet quality, and should be considered in efforts to improve diets of these children.

Keywords

Diet quality; Obesity; Preschool diet; HEI-2005

The period two to five years of age is a critical time of development, during which food preferences and eating habits are established.[1] However, studies have found that preschoolers are not meeting the recommendations for a healthy diet, especially for vegetables, fruits, milk, and whole grains.[2–8] Additionally, preschoolers are exceeding the recommended amounts of sodium and energy from non-nutrient dense foods.[4,5,8] This is of particular concern as eating habits impact health and potential risk of developing chronic health conditions.[9] With rising rates of obesity, and an estimated 12% obese and 15% overweight preschoolers, it is important to determine strategies for preventing excessive weight gain.[10]

The Healthy Eating Index (HEI)-2005 is a tool to measure diet quality based on the major dietary recommendations of the 2005 Dietary Guidelines for Americans (DGA).[11] These guidelines are scientific-based advice and recommendations for improving overall health and reducing risks of chronic diseases.[9] Few studies have examined the quality of preschooler's diets using the Healthy Eating Index (HEI)-2005. One study using a nationally representative sample of preschoolers found the average HEI-2005 score was 53.0 ± 0.3 out of a maximum possible score of 100.[12] Another study determined that none of the children between two to three years old or four to eight years old met the recommendations for vegetables (score of five).[13] Another study using a nationally representative sample found

that preschoolers had low scores for total vegetables, dark green and orange vegetables and legumes, whole grains, saturated fat, sodium and energy from solid fat and added sugar.[14] These preschoolers met or almost met the recommendations for total fruit, whole fruit, milk, and total grains. These studies, together with previous studies examining consumption patterns of preschoolers, suggest that the diets of preschoolers need improvement.

The position of parents as authority figures and role models is important particularly for young children. While research suggests that children of obese parents are more likely to become obese themselves, it is unclear what contributes to this increased risk.[15] There is a gap in the literature regarding diets of children of overweight or obese parents.

Previous research also suggests parent-child diets are related with one another.[16–18] One study found moderate HEI-2005 correlations (r = 0.26, p <0.01) between parents and children, with higher correlations for younger children (r = 0.31 for children two to 10 years old vs. r = 0.19 for children >10 years old).[19] Other studies have found weak to moderate correlations of dietary or nutrient intakes for parents and children.[16–18, 20] However, it is unclear whether these results are applicable for overweight/obese mothers and their children. In addition, socioeconomic status has been found to have an effect on food choices and availability, and may affect diet quality in this sample.[21]

The purpose of this study was to evaluate the diet quality of obese or overweight mothers and their preschoolers as measured by HEI-2005 scores and average nutrient intake. Other objectives of this study were: 1) to determine if maternal and child diet quality were correlated, and 2) to determine if demographic (education, income, marital status, and parity), biological (race, maternal BMI, child age, child BMI, and gender), and behavioral (work status, smoking status, child breastfeeding exposure, maternal current breastfeeding status) variables predict child's diet quality.

METHODS

Study Design and Participants

Kids and Adults Now!–Defeat Obesity (KAN-DO) was a randomized controlled behavioral intervention aimed at promoting healthy weight attainment of preschool children, with a secondary goal of weight loss and improved health behaviors in mothers. The trial included information for mothers on parenting and emotional regulation, as well as education about healthy behaviors, such as diet, eating patterns and habits, and physical activity. The rationale and design of the study have been previously published.[22] The current paper reports on the analysis of data collected at baseline, prior to random assignment to intervention or control groups.

Participants were English-literate women, two to seven months postpartum, in the Triangle and Triad regions of North Carolina who had a preschooler two to five years old in the home and who had a self-reported pre-pregnancy and current body mass index [body weight (kg)/ height (m) ^{2}, BMI] ≥25 kg/m^2. Participants also had a mailing address, access to a telephone, were at least 18 years of age, and there were no medical complications in either preschooler or mother that would prevent physical activity. Women were recruited through postcard mailings from state birth certificate records; a purchased search for public phone numbers from the birth registry sample; and from posting flyers and brochures in health care centers, child care centers, and community areas such as libraries, community bulletin boards and stores. Posted flyers and brochures listed a toll-free phone number for interested women to call and be screened for eligibility.

Interested and eligible mother-child dyads were scheduled for an in-person baseline appointment at the most convenient of two study sites, University of North Carolina at Greensboro or Duke University. At this appointment, staff described the study and requested written consent for participation. Randomization of participants occurred after successful completion of baseline measurements. Participants received monetary incentives for completing assessments. The Institutional Review Boards of both the University of North Carolina at Greensboro and Duke University Medical Center approved recruitment and enrollment protocols.

Measurements

Assessment of Demographic and Breastfeeding Characteristics—

Questionnaires were mailed to mothers, and they were encouraged to complete these prior to the scheduled baseline visit. These questionnaires included items querying demographic characteristics of mother – household income, education, race, marital status, parity, work status, smoking status – and current and past infant feeding behaviors. Mothers were asked how they were currently feeding their baby (breastfeeding, formula feeding, or combination). They were also asked how their preschooler was fed at each month from one to 12 months of age, and a lactation score was calculated to measure the preschooler's exposure to breastfeeding as follows. For each month that the child was breastfed exclusively during their first year, a score of two was given. If the child was fed a combination of formula and breast milk, a score of one was assigned, and a score of zero was given if the child was formula fed exclusively. Scores could range from zero to 24. These scores were then dichotomized to: 1) low breastfeeding exposure, defined as a score less than 12; and 2) high breastfeeding exposure, defined as a score ≥12.

Anthropometrics—Heights and weights of participants were measured utilizing a Seca portable stadiometer (Columbia, MD) and a Tanita BWB-800 scale (Arlington Heights, IL), respectively. Measured heights and weights were used in calculating participants' BMI. For mothers, BMI category was based on the standard categories of overweight 25–29.9 kg/m^2 and obese ≥30 kg/m^2. For preschoolers, BMI percentiles were based on the Centers for Disease Control and Prevention (CDC) guidelines based on age and gender. Underweight is defined as a BMI $<5^{th}$ percentile, normal weight as a BMI $\geq 5^{th}$ percentile to $<85^{th}$ percentile, overweight as a BMI $\geq 85^{th}$ percentile to $<95^{th}$ percentile and obese as $\geq 95^{th}$ percentile.[23] BMI z-score indicates the number of standard deviations from the average BMI for age and gender.

Dietary Intake—Mothers completed two 24-hour dietary recalls via telephone interview within two weeks following the baseline visit to capture intake for themselves and preschoolers. These calls were unannounced based on the mother's availability, and were any day of the week, including weekend days. The Nutrition Data System for Research (NDSR) software system from the University of Minnesota (versions 2008 and 2009, Nutrition Coordinating Center, Minneapolis) was used to conduct dietary recalls. Participants were also provided with a validated serving size booklet to help accurately estimate food intake during the recalls. Mothers who indicated their preschooler attended child care were given a "Preschooler Daycare Intake Record" form to provide to child care personnel so that items consumed at daycare were included in the preschooler's dietary recall. Daycare providers were instructed to list the foods and beverages and the amounts the child consumed. However, they were not provided a serving size booklet.

The multiple-pass method was followed to help ensure more accurate participant recall. Participants first briefly described dietary intake for the previous day, then the interviewer probed for more details of food preparation and portion sizes. After all dietary information

was collected, the interviewer reviewed the list for a final time. This method has been validated against doubly-labeled water.[24]

Data from the dietary analysis using NDSR were used to calculate HEI-2005 scores as previously described by Miller et al.[25] The HEI-2005 score measures diet quality based on the major diet-related recommendations of the 2005 Dietary Guidelines for Americans (DGA), as described by Guenther et al.[11] Recommendations for foods from the MyPyramid food patterns along with the Adequate Intake (AI) and Tolerable Upper Intake Level (TUL) for sodium were standardized for amounts per 1,000 kilocalories. Energy from solid fats, alcoholic beverages, and added sugars (SoFAAS), as well as saturated fat intake were expressed in percentages and used for the discretionary energy allowances specified in the DGA.

The HEI-2005 is divided into adequacy and moderation components. The adequacy components include total fruit, whole fruit, total vegetables, dark green and orange vegetables and legumes, total grains, whole grains, milk, meat and beans, and oils. These are considered adequacy components because the recommendations are based on levels of intake needed to ensure adequate nutrient intake. The moderation components include saturated fat, sodium, and energy from SoFAAS. These components are ones that are recommended to limit consumption or stay below certain limits.

The HEI-2005 score is the sum of the component scores, and ranges from zero to 100. A maximum score for each adequacy component is obtained by intake at the recommended level or better. A score of zero is equated with no intake, with scores being prorated linearly. Increased intake is associated with lower scores for moderation components.

Statistical Analysis

JMP software version 9.0 (SAS, Cary, NC) was used for statistical analyses. Pearson correlation was used to determine if maternal diet quality was associated with child's diet quality. Percentages of children and mothers meeting the recommendations for each HEI-2005 component and total HEI-2005 scores were calculated. Chi-square analysis was performed to determine if there was a significant difference between the proportions of mothers and children meeting the HEI-2005 component and total HEI-2005 recommendations.

To determine if other demographic, biological, and behavioral variables were associated with child's diet quality, analysis of variance was performed with child HEI-2005 score, a continuous variable, as the outcome variable and the following categorical baseline characteristics: maternal education, household income, maternal race, maternal BMI category, marital status, parity, work status, maternal current breastfeeding status, smoking status, child age, child BMI category, child breastfeeding exposure, and gender. The association between child BMI z-score and child HEI-2005 score was determined using Pearson correlation.

Variables found significant from the analysis of variance ($p < 0.05$) were entered into a regression model to determine predictors of child's diet quality. Forward stepwise regression was used and variables with a significance level ≤ 0.50 were included in the final model. The use of this large alpha level is suggested to avoid over-fitting the data.[26] All variables included in the final model are considered potential predictors of child diet quality, regardless of their p-value. Results are reported as means and standard deviations. Significance was set at $p < 0.05$.

RESULTS

There were 177 mother-child dyads that completed two 24-hour dietary recalls at baseline. Baseline characteristics are reported in Table 1. Over half the mothers were white/other (Asian, American Indian/Alaskan Native, or other non-black race), obese, married, had two children, had graduated from college, had a household income greater than $60,000, and did not work outside the home for pay. About half of mothers were breastfeeding their infant. Most mothers were non-smokers. Most children were between two and three years old, normal weight, and over half the children were male.

The mean ± standard deviations of HEI-2005 scores were 67.6 ± 9.9 and 64.0 ± 12.1 for children and mothers, respectively (see Table 2). Maternal and child HEI-2005 scores were correlated with each other (r = 0.44, p <0.0001). More than half of the children met the recommendations for total grains, milk, and oils; and more than half of the mothers met the recommendations for total grains, meat and beans, and oils. However, only 6% of children met the recommendation for total vegetables compared with 18% of mothers. Children and mothers differed significantly in the percentage that met the recommendations for fruits, vegetables, total grains, milk, and meat and beans. Few participants met the recommendations for sodium, saturated fat, and energy from SoFAAS.

Average maternal energy intake was 2012 ± 572 kcal and children's was 1310 ± 328 kcal. Percent of energy consumed was 51 ± 8% and 55 ± 7% carbohydrate, 16 ± 4% and 15 ± 4% protein, and 32 ± 7% and 30 ± 6% fat (mothers and children, respectively). Average vitamin D intake was 4.5 ± 3.6 μg and 4.8 ± 2.8 μg, calcium was 980 ± 522 mg and 834 ± 359 mg, and iron was 15.5 ± 6.3 mg and 9.4 ± 3.8 mg (mothers and children, respectively).

In the analysis of variance, child breastfeeding exposure, mother's race, education, household income, marital status, smoking status, and current breastfeeding status were significantly associated with child HEI-2005 score (see Table 3). Diet quality of children was higher for those with high breastfeeding exposure (breastfed longer as determined by lactation scores ≥12), of mothers that were white/other race, married, and non-smokers. Also, diet quality was higher for children of women with more education and a greater household income. However, child BMI z-score and child BMI category were not associated with child diet quality.

Variables listed above that were significantly associated with child's diet quality were entered into the stepwise regression model to determine predictors of child's diet quality. Because education was highly correlated with household income, education was excluded from the model. Child's gender, the mother's method of currently feeding her infant, household income and mother's diet quality remained in the final model (adjusted r^2 = 0.24, p <0.0001). The effect sizes of the variables in the final model were as follows: mother diet quality (β-coefficient = 0.29, SE = 0.06, p <0.0001), household income ≤$15,000 relative to higher incomes (β-coefficient = −2.33, SE = 1.10, p = 0.04), and household income $15,001–60,000 relative to incomes ≥$60,001 (β-coefficient = −1.73, SE = 0.72, p = 0.02), male children relative to female children (β-coefficient = −1.14, SE = 0.67, p = 0.09) and children of mother's formula feeding only relative to mother's breastfeeding or combination feeding (β-coefficient = −0.94, SE = 0.72, p = 0.19).

DISCUSSION

While all of the mothers were overweight or obese, most of the children in this sample were of normal weight. Only 7% of the preschoolers were classified as obese, which is less than the national report of 12% obese preschoolers. However, the percent of overweight preschoolers was comparable to the 15% observed nationally.[10] The diets of these children

were analogous to what has been reported previously in the literature: most children did not meet the recommendations for vegetables, whole grains, sodium, saturated fat, and energy from solid fat and added sugar.[3–5, 8] This sample differed from previous studies in that almost 50% met the recommendation for total fruit, but only 33% met the recommendation for meat and beans. Diet quality was higher with an average HEI-2005 score of 68, as compared to a nationally representative sample of preschoolers with an average HEI-2005 score of 53.[12] Although average HEI-2005 scores were higher, only 11% of children and 7% of mothers had a score ≥80, which is indicative of a healthy diet.[27] The average HEI-2005 scores for both mothers and children indicate that their diets need improving. For children, consumption of vegetables, whole grains and meat and beans needs increasing, whereas intake of sodium, saturated fat, and energy from solid fat and added sugar needs to be decreased. For mothers, consumption of fruits, vegetables, whole grains, and milk needs increasing, while intake of sodium, saturated fat, and energy from solid fat and added sugar needs to be decreased.

A higher correlation between diet quality of mothers and children was seen in this sample of preschoolers of overweight/obese mothers ($r = 0.44$) than Beydoun & Wang reported for children two to 10 years old ($r = 0.31$).[19] However, while overall diet quality was correlated, there were significant differences in the proportions of mothers and children that met the recommendations for various components in the HEI-2005. A lower proportion of mothers compared to children met the recommendations for total fruits, whole fruits, and milk. Conversely, a lower proportion of children compared to mothers met the recommendations for meat and beans, total vegetables, dark green and orange vegetables and legumes, and total grains. A low proportion of both mothers and children met the recommendations for whole grains, sodium, saturated fat, and energy from SoFAAS.

The differences found between the percent of mothers and children meeting the recommendations may relate to food consumption in separate environments as well as differences in food preferences. While about half of mothers were not working for pay, those who were working outside of the home may not be preparing the same foods for their children as themselves.

Despite the fact that two-thirds of children did not meet the recommendation for meat and beans, protein intake was not compromised. Preschoolers in this sample consumed on average 3.0 g protein/kg bodyweight per day, far greater than the recommended 0.95–1.0 g/kg bodyweight.[28] While most preschoolers did not meet the recommendation for meat or bean products, consumption of dairy products may have been enough to meet protein requirements. On average, mothers and children did not meet the 15 mcg recommendation for vitamin D.[29] Additionally, mothers and children did not meet the recommendations for daily intake of calcium.

These results indicate that children in households with the lowest income have lower diet quality, with a 10-point difference in scores for those at the lowest income level compared to those at the highest income level. There is continued need for food assistance programs for low-income households to achieve optimum diet quality and health. While participation in programs such as the Special Supplemental Nutrition Program for Women, Infants, and Children, and the Supplemental Nutrition Assistance Program was not assessed, the association between household income and child diet quality suggests that without the available funds to purchase healthy foods, nutrition education alone is not enough to increase diet quality. This highlights the continued need for programs that minimize disparities, particularly in the face of poor diet quality and low income.

The method used to assess dietary intake was similar to that used in the Feeding Infants and Toddlers Study 2008.[2] One of the limitations of this study is the possibility for bias by having mothers report the intake of their children. Mothers may have been more likely to report or recall foods their children consumed that were similar to their own food consumption. This may have influenced the correlation between maternal and child diet quality. However, as the children were too young to accurately report their food intake it was necessary to capture food intake through mothers. In addition, if the child had been away from the mother during the previous 24 hours, a child care provider completed a Preschooler Daycare Intake Record form to capture foods consumed by the preschooler. The portion sizes may not have been reported accurately, as the child care providers were not given the serving size booklet.

Another limitation of this study is the possibility of under- or over-reporting foods during the 24-hour dietary recalls because of social desirability bias. Participants may have been more likely to report foods considered healthy, such as fruits and vegetables, and/or to under-report foods considered unhealthy, such as candy and fried foods. However, the dietary analyses still shows very low intake of fruits and vegetables and higher intakes of SoFAAS.

The strengths of this study include the relatively large sample size, the racial and economic diversity of the sample, and the unique developmental stage that was targeted. In addition, the children in this study are all considered higher risk for overweight since the mothers were overweight or obese. The dyadic sample of overweight mothers and their preschool-age children is unique.

Conclusions

These results suggest that mother's diet quality is an important predictor of child's diet quality, and that interventions aimed at improving diets of preschoolers should also focus on improving their mother's diets. Even if overall diet quality in the mothers and the children were associated with one another, significant differences were found between the proportions of mothers and children meeting the recommendations for specific food groups. Overweight/obese mothers should increase consumption of total fruits, whole fruits, and milk; while preschoolers should increase consumption of meat and beans, vegetables and total grains. Even though preschoolers exceeded the recommendation for protein, their diets may be lacking in important trace minerals found in meat and beans. Both mothers and preschoolers should increase consumption of whole grains, and decrease consumption of sodium, saturated fat, and energy from SoFAAS.

The findings from this study contribute to the understanding of diets of children of obese or overweight mothers. The differences found between mothers and children who met the recommendations provide pointers towards future interventions in planning nutrition education for families with obese or overweight mothers. It may be necessary to have targeted messages that are different for mothers and children, such as a greater emphasis on increasing milk consumption for mothers and on increasing meat and beans consumption for children. Continued encouragement of fruit, vegetable, and whole grain intake with a reduction in discretionary calories is important as these continue to be areas needing improvement in both children and mothers. Additionally, the positive association between low income and low diet quality is an important consideration both for public policy and future research.

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Table 1

Characteristics of Participants

Variable	n = 177 % (n)
Mother Characteristics	
Age, years (mean ± SD)	32.2 ± 4.7
Race	
White/other	79.1 (140)
Black	20.9 (37)
BMI category	
Overweight	42.9 (76)
Obese	57.1 (101)
Education	
≤ 12th grade	11.3 (20)
Some college or vocational	20.3 (36)
College graduate	42.9 (76)
Graduate school	25.4 (45)
Household income[a]	
Up to $15,000	11.3 (20)
$15,001 -- $30,000	10.2 (18)
$30,001 -- $60,000	23.7 (42)
$60,001+	53.7 (95)
Marital status	
Single	13.6 (24)
Married	86.4 (153)
Parity	
Second	67.8 (120)
Third	22.6 (40)
Fourth or more	9.6 (17)
Work status	
Full time	26 (46)
Part time	16.9 (30)
Not paid for work	57.1 (101)
Smoking status	
Current smoker	5.6 (10)
Non-smoker	94.4 (167)
Current breastfeeding status	

Variable	**n = 177 % (n)**
Breastfeed (BF) only	48 (85)
Formula feed (FF) only	36.7 (65)
Combination BF and FF	15.3 (27)
Child Characteristics	
Age, months (mean ± SD)	42.3 ± 12.4
Age, years	
Two	35 (62)
Three	35.6 (63)
Four	16.9 (30)
Five	12.4 (22)
Gender	
Male	58.2 (103)
Female	41.8 (74)
BMI category	
Underweight	0.6 (1)
Normal	76.8 (136)
Overweight	15.3 (27)
Obese	7.3 (13)

[a]Missing information for 2 participants at baseline

Table 2

Child and Mother HEI-2005 Component and Total Scores and Percent Meeting Recommendations (n = 177).

Category	Score Range	Child's Average HEI ± SD	Mom's Average HEI ± SD	Recommended Amount per 1,000 kcal	% Children Meeting Recommendation	% Mothers Meeting Recommendation
Total fruit	0 – 5	3.7 ± 1.7	1.9 ± 1.8	≥ 0.8 c	49.7	13.6*
Whole fruit	0 – 5	3.3 ± 2.0	2.2 ± 2.0	≥ 0.4 c	45.8	27.7*
Total vegetables	0 – 5	1.7 ± 1.4	3.0 ± 1.5	≥ 1.1 c	6.2	18.1*
Dark green and orange vegetables and legumes	0 – 5	0.9 ± 1.5	2.1 ± 1.9	≥ 0.4 c	6.8	19.2*
Total grains	0 – 5	4.4 ± 0.9	4.7 ± 0.6	≥ 3.0 oz	56.5	71.2*
Whole grains	0 – 5	2.5 ± 1.9	2.8 ± 1.9	≥ 1.5 oz	23.7	27.7
Milk	0 – 10	8.6 ± 2.5	6.3 ± 3.0	≥ 1.3 c	62.7	21.5*
Meat and beans	0 – 10	7.4 ± 2.6	8.7 ± 2.1	≥ 2.5 oz	33.3	59.9*
Oils	0 – 10	9.9 ± 0.4	9.9 ± 0.4	≥ 12 g	92.7	95.5
Sodium	0 – 10	4.5 ± 2.6	3.2 ± 2.7	≤ 700 mg	0	1.1
Saturated fat	0 – 10	5.8 ± 3.4	5.5 ± 3.5	≤ 7% of total kcal	10.7	10.2
Energy from solid fat and added sugar	0 – 20	14.8 ± 4.5	13.5 ± 4.8	≤ 20% of total kcal	16.4	10.2
Total HEI-2005 Scores	0 - 100	67.6 ± 9.9	64.0 ± 12.1	≥ 80	10.7	6.8

*Significantly different from children, χ^2, $p < 0.05$

Table 3

Average Child HEI-2005 Score by Demographic, Biological and Behavioral Variables (n = 177)

Variable	Child Average HEI Score ± SD	*p*-value[a]
Gender		0.05
Male	66.4 ± 10.3	
Female	69.3 ± 9.2	
Child age (years)		0.70
Two	68.7 ± 8.8	
Three	67.4 ± 10.6	
Four	67.1 ± 11.9	
Five	65.9 ± 8.2	
Child BMI category		0.27
Normal	68.2 ± 10	
Overweight	66.1 ± 9.3	
Obese	64.2 ± 10.3	
Child breastfeeding exposure		0.005
Low (<12 lactation score)	65.7 ± 9.1	
High (≥12 lactation score)	70 ± 10.4	
Mother race		0.02
White/other	68.5 ± 10	
Black	64.4 ± 9.2	
Mother BMI category		0.84
Overweight	67.8 (10.0)	
Obese	67.5 (9.9)	
Mother education		0.001
≤ 12th grade	63.1 ± 11	
Some college or vocational	63.7 ± 9.6	
College graduate	68.8 ± 9.3	
Graduate school	70.9 ± 9.3	
Mother household income[b]		<0.0001
Up to $15,000	59.5 ± 9	
$15,001 -- $30,000	65.9 ± 11	
$30,001 -- $60,000	66.4 ± 10.5	
$60,001+	70.3 ± 8.7	
Mother marital status		0.0005
Single	61.2 ± 8.6	
Married	68.6 ± 9.8	

Variable	Child Average HEI Score ± SD	*p*-value[a]
Mother parity		0.35
Second	67.4 ± 9.6	
Third	69.3 ± 9.6	
Fourth or more	65.3 ± 12.5	
Mother work status		0.26
Full time	66.8 ± 9.7	
Part time	70.3 ± 10.9	
Not paid for work	67.2 ± 9.7	
Mother smoking status		0.01
Current smoker	58.2 ± 10	
Non-smoker	68.2 ± 9.7	
Current breastfeeding status		0.008
Breastfeed (BF) only	69.7 ± 10	
Formula feed (FF) only	64.7 ± 9.6	
Combination BF and FF	68.1 ± 9.2	

[a]Analysis of variance for differences in means

[b]Missing information for 2 participants