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Eating in the Absence of Hunger: Correlations between Anthropometrics, Feeding Styles, and Sociodemographic in 2-year-olds

Introduction

Obesity is a complex chronic disease, and if unaddressed over time, obesity can increase the risk of type 2 diabetes, various heart conditions, a decline in bone health, and reproductive issues.[1,2,3] It is well established that obesity has many contributing factors, such as a sedentary lifestyle or unhealthy eating.[1] Additional factors, such as socioeconomic status, genetics, inherited diseases, and other factors, also contribute to the development of obesity over time.[1] Obesity is associated not only with an increased risk of physical, but also psychological health problems, such as depression, social isolation, and poor self-esteem.[1] Obesity is defined as having excess adipose tissue in the body.[1,3] In children, obesity is most commonly assessed by using the Body Mass Index-for-age (BMI-for-age), which is a measure of weight relative to the child's height, but also considers gender and age since males and females continue to grow at different rates through puberty and beyond.[1,3,4] A gender-specific BMI-for-age between the 5th and 85th percentile is considered to be within a healthy weight range, while a BMI above the 85th percentile is classified as overweight, and a BMI at or above the 95th percentile is considered to be in the obese weight status category.[1,3,4]

In recent years, rising rates of obesity among children have become a significant concern across the globe. According to the United Nations Children's Fund (UNICEF), World Health Organization (WHO), and The World Bank Inter-Agency Team joint report, there are currently 37 million children under the age of 5 years old who fall within the overweight weight status

category.[1] Since 2000, there has been a 4 million increase in overweight children globally.[3,5] Furthermore, obesity is no longer an issue in countries with high economic value, but also in low and middle-income countries.[4] Based on the data collected from the National Health and Nutrition Examination Survey (NHANES), the Centers for Disease Control and Prevention (CDC) reported a rise in obesity, severe obesity, and overweightness among the ages of 2-5 years old.[3] Specifically, the prevalence of childhood obesity has grown from 17.1% in 2004 to 19.7% in 2018.[3] Most recently, the CDC states that the prevalence of obesity in children ages 2-19 years was 19.7% between 2017 and 2020.[6] This edifies the need for further research to better understand the mechanisms of obesity risk development during childhood, so more effective interventions can be developed for the prevention of obesity as early as possible.

Although many genetic, physiological, and socio-environmental factors contribute to obesity development, individuals' appetitive traits, such as eating palatable foods when not hungry, known as eating in the absence of hunger (EAH), have been shown to play an important role in daily food intake that ultimately influence total energy balance in adulthood.[7,8,9,10] However, little research has been conducted on EAH in early childhood, when eating habits begin to develop.[2,8] EAH has been defined in previous research as the inability to self-regulate one's energy intake by eating palatable foods when satiated and/or after eating a full meal.[1,7,8,10] EAH is an eating behavior that has been associated with an increased risk of obesity and can be measured via self-report, but has been most commonly assessed via observation.[2,8,9] While the EAH task is most often completed in a laboratory setting, some studies have completed EAH tasks in daycares or the child's home.[9,10,11] Prior to completing the EAH task, children are given a full meal until the child is satiated (i.e., self-report of feeling hungry, somewhat full or not hungry), which is assessed either by asking the child directly, depending on their age or by asking the parent who is present during the meal. Then, the child is offered a variety of high-

calorie, low-nutrient dense but palatable finger foods, while also being presented with different toys to play with [2,7,8,9,10] The foods are weighed before and after the task by the researcher to measure the amount (in grams) and the energy (in kcal) the child has eaten during a specified time period (i.e., typically 7-10 minutes) despite being full from the previous meal.[2,7,8,9,10]

Although infants and young children are thought to be born with the ability to self-regulate their food intake (i.e., homeostatic eating based on energy status), hedonic eating (i.e., eating based on internal and external stimuli) becomes a stronger influence on children's eating habits over time.[7,9,11,12] As children get older, social, environmental, and/or parental influences can potentially begin to influence their food choices and the amount of food consumed more strongly.[7,9,12] Researchers observed that children with higher scores on EAH have an increased risk for obesity, possibly due to being more tempted to eat when not hungry.[2,8,9,10] Specifically, children with higher EAH scores might be more vulnerable to highly palatable foods/snacks, such as those high in sugar and fat.[8,9,10] Since foods high in fat and sugar tend to be energy-dense, children with higher EAH scores might more easily exceed their daily energy needs if exposed to such foods, which may lead to a greater risk of obesity over time.[7,8,9,10,11]Based on previous research, EAH appears to be a learned behavior that can extend throughout childhood.[2,7,11] Findings of previous studies show that EAH may be influenced by caregivers and/or mothers who tend to use restrictive eating practices, monitor food consumption, or use food as a reward system to modify the child's behavior.[2,7,11] It is speculated that over time, this can reduce internal food cues of satiety and fullness.[9,10] Several factors have been associated with a higher level of EAH in previous studies with adolescents, including being female,[2,10,11] being born at a low or high birth weight,[11] and having a mother with a higher adiposity and/or higher BMI.[2] Additional factors that have been suggested to be positively associated with EAH in young children are food responsiveness and enjoyment of palatable foods, which are both classified as

food approach appetitive traits that have been linked to a greater obesity risk.[9] However, most research on EAH has been conducted in samples of preschool-aged children, with little data coming from toddlers, an age group that is in the process of developing eating habits and taste preferences while still largely protected from external social and environmental influences. Thus, a better understanding of the associations among EAH and a variety of factors between infancy and pre-school age is warranted to better inform the development of future behavioral interventions focused on early childhood obesity prevention and treatment.[1,2,9]

The purpose of the current study was to conduct an in-depth examination of EAH scores in a sample of 2-year-old children participating in the Infant Growth and Development Study (iGrow). The first aim of the study was to characterize the sample in terms of the overall energy intake from palatable foods during the EAH task, and the energy consumed from high-sugar snacks versus high-fat/savory snacks. The second aim was to examine potential associations between children's EAH scores and a variety of socio-demographic (i.e. gender, household income, food security status) and anthropometric (i.e., birthweight; weight status at age 2) characteristics, and associations with feeding-related experiences during infancy (e.g., breastfeeding intensity in the first year of life, early introduction of solid foods). Examples of specific hypotheses are as follows:

H1) Children classified in the obese vs. non-obese weight status category and girls vs. boys will have higher EAH scores at age 2.

H2) Children who live in food-insecure households will have higher EAH scores compared to children who live in food-secure households.

H3) A higher proportion of feeds from formula in infancy will be associated with a higher EAH score at 2y.

H4) There will be a positive association between EAH score and maternal Laisse-Faire, indulgent, and permissive feeding styles, while there will be a negative association between EAH and maternal responsive feeding style.

Methods

Background of the iGrow Study

iGrow is an interdisciplinary, longitudinal, multi-method study conducted in the Greensboro area in North Carolina at the University of North Carolina at Greensboro (UNCG), funded by the National Institutes of Health (R01HD093662).[8] This study collected data from 299 pregnant women and their infants across five data waves: 3rd trimester of pregnancy, 2 months, 6 months, 14 months, and 24 months of age of the child.[8] Methods used to collect data included socio-demographic and household characteristics, biological assays, medical records, maternal and infant anthropometrics, direct observations with behavioral coding, physiological assessments, dietary intake evaluations, and additional surveys such as acute illness around the data collection time.[8] The eligibility criteria for the mothers included being 18 years or older, delivering a singleton, being English-speaking, and not planning to relocate outside of the area for 3 years.[8] Infants must not have any birth defects or metabolic disorders, and gestational age must be >32 weeks.[8] The qualifying mothers were recruited in their third trimester through advertisements during WIC clinic visits, public health departments, childbirth education classes, and social media platforms. Data collection waves included the prenatal stage, 2 months, 6 months, 14 months, and 24 months, during which the mother-child dyad's anthropometrics, socio-demographics, and feeding practices were gathered.[8] At each data collection wave, when applicable.[8] The EAH task was completed only at 2y visit due to the children being too young to complete the task at previous visits.[8] During the prenatal wave, mothers were expected to come

into the laboratory six to eight weeks prior to their due date.[8] During the visit, the mother's anthropometrics were measured (e.g., weight, height, arm circumference), provided blood samples, and completed questionnaire forms (i.e., dietary screeners).[8] After five days post-birth, information on the infant (name, gender, birth type, birth weight/length) was given by the mother. Prior to the 2-month, 6-month, 14-month, and 24-month visits, the mothers filled out a questionnaire and completed a form asking about the infant's feeding habits, sleep, mood, and health.[8] At all visits, data on the infant's weight, urine, and five-skinfold measures (i.e., triceps, subscapular, suprailiac, thigh, bicep) were taken.[8] Specifically, at 2 months, the infant's saliva and heart rate were measured.[8] At the 14 and 24-month visits, a Food Frequency Questionnaire was filled out by the mother.[8] Specifically, at 24 months, the children's body composition was assessed using the BODPOD, their height was taken, and the Eating in the Absence of Hunger task began.[8] Additional details on the study design, participant characteristics, study procedures, and data collection can be found in the original study (Leerkes et al., 2020). The information presented above pertains to the overall iGrow study, which included a complex conceptual model with 2 aims. The current study only utilized selected variables and measures from some of the visits of the iGrow study, and the relevant information and appropriate details are presented below.

The Present Study

The current study utilized secondary data that were collected from the 299 mothers and their children who participated in the Infant Growth and Development Study (iGrow).[8] Children were excluded if they did not complete the seven-minute EAH task, which reduced the sample

size to 162 toddlers and their mothers.[8] Data were collected at the 2-month, 6-month, 14-month, and 24-month visits, including anthropometrics, sociodemographic information, and household-related data.[8] Most of the household characteristics and maternal anthropometrics were utilized from the prenatal lab visit, with some data utilized from the 2y visits.[8] At the 24-month visit, the toddler's weight, height, and percentage of body fat from two skin folds were utilized, and the results of the EAH task were analyzed for the current study.[8]

Study Variables and Measures Utilized in the Current Study

Maternal Sociodemographic and Household/Family-related Information & Maternal Anthropometrics

The data collected on the socio-demographic, household/family-related information, and household income of the mothers were gathered at the prenatal, 6-month,14-month, and 24-month visits within the overall iGrow research study.[8] At the six to eight weeks prior to their due date, the mothers filled out the Qualtrics questionnaire, obtaining information on the demographics of the mother.[8] Information included race/ethnicity, marital status, income-to-needs ratio, food security status, age, and additional demographic information.[8] Additionally, the mother's anthropometrics (height, weight, and arm circumference) were also taken when participants visited a lab at UNC Greensboro for data collection at the prenatal visit.[8]

Infant/Child Anthropometrics

Anthropometric data were used to evaluate the weight-for-length percentile of the infant from the data collected at the 2-month, 6-month, 14-month, and 24 months.[8] Specifically at the 2-month, 6-month, and 14-month visits, a recumbent length of the child was taken using the infant measuring board (Perspective Enterprises, Portage, MI), and the five skin folds were

measured (e.g., triceps, subscapular, suprailiac, thigh, bicep) using the Lange skinfold caliper.[8] Only two skinfold measurements (tricep and subscapular) were utilized in the current study, using the WHO Growth Standards (cite WHO growth standards here). At the 24-month visit, the toddler's height was measured using the SECA 214 portable stadiometer without shoes on, as well as the other measures taken at previous visits.[8] Maternal pre-pregnancy BMI was calculated from the self-reported prenatal weight and height that were measured at the prenatal visits.[8] Obesity risk was measured using the age and sex-specific BMI-for-age z scores from the WHO growth standards, and infants were classified as obese or non-obese using the cutoff of the 90th percentile.[8]

Maternal Feeding-related Practices

Maternal feeding practices were evaluated using the Infant Feeding Practices Questionnaire II, and data from the 2-month and 6-month visits were utilized for the current study.[8] Questions consisted of *feeding* type(breastmilk, formula, mixed), *feeding mode* (percent of total feeds, from bottle), *duration of exclusive breastfeeding, timing of solid food introduction* (early introduction of solid food was defined as prior to 4 months of age), and *maternal provision* of sugar sweetened beverages, high-fat foods, fruit, and vegetables.[8]Additionally, using the Indulgent Feeding Style Questionnaire (IFSQ), the mothers were asked questions based on which they received a score on the Laisse-Faire, Restrictive, Indulgent, Responsive, and Pressure feeding style.[8]The score from the 24-month visits was used for the current study.[8]

Eating In the Absence of Hunger (EAH)

At the 24-month visit, the toddler's consumption of energy from palatable foods when not hungry was assessed using the EAH task.[8] First, the mother was instructed to fill out a questionnaire that gathered information on the toddler's exposure and consumption of each of the

six palatable snack foods that their child was about to be offered in the lab (i.e., Oreo cookies, Fudge stripe cookies, Frosted animal cookies, Potato chips, Cheez-it, Cheese puffs).[8] The mothers were also asked whether each of the palatable foods was present in the home.[8] In a laboratory, the toddler was given a preload meal that consisted of all five food groups to ensure the child was not hungry at the beginning of the EAH task.[8] The toddlers were given approximately 10 minutes to eat the pre-load meal, and extra time if needed.[8] After the preload meal was completed, the research staff asked each child whether they were full, partially full, or hungry, using pictures that portrayed a child with a full, partially full, and empty stomach.[8] The research staff also asked the mothers to confirm the child was at least partially full based on their knowledge and experiences with the child at home.[8] After the pre-load meal, each child waited for 10 minutes before the EAH task began.[8] The EAH food consisted of three sweet options (Frosted animal crackers, Oreo cookies, Fudge striped cookies), and three savory options (Potato chips, Cheese Puffs, Cheese-it crackers).[8] Each food was carefully measured in grams by the research staff prior to being placed on a tray for the child, to ensure all children will be offered approximately the same amount of food and kilocalories.[8] Once the EAH tasks began, the toddler was shown the foods and told they could eat as much as they wanted or they could play with the toys that were present in the room.[8] The mother was instructed not to interfere with the child during the seven-minute task.[8] Pre and post the EAH task, the researcher weighed each container of the palatable options in grams and recorded them on a special EAH form.[8] The, each amount of food eaten was multiplied by the amount of energy (kcal) present in each gram of the specific food (e.g., 1 g of Oreo cookies contains 5 kcal; when the child consumed 10 g of Oreo cookies, then energy consumption was 50 kcal (10g x 5kcal/g = 50 kcal). The researcher also noted whether the mother interacted with the toddler during the task.[8] Data from the EAH task were

used to assess the toddler's consumption of total kilocalories (kcal) during the task, including energy consumption from sweet and savory foods separately.[8]

Statistical Analyses

Descriptive statistics (e.g., frequencies, mean, standard deviations, and bivariate correlations) were used to describe the sample characteristics and examine associations between EAH and selected variables. Differences in EAH scores were examined using Chi-square statistics for categorical variables (e.g., difference in EAH score by the obese vs. non-obese weight status). T-test and/or ANOVA test were used to test differences in EAH score for continuous variables (e.g., formula feeding intensity). All statistical analyses were conducted using SPSS (version 29, IBM, Chicago, IL) with the level of significance at $p<0.05$.

Results

Maternal and family characteristic results can be seen on Table 1. At the 24-month visits, 162 toddlers completed the EAH task form from the primary study. The sample size consisted of mothers who identified as white/Caucasian, had a bachelor's degree or higher, and earned at least $35,000/year or more. In the sample, 127 toddlers were classified as non-overweight (78%), and 34 toddlers (21%) were classified as overweight.

Results for Aim 1 are presented in Table 2 and Table 3. The total energy consumed during the EAH task was 64.2±39.8 kcal (Mean ± SD). The toddlers consumed more energy from sweet snacks (47.0 ± 42.0 kcal) than from savory snacks (17.7 ±19.6 kcal). There were no significant differences in energy intake during the EAH task by the level of availability of the item at home that was reported by mothers. The Oreo snacks have never been eaten by 26.5% of the sample amongst the toddlers, and 70% of mothers reported they did not have them at home regularly. Most of the toddlers within the sample have never eaten the Fudge Strips (79%) or have not had

the snack readily available at home (87%). For the Frosted Animal cookies, 70% of the sample have never had this snack, and 84% of mothers reported not having it at home regularly. The early half of the toddlers have had the potato chip snack (48.8%), leaving only 6% of the toddlers as never eaten this snack, as reported by mothers. Nearly a third of the mothers (32%) reported not having it regularly at home. Only 7% of toddlers have never had the Cheeze-It snack, and 33% of the mothers reported not having it regularly at home. Finally, only 19% of the toddlers have never had Cheese Puffs, and 49% of the mothers reported not having it regularly at home.

Table 1. Maternal and Family Characteristics

		Mean±SD	N	Percentage %
Maternal Age		31.01		
Education	Some high school		1	0.6%
	High school degree or GED		16	10.0%
	Attended some college		21	13.1%
	2 year college degree		14	8.8%
	4 year college degree		49	30.6%
	Post-graduate work		8	5.0%
	Graduate degree		51	31.9%
Family Annual Income	less than $10,000/year		14	8.9%
	$10,000 - $34,000/year		28	18%
	$35,000 - $99,999/year		75	47.5%
	$100,000/year or more		41	25.9%
Marital relationship/status	Married, living together		113	70.6%
	Married but separated		2	1.3%
	Divorced		1	0.6%
	Not married, living with partner		25	15.6%
	Not married or living together, but in a serious romantic relationship		7	4.4%
	Single, not in a romantic relationship		12	7.5%

	Widowed		0	0.0%
Hispanic, Latino, or of Spanish origin	No		149	93.1%
	Yes		11	6.9%
‘Self-identified participant race	‘White only’		98	63.2%
	‘Native Hawaiian or Pacific islander only’		1	0.6%
	Asian only		2	1.3%
	‘Black or African American only’		42	27.1%
	‘American Indian or Alaskan native only’		0	0.0%
	‘other only’		1	0.6%
	‘biracial’		8	5.2%
	‘multiracial’		3	1.9%
WHO Weight-for-age percentile at 2y		61.64±25.6	162	
WHO BMI-for-age percentile at 2y		65.43±25.0	162	
Infant Weight Status >= 90th BMI percentile 2y	Not overweight		127	78.9%
	Overweight		34	21.1%

Table 2. Total Kilocalories Consumed during the EAH Task

	Mean	Standard Deviation
Total energy (kcal) from all foods	64.2	39.8
Total energy (kcal) from Savory foods	17.7	19.5
Total energy (kcal) from Sweet foods	46.9	41.9

Table 2.a Frequency of Regular Availability of Palatable Foods

	N	Percent %
No	112	69.6%

Food in home on regular basis: Oreo Cookies	Yes	33	20.5%
Food in home on regular basis: Fudge Stripe Cookies	No	137	85.6%
	Yes	6	3.8%
Food in home on regular basis: Frosted Animal Cookies	No	136	85.0%
	Yes	9	5.6%
Food in home on regular basis: Potato Chips	No	52	32.5%
	Yes	104	65.0%
Food in home on regular basis: Cheese puffs	No	79	49.1%
	Yes	70	43.5%
Food in home on regular basis: Cheez-it Crackers	No	54	33.8%
	Yes	99	61.9%
How often child eats: Frosted Animal Cookies	Has never eaten it	113	70.6%
	Has eaten it a few times	40	25.0%
	Has eaten it many times	7	4.4%
How often child eats: Oreo Cookies	Has never eaten it	43	26.9%
	Has eaten it a few times	89	55.6%
	Has eaten it many times	28	17.5%
How often child eats: Fudge Stripe Cookies	Has never eaten it	128	81.0%
	Has eaten it a few times	27	17.1%
	Has eaten it many times	3	1.9%
How often child eats: Potato Chips	Has never eaten it	10	6.3%
	Has eaten it a few times	71	44.4%
	Has eaten it many times	79	49.4%
How often child eats: Cheez-it Crackers	Has never eaten it	12	7.5%
	Has eaten it a few times	68	42.5%
	Has eaten it many times	80	50.0%
How often child eats: Cheese puffs	Has never eaten it	31	19.3%
	Has eaten it a few times	65	40.4%

	Has eaten it many times	65	40.4%

Despite some toddlers receiving higher formula feedings during their infancy (between 2m and 6m), our findings showed that children who received higher feeds consumed less energy than other children (r=-.166; p=0.036). Our results also showed that there was a negative association between formula feeding intensity in early infancy and energy consumed from sweets (r= -.199; p= < .011). The toddlers who were breastfed during infancy (data from 2m and 6m waves) had a trend towards consuming more energy during EAH than those who were formula fed (72.2 kcal vs. 60.5kcal; p= 0.066). There were no associations between EAH and bottle-feeding intensity (r= -.083; p=*.298*). Our results related to the mother's feeding styles using the findings from the Infant Feeding Style Questionnaire (IFSQ) at the 2y visit found that most of the feeding styles were not associated with children's total energy consumption during the EAH task. However, there was a significant negative association between energy consumption during EAH and the indulgent feeding style, with children of more indulgent mothers consuming less energy during the EAH task (r=-.171; p=0.031). Detailed results are presented in Table 3.

Table 3. Bivariate Correlations between EAH scores and Maternal Feeding Styles (n=159)

		Total energy (kcal) from all foods
Total energy (kcal) from all foods	Pearson Correlation	1
	Sig. (2-tailed)	
	N	162
IFSQ laissez-faire total score, mean attention and diet quality 2y	Pearson Correlation	-.038
	Sig. (2-tailed)	.639
	N	158

IFSQ pressure total score, mean of finishing, cereal, and soothing 2y	Pearson Correlation	-.075
	Sig. (2-tailed)	.347
	N	159
IFSQ restrictive total score, mean amount and diet quality 2y	Pearson Correlation	-.102
	Sig. (2-tailed)	.200
	N	159
IFSQ responsive total score, mean of satiety and attention 2y	Pearson Correlation	-.001
	Sig. (2-tailed)	.994
	N	158
IFSQ indulgent total score, mean of permissive, coaxing, soothing, and pampering 2y	Pearson Correlation	-.171*
	Sig. (2-tailed)	.031
	N	159

Results related to weight status and EAH score showed there were no significance differences in energy consumption during EAH task between overweight and non-overweight infants. However, there was a slight trend of more energy being consumed among overweight compared to non-overweight children (p=0.07). A higher % body fat, based on and using the WHO growth standards for 2 infant skinfolds (tricep and subscapular) at 2 years of age was associated with a higher energy consumption from sweets (p=0.004). There was also a positive trend between a higher % body fat and a higher overall energy consumption (p=0.059).

There were significant associations between the EAH score and selected socio-demographic characteristics. Boys consumed significantly more energy during EAH than girls (72.2±SD vs. 56.1± kcal; p=.01). Mothers who were enrolled with their child in the WIC program at 2y had toddlers that consumed a lower amount of energy during the EAH task (53.1± 34.3kcal vs. 71.5±41.9 kcal; p<.01) than children who were not enrolled in WIC. Additionally, children who were classified as living in poverty (n=28) consumed less energy than the toddlers who did not live in poverty (n=130), 47.1 kcal vs. 67.2 kcal; p<.05).

Discussion

The main purpose of the current study was to explore a lab-based measure of food approach appetitive trait, eating in the absence of hunger (EAH), and examine associations between the EAH score and socio-demographic, anthropometric and feeding-related characteristics among young children and their mothers. Our findings show that EAH does not appear to be clearly associated with children's current weight status at 2y, breastfeeding intensity in early infancy, bottle-feeding intensity, and most feeding styles reported by mothers at 2y, contrary to what was discovered in previous studies in older children.[9,12,13] Also, the EAH scores for each food did not differ among children based on whether or not they had the specific foods regularly available in their home. Our study revealed that children from lower income families and those enrolled in WIC, which indicates a lower socio-economic status, consumed less energy from palatable food during the EAH task than children from higher income families. Given that the EAH has not been explored among toddlers in previous research,[2,14] the current study provides unique data on EAH on this young age group that can be used as a foundation for future research that will examine EAH in early childhood.

There were no clear differences in EAH score by weight status in our sample. This was unexpected because previous studies have shown that children who are classified as overweight do eat more calories during EAH.[3,6,9,13]Although not statistically significant, our data showed that there was a trend towards children with a higher weight (overweight vs non-overweight) consuming slightly more energy from snacks during the EAH task. This trend was also supported by our finding related to body fat. We found that children with a higher % body fat from two skinfolds (tricep and subscapular) consumed significantly more energy from the snacks, and particularly from sweets that were offered. This finding supports results of a systematic review with older children (over 3 years of age), which reported that children with higher adiposity

tissue may be at a disadvantage due to greater levels of hormones being secreted and a diminished satiety response[2,15]. However, our sample size was relatively small, and thus, these associations and trends should be examined further in future studies with larger samples of toddlers.

The toddler's total energy consumption in our sample during the EAH tasks was only 64.2 kcal (±39.8 kcal), and mothers reported that most of the foods offered were not regularly available in their homes. Thus, the relatively low energy consumption seen in our sample may be at least partially explained by children in our sample still being in early developmental stage where they have had a limited exposure to a variety of palatable foods and/or have not had an opportunity yet to develop strong taste preferences or cravings for such palatable snack foods. Thus, toddlerhood may be an ideal time period for promoting healthy food choices and encouraging young children to consume nutrient-dense foods while mitigating their exposure to highly palatable low nutrient-dense foods, such as those offered during the EAH task.

Our examination of the links between socio-demographics and EAH score were interesting and not all consistent with our hypotheses. Toddlers living in a low-income household or who were a part of the WIC program at 2 m, consumed less energy than toddlers living in higher-income families. We speculate that children who are a part of WIC programs or live in low-income homes are used to not overindulging and/or have a generally more limited food supply, which is based on what food their caregivers can buy using the supplemental nutrition program, such as WIC. Thus, a lower income level may be influencing not only the amount but also the type of foods children consume at this young age. In our study, boys consumed more energy during the EAH task than girls. However, previous research with older children showed that girls were more likely to consume more energy than boys, possibly due to the influence of external factors, such as maternal restriction.[2,7,12] It is possible that these associations influence

girls' intake of energy during the EAH, but among older girls, who are likely more influenced by their mothers and peers as they age, according to previous research.[7,10]

In terms of feeding-related constructs that we examined in relation to EAH scores in our sample, a notable finding was that formula-fed children consumed less energy during the EAH task than toddlers who received more feeds from breastmilk when they were infants. Since we only examined bivariate correlations between EAH scores and breastfeeding intensity in the current study, it is possible this negative significant association would disappear once other confounding variables are considered in more complex statistical tests. Thus, more research needs to be done to determine whether breastfeeding intensity during infancy is significantly associated with EAH score among toddlers.

The current study had several strengths as well as limitations. First, data analyzed here was as part of a prospective, longitudinal, multi-method study that followed participants from the mothers' pregnancy to the child's age of 2 years. Second, the current study was one of very few studies that examined EAH among very young children aged 2 years. Third, the EAH task was administered by trained research staff as part of the larger iGrow study, in a controlled laboratory environment. Lastly, the sample was very diverse in terms of both race/ethnicity and socio-economic characteristics, with a wide range of educational and income levels represented in our study. The limitations include the following: 1) the self-reported nature of questionnaire and maternal report of child's "fullness" during the EAH tasks; 2) missing data from some participants across various variables; 3) although the full iGrow sample was 299, only 162 children and their mothers completed the EAH task.

Implications for Future Research

For future studies, standardizing the EAH tasks across studies is essential so findings can be compared across age groups and different samples. In addition, further research is warranted ion better understanding how EAH develops and changes across developmental stages, starting in toddlerhood through childhood. Better understanding of the influence of maternal feeding practices (i.e., formula fed, breastfed) and feeding styles on EAH is also warranted, especially among low-income mother/child dyads who may be experiencing poverty and/or food insecurity and depend on federal supplemental nutrition programs. Given our findings, toddlers did not show high interest in "junk" foods despite being exposed to it in a lab setting during the EAH task. Since toddlers might still be somewhat protected from developing strong cravings and taste preferences for "junk foods," toddlerhood might be an ideal time period for interventions to foster taste preference for healthy foods while limiting exposure to high-sugar/high-fat foods, thus diversifying their palates early in life and preventing future risk for obesity.

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