Sweetened Food Purchases and Indulgent Feeding Are Associated With Increased Toddler Anthropometry

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ABSTRACT

Objective: To explore the role of feeding practices and food purchases in toddler dietary intake and anthropometry.

Methods: A convenience sample of Latino mother and toddler pairs were interviewed at baseline and at 6-month follow-up. Data on feeding practices, toddler dietary intake, anthropometry, and food purchases were collected using the Toddler-Feeding Questionnaire; 24-hour recalls; measurements of weight, height, and/or length; and food purchase receipts.

Results: Indulgent feeding scores and high intake of sweetened beverage were associated with a 0.52 increase ($P = .03$) and 0.46 increase in toddler weight-for-height z-score ($P = .05$), respectively. Households with 10 percentage points of more sweetened food and beverage expenditures were associated with increases in weight indicator z-scores.

Conclusions and Implications: Indulgent feeding, high intake, and purchase of sweetened beverage are associated with weight gain in Latino toddlers. Programs should target food purchasing decisions and provide concrete guidance for the division of responsibility around feeding.

Key Words: Hispanics, Latinos, child feeding, overweight, sweetened beverage (*J Nutr Educ Behav*. 2014;46:293-298.)

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INTRODUCTION

Childhood obesity is a grave concern in the United States (US), particularly among minorities, for whom an estimated 49.2% of African American children and 44.0% of Hispanic children aged 5–18 years are overweight or obese, compared with 32.3% of Caucasian children.[1] The etiology of childhood obesity is related to genetic, cultural, psychosocial, socioeconomic, and environmental factors. This research investigates the role of the household food environment in Hispanic families and the mediating effects of food purchases and feeding practices on child obesity risk.

The US Department of Agriculture Nutrition Evidence Library and other recent reviews concluded that sweetened beverages contribute to adult and child obesity.[2-5] Excessive consumption of sweetened beverages and even fruit juice has been linked to obesity risk in young Mexican children.[6,7] Moreover, data from the Feeding Infants and Toddlers study found that intake of sweetened beverages begins in infancy and is more likely to occur in Hispanic infants and toddlers than non-Hispanic infants and toddlers.[8] Based on this evidence, it is apparent that interventions targeting early childhood obesity are needed.

Despite the documented connections between consumption of sweetened foods and child obesity, there is little evidence connecting the types of foods purchased at the household level and child obesity. The types of food that a child eats at home are affected by the parents' and/or caregivers' decisions about food availability and accessibility. First, at a grocery store, the caregiver must decide which foods to buy and how much to purchase of each food (availability). Second, the caregiver decides which of the purchased foods the child is allowed to consume (accessibility). Two potential mechanisms through which mothers could improve toddlers' diets were explored in a Mexican American population: feeding practices and food purchases. Previously in this same sample, indulgent feeding practices were associated with increased energy consumption and higher intakes of total fat and sweetened beverages in a cross-sectional design using baseline data.[9] The objectives of this follow-up study conducted 6 months later were to examine the respective roles of household food purchases and toddler feeding practices in determining toddler dietary intake and anthropometry.

METHODS

Study Design and Protocol

The study involved an observational cohort design, with baseline and 6-month follow-up data collection.

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The Institutional Review Board at the University of California–Davis approved the Human Subjects Protocol. Parents signed informed consent forms. Second-generation Mexican Americans with moderate proficiency conducted interviews in participants' preferred language (English or Spanish).

Study Sample

A convenience sample of 94 Latino mother and child pairs was obtained largely through the Supplemental Nutrition Program for Women, Infants, and Children (WIC); 67 women were interviewed at follow-up. Study criteria were that: (1) the mother self-identified as Latina, and (2) the family had a toddler child between the ages of 12 and 24 months at baseline. All participants interviewed were the mothers of the toddlers. The authors obtained informed written consent at the first scheduled interview.

Construction and Validation of Survey Instrument

Findings from earlier formative research were used to develop the Toddler-Feeding Questionnaire (TFQ).[10] The final draft of the questionnaire contained 34 items and was similar in formatting and Likert-type responses to the Caregiver Feeding Style Questionnaire of Hughes and colleagues.[11,12] Development and validation of the instrument were described elsewhere.[9,10] The TFQ was composed of items that were expected to measure indulgent and authoritative feeding practices. Indulgent feeding is defined here as a caregiver style that caters to the child and offers little or no structure, guidance, or limit-setting.[11] In contrast, authoritative feeding is defined as a caregiver style that offers structure, guidance, and positive modeling of eating behaviors.[11]

Anthropometric Measurements

The researchers measured the height and weight of mothers and the child's length (or height if the child had reached 2 years of age).[13] Toddler anthropometry was measured twice: at baseline and 6 months later. Height/length was assessed using a portable stadiometer (Model PE-AIM-101, Perspective Enterprises, Portage, MI) and weight was measured using a calibrated scale (Model 1582 Digital Scale; Tanita, Arlington Heights, IL). Because the 2006 World Health Organization growth standards had recently been adopted for use in the US for children 0–24 months, both the World Health Organization standards and the Centers for Disease Control growth reference were used in this study.[14] Anthropometric outcome variables included 6-month change in *z*-scores for toddler weight for height (ΔWHZ), weight for age (ΔWAZ), height for age (ΔHAZ), body mass index (ΔBAZ), and rapid growth. Change in *z*-scores was calculated by subtracting anthropometric *z*-scores at baseline from follow-up *z*-scores; rapid growth is defined as a change in ΔWHZ > 0.67.

Dietary Assessment

Details on the dietary assessment are provided in more detail elsewhere.[9] Briefly, dietary intake was collected at baseline and 6 months later for toddlers, using 2 24-hour dietary recalls administered to the mothers at each time point (4 in total). Methods for using 2 days of 24-hour dietary recalls followed procedures as used in the Feeding Infants and Toddlers study and the Continuing Survey of Food Intakes by Individuals.[15] The authors analyzed dietary intake data using Nutrition Data System for Research software (Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, 2007). Dietary outcome variables included total energy (kilocalories), total fat (grams), added sugars (grams), and percentage of kilocalories from fat and added sugar. Only dietary variables that were significantly related to toddler feeding practices at baseline were used in analyses at the 6-month follow-up.[9]

Food Purchases

Participants were asked to collect and save receipts for all household food purchases for an entire month at baseline, and again at the 6-month follow-up. Food purchases included trips to the grocery stores, or any type of store that sold foods items; foods consumed at restaurants, from street vendors, and so forth, were not included. Food expenditures were grouped into 6 categories: (1) fresh fruits and vegetables, (2) proteins, (3) canned foods, (4) cereals, (5) sweetened foods and beverages, and (6) miscellaneous foods. Sweetened beverages did not include 100% fruit juice. To reduce the effects of household size and incomplete receipt records, the percentage of food expenditures in each category was used in analyses.

Statistical Procedures

The authors analyzed descriptive statistics for all variables. To examine bivariate relationships, the following procedures were used: Spearman's rank correlation for ordinal or nontransformable variables, *t* tests, and Mann-Whitney U/Wilcoxon rank-sum test for variables that were not normally distributed. Simple linear regressions and multivariate regressions of anthropometry outcomes (with changes in WHZ, WAZ, and BAZ as dependent variables) were also conducted using toddler feeding practices; dietary variables; and food expenditure category percentages. In the food purchases analyses, TFQ indulgent and authoritative scores and the 34 TFQ items were standardized to have a mean of 0 and standard deviation of 1. The researchers conducted statistical analyses using SAS (version 9.1, SAS Institute Inc, Cary, NC, 2002–2003) or Stata (version 10, StataCorp LP, College Station, TX, 2007), with statistical significance designated at $P < .05$.

RESULTS

Characteristics at Follow-up

A total of 67 women were interviewed at follow-up. Women at follow-up were older and a larger proportion were foreign-born than were women lost to follow-up. No other differences were noted (Table 1). Average age of toddlers at follow-up was 27.7 months ($\pm$ 3.11 months). Median follow-up time was 6.11 months, with a range of 5.49–7.45 months after baseline interview. Approximately 11% (n = 7)

Table 1. Comparison of Maternal Characteristics Between Mothers Lost to Follow-up and Final Follow-up Sample

Characteristic	Baseline (n = 94)	Lost to Follow-up (n = 27)	Follow-up (n = 67)[a]	P[b]
Maternal age, y	28 ± 6.56	26.5 ± 8.1	30.2 ± 5.6	.02*
Maternal education, y	10.9 ± 3.8	10.1 ± 3.2	11.1 ± 4.0	.24
Child birth weight, g	3,501 ± 610	3,400 ± 503	3,539 ± 644	.18
Maternal birthplace				.01*
United States	22 (23%)	11 (41%)	11 (16%)	
Mexico/other	72 (77%)	16 (59%)	56 (84%)	
Maternal language				.92
Spanish	76 (81%)	22 (82%)[c]	54 (81%)	
English/bilingual	18 (19%)	5 (19%)[c]	13 (19%)	
Monthly household income, median (range)	1,350 (0-6,549)	1,328 (0-3,941)	1,366 (300-6,549)	.60

*$P < .05$; [a]67 women were interviewed at follow-up, but various data may be missing because toddlers were not cooperative for anthropometric measures, or the interviewer may have been unsuccessful reaching the participant for an interview of economic indices; [b]P provided to test for differences between women lost to follow-up and the final follow-up sample; [c]Percentages may not add up to 100 due to rounding.
Note: Means were compared using t test. Categorical data were analyzed using chi-square. Medians were compared using Wilcoxon rank-sum nonparametric procedure. Data represent means ± standard deviation unless otherwise noted.

of the sample of toddlers experienced rapid growth during the 6-month follow-up time frame.

Relationship Between Toddler Feeding Practices and Toddler Diet

Paired t test revealed no significant changes in scores for toddler feeding subscales between the baseline and follow-up visits, but changes in intake, specifically greater energy, carbohydrate and added sugar, were noted (data not shown). As seen at baseline, indulgent feeding scores were positively related to fat intake but were not related to energy intake (Table 2). Results of regression equations showed that indulgent and authoritarian subscale scores explained a small but significant variance in percent calories from fat and sweetened beverage. More specifically, indulgent scores were positively related and authoritative scores were negatively related to fat and sweetened beverage consumption.

Factors Associated With Changes in Toddler Anthropometry

Multivariate linear regression equations indicated that the variance in WHZ, BAZ, and WAZ toddler outcomes was explained, in part, by changes in indulgent and authoritarian subscales. Indulgent feeding scores contributed to greater positive changes in WHZ, BAZ, and WAZ during the 6-month window (Table 3). Also, high intake of sweetened beverages was associated with increased WHZ and BAZ. Baseline and follow-up data were combined to determine median splits and were used to categorize toddlers into a high- or low-intake group. High intake of sweetened beverage was associated with a 0.46 increase in WHZ ($P = .05$) and a 0.47 increase in BAZ ($P = .07$), even after controlling for birth weight, gender, baseline z-score, maternal education, and income.

Table 4 illustrates the relationship between food purchases for the 6 food groups and toddler anthropometry indicators at follow-up. Multivariate regression equations indicated that the variance in toddler

Table 2. Relationships Between Toddler Diet Variables and Toddler Feeding Practices

	Sweetened Beverage	Percent Kilocalories From Added Sugar	Percent Kilocalories From Fat	Energy (Total Kilocalories)
Average Toddler Feeding Questionnaire Indulgent Subscale	n = 65[a]	n = 65[a]	n = 65[a]	n = 65[a]
	$\beta = 0.01$ $R^2 = 0.03$ $P = .09$	$\beta = -0.07$ $R^2 = -0.003$ $P = .36$	$\beta = 0.22$ $R^2 = 0.09$ $P = .009$*	$\beta = 3.40$ $R^2 = -0.004$ $P = .40$
Average Toddler-Feeding Questionnaire Authoritative Subscale	n = 65[a]	n = 65[a]	n = 65[a]	n = 65[a]
	$\beta = -0.03$ $R^2 = 0.095$ $P = .007$*	$\beta = -0.18$ $R^2 = 0.007$ $P = .23$	$\beta = -0.08$ $R^2 = -0.01$ $P = .61$	$\beta = -5.74$ $R^2 = -0.006$ $P = .44$

*$P < .01$; [a]A total of 67 women were interviewed at follow-up but various data are missing because the interviewer was unsuccessful reaching participants for interviews of economic indices.
Note: Stepwise linear regressions were conducted adjusting for child age, gender, maternal education, and household income. All dietary variables were averaged using baseline and follow-up intake data.

Table 3. Relationships Among Toddler Feeding Practices, Diet Variables, and Child Growth

	ΔWHZ[a]	ΔBAZ[a]	ΔWAZ[a]
Indulgent[b]	n = 56[d] $\beta = 0.52$ $R^2 = 0.02$ $P = .03$*	n = 55[d] $\beta = 0.53$ $R^2 = 0.02$ $P = .05$*	n = 61[d] $\beta = 0.33$ $R^2 = 0.02$ $P = .04$*
Authoritative[b]	n = 56[d] $\beta = -0.40$ $R^2 = 0.03$ $P = .11$	n = 55 $\beta = -0.45$ $R^2 = 0.03$ $P = .11$	n = 61[d] $\beta = -0.29$ $R^2 = 0.05$ $P = .06$
High sweetened beverage[c]	n = 52[d] $\beta = 0.46$ $R^2 = 0.07$ $P = .05$*	n = 51[d] $\beta = 0.47$ $R^2 = 0.06$ $P = .07$	n = 56[d] $\beta = 0.13$ $R^2 = 0.01$ $P = .35$
High fat (%kcal)[c]	n = 54[d] $\beta = -0.006$ $R^2 = 0.001$ $P = .97$	n = 53[d] $\beta = -0.02$ $R^2 = 0.002$ $P = .93$	n = 58[d] $\beta = 0.12$ $R^2 = 0.01$ $P = .32$
High added sugar (%kcal)[c]	n = 54[d] $\beta = .39$ $R^2 = 0.07$ $P = .07$	n = 53[d] $\beta = .39$ $R^2 = 0.07$ $P = .10$	n = 58[d] $\beta = .15$ $R^2 = 0.02$ $P = .22$

WHZ indicates weight for height z-score; BAZ, body mass index z-score; WAZ, weight for age z-score.

*$P < .05$; [a]Adjusted for birth weight, gender, baseline *z*-score, maternal education, and income; [b]Median splits on subscale feeding scores were used to determine an indulgent or authoritative feeding style; [c]Median splits were used to determine high intake of respective dietary variables; [d]A total of 67 women were interviewed at follow-up, but various data are missing, partly because toddlers were uncooperative for anthropometric measures, and/or the interviewer was unsuccessful in reaching participants for an interview of economic indices.

Note: Multivariate linear regression analysis was conducted adjusting for birth weight, baseline anthropometric measure, child age, gender, maternal education, and household income.

anthropometric outcomes was explained by household expenditures of sweetened foods and beverages only, where the relationship was large and statistically significant. Households with 10 percentage points of more sweetened food and beverage expenditures were associated with 0.5, 0.4, and 0.5 higher toddler WHZ, WAZ, and BAZ, respectively. (The interquartile range of the percentage of expenditures in sweetened foods and beverages is 10.1.)

Relationships Between Feeding Practices and Food Purchases

There were no significant relationships between indulgent scores or authoritative scores of the TFQ and food purchases. However, 2 TFQ items, "I give my child fruit juice when he/she is thirsty" and "I let my child have a drink of soda if he/she sees others in the house drinking it and wants it," were positively correlated with purchases of sweetened foods and beverages (data not shown).

DISCUSSION

In this study, the relationship between toddler feeding practices and dietary intake over a 6-month follow-up period supports previous findings indicating that indulgent feeding scores are associated with higher intakes of fat and sweetened beverages in toddlers. Conversely, authoritative feeding scores are associated with decreased sweetened beverage consumption.[9] Toddler feeding scores remained unchanged over time, which suggests that an overall feeding style may be consistent for parents, at least in the toddler phase, despite guidance provided by WIC and other sources. More importantly, indulgent feeding was positively associated with toddler changes in WHZ, BAZ, and WAZ. In this sample of toddlers, rapid growth took place in 7 children in a 6-month window between approximately 18 and 24 months of age. Rapid growth early in life has been implicated as a risk factor for childhood obesity.[16] However, the associations between rapid growth and either toddler feeding practices or dietary variables could not be determined, possibly because of the small sample size.

Furthermore, these results suggest that the relationship between indulgent feeding and increased toddler anthropometry may be mediated by high intake of sweetened foods and beverages. Sweetened beverages have been implicated as a contributor to weight gain and childhood obesity in the US.[2,3,5,6,17,18] In this study, sweetened beverage consumption was positively associated with indulgent feeding scores and negatively associated with authoritative feeding scores. This supports the notion that indulgent feeding has negative influences whereas authoritative feeding has positive influences on toddlers' dietary intakes. An authoritative feeding style has been shown to have a positive influence on child feeding, such as increased availability of fruits and vegetables and reported child consumption of dairy and vegetables,[19] and there is growing concern that permissive feeding styles (eg, indulgent or uninvolved styles) relate negatively to children's intake of nutrient-rich foods such as fruits, vegetables, and dairy products.[20]

Findings indicate that the share of food expenditures on sweetened foods and beverages is related to both child obesity and child feeding practices. It may be that once sweetened foods and beverages enter the household, even if they are intended for consumption by adults, young children may end up consuming them. A case might be made by policy makers to cease provision of WIC supplemental foods if these free up family resources to purchase unhealthy foods. However, research has shown

Table 4. Relationships Between Food Expenditure Shares and Toddler Anthropometry (n = 55)

	WHZ	WAZ	BAZ
Beans, fresh fruits, and vegetables	0.004 (0.018)	0.016 (0.012)	0.001 (0.021)
Proteins	0.001 (0.011)	0.010 (0.012)	0.001 (0.011)
Canned foods	0.013 (0.013)	−0.014 (0.011)	0.02 (0.014)
Cereals	0.030 (0.023)	−0.009 (0.025)	0.034 (0.024)
Sweetened foods and beverages	0.503* (0.013)	0.412* (0.014)	0.530* (0.014)
Miscellaneous foods	−0.220 (0.132)	−0.140 (0.109)	−0.206 (0.151)
R^2	0.2	0.17	0.22

WHZ indicates weight for height z-score; BAZ, body mass index z-score; WAZ, weight for age z-score.
*$P < .01$.
Note: Each column reports results from a multivariate ordinary least-squares regression of the anthropometry outcome indicated in the column header on the percentages of expenditures in food categories indicated in the row headers. Huber-White standard errors, which are robust to heteroscedasticity, are reported in parentheses. Variables are equally weighted. n = 55. Because the percentage expenditures in food categories sum to unity, the regressions do not include a constant term. Two other variables are included without reporting their results: an indicator variable equal to 1 if the child is male and equal to 0 if the child is female, and the total amount of food expenditures.

that food insecurity in Latinos is significantly associated with lower household supplies of fruit and vegetables, which in turn are associated with lower consumption of these foods in preschoolers.[21] On the other hand, food insecurity is also associated with higher intakes of saturated fat and salty and sweet snacks among Latino preschoolers.[22,23] Therefore, reducing WIC benefits would be expected to increase food insecurity and could make food consumption patterns worse. Furthermore, indulgent parents may have a harder time providing restrictions on consumption of sweetened foods and beverages even by toddlers, for whom accessibility of such foods should be limited. Indulgent parents unknowingly put their children at risk by allowing the child to determine both what and when to eat; this contradicts Satter's[24] division of responsibility, in which these responsibilities are assigned to the parents. Currently, WIC materials discuss what to feed children and what not to feed them, but it may be prudent to raise awareness about the risks of toddler consumption of unhealthy foods purchased for adult consumption.

Several limitations are worth noting. First, the study was based on a convenience sample with a relatively small size, and approximately one third of the sample was lost to follow-up. Unfortunately, this group was difficult to follow, largely because of phone numbers that were no longer in service. Second, the sample was exclusively Latino of predominantly Mexican origin, so findings may not be representative of other Latino subgroups or ethnic groups. Third, only indulgent and authoritative feeding practices were examined, so findings may not be generalizable to authoritarian or neglectful feeding practices. Furthermore, feeding practices were all self-reported and therefore were subject to inaccuracies and biases. Finally, the authors did not measure physical activity of toddlers in this study. Strengths include the use of a TFQ designed and validated for use in Latinos and the use of an objective measure (food receipts) of household food availability.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The results of this study are not surprising, and confirm that the relationship between consumption of food with added sugars and child obesity is reflected in food purchases. Share of food expenditure on sweetened foods and beverages was associated with a few specific feeding practices that comprise the TFQ score, but not the overall indulgent or authoritative feeding scores. It is plausible that specific feeding practices, rather than an overall composite score of feeding practices, are better predictors of a child's risk for overweight. For example, it is conceivable that in households that regularly purchase soda, "I let my child have a drink of soda if he/she sees others in the house drinking it and wants it" is related to a toddler's exposure to sweetened beverages, which in turn serve as a risk factor for excessive weight gain.

To combat child obesity, programs should target the food purchasing decisions and provide simple but concrete guidance on the division of responsibility around feeding for the parent and child. Nutrition education, paired with wider environmental changes, is needed to keep sweetened foods and beverages out of the household—as opposed to merely out of the bellies of young children. Because a significant proportion of WIC participants are Hispanic, nutrition education interventions aimed at caregivers in the WIC setting can significantly increase the consumption of healthier foods in both English- and Spanish-speaking families.[25,26] Furthermore, nutrition education can be most effective when messages are culturally sensitive, relevant, timely, and consistent.[27-29]

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