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Food security, maternal feeding practices and child weight-for-length

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ABSTRACT

Background: Over consumption of energy-dense nutrient-poor foods may contribute to childhood obesity. We hypothesized that greater than recommended servings of sugar sweetened beverages and foods, indicators of food security, and a high maternal recumbent weight-for-length are positively associated with high percentages of child overweight/obesity.
Methods: This secondary data analysis consisted of a sample of 240 mother-child dyads. The original studies were designed to examine the effect of a public health nursing intervention on optimal childhood growth for low-income, minority children. Eligibility to participate included: 1) mothers self-identified as Hispanic; 2) children were 12–24 months old; and 3) children were enrolled in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC); and 4) children were free of any major disease. Multivariate logistic regression examined the association between child weight, weight-for-length, maternal recumbent weight-for-length, child's eating schedule, maternal attitudes on feeding, food security, and consumption of sugar-sweetened beverages, desserts and fatty meats.
Results: Receiving SNAP was positively associated with child weight-for-length (WL). Children whose mothers reported ever having received SNAP were 2.01 times more likely to be overweight compared to children whose mothers did not report ever having received SNAP (95% CI = 1.04–3.90). Children who consumed desserts were 2.87 times more likely to be overweight compared to children who did not consume desserts (95% CI = 1.19–6.88). Also, child's caloric intake was significantly associated with child WL. Children who consumed more calories were 1.00 times more likely to be overweight compared to children who consumed fewer calories (95% CI = 1.00–1.00).
Discussion: Research on food security and children's weight has reported mixed findings. Methodological issues have been identified as contributory to the inconsistent findings. Of paramount importance to these studies is the measurement of low food security.
Conclusion: Children in this sample who were food insecure, as indicated by SNAP recipients, were more likely to have a higher WL measurement. Future studies should focus on the correlation between food security and hunger/satiety cues.

1. Introduction

For infants and toddlers, growth and development reflect nutrition status and are primarily monitored by weight-for-length (WL) measurement. Even though very young children in the U.S. meet or exceed energy and protein requirements with negligible vitamin and mineral deficiencies, most consume low levels of dietary fiber and excessive amounts of dietary fat (e.g., saturated fat) and sodium (Butte, Fox,

Abbreviations: WL, weight-for-length; BMI, body mass index; CI, confidence intervals; HFSS, Household Food Security Survey; NHANES, National Health and Nutrition Examination Survey; OR, Odds ratios; WIC, Special Supplemental Nutrition Program for Women, Infants and Children; SNAP, Supplemental Nutrition Assistance Program; USDA, United States Department of Agriculture.

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Briefel, et al., 2010; Cole & Fox, 2008). The over consumption of energy-dense nutrient-poor foods is believed to contribute to the high estimates of childhood obesity (Nicklas, Yang, Baranowski, Zakeri, & Berenson, 2003; Ogden, Carroll, Kit, & Flegal, 2012). According to the 2009–2010 National Health and Nutrition Examination Survey (NHANES), 9.7% of U.S. infants and toddlers had a high weight-for-length (Nicklas et al., 2003). Estimates for high weight-for-length among U.S. Hispanics and Mexican Americans (a Hispanic sub-group) were more severe, 14.8% and 15.7%, respectively (Nicklas et al., 2003).

Because overweight and obesity are ubiquitous health concerns for Mexican American preschool children and contribute to future health outcomes, there is an unequivocal need to understand and address the ecological factors that may influence the onset of overweight and obesity in this group. The purpose of this study was to determine the association between measures of food insecurity, maternal feeding practices, maternal weight, and child WL in a sample of low income Mexican Americans. The women and children in the study were clients in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and received nutrition education every six months. This study illustrates behavioral factors that persist even with nutrition education as well as the influence of family and home environment.

To reduce the incidence and prevalence of childhood overweight and obesity in minority populations, it is necessary to create deep understandings of factors that contribute to the problem. Descriptive research allows for discovery of hypotheses that can be further tested through experimental research. Without such understanding, it becomes much more difficult to create parsimonious research trials that can yield useful and meaningful data for clinical practice. The authors hypothesized that these social, interpersonal, and behavioral factors, in particular, food and beverage intake, various measures of food insecurity, including receiving Supplemental Nutrition Assistance Program (SNAP) benefits (known colloquially as Food Stamps), and a high maternal body mass index (BMI) are positively associated with high percentages of child overweight and obesity (WL values ≥85th percentile using CDC standards for WL) (Barlow & The Expert Committee, 2007).

It is now commonly accepted that by age five, children's dietary patterns and food preferences are well established (Birch & Fisher, 1998; Farrow & Blissett, 2012). Dietary patterns and ultimately food preferences of children are influenced by their parents' feeding practices (Benton, 2004; Faith, Scanlon, Birch, Francis, & Sherry, 2004; Hodges, 2003). Parental feeding practices create the social learning environment wherein the child adopts the eating behaviors role-modeled by the parent. Harmful feeding practices such as restrictive feeding, insistence/pressure to eat, and emotional eating as well as the amount and type of foods given are associated with unhealthy eating behaviors and increased caloric intake in children (Faith et al., 2004; Hodges, 2003; Johnson, 2000; Satter, 1996; Stang & Loth, 2011; Thompson & Bentley, 2013). However, more formative research on the role of feeding practices in mothers of Mexican origin, an at-risk population for childhood obesity, is needed.

Foods offered to children are dependent on their families' food security. The United States Department of Agriculture (USDA) categories food security into four levels: high food security (no food access problems), marginal food security (anxiety over food sufficiency with no changes in diets or food intake), low food security (reduced quality, variety, or desirability of diet without changes in food intake), and very low food security (disrupted eating patterns and reduced food intake) (United States Department of Agriculture, 2012). The last two levels encompass food insecurity. Food insecurity is a household-level indicator of minimal economic conditions and reflects limited or uncertain access to food (National Academic Press, 2006). Very low food security indicates that hunger is present, which is an individual-level condition (National Academic Press, 2006). Food banks, large distribution sites of donated foods and other products, are sponsored by non-profit agencies, provide food to clients who meet eligibility criteria, and serve as a private response to community hunger via smaller, local food pantries. Obtaining emergency food assistance from food pantries, emergency kitchens, or similar programs is a coping mechanism used by low-income households to augment household food supplies (United States Department of Agriculture, 2012).

The lack of nutrient-dense food has deleterious effects on children's mental and physical development, including developmental delays, iron-deficiency anemia, learning difficulties, and emotional/behavioral problems (Ludwig, Blumenthal, & Willett, 2012). Evidence for the association between obesity and food security is inconsistent; some researchers reported no associations (Jones & Frongillo, 2007; Whitaker & Sarin, 2007) while others reported a lower risk between obesity and low food security (Rose & Bodor, 2006). The most consistent evidence for a positive association between obesity and low food security is among low-income women (Laraia, Epel, & Siega-Riz, 2013; Townsend, Peerson, Love, Achterberg, & Murphy, 2001). Moreover, very low food security is associated with an increased intake of total calories, calories from fat, and added sugar in children of Mexican origin (Sharkey, Nalty, Johnson, & Dean, 2012).

Results from several studies show that maternal weight is a strong predictor of childhood obesity (Gibson et al., 2007; Kaar, Crume, Brinton, et al., 2014; Maffeis, Talamini, & Tato, 1998; Starling, Brinton, Glueck, et al., 2015; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). Genetic predisposition, prenatal influences, and factors in the home environment contribute to this association. Additionally, among U.S. Hispanic immigrants, maternal weight and child weight are highly correlated regardless of acculturation level (Barroso, Roncancio, Hinojosa, & Reifsnider, 2012; Rosas et al., 2011). It is speculated that immigrant families who experience very low food security, consume more energy-dense nutrient-poor foods, eat larger portion sizes, have higher rates of binge eating, and have adopted sedentary lifestyles.

Social-ecological models provide a framework to comprehend and address the intrapersonal, interpersonal, socio-cultural, built, and policy environments that interactively influence a person's health decisions, behaviors, and, eventually, outcomes (McLeroy, Bibeau, Steckler, & Glanz, 1988; Richard, Gauvin, & Raine, 2011; Stokols, 1996). For a child, a social-ecological model outlines the various levels of influence in his/her environment that contribute to his/her growth and development (Reifsnider, Allan, & Percy, 2000; Reifsnider et al., 2006). In Reifsnider's Ecological Model of Growth (EMG), an experience-based model grounded in human ecology (Brofenbrenner, 1979) and epidemiology (Reifsnider, 1995), the microsystem, mesosystem, exosystem, and macrosystem interact synergistically with the epidemiological concepts of agent and host to support and guide growth and development. The microsystem consists of relationships within the family, most intensely with the parents. The activities and social interactions of a child in various settings (the home, daycare center, school, etc.), and the linkages and processes between the various settings of the child comprise the mesosystem. The mesosystem also includes the linkages and processes of the various settings of the parent (caretaker) that indirectly influence the child. The exosystem reflects the influence of the broader community in which the child and the family reside. The macrosystem can be considered as the broader culture that embraces all of the characteristics of the microsystems, mesosystems, and exosystems of the child and his/her salient others (parent) (Brofenbrenner, 1979). The concept of agent reflects the food available to the child to enhance and sustain growth. The host is the child and includes the child's individual characteristics including weight, length, eating behaviors, caloric intake. In this study, the EMG provided the theoretical framework to examine the influences of the child's microsystem (parental feeding practices, parental body size, food accessibility) and mesosystem (neighborhood characteristics including food banks) to child overweight/obesity. The parent tends to be an active participant in the child's microsystem and mesosystem; hence, the influence of the parent (positive or negative) is imperative (Acharya, Feese, Frankli, & Kabagambe, 2011; Reifsnider, Gallagher, & Forgione, 2005). The influences of the exosystem or macrosystem are beyond the scope of this paper.

2. Materials and methods

2.1. Study participants

This cross-sectional secondary data analysis used visit 1 data from a longitudinal study with 374 children, ages 12 through 24 months, and their mothers who were enrolled in a WIC program in the Southwestern United States. Details of the full study are reported elsewhere (Reifsnider et al., 2005; Reifsnider et al., 2006). The original studies were designed to examine the effect of a public health nursing intervention on optimal childhood growth for low-income, minority children. For the current study, only 240 dyads with complete data on all measures were available for final analysis. English-Spanish bilingual study personnel trained in research methods recruited and enrolled eligible mother-child dyads at WIC clinic visits. Mother-child dyads were eligible to participate in the original study if: 1) the mothers self-identified as Hispanic (Hispanic sub-group was recorded); 2) the children were 12–24 months old at enrollment; and 3) the children did not have any major disease, metabolic illness, or neurological or developmental delays. The study was approved by the institutional review boards of a local university, a local health district, and the state level public health agency. Informed consent was obtained from all mother-child dyads. Study materials were available in English and Spanish and were interviewer- or self-administered based on the mother's preference.

The Ecological Model of Growth guided the selected of variables to be studied and the data collection during the study. The variables represented data from the Agent (Food; number of servings, types of foods eaten, caloric intake, food security); Host (child anthropometrics, caloric intake); Microsystem/Home environment (maternal BMI, parental education and employment, child feeding/eating schedule, number and type of family members, parental acculturation measures), and Mesosystem (neighborhood characteristics). Characteristics of child, parent, and family situation were also collected. Data details about food security included the amount of SNAP received per month, the number of times meals were cut or reduced in size, number of times food banks used, family income and amount of money available for food.

2.2. Anthropometrics

The child's length in centimeters to the nearest 0.1 cm and weight in kilograms to the nearest 0.1 kg were measured while the child wore only a dry diaper. The mother's height was measured using a wall-mounted stadiometer while wearing indoor clothing and shoes with heels of 1" or less and her weight was measured using a balance beam scale. WL was calculated using methods established by the National Center for Health Statistics. The growth chart from NCHS (2001) was used as the baseline to categorize children as healthy or overweight/obese. Children were categorized as healthy weight (<85th percentile for WL) or overweight/obese (≥85th percentile for WL) (Barlow & The Expert Committee, 2007). Although the category of overweight/obese is not recommended for clinical use in children under the age of two (Ogden et al., 2012), it is useful to examine the child's anthropometrics before the age of two to evaluate the child's weight status. If the child is already at the upper end of the growth continuum, it may indicate a concern about nutrition and activity that can be pursued during clinical interactions.

2.3. Food intake

A 24-hour diet recall questionnaire was used to collect information on food intake in the past 24 hours. This dietary technique is appropriate for this population because it does not require any literacy or computation skills as does a food frequency questionnaire. The reported 96 food items were re-coded into 11 categories: sugar-sweetened beverages, fruit, 100% fruit juices, unsweetened beverages, high-fat dairy, refined grain, lean meat, fatty meat, cakes and desserts, non-fried vegetables, and fried vegetables (Acharya et al., 2011). The number of servings in the new categories were used in this analysis. The recall data were then analyzed using *The Food Processor II* (Bazzano et al., 2002) (ESHA Research, Salem, Oregon), a computer program for dietary analysis for macro- and micronutrients.

2.4. Home environment and food security

Data about the child's home environment were collected from the Questionnaire about Growth and Nutrition, which was a clinical tool used by the senior author in clinical practice. The Questionnaire is completed by the child's mother and includes sections on the child's feeding history, the arrangement for daily feeding of the child, the family history of disruptive events (violence, frequent moves, etc.), parental employment, nativity, education, food security, and child's symptoms of illnesses. This questionnaire contained both qualitative and quantitative questions. The questions about food security were adapted from the USDA's Household Food Security Survey (HFSS) (Keenan, Olson, Hersey, & Parmer, 2001), and asked the mothers how often there was not enough food to feed their children, how often they had no money to buy food, and how often they skipped meals to ensure their children had enough to eat. These questions, along with the demographic information about the use of SNAP (the amount of food assistance dollars obtained monthly) and food bank use, provide a picture of food insecurity/security within the household. While the Questionnaire used in this study has yet to be validated in total, the 18-item HFSS, from which the food security questions are taken, has been validated (α = 0.74–0.93) (Frongillo, 1999; Keenan et al., 2001). Although the food insecurity measure includes items in addition to the HFSS questions, it provide a fuller picture of the family's food environment, which is part of the ecological model that surrounds the child. The additional items also provide a clinician with insight into the family's nutritional status and potential need for referral for additional food resources such as the SNAP.

2.5. Maternal feeding practices

Maternal feeding practices were obtained from the Child Feeding Questionnaire (Johnson & Birch, 1994), which determines the amount of direction about eating provided by a mother to her child and the mother's beliefs and practices on child feeding. This study was validated (internal consistencies greater than 0.70) for Hispanic individuals from Denver, Colorado (Birch et al., 2001). Additional items were provided from qualitative questions on the Questionnaire about Growth and Nutrition that query on items about family structure, family life disruptions, amount and type of food eaten by the child, and how meals are structured for the child.

2.6. Statistical analysis

Statistical analyses were performed using the statistical software package SPSS Version 19 (SPSS, 2013). Child WL percentile values were converted into z-scores. Only one child in the sample was classified as underweight based on the CDC age and sex growth charts, therefore we made the decision to drop this case from all analyses (N = 240). Descriptive statistics are reported as frequencies, percentages, means, and standard deviations (SD). A multivariate logistic regression analysis was performed in which child WL (healthy weight vs. overweight) was regressed on child's gender, maternal BMI, child's feeding schedule, cutting the size of the child's meal, running out of money for food, running out of food, visiting a food bank, receiving SNAP, child's consumption of sweetened beverages, child's consumption of desserts, and child's consumption of fatty meats, and child's caloric intake. All food items were based on consumption in the past 24 hours. Odds ratios (OR), 95% confidence intervals (95% CI), and levels of significance are reported. A two-sided significance level of .05 indicated statistical significance. Child's

consumption of fatty meats and child's caloric intake were evaluated as continuous variables whereas child's gender, maternal BMI, child's feeding schedule, cutting the size of the child's meal, running out of money for food, running out of food, visiting a food bank, receiving SNAP, child's consumption of sweetened beverages, and child's consumption of desserts were dichotomous.

3. Results

The mean age of the 240 children included in the present study was 17.0 months (SD = 4.17) and the mean age of the mothers was 26.20 years (SD = 5.81). The mean education of mothers was 10.6 years (SD = 2.4). In terms of child gender, 125 (51.7%) of the children were boys and 116 (48.3%) were girls. The majority of the infants and toddlers were overweight (52.9%) and 78.4% of the mothers were overweight.

Chi-square Fisher's Exact Tests compared all binary predictors (i.e., child's gender, maternal BMI, child's feeding schedule, cutting the size of the child's meal, running out of money for food, running out of food, visiting a food bank, receiving food stamps/SNAP, child's consumption of sweetened beverages, and child's consumption of desserts were dichotomous) by child WL. The results are presented in Table 1. No statistically significant differences were observed for child's feeding schedule, cutting the size of the child's meals, visiting a food bank, or the consumption of sugar-sweetened beverages by child WL. However, child's gender, maternal BMI, running out of money for food, receiving SNAP, and the consumption of desserts differed significantly by child WL. The majority of families did not experience food insecurity to the level of cutting the size of the children's meals, running out of money to buy food, running out of food, or visiting a food bank. However, there was a subset of families who did experience these deleterious events, and the percentage varied from 32.5 percent for running out of money for food, to 10.8 percent for visiting a food bank.

Multivariate logistic regression was used to examine the association between child WL and child's gender; maternal BMI; child's eating schedule; cutting the size of the child's meals, running out of money for food, running out of food; visiting a food bank, receiving SNAP; child's consumption of sweetened beverages, desserts and fatty meats; and child's caloric intake. Child's gender, maternal BMI, child's feeding schedule, cutting the size of the child's meal, running out of money for food, running out of food, visiting a food bank, child's consumption of sweetened beverages, and child's consumption of fatty meats were not significantly associated with child WL. However, receiving SNAP, the child's consumption of desserts, and the child's caloric intake significantly predicted child WL. Specifically, receiving SNAP was positively associated with child WL in that children whose mother's reported ever having received SNAP were 2.01 times more likely to be overweight compared to children whose mothers did not report ever having received SNAP (95% CI = 1.04–3.90). Also, children who consumed desserts were 2.87 times more likely to be overweight compared to children who did not consume desserts (95% CI = 1.19–6.88). Finally, child's caloric intake was significantly associated with child WL in that children who consumed more calories were 1.00 times more likely to be overweight compare to child who consumed fewer calories (95% CI = 1.00–1.00) (Table 2).

Table 1
Comparisons by child weight status (N = 240).

	n (%)
Child WL	
Healthy weight	113 (47.1)
Overweight	127 (52.9)
Child gender	
Male	124 (51.7)
Female	116 (48.3)
Maternal BMI	
Healthy weight	49 (21.6)
Overweight	178 (78.4)
Child's feeding schedule	
No schedule	89 (38.9)
Scheduled	140 (61.1)
Cut size of child's meals	
Never	202 (88.6)
Ever	26 (11.4)
Run out of money for food	
Never	154 (67.5)
Ever	74 (32.5)
Run out of food	
Never	164 (68.3)
Ever	63 (26.3)
Visited a food bank	
Never	202 (84.2)
Ever	26 (10.8)
Received SNAP	
Never	133 (58.3)
Ever	95 (41.7)
Consumption of sugar-sweetened beverages	
None	165 (74.7)
Some	56 (17.9)
Consumption of desserts	
None	188 (82.1)
Some	41 (17.9)
Consumption of fatty meats	mean = 0.98, SD = 1.07
Child's caloric intake	mean = 1,294.72, SD = 535.13

Frequencies that do not sum to the total N represent missing data.
SD: standard deviation.

4. Discussion

The primary goal of this study was to determine the association between maternal BMI and child WL, measures of food insecurity, and maternal feeding practices among a low-income sample of Mexican American mothers and their children. In this study, greater than 50% of children and 70% of mothers were overweight and a significant bivariate difference was found between children's WL based on their mothers' BMI (p = .021); however the mother's BMI did not predict the child's WL in the multivariate model. The positive association is congruent with that of Rosas et al (Barroso et al., 2012) who report a significant association between obese mothers of Mexican descent and overweight and obesity among their children (>85th percentile of BMI; crude OR = 2.5, 95% CI = 1.2–5.2; adjusted OR = 2.4, 95% CI = 1.1–5.3). Barroso et al (Rosas et al., 2011) also found a significant relationship between maternal body size and child size in low-income Mexican American mothers and children, with normal weight mothers more likely to have normal weight children, and overweight women more likely to have overweight children. The finding of a large percentage of overweight children among a low-income population is not surprising when viewed from the Latino cultural norm that an infant or child's being *llenito* or *gordito* (chubby) is a good thing (Brotanek,

Table 2
Logistic regression model for child recumbent weight-for-length (N = 240).

Predictor	ß	SE ß	P value	Exp(ß)	95% CI for Exp(ß)
Child's gender	−0.003	0.34	0.99	0.99	0.57–1.92
Maternal body mass index	−0.650	0.39	0.09	0.52	0.25–1.11
Child's feeding schedule	0.561	0.34	0.10	1.75	0.90–3.41
Cut size of child's meals	0.862	0.60	0.15	2.37	0.73–7.66
Run out of money for food	0.109	0.43	0.80	1.12	0.49–2.57
Run out of food	0.114	0.41	0.78	1.12	0.50–2.52
Visited a food bank	−0.185	0.55	0.74	0.83	0.28–2.45
Received food stamps/SNAP	0.700	0.34	0.04	2.01	1.04–3.90
Consumption of sugar-sweetened beverages	0.032	0.39	0.94	1.03	0.48–2.24
Consumption of desserts	1.05	0.45	0.02	2.87	1.19–6.88
Consumption of fatty meats	−0.191	0.18	0.28	0.83	0.59–1.17
Child's caloric intake	0.001	.000	0.03	1.00	1.00–1.00

SE: standard error.
CI: confidence interval.

Schroer, Valentyn, Tomany-Korman, & Flores, 2009). Among Mexican-Americans, a chubby child is perceived as a healthy child (Reifsnider et al., 2000; Rosas et al., 2010) and a mother's successful efforts of providing appropriate nourishment (Chaidez, Townsend, & Kaiser, 2011). Additionally the preference for larger bodied children may keep Mexican-American mothers from identifying their child as overweight (Kalin & Fung, 2013; Rosas et al., 2010). Reifsnider et al (Reifsnider et al., 2000) reported that among Mexican American mothers of children who attended Head Start, a healthy child was described as one who was happy and active, regardless of child WL. An unhealthy child was described as thin, unkempt, and obviously in need of maternal attention. In the Reifsnider et al (Reifsnider et al., 2000) study, child appearance reflected a mother's competence as a mother, and a thin child demonstrated a mother's lack of attention, which reinforces the findings of Chaidez et al (Chaidez et al., 2011).

In our study, food insecurity measures as indicated by the items of 'run out of money for food'; 'run out of food'; 'visit a food bank'; and 'cut size of child's meals' are significantly different between the children with healthy weight and those who are overweight. The children with healthy weight are more likely to be in families that run out of money for food, run out of food, cut the size of meals, or visit food banks. These practices could reflect lack of excess calories from food of poor nutritional value since many non-nutritive foods are heavy with calories from fat and sugar. Contrary to our expectations of the impact of food insecurity on children's W/L, receiving SNAP is significantly associated with a child's WL in the multivariate model. Previous research on food security and children's weight has reported mixed findings, with some studies reporting a positive association between food insecurity, others a negative association, and still others reporting no association (Andersen, 1990; Jones & Frongillo, 2007; Kalin & Fung, 2013; Laraia et al., 2013; Rose & Bodor, 2006; Whitaker & Sarin, 2007). In their summary of food security and overweight and obese children research, Eisenmann et al (Eisenmann, Gundersen, Lohman, Garasky, & Stewart, 2011). identify several methodological issues that may contribute to the inconsistency of these findings. Of paramount importance is the measurement of food insecurity, a concept measured at the household-level rather than at the child-level, where individual hunger (potentially related to food insecurity) is experienced (Coleman-Jensen, Nord, Andrews, & Carlson, 2012). However, valid methods for the measurement of resource-constrained hunger resulting from food insufficiency have not been developed (Barlow & The Expert Committee, 2007). Other methodological issues cited by Eisenmann et al (Eisenmann et al., 2011) include small sample size and differences in study populations related to age, gender, and race variations. For our study, we chose to use items that reflect a family's practices regarding the acquisition of food rather than a global measure of food security.

Not unexpectedly in our results, children who ate more desserts twice as likely to be overweight than children who did not eat desserts, a finding which is consistent with previous reports, and children who consumed more calories were more likely to be overweight. Although a minority of families allowed their children to eat desserts (17.9%) and drink sugar-sweetened beverages (17.9%), the extra calories made enough of an impact on the child's W/L to be statistically significant in the multivariate model. Calories contribute to weight gain and even very young low income children are not resistant to this finding. The American Academy of Pediatrics has clear nutritional and feeding guidelines for preschool children and the guidelines are available in the publication *Bright Futures* (Hagan, Shaw, & Duncan, 2008), and the USDA has multiple online resources for planning meals for children under ChooseMyPlate (Resources for Nutrition & Health & United States Department of Agriculture). Neither resource includes desserts as a regular part of a preschooler's meals and sugar-sweetened beverages are discouraged.

In the past, food insecurity was associated with an underweight child who did not consume enough food to sustain healthy growth. Many of the current food assistance programs such as SNAP and WIC have reduced but not eliminated food insecurity. Although these programs are designed to be supplemental to a family's diet, families may rely on these programs for the majority of their food and use food pantries when the food supplies from the supplemental programs are gone. Ludwig et al (Ludwig et al., 2012) reported that food insecurity is associated with an overweight child who eats a low-quality high calorie diet. More than seven times as many children in low-income families are overweight compared to underweight (Coleman-Jensen et al., 2012). Our finding that overweight low income children are more likely to be in families that receive SNAP may reflect the food items that are purchased with the SNAP vouchers. If the SNAP benefits are used to purchase food of low nutritional quality in the families of overweight children while the families of healthy weight children purchase food of higher nutritional quality with their food assistance, the resulting differences in child's WL may be explained. An alternative explanation is that even with SNAP, very low income families do not purchase sufficient food to allow for excess body weight. Further research in the area of the types of food purchased with SNAP and the distribution of nutrients in those foods is warranted, especially in families of varying income levels, considering that all families who receive SNAP and WIC are considered low-income but some are much more below the poverty level than others.

The current study also found that over a third (37.1%–40.2%) of children had no eating schedule, and approximately a quarter (26.2%–24.6%) reported consumption of sweet beverages. A systematic review by Hurley et al (Hurley, Cross, & Hughes, 2011) examined 31 studies of responsive or non-responsive feeding. Hurley et al (Hurley et al., 2011) characterized responsive feeding as being guided by caregivers' identifying and reacting to children's satiety and hunger cues, whereas nonresponsive feeding was described as caregivers' excessive control of feeding or lack of involvement in feeding. Most studies in their review found significant relationships between caregiver feeding and child weight, but Hurley et al. suggest that study designs limit interpretation of the direction of causality. Hurley et al (Hurley et al., 2011) also noted studies linking indulgent feeding (e.g., use of feeding to regulate or calm child behavior) to lower intake of fruits/vegetables and higher intake of sweets (sodas, desserts). Though recognition of hunger/satiety cues and of indulgent feeding were not examined in the current study, current literature supports the need for further exploration.

Research is most effective when it provides information that is clinically relevant to practitioners and provides data relevant to the health and wellbeing of their patients. An ecological approach, such as used in this study, is useful for pointing out parental or caregiver behaviors that may influence child weight.

5. Conclusions

Many current sources document that food insecure children are overweight or obese and we also found that food insecure children were more likely to be overweight when the measure of food insecurity is the receipt of SNAP. These results indicate the need for practitioners to conduct careful dietary assessment along with accurate anthropometrics. It is not appropriate to assume that an overweight child is getting sufficient food to eat or that the food is of good nutritional quality. It may be that such a child has a diet comprised of large amounts of low-quality food and food of poor nutritional quality. Weight-for-length status among low income young children is not a reliable indicator of adequate nutrition. Hunger and food insecurity are still present in the United States and concentrated among the poor who rely on food assistance programs.

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