Salud Infantil:
Daily Nutritional Well-being among Latino Infants

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Peggy Bentley is a nutritional and medical anthropologist with expertise in the use of ethnographic methods for reproductive and nutrition research. She has conducted infant feeding and nutrition research in a number of international settings and has also conducted research on parenting and infant feeding among African-Americans in Baltimore, Maryland and North Carolina. Dr. Bentley is a professor of nutrition at UNC's Gillings School of Global Public Health.

Anna Maria Siega-Riz is a Professor and Associate Chair of Epidemiology at the University of North Carolina, Gillings School of Global Public Health. She has a joint appointment in the department of Nutrition and she is a fellow of the Carolina Population Center. She serves as the leader for Reproductive, Perinatal, and Pediatric epidemiology program in Epidemiology and as the Director of the Nutrition Epidemiology Core of the Nutrition Department's Clinical Nutrition Research Center. She received her Doctorate degree from the University of North Carolina at Chapel Hill in 1993 and completed a postdoctoral fellowship in reproductive epidemiology at the Carolina Population Center. Dr. Siega-Riz research interests include maternal nutritional status and its relationship with birth outcomes, gestational weight gain and obesity development, diet methodology, reproductive epidemiology, child and adolescent dietary behaviors, and trends in dietary intakes among minority populations.

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CONTENTS

EXECUTIVE SUMMARY

This preliminary report focuses on the nutritional health of Latino infants and toddlers ages 7-18 months who were enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) between October 2008 and May 2009. In this report we provide an overview of nutrient intake for infants (age 7-11 months) and toddlers (age 12-18 months) who volunteered to participate in the LIN study. We then discuss important maternal characteristics and environmental factors that affect infant and toddler micronutrient, macronutrient, and total energy intake.

- Infants and toddlers of both genders had a mean total energy intake below the dietary recommendations. The infants in the study, however, had an average weight for length z-score of -0.07. Micronutrient and macronutrient intake also varied by gender.

- The average mother in the LIN study was 25 years old, did not work outside of the home (72%), and had not graduated from high school (52%). Nearly 90% of mothers reported living with a spouse or partner. Maternal employment, maternal education, and maternal cohabitation did not influence the child's nutritional intake.

- Maternal depression was associated with varying levels of total fat, sugar and iron intake. Total energy consumption did not vary by maternal depression.

- 71% of mothers in our study were overweight or obese. Micronutrient intake varied between children with overweight mothers and children with mothers who were not overweight, while macronutrient and total energy intake was similar.

- Mothers in our study lived in households with an average of 5 persons and 92% of respondents reported a household income of less than $30,000. The majority of mothers in our sample (77%) had experienced economic hardship at some point in the past year.

- Several indicators of maternal acculturation status, including ethnic identification, American identification, English/Spanish fluency, and years in the US, suggest an association between maternal acculturation status and a child's dietary.

- Maternal feeding styles were most likely to affect micronutrient intake levels. Macronutrient intake levels varied only across feeding styles in which the mother used food to soothe her child or in which the mother reported restricting the amount of food the child could consume.

- Despite a reduced energy intake, malnutrition indicators such as weight-for-length z-scores and micronutrient consumption indicate that the children in this study are generally healthy.

PROJECT DESCRIPTION

Hispanics[1] living in the United States are at high risk for obesity. As early as preschool, disparities in overweight[2] between Hispanic children and Non-Hispanic black and white youth arise. National and state level data show high rates of overweight among preschool-aged children, with the highest prevalence observed in the Hispanic population. For the period 2003-2006, rates of overweight among U.S. children ages 2-5 years were 16.7%, 14.9%, and 10.7% for Hispanic, Non-Hispanic black, and Non-Hispanic white, respectively (Ogden et al. 2008). Similarly, in North Carolina, 2007 data show that the percentage of Hispanic children age 2-4 years that were overweight was 20.3% as compared to 12.8% for non-Hispanic children (NC-NPASS 2007). Early childhood obesity rates among Latino children pose numerous health risks and lead to an increased likelihood of adult obesity.

Although various studies have focused on overweight and obesity in young children and adolescents, few focus on Latino immigrant populations. Latino families who migrate to the United States have an increased risk for obesity through increased exposure to American diets and lifestyles that are obesegenic. However, the reasons for the transition to these obesegenic diets and lifestyles are poorly understood. The development of healthful eating patterns begins during the infant and toddler years. Therefore, early life feeding practices may help to explain the increased risk of overweight experienced by Hispanic pre-school children (Briefel et al. 2006).

Research on the assimilation of children of immigrants, strongly suggests that the contexts of reception will shape their acculturation and their development (Portes and Rumbaut 2001). In emerging Latino communities such as North Carolina, limited availability of culturally-preferred food, restrictions on driving and access to medical care and other social services, may all affect the lifestyles of mothers and their infant care practices. This study will therefore provide insights into how the context of the South is shaping infant diet and feeding practices among Latinas.

Specifically, the *Latino Infant Nutrition Study* (LIN) study aims to:

(1) Describe the dietary patterns and infant feeding practices of Latino families in North Carolina and explore associations between acculturation, infant and toddler diet, and risk of obesity;
(2) Identify Latina mothers with depressive symptoms and evaluate the relationship between maternal depressive symptoms and infant-toddler feeding patterns, infant-toddler diet, and infant-toddler activity; and
(3) Evaluate the feasibility of conducting a longitudinal, observational study of infant care, feeding practices, and the risk of obesity among Latino families.

[1] Throughout this report, the terms "Hispanic" and "Latino" will be used interchangeably to describe our study population. We recognize that these terms represent ancestries from many different countries and diverse cultures.
[2] BMI ≥ 95th percentile

NUTRITIONAL INTAKE AND HEALTHY INFANT DEVELOPMENT

Infancy and early childhood are periods of rapid physical growth and sensorimotor and cognitive development (Brown 2008). Some studies indicate that the first two years of life are the most critical for nutritional impact on growth and development (Grantham-McGregory and Baker-Henningham 2005). Carbohydrates, fats and proteins are used to provide energy, and along with vitamins and minerals provide the materials for tissues and regulating agents to support growth, maintenance and repair of the body. Specific minerals and vitamins, such as iron and zinc, are needed at specific stages of development in order to achieve full potential for cognitive development (Rosales and Zeisel 2008).

Growth is an indicator of nutritional adequacy and health status (Brown 2008). Appropriate nutrient intake is necessary to achieve full growth potential. Tracking weight gain and linear growth from birth helps to identify health problems and the need for intervention. In order to track this growth, the Centers for Disease Control and Prevention 2000 growth charts for infants 0-36 months are based on height and weight data collected by the National Health and Nutrition Examination Surveys (NHANES) are employed. These gender-specific charts show weight-for-age, length-for-age, weight-for-length and head circumference-for-age (Centers for Disease Control and Prevention 2000). The charts were compiled using information on breast-fed and formula-fed infants (Centers for Disease Control and Prevention 2000). Taking both weight and length measurements is necessary to determine how appropriate the weight is for the child's length.

Infant and toddler growth needs to be plotted regularly over time for trends to be seen. There can be wide variations in what is considered normal growth with infants following different growth patterns. The overall pattern for each individual child is what is important. If a child has an increase or decrease of 2 or more percentile lines on the growth chart since the previous visit, the child's feeding environment should be examined more closely to determine reasons for any abnormal growth patterns (Bright Futures 2008).

Though there may be periods when growth is slower or faster, healthy newborns will typically triple their weight and double their length within the first 12 months. Exclusively breast-fed infants will grow faster in the first 6 months and tend to weigh less from 6-12 months than formula-fed infants. From 6-12 months of age, infants typically gain 0.7-0.9 pounds and 0.6 inches per month (AAP 2005). Toddlers experience a significantly slower rate of weight gain with an average increase of 8 ounces and 0.4 inches per month (AAP 2005).

With the increase in weight and length comes the development of gross and fine motor skills. Brain growth occurs rapidly during the first two years of life and accounts for a high percentage of the infant's energy needs (Benton 2008). Soft bones gradually harden as calcium and other minerals are deposited into them, and muscles grow larger (Sigelman

1999). By about 12 months, most children will be able to walk independently, and most children are crawling up stairs at 15 months and able to run by 18 months (Brown 2008). As motor development occurs and activity increases, the infant's caloric needs also increase. During this period the child's intestinal tract is also maturing which will enable him or her to transition from a diet of only breast milk or formula to one that is increasingly diverse (Bright Futures 2008).

Head and tongue control, the ability to sit alone, and grasping reflexes are all part of typical physical development and are necessary for adequate nutrient intake and continued feeding skills development. At about 9 or 10 months of age, as milk or formula intake decreases and solid food intake increases, infants may begin to wean from the breast or bottle (AAP 2005). Weaning is usually complete by 12 or 14 months. Further development of gross and fine motor skills enables children to chew foods of different textures and to use cups and spoons for self-feeding (AAP 2005).

CONSEQUENCES OF POOR NUTRITIONAL INTAKE

Inadequate or inappropriate nutrient intake during infancy can impact both short and long-term health (Barker 2004), including physical and cognitive development (Grantham-McGregor and Baker-Henningham 2005). Inappropriate amounts of nutrients may cause loss of memory or increase risk of adult mental illnesses (Rosales and Zeisel 2008). Inadequate weight or height gain or lack of increase in head circumference lasting more than a few weeks can be signs of nutrition-related growth impairments. As a child transitions from a diet of only breast milk or formula, to one that includes complementary foods, it is essential that the solid foods are high in quality and adequate in quantity, including sufficient micronutrients (Black et al. 2008).

Failure-to-thrive is inadequate weight or height gain due to a calorie deficit. Energy insufficiency may be due to non-food related factors such as maternal depression, drug abuse in the home, or chronic ear infections (Krugman and Dubowitz 2003). Nutrition-related causes include over-dilution of infant formula or poor intake of iron-rich foods (Krugman and Dubowitz 2003). Infants with untreated failure-to-thrive may be at risk for cognitive and motor deficits (Krugman and Dubowitz 2003). Studies conducted in high-income countries, such as the United States, show that children who do not receive adequate nutrients during the first 2 years of life and then experience rapid weight gain later in childhood and adolescence are at increased risk of developing nutrition-related chronic diseases (Victora et al. 2008, Barker 2004).

Iron deficiency is the most common nutritional deficiency and is prevalent in the United States (Centers for Disease Control and Prevention 1998). Iron is necessary for central nervous system development. Children between 9 –18 months of age are at greatest risk of any age group for iron deficiency due to a combination of rapid growth, which increases iron needs, and inadequate intake of dietary iron (Centers for Disease Control and Prevention 1998, Brotanek et al. 2005). Pre-term or low-birthweight infants are at even greater risk of iron deficiency due to low iron stores at birth and rapid rates of growth in early infancy (Centers for Disease Control and Prevention 1998) According to NHANES data, iron deficiency is more prevalent in African American and Mexican-American children (Centers for Disease Control and Prevention 1998, Brotanek et al. 2005). Rates are also higher among children living at or below the poverty level, perhaps due to lower intakes of expensive iron-rich foods such as red meat, fish and poultry (Black et al. 2008).

The increased risk for iron-deficiency in Mexican-American children may be due to prolonged bottle use (Brotanek et al. 2005). Mexican-American parents are more likely to bottle-feed their children for extended periods of time. Prolonged bottle-feeding is associated with increased consumption of cow's milk, which can replace consumption of iron-fortified foods and cause gastrointestinal blood loss, thereby increasing risk of iron-deficiency (Brotanek et al. 2005). Effects of iron deficiency include long-term learning delays and disturbances in behavior, such as decreased motor activity and social interaction (Centers for Disease Control and Prevention 1998). Iron deficiency may also increase the risk of lead toxicity in children by increasing the body's ability to absorb lead through the intestinal tract.

Zinc is another micronutrient that is essential for adequate growth. The levels of zinc found in breast milk and the stores in infants from the prenatal environment are typically sufficient for the first 4-6 months of life (Maret and Sandstead 2006). From 7-12 months, infants need to consume adequate and appropriate amounts of complementary foods to meet increasing zinc needs (NIH 2009) Zinc deficiency initially manifests as impaired ability for wound healing, dermatitis, and loss of appetite (Maret and Sandstead 2006). More severe or long-term zinc deficiency may result in hair loss, stunting or growth retardation, increased risk of diarrhea and pneumonia (Black et al. 2008), and delayed sexual maturation. Studies in low and middle-income countries have shown stunting, defined as low height-for-age (Black et al. 2008), during the first 2 years of life, can lead to reduced height, academic achievement and economic productivity as adults, and decreased birthweight of offspring. According to NHANES (Devaney et al. 2004) data, most infants in the United States do receive adequate amounts of zinc.

Excess energy and fat in combination with inadequate amounts of physical activity can lead to overweight and obesity in childhood and adulthood (Magarey et al. 2003). Overweight and obese children are at risk of developing chronic weight-related diseases including high blood pressure, elevated cholesterol levels and insulin resistance (Magarey et al. 2003). Excessive energy and fat intake during childhood has also been shown to be associated with an increase in cancer risk during adulthood (Food and Nutrition Board 2002/2005).

RECOMMENDED DAILY NUTRITIONAL INTAKE FOR INFANTS

Nutrition needs vary for each stage of infant and child growth and development. Nutrient requirements depend on the amount of physical growth, energy expenditure, and reserves acquired in-utero or from dietary intake, and amount needed for maintenance. Appropriate nutrient intake and feeding practices during infancy and early childhood provide the basis for a lifetime of healthy eating habits (Butte et al. 2004). Caloric needs are higher per pound during infancy than any other time in the lifecycle.

Recommendations made by the 2005 Dietary Guidelines for Americans were developed for those 2 years of age and older. In order to ensure nutritional adequacy and the prevention of disease in infants and toddlers, a set of reference values has been established for each dietary nutrient (Food and Nutrition Board 2002/2005). Requirements for infants and toddlers under two are derived from the Dietary Reference Intakes (DRIs) and studies of infants and adults (Food and Nutrition Board 2002/2005). DRIs are targeted at the healthy individual and are intended to be met as an average daily intake over time, or usual intake, with day-to-day variations expected (Food and Nutrition Board 2002/2005). DRIs are estimates so it is important to monitor growth, particularly under special circumstances such as low birthweight, malnutrition, disease or disorders (Food and Nutrition Board 2002/2005).

All infants and toddlers require adequate intakes of energy, protein, fats, vitamins and minerals for developmental needs and the establishment of healthy eating habits. For about the first 6 months of life, breast milk or formula is typically adequate to meet the nutrient needs of infants (American Dietetic Association 2005). This allows the infant time to develop the muscular strength and coordination needed to eat more solid foods, and time for the gastrointestinal tract to mature enough in order to be able to digest a wider variety of foods. Starting around 4-6 months, infants start to require additional nutrients, which can be supplied through complementary foods.

Complementary foods are any food or liquid that is fed to a child in addition to breast milk or formula (Butte et al. 2004). The introduction of complementary foods provides additional nutrients and also introduces the infant to new textures and flavors, which may increase acceptance of a wider variety of foods later in life (Butte et al. 2004). Additional nutrients needed from complementary foods include energy, manganese, iron, fluoride, vitamin D, the B vitamins, zinc, vitamin E and magnesium (Butte et al. 2004). Appropriate first solid foods include single-ingredient items, such as iron-fortified cereals and pureed meats (Bright Futures 2008, Briefel et al. 2004).

The American Academy of Pediatrics and the American Dietetic Association encourage breastfeeding for at least the first 12 months of life (American Dietetic Association 2005, AAP 2005). Breastfeeding improves gastrointestinal tract functioning, neurodevelopment, immunity, and maternal and child survival (American Dietetic Association 2005). Studies have also shown that infants who breastfeed have better self-regulation of intake than those infants who are bottle-fed (Gidding et al. 2006). The American Academy of Pediatrics' infant feeding recommendations also include limiting the introduction of 100% juice until after 6 months of age, at which time no more than 4 to 6 ounces should be served daily (Bright Futures 2008; AAP 2005). Overconsumption of juice can lead to a decrease in milk consumption and an increase in energy intake, diarrhea and dental caries (Bright Futures, 2008). Cow's milk should not be consumed before 12 months as this may increase risk for iron deficiency (AAP 2005). Reduced-fat milk should not be used until after 2 years of age since fat intake should not be restricted during the first 2 years of life due to the high energy needs of infants and toddlers. If fat is restricted the child's intake of various other nutrients may also be restricted to the extent that the DRIs are not reached (Hardy and Kleinman 1994).

Toddlers eat small portions of food, approximately 1 tablespoon of food per year of age (Brown 2008). This creates the need for parents to provide three regular meals and 2 or 3 healthy snacks each day so that toddlers can consume adequate amounts of nutrients (Butte et al. 2004). Caregivers should be encouraged to gradually introduce a variety of fruits and vegetables daily to infants and toddlers with a focus on nutrient-dense foods (Fox et al. 2004). Nutrient requirements are significant enough that there is little room in the infant and toddler's diet for "empty" calories (Fox et al. 2004). The table below shows DRIs for key nutrients for two age groups, 7-11 months and 12-24 months.

7-11 months (Food and Nutrition Board 2002/2005)

- Energy needs (EER): (89 x weight of infant (kg) – 100) +22 kcals for energy deposition.
- Iron: EAR 6.9mg/day and RDA 11 mg/day
- Protein: RDA 1.1gm/kg (11+ g/day)
- Vitamin C: AI 50mg/day
- Vitamin D: AI 5 µg/day
- Vitamin E: AI 5mg/day
- Fat: 50% of calories from fat (AI 30g/day)
- Zinc: AI 3 mg/day and RDA 2.5mg/day
- Total Fiber: ND (not determined)
- Calcium: AI 270mg/day

12-24 months (Food and Nutrition Board 2002/2005, Devaney et al. 2004)

- Energy needs (EER) (Brown 2008) (13-35 months): (89 x weight of infant (kg) – 100) + 20 kcals for energy deposition.
- Iron: RDA 7mg/day
- Protein (1-3years): RDA 13g/day or 1.1g/kg/day
- Vitamin C: RDA 15 mg/day
- Vitamin D: AI 5 µg/day
- Vitamin E: RDA 6 mg/day
- Fat (1-3 years): ND (30-40 percent of energy)
- Zinc: RDA 3 mg/day
- Total Fiber: AI 19g/day
- Calcium (1-3years): AI 500mg/day

FACTORS AFFECTING NUTRITIONAL INTAKE AMONG INFANTS AND TODDLERS

Various factors are positively associated with healthy eating behaviors and intakes in infants and toddlers. In the 2002 Feeding Infants and Toddlers Study, among women of all races, college education was the greatest predictor of whether a mother would follow infant feeding recommendations and was positively associated with breastfeeding duration and fruit consumption (Hendricks et al. 2006). Mothers who were married and older also tended to follow most of the infant feeding guidelines (Hendricks et al. 2006).

Socioeconomic factors such as low family income and food insecurity are associated indirectly with poor eating habits and increased risk for childhood overweight (Reifsnider, Keller and Gallagher 2006). Food insecurity or food insufficiency is when a household has "limited or uncertain availability of nutritionally adequate and safe foods, or the uncertain ability to acquire appropriate foods in socially acceptable ways" (Bright Futures 2008). Food insecurity has been shown to increase risk of micronutrient deficiencies, illness and infections (Bronte-Tinkew et al. 2007). Bronte-Tinkew et al (2007) have shown that parents in households with food insecurity have high levels of anxiety and depression, which is associated with poor parenting practices and poor infant feeding practices which ultimately increases risk for child overweight (Bronte-Tinkew et al. 2007). Households in which families are at or below the poverty level are more likely to not follow infant feeding recommendations regarding duration of breastfeeding, limits on juice consumption or complementary feeding recommendations (Hendricks et al. 2006).

Genetics and the home environment are also influential. Studies of toddlers enrolled in WIC in the Southwestern US have demonstrated that those toddlers who are at risk of overweight typically had mothers who were obese (Reifsnider, Keller and Gallagher 2006, Melgar-Quinonez and Kaiser 2004). The relationship between maternal BMI and childhood overweight status could be related to heredity, shared eating patterns or home food preparation methods (Reifsnider, Keller and Gallagher 2006). Additionally, mothers who were not aware of satiety cues sent by their infant or toddler were more likely to have overweight children (Worobey, Lopez and Hoffman 2009, Reifsnider, Keller and Gallagher 2006).

Compared to non-Hispanic mothers, the 2002 Feeding Infants and Toddlers Study revealed that Hispanic mothers were younger, had lower education and income levels and were less likely to be married (Briefel et al. 2006). In general, Hispanic children had higher levels of sodium intake and lower levels of calcium intake compared to non-Hispanics (Briefel et al. 2006). However, Mexican-American households in which the mother had a high level of education were more likely to serve healthy foods than those with less-educated mothers (Crawford et al. 2001).

Female-headed Latino households, which tend to have lower incomes than two-parent households, also have greater risk of food insufficiency (Mazur, Marquis and Jensen 2003). Food insufficiency can have long-term impacts on the dietary behaviors of children, including eating less expensive but nutritionally poor foods, which contribute to obesity (Mazur, Marquis and Jensen 2003). Children in food insecure households are also more likely to demonstrate behavioral, academic and emotional difficulties than children who do not report multiple experiences of hunger (Kleinman et al. 1998).

Among Mexican-American families, family support for eating meals together and having healthy foods available in the home is strongly correlated with healthful behaviors in children (Ayala et al. 2007). Using data focused exclusively on Mexican-American mothers, Matheson et al. (2006) link the desire of Mexican-American mothers to provide healthy foods to higher intakes of fruit in children. In addition, modeling of healthy food behaviors showed a negative association with percentage of energy from fat consumed (Matheson et al. 2006).

Hispanic mothers have much higher WIC participation rates compared to non-Hispanic mothers (Briefel et al. 2006). Enrollment in WIC has been shown to have a positive effect on the iron status and dietary intakes of Mexican-American participants (Melgar-Quiñonez and Kaiser 2004). However, WIC participants of all race-ethnicities are also more likely to formula feed (Hendricks et al 2006).

Acculturation status has also been thought to impact weight and dietary habits, with limited acculturation associated with lower intakes of fat and sodium, and less food insufficiency (Mazur, Marquis and Jensen 2003). Acculturation is generally defined as the process in which individuals adopt some or all of the values, behaviors and beliefs of a new culture and at the same time may reject some or all traditional beliefs, values and behaviors (Dave et al. 2009). This may involve a change in eating behaviors such as the addition, rejection or substitution of certain foods or groups of foods (Bright Futures 2008). Acculturation status can be measured by asking about primary language use, generation status, age upon arrival in the United States and number of years in the US (Ayala, Baquero and Klinger 2008).

Hispanic toddlers in English-speaking homes have been shown to have higher levels of energy consumption with a higher percentage of calories coming from carbohydrates (i.e. sugar-sweetened beverages) compared to Hispanic toddlers in Spanish-speaking households (Briefel et al. 2006). NHANES data has revealed that higher acculturation status in Hispanic mothers, as identified by the language spoken in the home, is associated with lower breastfeeding rates compared to less acculturated mothers (Hendricks et al. 2006). Conversely, other studies have shown that fruit and vegetable intake among Latino children is low regardless of language spoken in the home (Dave et al. 2009). Additionally, country and location of origin, such as rural or urban, may have an impact on dietary habits, with some families reluctant to purchase unfamiliar fruits or vegetables (Ayala, Baquero and Klinger 2008).

Studies using data from NHANES and Hispanic HANES showed that regardless of the measure of acculturation, Latinos who are less acculturated are more likely to consume recommended levels of nutrients (Ayala, Baquero and Klinger 2008). Parents of Latino children who have a desire to eat American food may have a strong influence on family choices to eat in fast food restaurants (Ayala, Baquero and Klinger 2008). Greater consumption of fast food, sodas, snacks and dietary fat was associated with parents who were influenced by their children to purchase food that was advertised on TV (Ayala et al. 2007).

Cultural views about what is considered a healthy body size can also impact child-rearing practices that influence bodyweight. Mexican-American mothers may have a greater preference for chubby babies (Crawford 2001). This preference may inhibit the parent's ability to recognize their child as overweight or unhealthy. Good health may be viewed as the ability to perform normal daily living tasks regardless of size (Ward 2008).

Throughout Latin America, the prevalence of overweight and obese youth is increasing and is now similar to the prevalence in the United States (Perez-Escamilla 2009). This may make it difficult to determine if overweight and obesity rates among Hispanic immigrants in the US are a function of acculturation or changes in dietary habits that are occurring within their home countries.

METHODS

In the LIN Study, data were collected on 56 low-income Latina mothers and their infants who attended WIC clinics in Durham County and Orange County, North Carolina. Mothers between the ages of 18 and 35 years with infants and toddlers ages 7-18 months who self - identified as Hispanic or Latina were included in the sample.

In order to obtain a sample of mothers with infants and toddlers across the full age spectrum of 7-18 months, we have included (1) 9 first-time mothers with infants 7-10 months, (2) 10 non first-time mothers with infants 7-10 months, (3) 8 first-time mothers with infants ages 11-14 months, (4) 10 non first-time mothers with infants ages 11-14 months, (5) 10 first time mothers with infants ages 15-18 months, and (6) 9 non first-time mothers with infants ages 15-18 months. Mothers were screened and recruited for participation at WIC clinics using convenience sampling. Eligible children were born after 38 weeks gestation, weighed more than 1500 grams at birth and had no chronic or congenital illness that interfered with dietary intake, growth, or development. Children with Down's syndrome, epilepsy, cleft lip or palate, cerebral palsy, failure to thrive, or diagnosed mental retardation were not eligible to participate. If eligible after screening, mothers were asked if they were interested in participating in the study and their contact information was recorded. Mothers were then contacted by phone to arrange a meeting time and interviewers visited mothers in their homes to complete data collection. Of the 84 mothers who were eligible after screening, 28 (33%) refused to participate in the study. Common reasons for refusal included having to consult a spouse or partner, not being interested, or not having enough time to participate.

In a single home visit, mothers completed an interview-administered survey which gathered information regarding diet, physical activity, self-esteem and depression, infant feeding styles, and the home environment. In addition, each mother provided a dietary recall detailing the foods and drinks her child had consumed the day prior to the interview. Height, weight, and skin fold measurements were taken of both mother and child. All mothers received a $40 thank you gift for their participation in the study. All data were collected between October 2008 and May 2009.

Table 1 provides a summary of the content covered by each data source in the LIN study. This report provides preliminary findings of the 24-hour dietary recall data collection and nutrient calculations performed using the Nutrition Data System for Research (NDSR) software developed by the Nutrition Coordinating Center (NCC) at the University of Minnesota. The NDSR is a dietary collection system that calculates nutrient levels in a given food, recipe, meal, and day (Nutrition Coordinating Center 2009). Data from the NDSR have been merged with data from the survey. Additional information on the results of the survey, qualitative interviews, and videotaped observations is summarized elsewhere (Toledo et al. 2009).

For the purposes of the nutritional analysis, the children were classified into two age groups, age 7 to 11 months (infants) and age 12-18 months (toddlers). These classifications reflect the age classifications identified by the Dietary Reference Intakes (DRIs). Children who were breastfeeding at the time of the interview were not included in the nutrient intake analysis due to an inability to accurately measure the amount of breast milk consumed during the 24 hour period.

Table 1. LIN Data

Full Sample Content Areas (N = 56)

(1) Infant Health and Behavior
(2) Infant Feeding Beliefs and Behaviors
(3) Infant Anthropometry
(4) Maternal Anthropometry
(5) Maternal Health and Behavior
(6) Maternal Employment and Income
(7) Maternal Acculturation and Social Support
(8) Obesogenic Environment, Shopping, and Eating Patterns
(9) Neighboorhood Environment
(10) Biological Father
(11) 24 hr Dietary Recall (NDS-R)

SubSample Content Areas (N = 21)

(1) Videotaped Feeding Observations
(2) Daily Diary Checklist
(3) Qualitative Interview

OVERVIEW OF STUDY PARTICIPANTS

The average mother in the LIN study was just over 25 years old and had relatively low levels of education (Table 2). Most mothers in this study did not graduate from high school (52%). 39% of mothers received their high school diploma or GED, but only 9% of the sample pursued education past 12th grade. Although a majority of mothers (68%) had previously worked in the US, only 38% were employed at the time of the study. Respondents cited difficulty finding work and preferring to stay home with their children as reasons for unemployment. Of those mothers who were employed, 10% of mothers worked early morning or late night shifts. Participants worked an average of 29 hours, 4 days per week. When asked if work conflicted with family life or caused stress, most mothers expressed that, at times, dealing with child care problems or meeting family needs was difficult due to conflicts with work environment or schedule.

Figure 1. Health Status by Education Level

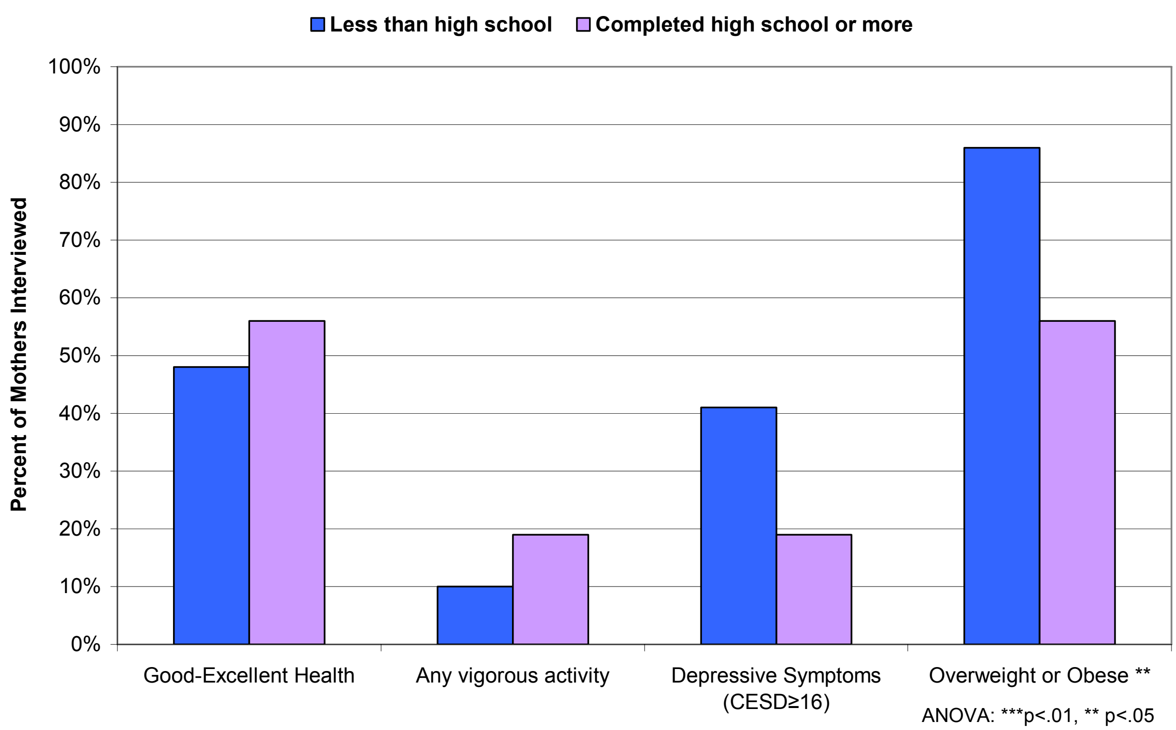


Figure 1 depicts four maternal health characteristics by education level. Respondents who completed high school or higher education were generally healthier. Those mothers who did not complete high school were more likely to be overweight or obese and to exhibit symptoms of depression. These same mothers were also less likely to report participating in any vigorous physical activity (e.g., participation in team sports, aerobics, running) or to consider themselves to be in good or excellent health.

Table 2. Selected Maternal Characteristics

	%/Mean	N Observed	N Missing
Maternal Education and Employment			
Less than High School	52%	56	0
Currently Employed Part- or Full-time	38%	56	0
Family Environment and Social Support			
Mother's Age	25.38	56	0
Living with Spouse or Long-term Partner	82%	56	0
Yougest Child's Age (Months)	12.07	56	0
First-time Mother	48%	56	0
Experienced Economic Hardship in past year	77%	56	0
Food Insecure Household (FSI>2)	21%	56	0
High Social Support (ISEL>=3)	41%	56	0
Maternal Heritage and Acculturation			
Mexican Heritage	89%	56	0
U.S. Citizen	10%	51	5
Foreign-born	91%	56	0
Less than 5 years in U.S.	34%	56	0
Strong Ethnic Identification (MEIM>3)	81%	56	0
Strong American Identification (SAI>3)	52%	56	0
BAS: High English Acc.	2%	56	0
BAS: Low Eng. and Spanish	0%	56	0
BAS:Bicultural	32%	56	0
BAS: High Spanish	66%	56	0
Experienced Discrimination in past year	41%	56	0
Maternal Health			
Self-reported health good-excellent	52%	56	0
Depressive Symptoms (CES-D >= 16)	30%	56	0
Overweight or obese based on BMI	71%	52	4
Feeding History			
Ever breastfed Infant	91%	56	0
Avg. months of breast feeding among those that breastfed	5.27	37	0
Breastfed less than 6 months	34%	56	0
Breastfed less than 12 months	61%	56	0
Ever fed infant formula	91%	56	0
Avg. age formula use began among formula users (months)	1.90	51	0
Avg. age other liquids introduced (months)	5.02	56	0
Avg. age solids introduced (months)	6.25	55	1
Feeding Beliefs and Behaviors Indicators (1=yes)			
Laissez-faire Diet	11%	56	0
Pressures to finish	54%	56	0
Overfeeds with cereal or breastmilk	41%	56	0
Soothes with food	20%	56	0
Restricts Food Intake	79%	56	0
Restricts Diet Quality	80%	56	0
Responsive to child's satiety	89%	56	0
Responsive attention provided during feeding	82%	56	0
Indulgent: Permissive Feeding	4%	56	0
Indugent: Coaxes child with food	0%	56	0
Indulgent: Soothes child with food	0%	56	0
Indulgent: Pampers child with food	0%	56	0

Note: Indicators are created based on responses to the subscales of the IFSQ.

OBSERVED DAILY NUTRITIONAL INTAKE FOR LATINO INFANTS AND TODDLERS

Our study evaluated breastfeeding behaviors and dietary intake (micronutrient and macronutrient consumption as well as total energy intake). Since only one day of intake was collected we were not able to estimate usual intake and thus cannot calculate the proportion of the population that has inadequate intake.

Breastfeeding

The vast majority of the mothers interviewed (91%) reported that they had breastfed their child. Fourteen mothers were breastfeeding at the time of the interview and were excluded from these nutritional analysis. On average, duration of any breastfeeding was 5.27 months, slightly below the AAP recommendation of 6 months of exclusive breastfeeding.

Micronutrient Consumption

With respect to micronutrient consumption, on average, intakes by both infants and toddlers were above the recommended intake for every micronutrient except vitamin E (Table 3). This lower intake of vitamin E is similar to the results of both the Feeding Infants and Toddlers Study (FITS) and NHANES (Devaney et al 2004). NHANES also found that while a majority of its respondents reported vitamin E intakes below the EAR, very few had low blood plasma levels of vitamin E (Devaney et al 2004). This may indicate that accepted recommendations are actually higher than minimally required for healthy development.

Adequate levels of zinc and iron are imperative for normal child development. According to the CDC, iron deficiency is the most common micronutrient deficiency. Infants in our study received a mean of 9.92 mg/day of iron (Recommended Intake (RI) = 11mg/day) while toddlers received a mean of 5.97 mg/day (RI=3 mg/day).

Recommended calcium intake for infants is 270mg/day, the mean intake for infants in this study was 492.82 mg/day. The recommended calcium intake for toddlers is 500 mg/day, the mean intake for toddlers in this study was 823.33 mg/day. The level of calcium intake corresponds to the FITS study, which found that the children of Hispanic mothers had significantly higher calcium intakes than the children of non-Hispanic mothers (Devaney et al 2004).

Table 3. Distributions of 24-hr Recall of MicroNutrient Intakes

	Recommended	Tolerable	Mean	(sd)
		Infants 7-11 months		
Antioxidants				
Ascorbic Acic or Vitamin C (mg/d)	50	*	62.0	(35.9)
Alphatocopherol or Vitamin E (mg/d)	5	*	4.3	(2.6)
B vitamins				
Thiamin (mg/d)	0.3	ND	0.5	(0.3)
Riboflavin (mg/d)	0.4	ND	0.8	(0.4)
Niacin (mg/d)	4	*	7.3	(3.7)
Vitamin B-6 (mg/d)	0.3	*	0.5	(0.3)
Folate (µg/d)	80	*	108.0	(55.7)
Bone-related Nutrients				
Calcium (mg/d)	270	*	492.8	(286.2)
Phosphorous (mg/d)	275	*	410.6	(225.5)
Magnesium (mg/d)	75	*	81.2	(37.2)
Vitamin D (µg/d)	5	25	6.3	(3.6)
Micronutrients				
Betacarotinoids	500	600	1144.3	(1437.0)
Iron (mg/d)	RDA=11 (EAR=6.9)	40	9.9	(5.8)
Zinc (mg/d)	RDA = 3 (EAR = 2.5)	5	5.2	(2.5)
		Toddlers 12-18 months		
Antioxidants				
Ascorbic Acic or Vitamin C (mg/d)	13	400	58.3	(45.9)
Alphatocopherol or Vitamin E (mg/d)	5	200	2.7	(2.7)
B vitamins				
Thiamin (mg/d)	0.4	ND	0.8	(0.4)
Riboflavin (mg/d)	0.4	ND	1.6	(0.7)
Niacin (mgd)	5	10	8.2	(6.5)
Vitamin B-6 (mg/d)	0.4	30	1.0	(0.6)
Folate (µg/d)	120	300	182.7	(105.7)
Bone-related Nutrients				
Calcium (mg/d)	500 (AI)	2500	823.3	(384.5)
Phosphorous (mg/d)	380	3000	828.5	(340.9)
Magnesium (mg/d)	65	65	138.8	(44.2)
Vitamin D (µg/d)	5 (AI)	50	6.9	(3.3)
Micronutrients				
Betacarotiniods	210	600	1288.5	(1978.0)
Iron (mg/d)	3	40	6.0	(4.5)
Zinc (mg/d)	2.5	7	6.1	(3.9)

Note: Recommended Intake is based on the Dietary Reference Intakes (DRI) for each age group.
For children ages 7-11 months, the recommended intake is expressed in terms of an adequate intake amount (AI).
For children ages 12-18 months, the recommended intake is the estimated average requirement (EAR).
RDA = Recommended Daily Allowance, intended to meet the needs of 97% of healthy individuals.
Infants currently breast feeding are not included in this analysis
*UL not established because of a lack of data, ND = not determined; NA = not applicable.

Macronutrient Consumption

Looking at macronutrient consumption, we found that the mean total energy intake (883.1 kcal/day) fell below the recommended intake of 1046 kcal per day, despite the fact that almost every micronutrient had a mean intake at or above the adequate intake level. This suggests that the Latino infants in our study consumed nutrient rich food, a finding which was affirmed by participants' expressing a preference for buying fresh meats and produce (Toledo et al., 2009). Fat intake expressed as the percent of energy was within the acceptable macronutrient range of 30 to 40% for toddlers. There is not AMDR range for infants.

Table 4. Distributions of 24-hr Recall of MacroNutrient Intake Distributions

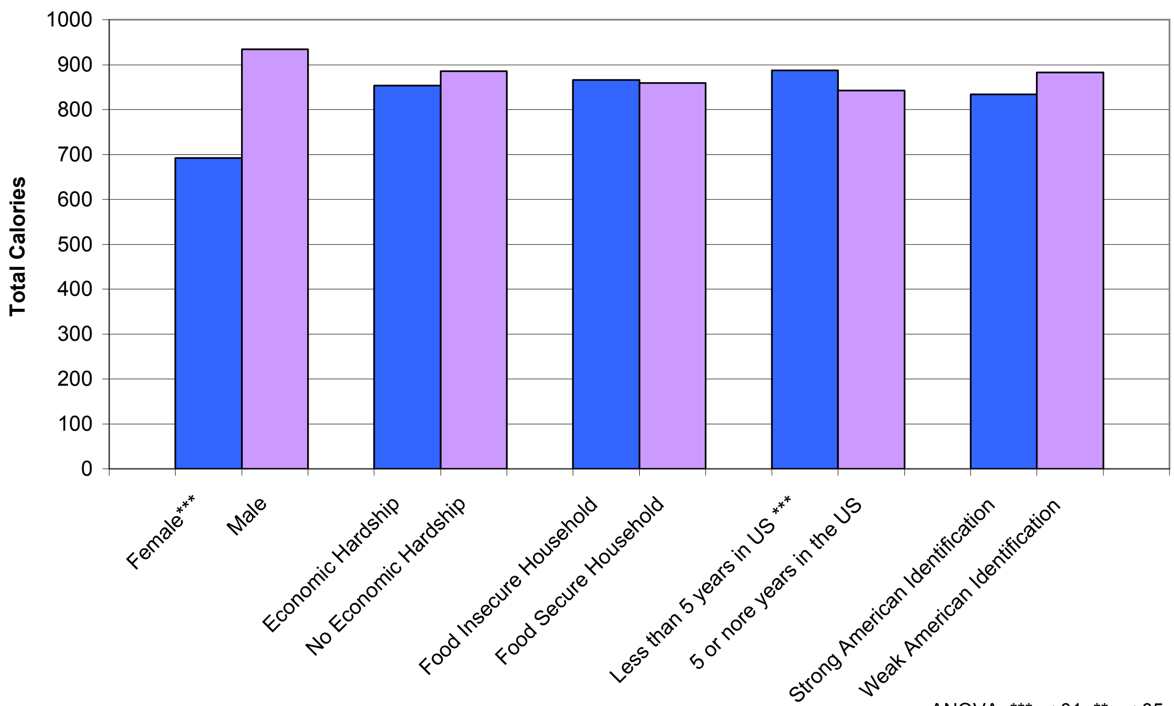
	Recommended Intake	Mean	(sd)
	Infants 7-11 months		
Total Sugar (g/d)	*	66.2	(3.9)
Fat (% of energy)	30	24.8	(13.8)
Total Saturated	ND	9.8	(5.3)
Total Monounsaturated (mu)	*	9.1	(5.3)
Total Polyunsaturated (g/d)	5.1 (AI)	4.8	(2.9)
Carbohydrate (g/d)	95	85.3	(36.9)
Total Protein (g/d)	11+ (RDA)	18.3	(9.8)
Animal Protein (g/d)	*	12.5	(9.1)
Vegetable Protein (g/d)	*	5.8	(5.7)
Dietay Fiber (g/d)	NA	3.4	(2.1)
Cholesterol (mg)	ND	45.0	(73.8)
Fat Calories	NA	32.9	(10.7)
Carbohydrate Calories	NA (130=RDA)	55.7	(11.6)
Protein Calories	NA	11.5	(5.7)
Total Calories (kcal/d)	743	633.4	(283.6)
	Toddlers 12-18 months		
Total Sugar (g/d)		73.7	(30.1)
Fat (% of energy)	30-40 (AMDR)	30.3	(13.8)
Total Saturated (g)	ND	13.3	(6.7)
Total Monounsaturated (mu)	*	9.6	(4.6)
Total Polyunsaturated (g/d)	7.7 (AI)	4.2	(2.2)
Carbohydrate (g/d)	100	114.8	(44.0)
Protein (g/kg/d)	13g/day	40.3	(20.0)
Animal Protein (g/d)	*	32.5	(20.1)
Vegetable Protein (g/d)	*	7.8	(6.0)
Dietary Fiber (g/d)	19	6.2	(3.6)
Cholesterol (mg)	ND	184.7	(128.4)
Fat Calories	30-40	30.4	(8.4)
Carbohydrate Calories	45-65	51.5	(10.4)
Protein Calories	5 to 20	18.1	(4.9)
Total Calories (kcal/d)	1046	883.1	(319.6)

Note: Recommended Intake is based on the Dietary Reference Intakes (DRI) for each age group.
For children ages 7-11 months, the recommended intake is expressed in terms of an adequate intake amount (AI).
For children ages 12-18 months, the recommended intake is the estimated average requirement (EAR) or acceptable macronutrient distribution range (AMDR).
RDA = Recommended Daily Allowance, intended to meet the needs of 97% of healthy individuals.
For energy intake, the recommended intake is based on the estimated energy requirements
Infants currently breast feeding are not included in this analysis

FACTORS INFLUENCING DAILY NUTRITIONAL INTAKE

To determine which factors influenced nutritional intake, we examined micronutrient and macronutrient consumption, as well as total energy intake (Figure 2) across child's gender, as well as across selected maternal characteristics. The maternal characteristics examined were education, employment, family environment/social support, acculturation, and feeding styles. Detailed results are included in Appendix 1. In this section, only significant results will be discussed.

Figure 2. Mean 24-hour Recall Total Caloric Intake



ANOVA: ***p<.01, ** p<.05

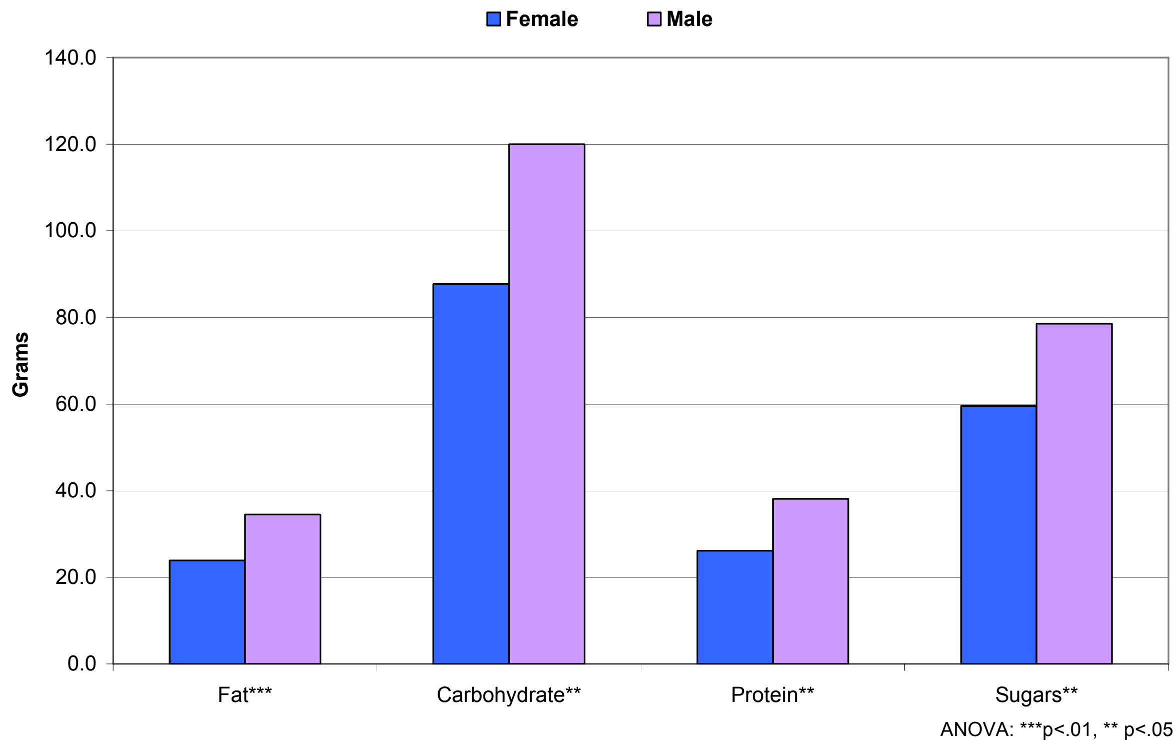
Gender

A child's gender is associated with differences in nutrient intake (Figure 3). Males were reported to have consumed higher levels of fat, carbohydrates, protein, sugars, total energy, zinc, iron, and calcium than did females. This may reflect cultural perceptions about increased energy needs of male children. Weight-for-length z-scores[3] were not statistically different across gender (mean Z_{boys} = -.48, mean Z_{girls} = .71), and Z-scores were close to 0, indicating that both genders were within the normal weight range for their length, despite

[3] A z-score is a way of standardizing a score based on known population data. In this case, the z-score is standardized to the U.S. population based on the mean weight-for-length of babies born in the U.S. and the standard deviation of their weight-for-length. Therefore, a mean z-score of 1 indicates that the mean for the infants in this study is 1 standard deviation *higher* than the mean for all infants born in the U.S. A mean of -1 would indicate that the mean for infants in this study was 1 standard deviation *lower* than the mean for all infants born in the U.S.

significantly different energy intakes. Males consumed an average of over 900 calories per day while females consumed an average of just less than 700 calories per day (Figure 2).

Figure 3. Mean Total 24-hr Intake by Child's Gender



Maternal Education and Employment

Our analysis indicated no significant differences between mean intake of either macronutrients or micronutrients between the children of women with less than a high school diploma or GED and those of women who completed high school or higher education. This is in contrast to what the FITS study found; higher education was the most important indicator of whether moms would follow dietary guidelines. Similarly, maternal employment status did not appear to affect the child's nutritional status. This analysis did not identify statistical differences in the macronutrient or micronutrient intake of the children of employed mothers as compared to those of unemployed mothers. The only statistical difference was that children of employed mothers consumed more vitamin C (78.89 g/day) as compared to the children of unemployed mothers (58.64 g/day).

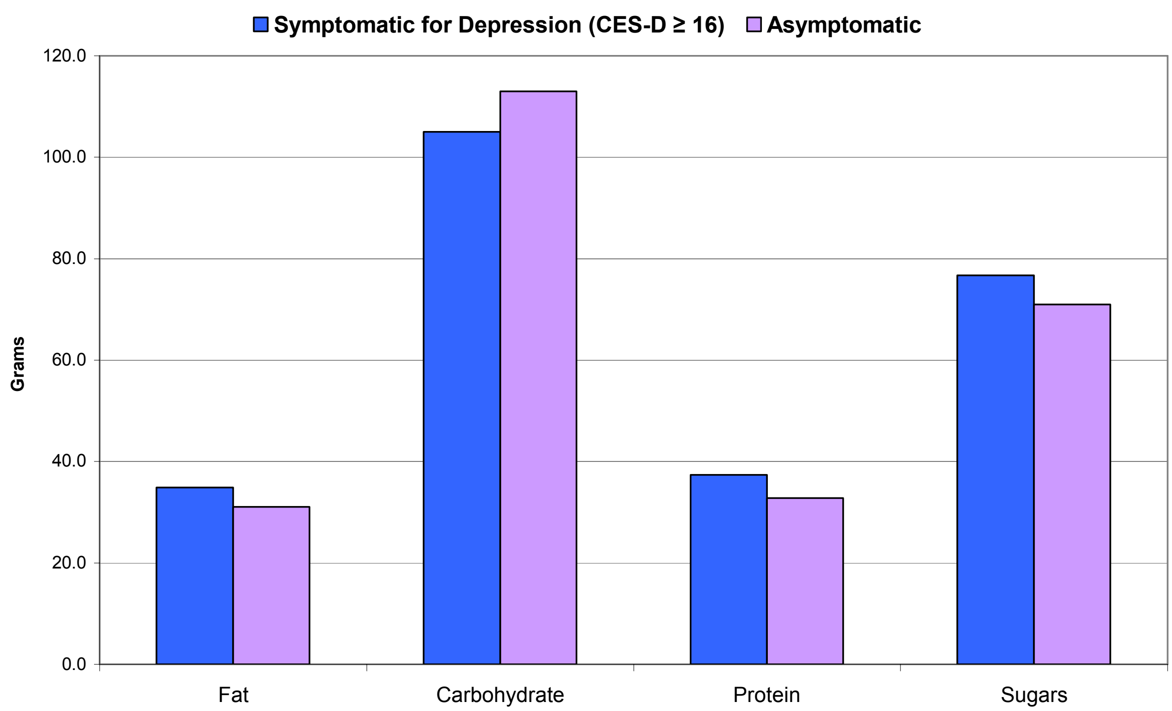
Family Environment and Social Support

A child's home environment has been found to be predictive of childhood obesity (Strauss and Knight 1999). The LIN study examined nutritional intake across the following home environment factors: maternal cohabitation, first-time mother, social support, maternal depression, maternal obesity, and economic status.

82% of mothers in the LIN study were living with their spouse or long-term partner (Table 2); however, with the exception of fiber, no statistical differences were found between the nutritional intakes of children whose mothers were cohabiting (5.6g/day of fiber) and those whose mothers were not living with a partner (2.9g/day of fiber). 48% of mothers in this study were first-time mothers (Table 2), but this did not appear to affect the nutritional status of their children. Similarly, children of mothers who reported high levels of social support (41%) did not differ significantly in their nutritional intake from children of mothers who reported low social support.

30% of mothers reported depressive symptoms[4], as indicated by a score of 16 or higher on the CES-D, a scale used to measure depressive symptoms (Appendix 2). Regarding micronutrient intakes, the only statistical difference between the children of mothers with symptoms of depression and children with asymptomatic mothers was found in iron consumption (6.0g/day vs. 9.0g/day). However, macronutrient levels did vary across the groups. The children of mothers who were symptomatic for depression consumed higher average amounts of fat and sugar per day than children whose mothers were not symptomatic for depression (Figure 4). No difference was found in total energy intake between these two groups.

Figure 4. Mean Total 24-hr Intake by Maternal Depression



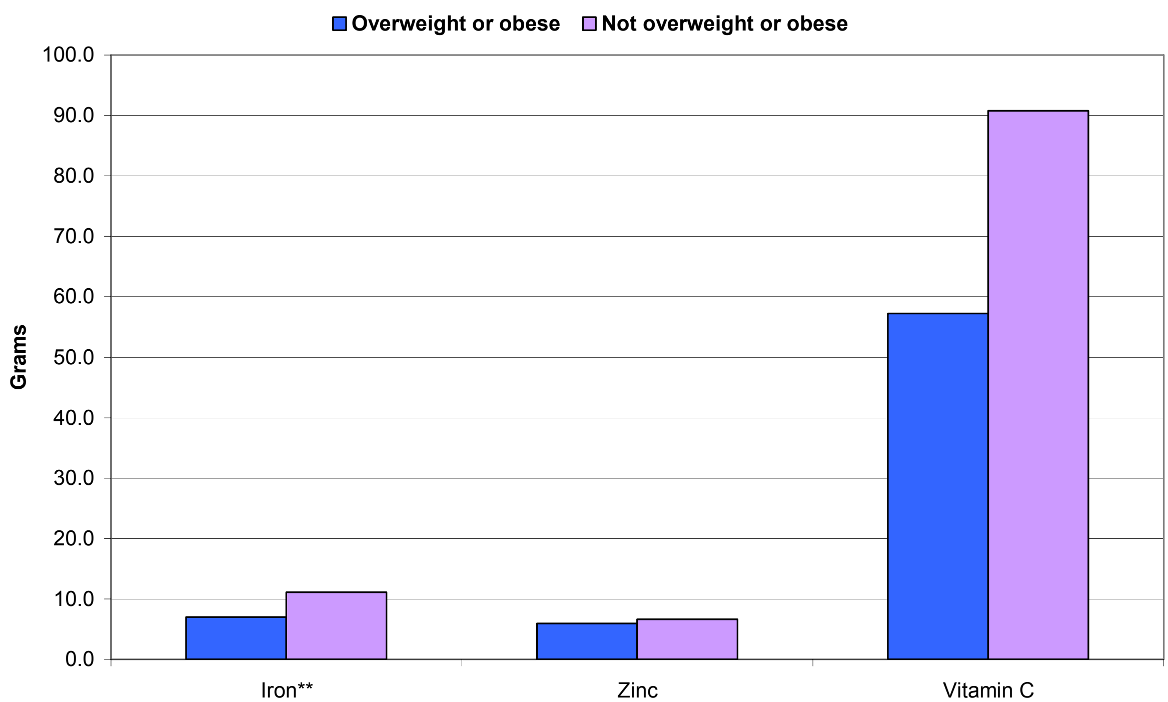
ANOVA: ***p<.01, ** p<.05

Maternal depressive symptoms are associated with a higher maternal BMI (Toledo et al., 2009). 71% of mothers in the LIN study were overweight or obese based on BMI[5] (Table 2). Like the children of mothers with depressive symptoms, children with overweight mothers

[4] References to mental health agencies were provided to these respondents.
[5] BMI of 25.0-29.9 is considered overweight. Any BMI score over 30.0 is considered obese.

had a lower average daily intake of iron than children of mothers who were not overweight (Figure 5). Children with mothers who were not overweight also had a higher average intake of vitamin C (Figure 5) than children with overweight mothers. Regarding macronutrient intake, children with overweight mothers were not found to be statistically different from children whose mothers were not overweight. Likewise child's mean total energy intake did not vary across maternal weight status.

Figure 5. Mean Micronutrient Intake by Maternal Weight Status

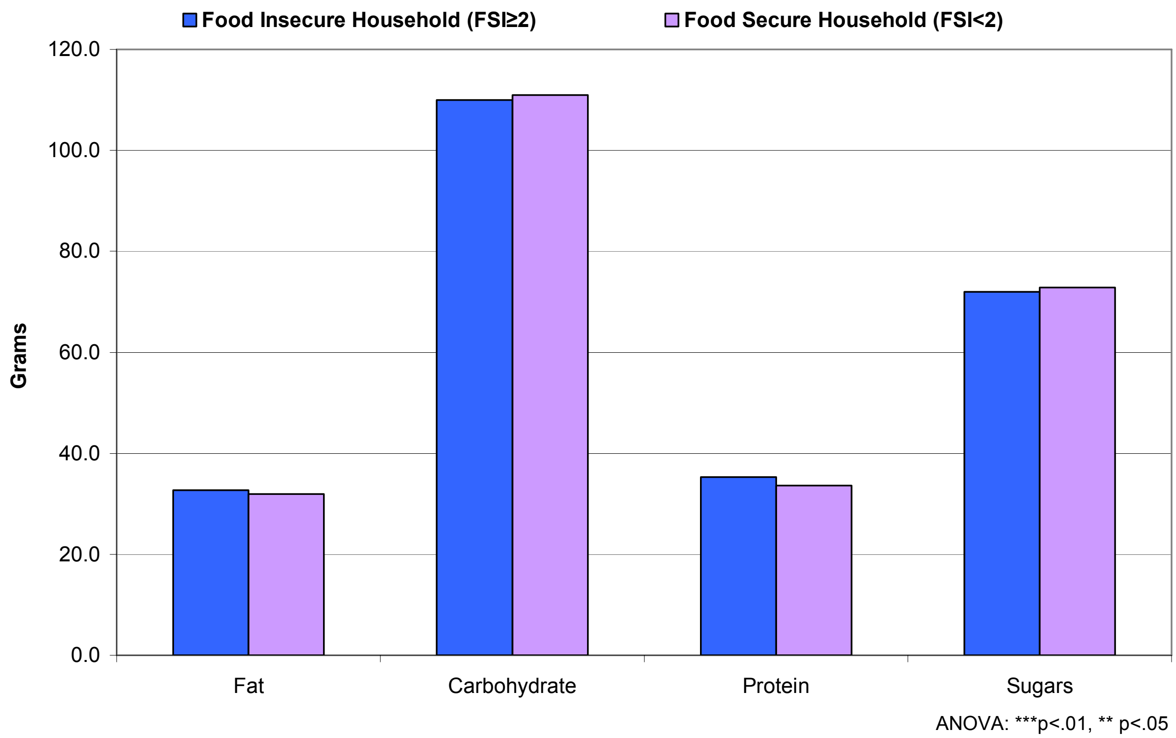


ANOVA: ***p<.01, ** p<.05

Only low-income respondents were included in the LIN study. Economic hardship can make meeting nutritional needs difficult. 77% of the respondents in this study reported experiencing economic hardship (Table 2), as characterized by discontinuance of utility service, eviction, or concerns about being unable to afford sufficient food. Nevertheless, with the exception of Vitamin E, all mean micronutrients met or exceeded recommended intake levels for children in this study. For some micronutrients, including betacarotinoids, magnesium, and phosphorous, mean intakes were more than doubled the recommended intake level. Moreover, weight-for-length z-scores did not differ statistically between children experiencing and not experiencing economic hardship. However, children of women who reported experiencing economic hardship consumed an average of approximately 32 fewer calories per day than the children of women who reported no economic hardship.

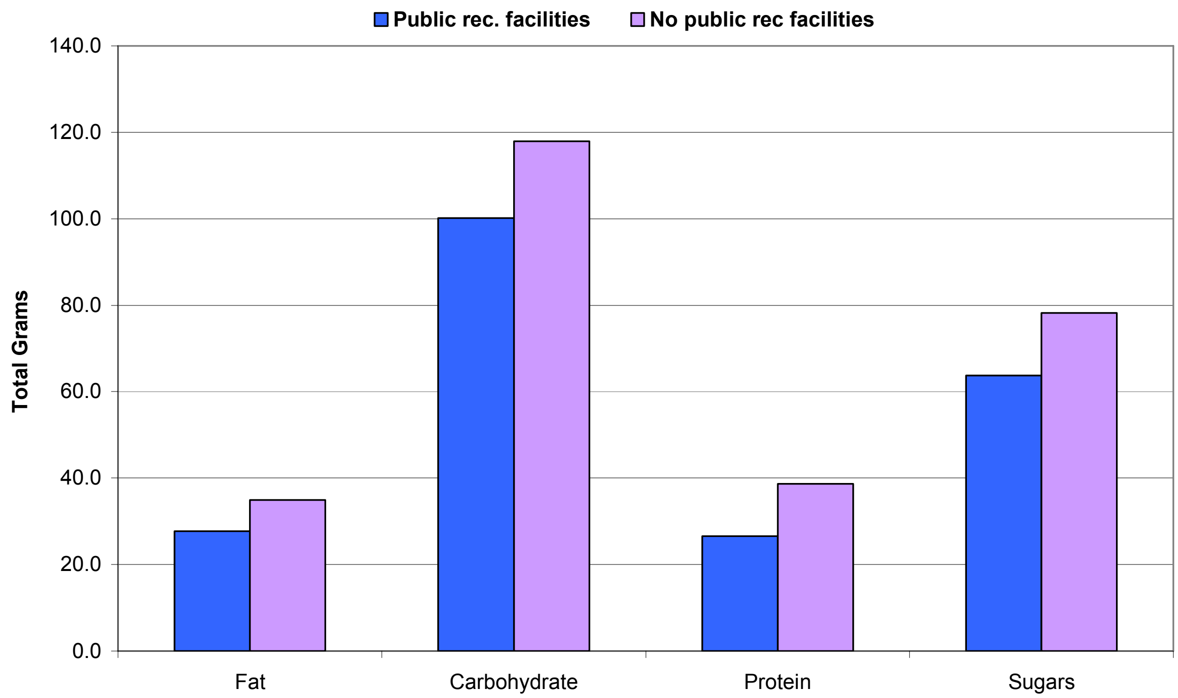
Another important indicator of economic hardship --food insecurity -- has been identified by other studies as a risk factor for childhood obesity and micronutrient deficiency (Reifsnider, Keller and Gallagher 2006). In this study, the six-item short form of the Household Food Security Scale was used to identify food insecure households. In previous research, Blumberg, Bialostosky, Hamilton, and Briefel (1999) found that this 6-item scale accurately predicted food insecurity in 97.7% of cases. We found that 21% of the households experienced food insecurity (Table 2). Nevertheless, in parallel with our findings on economic hardship, the mean micronutrient intakes for the children did not differ by food insecurity. However, children in food insecure households had a higher mean fat intake and a lower mean sugar intake than children in food secure households (Figure 6). Children in food insecure households also had a slightly higher mean energy intake than children in food secure households (Figure 2). Because the energy intake was higher but the micronutrient intake remained similar, children in food insecure households may be receiving less nutrient rich food than children who live in food secure households.

Figure 6. Mean Total 24-hr Intake by Household Food Security



This study also examined family neighborhood environments. Factors such as the presence of sidewalks, proximity to public recreation facilities, and traffic levels can influence access to local grocery stores and physical activity levels, which can thus affect individual nutritional status (Sallis and Glanz 2006). In our study, neither the presence of sidewalks nor the amount of traffic was significantly associated with children's intake of macronutrients or micronutrients. However, family access to public recreation facilities was associated with lower levels of both sugar and protein consumption. Children with access to public recreation facilities also consumed a mean of only 750.9 kcal/day while children with no access consumed a mean of 932.1 kcal/day.

Figure 7. Mean Total 24-hr Intake by Access to Public Recreation Facilities

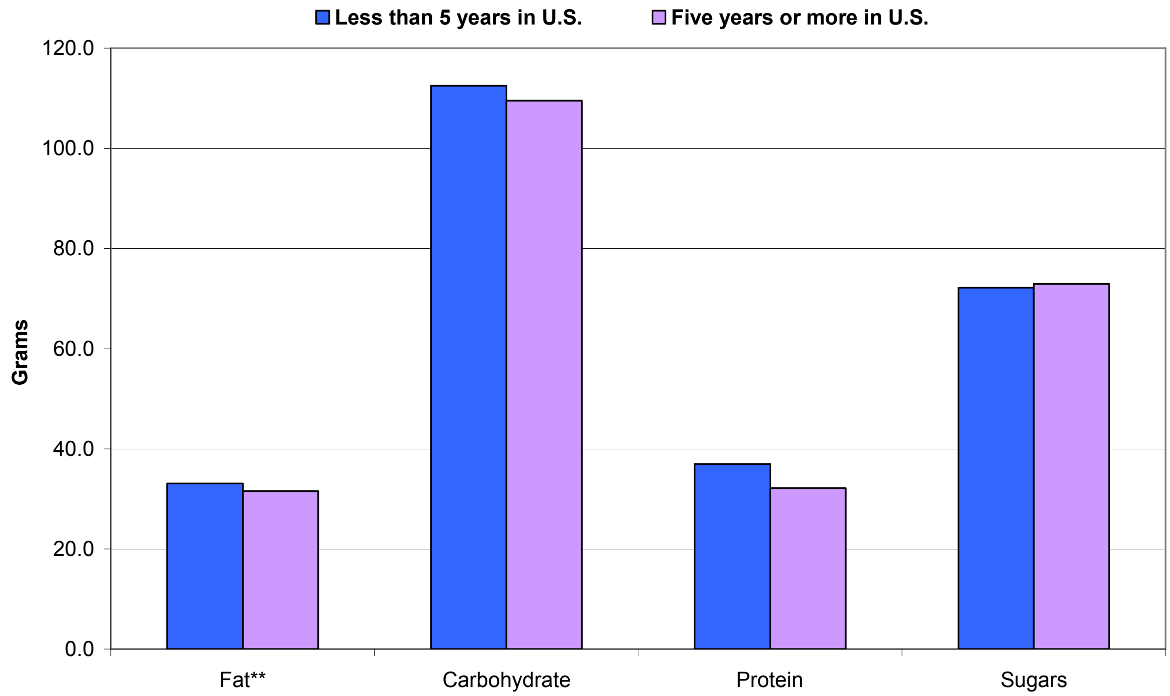


ANOVA: ***p<.01, ** p<.05

Maternal Heritage and Acculturation

Most mothers in our sample (89%) were either born in Mexico or had a parent with Mexican origins (Table 2). Over 90% of mothers were foreign born and only 10% were US citizens. Of those mothers born outside of the US, the length of time lived in the US averaged 6 years; however, 34% of the mothers in our sample had been in the US for less than 5 years. Mean micronutrient intake was similar for children whose mothers had lived in the US for at least 5 years and for those whose mothers had lived in the US for less than 5 years. In regard to macronutrient intake, children whose mothers had lived in the US for less than 5 years consumed slightly higher amounts of fat and protein per day (Figure 8). Children whose mothers had lived in the US less than 5 years had a mean total energy intake that was 44.7 kcal/day higher (p<.01) than children whose mothers had been in the US longer than 5 years (Figure 2).

Figure 8. Mean Total 24-hr Intake by Maternal Years in the U.S.

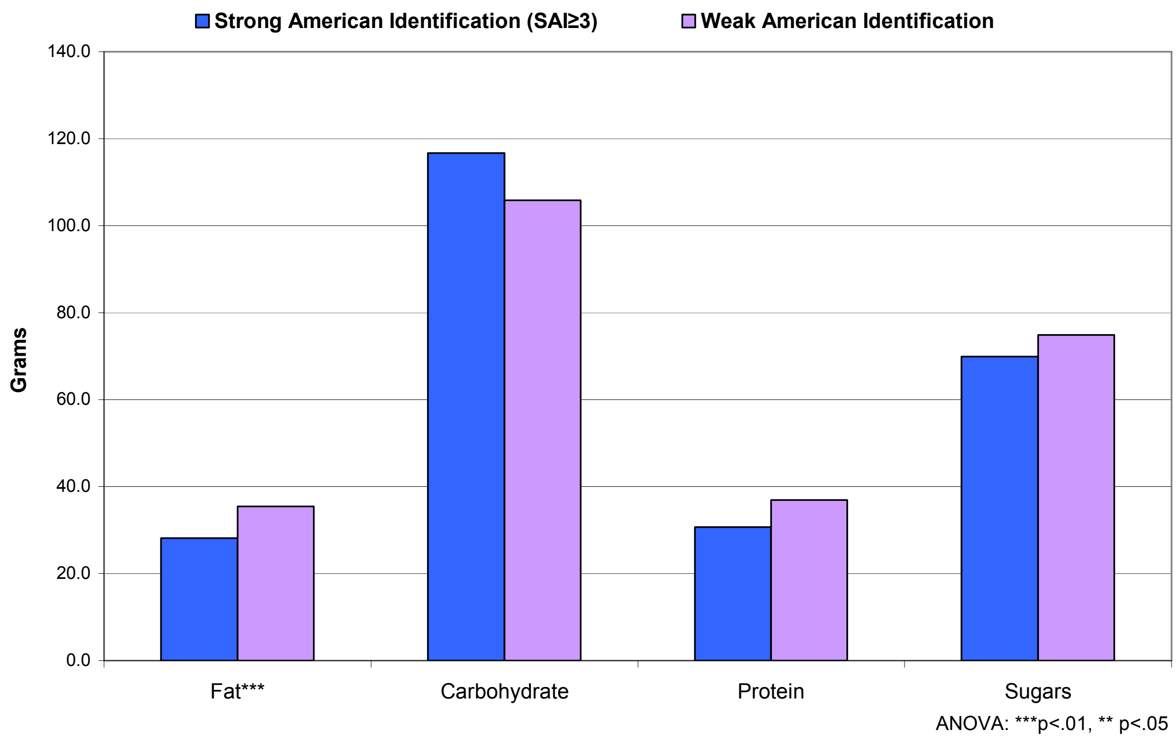


ANOVA: ***p<.01, ** p<.05

The majority of mothers (88%) reported having strong ethnic identification and over half of our sample strongly self-identified as American (52%). Children of mothers who reported strongly self-identifying with their ethnic group had intake levels of micronutrients, macronutrients, and total energy that were statistically similar to the intake levels of children with mothers who did not strongly identify with their ethnic group. The only exception was iron intake. Children whose mothers reported strong ethnic identification had a lower mean intake (7.5mg/day) of iron than children whose mothers did not report strong ethnic identification (10.6mg/day).

Children with mothers who reported strongly self-identifying as American did not differ significantly in micronutrient intake from children whose mothers did not strongly identify as American. In contrast, children with mothers who strongly identified as American consumed a mean total intake of fat and protein that was slightly lower than the mean total intake for children with mothers who did not strongly identify as American (Table 9). The mean total caloric intake was also lower for children with mothers who strongly identified as American (Table 2).

Figure 9. Mean Total 24-hr Intake by Maternal American Identification

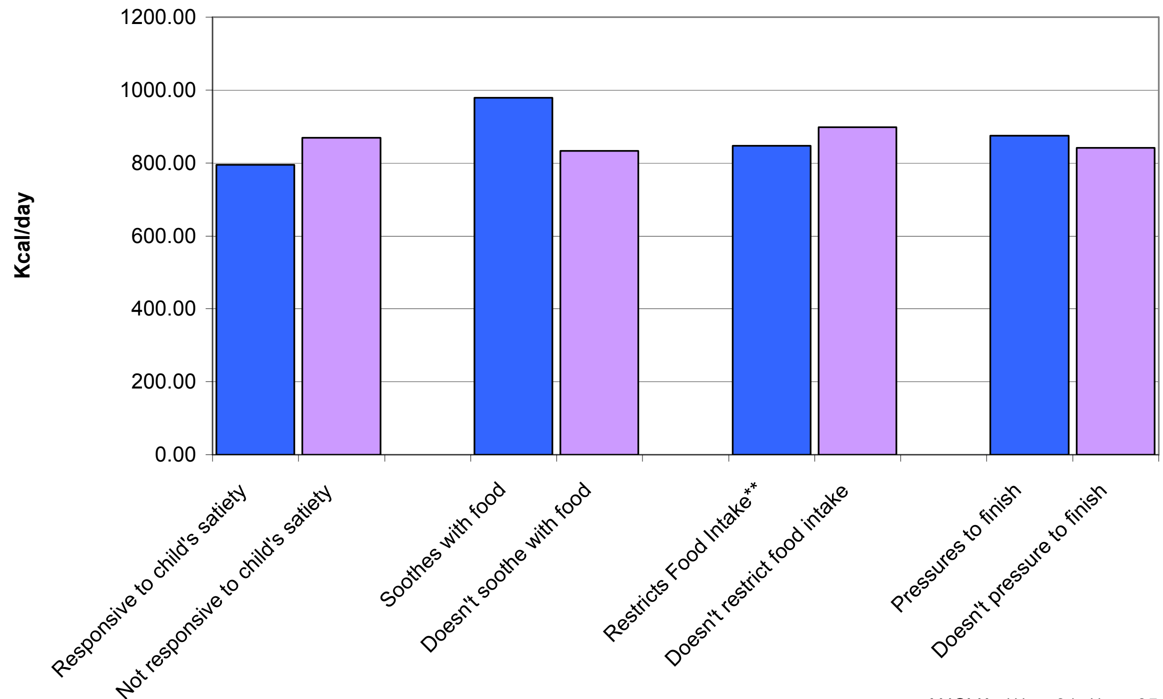


Language was another measure of acculturation status in the LIN study. Only 2% of mothers reported that they could only read, write, and comprehend English well or very well. The majority of mothers in our survey (66%) reported understanding Spanish well or very well and 32% of mothers were bilingual – they could read, write, and comprehend both Spanish and English well (Table 2). No mothers reported an inability to understand both English and Spanish well or very well. No statistical differences were found in micronutrient, macronutrient, or total caloric intake for children with mothers who were bilingual or predominantly Spanish-speaking. The child of the single respondent who reported high English acculturation consumed a higher level of carbohydrates than the mean of either the bilingual or predominantly Spanish-speaking group. The children of predominantly Spanish-speaking mothers had lower fat, carbohydrate, protein, and sugar intake that those with bilingual mothers. Though suggestive, given our small sample size, these differences were not statistically significant.

Maternal Feeding Styles and Beliefs

Maternal feeding styles and beliefs can influence the amount and quality of food that children receive. Research indicates that mothers who are not responsive to satiety cues are more likely to have an overweight child (Worobey, Lopez and Hoffman 2009, Reifsnider, Keller and Gallagher 2006). However, our analysis found no significant differences between micronutrient, macronutrient, or total energy intake in the children of mothers who were responsive to satiety cues as compared to those who were not responsive to satiety cues (Figure 10).

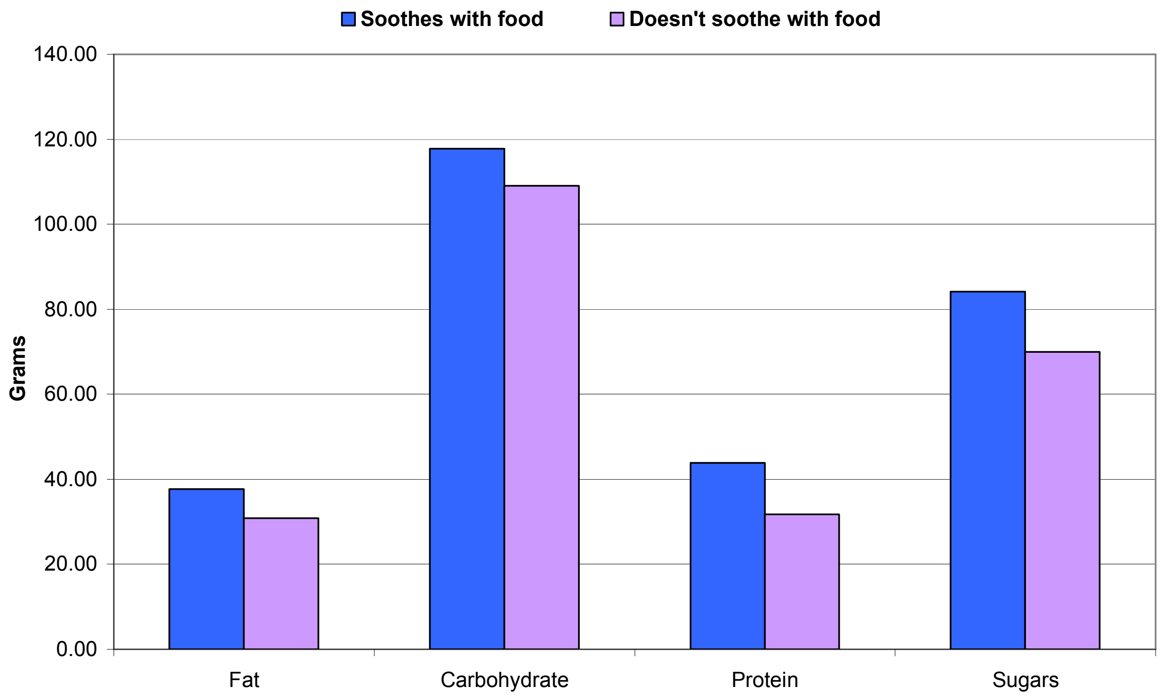
Figure 10. Mean 24-hour Recall Total Caloric Intake



ANOVA: ***p<.01, ** p<.05

In contrast, we did detect significant intake differences between mothers who reported using food to soothe their child (21%) and those who did not (Table 2). Children with mothers who soothe with food had a lower mean intake of iron (6.16mg/day vs. 8.64mg/day). Other micronutrient intake levels were similar to those of children whose mothers did not soothe with food. Regarding macronutrient intake, we found that children with mothers who reported using food to soothe her child had mean intakes of fat, protein, and sugars that were slightly higher than the mean intakes of children whose mothers did not use food to soothe (Figure 11). Mean total energy intake was also slightly higher for children whose mothers soothed with food than for children whose mothers did not (Figure 10).

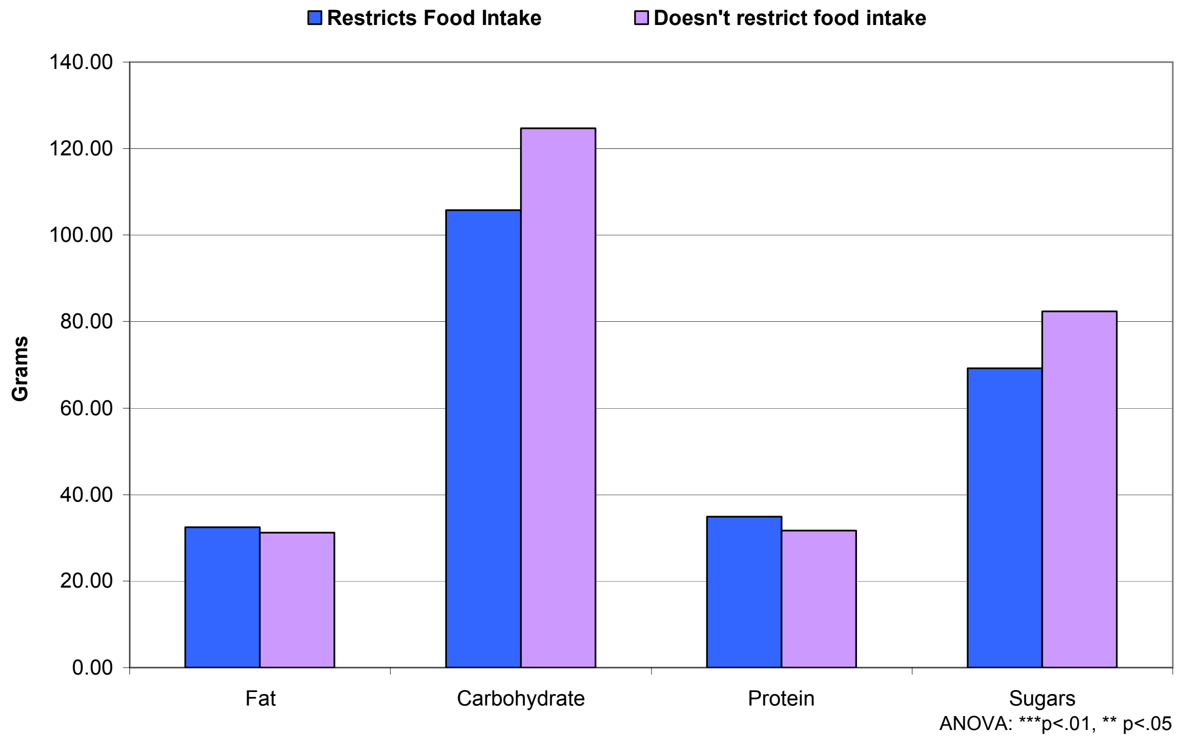
Figure 11. Mean Total 24-hr Intake by Selected Maternal Feeding Style



ANOVA: ***p<.01, ** p<.05

In addition to soothing feeding styles, children of mothers who reported restricting the amount of food the child consumed differed from those with non-restrictive styles in their daily intake of macronutrients. Children whose mothers did not restrict intake amount consumed a mean of 82.34g of sugar whereas those whose mothers did restrict intake consumed a mean of 69.18g of sugar. Similarly, children with mothers who did not restrict food intake consumed a mean of 124.65g of carbohydrates while children with intake-restrictive mothers consumed a mean of 105.77g of carbohydrates. This may indicate that mothers who did not report restrictive feeding behaviors allowed their children to consume more "junk" foods, with low nutritional value and high sugar content. However, fat and protein intake were not statistically different for children with mothers with restrictive feeding styles as opposed to those with nonrestrictive feeding styles (Figure 12). Children whose mothers have a restrictive feeding style had a mean total energy intake (847.38 kcal/day) that was 50.52 calories fewer than the children of mothers who did not restrict amount of food (897.90 kcal/day) (Figure 10).

Figure 12. Mean Total 24-hr Intake by Selected Maternal Feeding Style



The final feeding style that was associated with differences in intake was pressuring to finish. This style typically reflects behaviors that encourage the child to finish all of the food on his or her plate. Children with mothers who reported a pressuring feeding style had a higher mean intake of zinc (6.5mg/day) compared to children whose mothers did not report a pressuring feeding style (5.7mg/day). Macronutrient intake was similar between the two groups with the exception of mean sugar intake. Children whose mothers had a pressuring feeding style had a mean sugar intake that was 4g/day higher than that of children whose mothers did not report a pressuring feeding style (74.3g/day vs. 70.4g/day). Mean energy intake was also higher for children whose mothers reported a pressuring feeding style (875.1kcal/day) as compared to children whose mothers did not have a pressuring style (841.3kcal/day) (Figure 10).

CONCLUSIONS

Children from families who did not have access to public recreation facilities had a mean energy intake that was 181.2 g/day higher than the mean intake for children who did have access to public recreation facilities. While no statistical difference was found between the mean weight-for-length z-scores for the two groups, this difference in energy intake may signal a difference in parental priorities that could eventually affect childhood obesity. Parents who actively choose residences that have access to public recreational facilities likely prioritize physical activity. Further research is needed to determine whether proximity to recreational facilities and a reduced caloric intake reflect an underlying concern with childhood obesity.

Dietary guidelines are not gender specific during early childhood, indicating that nutrient requirements for healthy development are the same for males and females. However, the results of this study indicated that females received significantly lower levels of both macronutrients and micronutrients than males but did not exhibit a statistically lower weight-for-length z-score. This may indicate that different nutrient requirements do exist across gender. The role of gender in shaping maternal feeding behaviors also presents an avenue for additional investigation. Since dietary guidelines are currently the same regardless of gender, reasons that females are receiving lower levels of nutrients need to be identified.

Some studies have suggested that respondents have difficulty distinguishing between the amount of food offered to a child and the amount actually consumed by the child, resulting in unintentional over-reporting of the child's food intake. This has been offered as an explanation for high levels of micronutrient intake in infants and toddlers. That explanation seems unlikely in this study, however, due to the low estimates of total energy intake. Mean micronutrient intake was high for both infants and toddlers across a broad spectrum of micronutrients but is unlikely to be explained by over-reporting. Instead, it may reflect a preference for nutrient-dense foods.

Further, the reduced energy intake of this sample was not associated with underweight, as the mean weight-for-length z-score was -.47, well within the normal range. Mothers may have under-reported certain foods that contribute more to energy intake. In any event, this preference for particularly nutrient-dense foods could explain the high micronutrient intake levels and the mean weight-for-length z-score despite a low mean energy intake.

LIMITATIONS

As with any research endeavor, there are some limitations to this study that should be noted. Due to resource constraints, only one 24-hour recall was collected for each participant. Thus we are enable to assess the adequacy of the diet since the Dietary Reference Intakes (DRIs) are calculated for healthy individuals and are intended as an average daily intake over time. Day-to-day variations of nutrient intake are expected, which cannot be adequately captured in a single 24-hour recall.

The small sample size of this study was further restricted by fact that infants who were breastfeeding at the time of the interview could not be included in the nutrition analysis due to an inability to accurately estimate breast milk consumption.

Due to the fact that this sample was a convenience sample, our study included only one respondent who ranked high on the BAS for English-language acculturation. The overwhelming majority of the respondents had either dominant Spanish-language acculturation or were either bicultural. Thus, we could not evaluate significant difference between English-language acculturation and Spanish-language acculturation.

Limited research exists on adequate nutrient intake in infants and toddlers. In some cases, most notably that of vitamin E, the tolerable upper limit was established by extrapolating the adult EAR downward to account for difference in body size. (Devaney et al 2004) Similarly, the tolerable upper limit for zinc intake is estimated to be 7 mg/day but the NHANES III found only one case of adverse effects from excessive intake of zinc, which only occurred with 16 to 24 mg of zinc per day over the course of many months. (Devaney et al 2004) These are just two such examples that serve as a reminder that more research is needed into the specific nutrient needs of infants and toddlers.

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APPENDIX 1

The LIN nutrition analysis analyzed micronutrient, macronutrient, and total caloric intake across a variety of characteristics. The tables in this appendix include the results from that analysis, whether differences were significant or not.

Tables for Mean Micronutrient Intake

Table A1. Mean Vitamin and Mineral Intake by Selected Maternal Characteristics (Infants 7-18 mo.)

	Iron			Zinc		Vitamin C		
Child's gender (female)	8.3	(4.5)		5.7	(1.5)	66.3	(37.1)	
(male)	7.6	(4.8)		6.3	(2.8)	65.1	(41.6)	
Maternal Education and Employment								
Less than High School	8.1	(5.1)		5.9	(1.9)	60.7	(31.4)	
Completed High School or Higher Education	8.2	(5.3)		6.4	(2.9)	73.0	(47.6)	
Employed Part- or Full-time	8.9	(5.3)		6.1	(1.4)	78.9	(43.5)	**
Unemployed	7.7	(5.1)		6.2	(3.0)	58.6	(36.7)	
Family Environment and Social Support								
First-time Mother	7.5	(4.4)		6.3	(2.8)	67.0	(40.5)	
Not first-time mother	8.9	(5.8)		6.0	(2.1)	66.7	(41.2)	
Experienced Econ. Hardship in past year	7.7	(5.1)		6.1	(2.7)	66.0	(41.9)	
No Economic Hardship in past year	9.8	(5.3)		6.4	(1.2)	69.9	(36.0)	
High Social Support (ISEL >=3)	10.4	(5.5)		6.2	(1.7)	73.8	(35.8)	
Low Social Support (ISEL<3)	6.3	(4.1)		6.1	(3.0)	61.1	(43.6)	
Public recreation facilities	7.1	(4.1)		5.3	(1.4)	60.5	(33.5)	
No public recreation facilities	9.1	(5.6)		6.7	(2.9)	69.6	(44.7)	
Maternal Heritage and Acculturation								
Less than 5 years in U.S.	6.9	(4.7)		6.1	(2.2)	67.7	(51.4)	
5 or more years in U.S.	9.0	(5.4)		6.2	(2.7)	66.3	(31.9)	
Strong Ethnic Identification (MEIM>=3)	7.5	(4.8)	**	6.2	(2.7)	62.0	(42.7)	
Weak Ethnic Identification (MEIM<3)	10.6	(6.0)		5.8	(1.7)	84.5	(24.6)	
Strong American Identification (SAI>=3)	8.9	(6.0)		6.0	(1.6)	75.1	(36.3)	
Weak American Identification (SAI<3)	7.6	(4.3)		6.3	(3.0)	60.0	(42.9)	
BAS: High English Acc.[a]	15.7			7.3		81.6		
BAS:Bicultural	8.0	(4.8)		5.9	(2.1)	77.5	(43.1)	
BAS: High Spanish	8.0	(5.3)		6.2	(2.7)	60.8	(39.1)	
Maternal Health								
Self-reported health good-excellent	8.5	(5.4)		6.0	(1.3)	66.5	(36.4)	
Self-reported health poor-fair	7.8	(4.9)		6.3	(3.4)	67.2	(45.7)	
Dep. Symptoms (CES-D >=16)	6.0	(3.1)		6.2	(3.6)	54.7	(36.4)	
No depressive symptoms (CES-D<16)	9.0	(5.6)		6.1	(1.9)	71.7	(41.4)	
Overweight or obese	7.0	(3.8)	**	5.9	(2.7)	57.3	(31.0)	
Not overweight or obese	11.1	(6.9)		6.7	(1.9)	90.8	(51.5)	
Food Insecure Household (FSI>=2)	6.3	(4.3)		5.3	(1.4)	56.8	(51.7)	
Food Secure Household (FSI<2)	8.8	(5.3)		6.5	(2.7)	70.4	(35.8)	

Note: Means are adjusted for age of the infant/toddler. Standard error in parentheses
Infants currently breast feeding are not included in this analysis
[a]No respondents scored low on both English & Spanish. Only one respondent scored as "high English" so there is no standard deviation.
*** p<.01, ** p<.05

Table A2. Mean Vitamin and Mineral Intake by Selected Maternal Characteristics (Infants 7-18 mo.)

	Iron		Zinc			Vitamin C		
Feeding Beliefs and Behaviors Indicators								
Laissez-faire Diet (yes)	7.73	(4.99)	5.87	(3.07)		54.52	(33.53)	
Laissez-faire Diet(no)	8.24	(5.24)	6.19	(2.41)		68.89	(41.39)	
Pressures to finish	8.43	(5.71)	6.50	(2.74)	**	71.47	(45.02)	
Does not pressure to finish	7.81	(4.43)	5.66	(2.03)		60.67	(33.27)	
Overfeeds with cereal or breastmilk	5.92	(3.69)	5.35	(1.21)		68.95	(45.83)	
Doesn't overfeed	9.86	(5.50)	6.73	(2.99)		65.26	(36.59)	
Soothes with food	6.16	(4.52)	7.23	(4.28)		61.17	(44.49)	
Doesn't soothe with food	8.64	(5.23)	5.89	(1.83)		68.17	(39.87)	
Restricts Food Intake	7.73	(4.96)	6.18	(2.72)		64.67	(41.04)	
Doesn't restrict food intake	9.41	(5.70)	6.04	(1.68)		72.94	(39.43)	
Restricts Diet Quality	7.66	(4.31)	6.22	(2.65)		67.76	(40.50)	
Doesn't restrict diet quality	10.02	(7.53)	5.85	(1.74)		63.45	(41.85)	
Responsive to child's satiety	8.11	(5.22)	6.24	(2.59)		65.73	(41.06)	
Not responsive to child's satiety	8.58	(5.10)	5.43	(1.32)		75.06	(37.32)	
Responsive attention provided during feeding	7.86	(4.98)	6.16	(2.64)		63.86	(40.35)	
Doesn't provide responsive attention	9.70	(6.12)	6.03	(1.47)		81.74	(39.62)	
Indulgent: Permissive Feeding	5.76	(3.16)	4.46	(0.83)		130.31	(82.05)	***
No permissive feeding	8.29	(5.22)	6.22	(2.50)		63.67	(36.32)	
Indulgent: doesn't coax with food	8.17	(5.15)	6.14	(2.47)		66.84	(40.31)	
Indulgent: doesn't soothe with food	8.17	(5.15)	6.14	(2.47)		66.84	(40.31)	
Indulgent: Doesn't pamper child with food	8.17	(5.15)	6.14	(2.47)		66.84	(40.31)	

Note: Means are adjusted for age of the infant/toddler. Standard error in parentheses
Infants currently breast feeding are not included in this analysis
No mothers coax, soothe, or pamper child with food. Therefore, means on these variables are not provided.
*** p<.01, ** p<.05

Tables for Macronutrient Intake

Table A3. Mean Total Macronutrient Intake by Selected Maternal Characteristics (Infants 7-18 mo.)

	Fat (g)			Carbohydrate (g)			Protein (g)			Sugars (g)		
Child's gender (female)	23.9	(9.6)	***	87.8	(24.1)	**	26.2	(14.8)	**	59.6	(15.4)	**
(male)	34.5	(11.5)		120.0	(39.5)		38.1	(20.3)		78.6	(25.0)	
Maternal Education and Employment												
Less than High School	31.9	(10.2)		110.3	(36.6)		33.2	(19.8)		71.8	(21.1)	
Completed High School or Higher	32.4	(12.5)		111.2	(40.7)		35.0	(19.1)		73.5	(26.5)	
Employed	32.4	(11.4)		121.9	(37.1)		36.1	(16.6)		76.3	(22.5)	
Unemployed	32.0	(11.5)		103.1	(37.8)		32.7	(21.0)		70.1	(24.6)	
Family Environment and Social Support												
First-time Mother	32.5	(11.2)		111.1	(40.7)		34.0	(18.5)		71.6	(20.1)	
Not first-time mother	31.8	(11.7)		110.4	(36.5)		34.2	(20.4)		73.7	(27.2)	
Experienced Econ. Hardship in past year	32.1	(11.6)		107.5	(34.9)		35.6	(20.8)		70.9	(23.9)	
No Economic Hardship in past year	34.0	(9.7)		112.4	(49.0)		28.4	(10.9)		78.8	(23.1)	
Food Insecure Household (FSI>=2)	32.7	(8.5)		110.0	(43.4)		35.3	(13.9)		72.0	(29.0)	
Food Secure Household	32.0	(12.3)		111.0	(37.0)		33.6	(21.0)		72.8	(22.0)	
High Social Support (ISEL >=3)	30.6	(10.7)		113.1	(38.0)		29.8	(13.9)		69.3	(20.8)	
Low Social Support	33.4	(11.9)		108.8	(39.1)		37.6	(22.4)		75.4	(25.9)	
Public recreation facilities	27.7	(8.8)		100.2	(36.3)		26.6	(13.2)		63.8	(17.3)	
No public recreation facilities	35.0	(12.1)		117.9	(39.2)		38.7	(21.5)		78.2	(26.2)	
Maternal Heritage and Acculturation												
Less than 5 years in U.S.	33.1	(10.5)	**	112.5	(39.0)		36.9	(19.2)		72.2	(27.2)	
5 or more years in U.S.	31.5	(12.0)		109.5	(38.4)		32.2	(19.4)		72.9	(21.5)	
Strong Ethnic Identification (MEIM>=3)	32.4	(12.1)		103.4	(35.5)		35.0	(20.5)		70.2	(22.5)	
Weak Ethnic Identification	31.3	(8.5)		137.7	(37.3)		30.6	(14.1)		81.5	(27.1)	
Strong American Identification	28.2	(8.5)	***	116.7	(39.0)		30.7	(12.0)		69.9	(18.0)	
Weak American Identification	35.4	(12.4)		105.8	(37.7)		36.9	(23.5)		74.9	(27.7)	
BAS: High English Acc.[a]	24.1			206.6			45.6			114.0		
BAS:Bicultural	33.9	(11.5)		117.1	(30.2)		36.8	(21.3)		77.2	(16.6)	
BAS: High Spanish	31.5	(11.4)		103.8	(37.7)		32.2	(18.5)		68.7	(25.5)	
Maternal Health												
Self-reported health good-excellent	32.9	(9.4)		114.6	(43.1)		33.8	(16.2)		72.4	(21.6)	
Self-reported health poor-fair	31.2	(13.5)		106.1	(31.7)		34.4	(22.8)		72.9	(26.5)	
Symptomatic for Depression (CES-D >=16)	34.9	(13.0)		105.1	(40.5)		37.4	(22.7)		76.7	(31.3)	
Aymptomatic	31.1	(10.6)		113.0	(37.7)		32.8	(17.9)		71.0	(20.3)	
Overweight or obese	30.2	(12.0)		110.4	(41.6)		35.7	(20.8)		71.9	(24.3)	
Not overweight or obese	36.9	(7.9)		111.6	(29.5)		30.1	(14.6)		74.5	(22.9)	
Food Insecure Household (FSI>=2)	32.7	(8.5)		110.0	(43.4)		35.3	(13.9)		72.0	(29.0)	
Food Secure Household (FSI<2)	32.0	(12.3)		111.0	(37.0)		33.6	(21.0)		72.8	(22.0)	

Note: Means are adjusted for age of the infant/toddler. Standard error in parentheses
Infants currently breast feeding are not included in this analysis
[a]No respondents scored low on both English & Spanish. Only one respondent scored as "high English" so there is no standard deviation.
*** p<.01, ** p<.05

Table A4. Mean Total Macronutrient Intake by Feeding Beliefs and Behaviors (Infants 7-18 mo.)

	Fat (g)		Carbohydrate (g)		Protein (g)		Sugars (g)	
Laissez-faire Diet (yes)	36.35	(11.32)	92.73	(26.37)	38.46	(31.48)	70.59	(16.94)
Laissez-faire Diet(no)	31.44	(11.30)	113.72	(39.29)	33.34	(16.95)	72.96	(24.79)
Pressures to finish	32.78	(9.84)	112.54	(39.10)	34.04	(17.46)	74.26	(24.09)
Does not pressure to finish	31.28	(13.24)	108.30	(37.91)	34.12	(21.87)	70.45	(23.62)
Overfeeds with cereal or	31.83	(7.31)	117.90	(43.72)	35.45	(11.21)	74.65	(24.56)
Doesn't overfeed	32.36	(13.71)	105.34	(33.40)	33.04	(23.72)	71.10	(23.48)
Soothes with food	37.70	(12.77)	117.79	(46.90)	43.83	(22.28)	84.10	(37.71)
Doesn't soothe with food	30.83	(10.71)	109.06	(36.47)	31.78	(18.03)	69.92	(18.85)
Restricts Food Intake	32.47	(11.24)	105.77	(35.73)	34.92	(21.66)	69.18	(22.16)
Doesn't restrict food intake	31.20	(11.96)	124.65	(43.13)	31.70	(8.31)	82.34	(26.14)
Restricts Diet Quality	31.98	(11.78)	110.67	(34.85)	34.77	(20.45)	73.34	(24.54)
Doesn't restrict diet quality	32.71	(9.91)	110.92	(51.13)	31.51	(14.51)	70.00	(21.27)
Responsive to child's satiety	32.81	(11.86)	110.36	(36.22)	35.14	(19.74)	72.03	(24.08)
Not responsive to child's	27.15	(2.49)	113.37	(55.91)	26.19	(13.77)	77.03	(22.32)
Responsive attention provided during feeding	32.20	(11.13)	113.34	(39.02)	36.43	(19.82)	72.63	(25.38)
Doesn't provide responsive	31.82	(13.04)	97.59	(33.09)	22.29	(10.11)	72.59	(13.41)
Indulgent: Permissive Feeding	28.59	(12.34)	117.58	(27.24)	25.91	(10.49)	94.06	(23.93)
No permissive feeding	32.31	(11.38)	110.38	(38.88)	34.48	(19.54)	71.55	(23.45)
Indulgent: doesn't coax with	32.14	(11.30)	110.72	(38.19)	34.07	(19.22)	72.62	(23.67)
Indulgent: doesn't soothe with	32.14	(11.30)	110.72	(38.19)	34.07	(19.22)	72.62	(23.67)
Indulgent: Doesn't pamper child with food	32.14	(11.30)	110.72	(38.19)	34.07	(19.22)	72.62	(23.67)

Note: Means are adjusted for age of the infant/toddler. Standard error in parentheses
Infants currently breast feeding are not included in this analysis.
No mothers coax, soothe, or pamper child with food. Therefore, means on these variables are not provided.
*** p<.01, ** p<.05

Tables for Total Caloric Intake

Table A5. Mean Calorie Intake by Selected Maternal Characteristics (Infants 7-18 mo.)

	Fat Calories		Carbohydrate Calories		Protein Calories		Total		
Child's gender (female)	34.6	(8.3)	50.5	(6.8)	15.0	(7.5)	691.6	(182.7)	***
(male)	33.4	(7.9)	50.7	(9.6)	15.9	(5.0)	934.5	(271.7)	
Maternal Education and Employment									
Less than High School	33.9	(7.6)	51.2	(8.8)	15.6	(5.9)	853.7	(256.0)	
Completed High School or Higher	35.3	(8.4)	50.5	(8.9)	16.0	(5.9)	867.6	(284.8)	
Employed Part- or Full-time	31.5	(6.6)	52.8	(7.2)	15.7	(5.9)	914.6	(257.1)	
Unemployed	35.3	(8.4)	49.5	(9.5)	15.3	(5.9)	823.9	(273.4)	
Family Environment and Social Support									
First-time Mother	33.4	(7.4)	51.0	(8.9)	15.6	(5.5)	856.4	(271.5)	
Not first-time mother	34.0	(8.5)	50.7	(8.8)	15.3	(6.3)	864.8	(270.2)	
Experienced Econ. Hardship in past year	33.6	(7.5)	50.2	(8.7)	16.2	(6.1)	853.9	(273.3)	
No Economic Hardship in past year	34.0	(9.7)	53.2	(9.1)	12.8	(3.7)	885.2	(259.4)	
Food Insecure Household (FSI>=2)	34.5	(6.7)	49.6	(9.0)	16.0	(4.3)	866.0	(266.1)	
Food Secure Household (FSI<2)	33.4	(8.4)	51.3	(8.7)	15.3	(6.4)	858.7	(272.4)	
High Social Support (ISEL >=3)	33.0	(8.6)	53.0	(9.0)	14.1	(4.9)	838.5	(220.4)	
Low Social Support (ISEL<3)	34.4	(7.4)	49.1	(8.3)	16.6	(6.4)	878.9	(304.8)	
Public recreation facilities	33.4	(8.1)	52.7	(8.8)	14.0	(15.6)	750.9	(232.7)	
No public recreation facilities	33.9	(8.1)	49.8	(8.9)	16.3	(6.0)	932.1	(274.0)	
Maternal Heritage and Acculturation									
Less than 5 years in U.S.	33.7	(8.1)	49.7	(8.3)	16.6	(5.6)	887.2	(270.7)	**
5 or more years in U.S.	33.7	(7.9)	51.6	(9.1)	14.7	(6.0)	842.5	(269.4)	
Strong Ethnic Identification (MEIM>=3)	34.7	(7.8)	49.0	(8.1)	16.4	(6.0)	838.5	(281.0)	
Weak Ethnic Identification (MEIM<3)	30.1	(7.5)	57.8	(7.6)	12.2	(3.7)	941.8	(204.2)	
Strong American Identification (SAI>=3)	30.8	(8.1)	54.4	(7.6)	14.9	(6.2)	833.6	(205.6)	
Weak American Identification (SAI<3)	36.1	(7.0)	47.9	(8.7)	16.0	(5.6)	882.9	(312.6)	
BAS: High English Acc.[a]	17.4		68.0		14.6		1212.2		
BAS:Bicultural	33.0	(6.8)	51.3	(9.3)	15.7	(6.9)	910.6	(227.5)	
BAS: High Spanish	34.7	(8.0)	50.0	(8.0)	15.4	(5.5)	821.7	(281.6)	
Maternal Health									
Self-reported health good-excellent	34.2	(8.4)	50.7	(9.8)	15.1	(5.9)	882.6	(241.2)	
Self-reported health poor-fair	33.1	(7.4)	51.1	(7.6)	15.9	(5.8)	834.0	(301.0)	
Depressive Symptoms (CES-D >= 16)	36.1	(7.0)	47.7	(8.6)	16.4	(6.1)	874.9	(329.7)	
Asymptomatic	32.8	(8.1)	52.1	(8.6)	15.1	(5.8)	854.9	(244.7)	
Overweight or obese	32.2	(8.0)	51.5	(9.1)	16.3	(5.8)	848.2	(299.0)	
Not overweight or obese	37.4	(6.5)	49.2	(7.9)	13.5	(5.7)	891.8	(172.3)	
Food Insecure Household (FSI<=2)	34.5	(6.7)	49.6	(9.0)	16.0	(4.3)	866.0	(266.1)	
Food Secure Household (FSI<2)	33.4	(8.4)	51.3	(8.7)	15.3	(6.4)	858.7	(272.4)	

Note: Means are adjusted for age of the infant/toddler. Standard error in parentheses
Infants currently breast feeding are not included in this analysis
[a]No respondents scored low on both English & Spanish. Only one respondent scored as "high English" so there is no standard deviation.
*** p<.01, ** p<.05

Table A6. Mean Calorie Intake by Selected Maternal Feeding Beliefs and Behaviors (Infants 7-18 mo.)

	Fat Calories			Carbohydrate Calories			Protein Calories		Total		
Laissez-faire Diet (yes)	39.28	(6.08)	**	44.32	(8.38)	**	16.41	(7.70)	844.97	(308.05)	
Laissez-faire Diet(no)	32.78	(7.84)		51.95	(8.41)		15.32	(5.59)	863.22	(265.05)	
Pressures to finish (yes)	34.28	(7.42)		50.58	(8.26)		15.20	(5.20)	875.08	(254.88)	
Pressures to finish (no)	32.96	(8.65)		51.23	(9.56)		15.85	(6.73)	841.32	(289.84)	
Overfeeds with cereal or breastmilk	33.02	(7.83)		51.30	(9.02)		15.74	(2.94)	890.07	(227.74)	
Doesn't overfeed	34.23	(8.07)		50.53	(8.70)		15.28	(7.36)	838.82	(296.79)	
Soothes with food	35.44	(7.62)		49.95	(8.99)		17.68	(4.29)	978.68	(341.36)	
Doesn't soothe with food	33.31	(8.01)		51.78	(8.55)		14.95	(6.08)	832.83	(245.05)	
Restricts food intake	34.71	(7.63)		49.60	(9.08)		15.73	(6.07)	847.38	(274.78)	**
Doesn't restrict food intake	30.90	(8.31)		54.41	(6.83)		14.75	(5.31)	897.90	(254.79)	
Restricts diet quality	33.24	(7.52)		51.16	(8.19)		15.64	(5.56)	861.52	(275.13)	
Doesn't restrict diet quality	35.43	(9.43)		49.78	(11.01)		14.85	(7.09)	857.27	(253.13)	
Responsive to child's satiety	33.07	(10.34)		54.54	(9.16)		12.39	(3.69)	794.65	(255.93)	
Not responsive to child's	33.80	(7.68)		50.36	(8.68)		15.89	(5.98)	869.52	(271.23)	
Responsive attention	33.11	(7.61)		50.90	(9.40)		16.04	(5.36)	880.28	(270.70)	
Doesn't provide responsive	36.70	(9.21)		50.67	(4.51)		12.67	(7.68)	762.25	(245.10)	
Indulgent: permissive	28.59	(12.34)		57.11	(4.83)		12.29	(1.40)	819.52	(264.22)	
No permissive feeding	33.86	(8.04)		50.55	(8.80)		15.63	(5.93)	862.66	(270.88)	
Indulgent: doesn't coax with	33.71	(7.89)		50.86	(8.73)		15.47	(5.84)	860.61	(267.55)	
Indulgent: doesn't soothe with food	33.71	7,89		50.86	(8.73)		15.47	(5.84)	860.61	(267.55)	
Indulgent: Doesn't pamper child with food	33.71	(7.89)		50.86	(8.73)		15.47	(5.84)	860.61	(267.55)	

Note: Means are adjusted for age of the infant/toddler. Standard error in parentheses
Infants currently breast feeding are not included in this analysis
No mothers coax, soothe, or pamper child with food. Therefore, means on these variables are not provided.
*** p<.01, ** p<.05

APPENDIX 2: LIN Survey Measurements

In the interview administered survey, information was collected on maternal depression, maternal acculturation, maternal physical activity, parenting stress, infant behavior and infant feeding styles using the following instruments:

Maternal depression symptom severity was evaluated using the 20-item **Center for Epidemiological Studies Depression Scale – Spanish version (CES-D).** In the CES-D, respondents rate symptom frequency in the previous week. Items include statements such as *I was bothered by things that don't normally bother me* and *I felt sad.* Each item is scored 0 to 3 (Rarely or none of the time, some or little of the time, occasionally or a moderate amount of time, most or all of the time) with total scores ranging from 0 to 60. A score of 16 or above indicates clinically significant symptoms; as the score increases, there is greater likelihood that the mother suffers from a major depressive disorder (Radloff, 1977).

Mother's acculturation to the U.S. was measured using the Linguistic Proficiency subscale of the **Bi-dimensional Acculturation Scale for Hispanics (BAS-LP)** (Marin & Gamba, 1996). The BAS-LP measures linguistic proficiency in two domains, Spanish and English, using 6 items for each language. The 6 items in each domain are averaged for every respondent providing two scores of acculturation for each mother. The possible score range is 1-4. Scores above 2.5 indicate a high level of adherence to the domain and scores above 2.5 in each domain indicate biculturalism.

Mother's physical activity was measured by assessing all levels of physical activity, light, moderate or vigorous for a normal week. Each mother reports the number of days per week and hours per day she participates in a list of activities arranged by intensity levels. Total hours participating in each level of physical activity are summed and averaged for the week.

Parenting Stress was measured used using the short form (17-item) version of the **Parental Stress Index – PSI-SF** (Loyd & Abidin, 1985; Reitman, Currier, & Stickle, 2002). Parents use a 5-point scale (Strongly agree-Strongly disagree) to indicate the degree to which they agree with each statement. The short form provides a total parenting stress score as well as two subscales – modified parental distress and parent-child dysfunctional interaction. The parental distress subscale reflects a parent's perception of child rearing competence, conflict with her spouse or partner, social support, and stresses associated with the restrictions placed on other life roles. The Parent-Child dysfunctional Interaction subscale assesses a parent's perception that her child is not meeting her expectations. The scores on each subscale are summed and added together to provide the total parenting stress score. The total Parenting Stress score ranges from 17 to 85; the modified parental distress score ranges from 5 to 25; and the parent-child dysfunctional interaction score ranges from 5 to 60.

Information about *Infant Behavior* was obtained using two instruments. For infants 7-11 months, the LIN Study used the **Infant Behavior Questionnaire-Revised (IBQ-R)** (Garthstein & Rothbart, 2003). In the IBQ-R, on a scale of 1-7 (Never to Always), caregivers report the frequency of infant reactions to specific occurrences in the past week or past two weeks. The instrument assesses various domains including (1) *Activity Level:* Movement of arms and legs, squirming and locomotor activity; (2) *Distress to Limitations*: Baby's fussing, crying or showing distress while a) in a confining place or position; b) involved in caretaking activities; c) unable to perform a desired action; (3) *Duration of Orienting*: The baby's attention to and/or interaction with a single object for extended periods of time; (4) *Smiling and Laughter*: Smiling or laughter from the child in general caretaking and play situations; *Low Intensity Pleasure*: Amount of pleasure or enjoyment related to situations involving low stimulus intensity, rate, complexity, novelty, and incongruity; and (5) *Soothability*: Baby's reduction of fussing, crying, or distress when the caretaker uses soothing techniques.

For toddlers 12-18 months, two scales from the **Infant-Toddler Social and Emotional Assessment (ITSEA)** were used (Carter, et al., 2003). In the ITSEA, adults or caregivers report on social-emotional problems and competencies in toddlers ages 1-3. Mothers were asked to report on a scale of 0-2 (Not true, somewhat true, Very true) the frequency that their child exhibited *negative emotionality* and *compliance*. The score from each instrument were averaged for each infant or toddler and then an average was calculated for the entire sample to obtain a score for each domain.

Parental Feeding styles evaluated by the **Infant Feeding Styles Questionnaire (IFSQ),** a 83-item that measures feeding beliefs and behaviors of mothers of infants and young children (Thompson, et al. 2009). The IFSQ defines five feeding styles (1)*Laissez-faire*: Parent does not limit their infant's diet quality or quantity and shows little interaction with their infant during feeding; (2) *Pressuring/Controlling*: Parent is concerned with increasing the amount of food their infant consumes and uses food to soothe the infant; (3) *Restrictive/Controlling*: Parent limits the infant to healthful foods and limits the quantity of food consumed; (4) *Responsive*: Parent is attentive to their child's hunger and fullness cues and interacts with their infant during feeding; and (5) *Indulgent*: Parent does not set limits on the quantity or quality of the food their infant consumes. Given scenarios for each domain, mothers answered on a scale of 1-5 (Strongly Disagree-Strongly Agree) regarding feeding beliefs and a scale of 1-5 (Never-Always) regarding infant behaviors. The answers for each domain were averaged for each infant or toddler and then an average was calculated for the entire sample to obtain a score for each domain.

Several instruments were used to collect the *Anthropometric measurements* of the mother and child. Infant weight was taken using the Tanita BD-585 Digital Baby Scale, the O'Leary length board was used to record infant length. Harpenden Skinfold calipers were used to measure skin-folds of both mother and child. Mother's hip and waist circumference were measured using a measuring tape, her height was measured using a Harpenden pocket stadiometer, and her weight was measured by an analog scale. All measurements were taken and recorded three times and then averaged together.