# EVALUATION OF FEEDING PRACTICES OF INFANTS AND TODDLERS AT THE SPECIAL SUPPLEMENTAL NUTRITION PROGRAM FOR WOMEN, INFANTS, AND CHILDREN IN SAN MARCOS, TEXAS

THESIS

Presented to the Graduate Council
of Texas State University-San Marcos
in Partial Fulfillment
of the Requirements

for the Degree

Master of SCIENCE

by

Julia Ann Von Bank, B.S.

San Marcos, Texas
August 2010

EVALUATION OF FEEDING PRACTICES OF INFANTS AND TODDLERS AT THE SPECIAL SUPPLEMENTAL NUTRITION PROGRAM FOR WOMEN, INFANTS, AND CHILDREN IN SAN MARCOS, TEXAS

Committee Members Approved:

_____
Sylvia Crixell

_____
BJ Friedman

_____
Gloria P. Martinez-Ramos

Approved:

_____
J. Michael Willoughby

Dean of the Graduate College

**DEDICATION**

For my parents and my sisters

for your unending love and support

**ACKNOWLEDGEMENTS**

I would like to thank my thesis adviser, Dr. Sylvia Crixell, for all of her support and guidance through this research project, thesis and coursework. I would also like to thank my other committee members, Dr. BJ Friedman and Dr. Gloria Martinez for their support throughout this thesis. I also need to thank Jesse Rogers for sharing her expertise in statistical analysis with me, my colleague Hope van der Heijden for working with me through this project, and all the research assistants, especially Hildreth England, Sadye Silva, Healther Bayles, Stacie Olivarri, and Jorge Cox, who have contributed to this study. Additionally, I would like to thank my fellow students and interns who have offered me support through this entire process. Finally, I would like to thank my parents Connie and Greg Von Bank and my sisters, Sarah Von Bank and April Iverson for their unyielding support throughout this endeavor.

This manuscript was submitted on June 28, 2010.

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## ABSTRACT

EVALUATION OF FEEDING PRACTICES OF INFANTS AND TODDLERS AT THE SPECIAL SUPPLEMENTAL NUTRITION PROGRAM FOR WOMEN, INFANTS, AND CHILDREN IN SAN MARCOS, TEXAS

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Julia Ann Von Bank, B.S.

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SUPERVISING PROFESSOR: DR. SYLVIA CRIXELL

The purpose of this study was to compare feeding practices of infants and toddlers enrolled in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) in San Marcos, TX, to practices reported in the 2002 national Feeding Infants and Toddlers Study (FITS) and to compare the feeding practices of Mexican American and non-Hispanic white infants and toddlers in San Marcos WIC. Researchers recruited caregivers of a child, aged 4-32 months, during WIC English and Spanish nutrition education classes. Ninety-seven caregivers completed a telephone interview during which the following information was collected: 1) 24-hour dietary recall of the infant/toddler (using Nutrition Data System for Research software); 2) health history and demographic information; and 3) infant/toddler feeding practices. Fruit and vegetable

consumption was similar to national trends; 25% of toddlers did not consume any fruit, and 36% did not consume any vegetables in the day studied. The most commonly consumed vegetable was French fries. Over 75% of toddlers consumed at least one sweetened food or beverage in the day studied, and approximately 60% of toddlers consumed at least one sugar-sweetened beverage. No differences in feeding practices were detected between Mexican American and non-Hispanic white infants and toddlers. The feeding practices of infants and toddlers in San Marcos WIC can lead to poor dietary habits throughout childhood and the lifespan. Therefore, the results of this study suggest that these feeding practices may result in increased risk for obesity and its co-morbidities.

## I. Introduction

The feeding practices of infants and toddlers are important not only because they determine nutrient intake, but also because they can shape the dietary habits of children, and thus have the potential to impact many aspects of health including the risk for developing pediatric obesity (1, 2). The term "feeding practices" can be used to describe a variety of behaviors that together constitute infant and toddler feeding. Some of these behaviors include the mode of infant feeding, the age at which foods are introduced to the infant and the types of foods offered to infants and toddlers (3, 4, 5). Other important components of feeding practices include parental and familial attitudes and behaviors, the food environment, and social experiences that occur during feeding (6, 7, 8). While many factors influence the development of dietary behaviors in children, this study focused on investigating the types of complementary foods provided to infants and toddlers and the age of introduction of complementary foods.

## The Roles of Complementary Foods

Complementary foods are the first foods introduced to infants and toddlers in conjunction with breastfeeding and/or formula feeding. The period of time in which complementary foods are introduced is unique because it is one of the few times in the lifespan when a caregiver has complete control over the food environment of another individual. Not only are complementary foods vital for providing nutrients, they are also important for establishing eating behaviors which can have significant health ramifications (1, 2). Thus, complementary foods should be carefully chosen to instill preferences for foods that support good health throughout life (9).

### *Nutrients*

Complementary foods should supply nutrients for optimal growth and development (9) and are especially important because infants and toddlers are at risk for having low intakes of iron, vitamin D, and omega 3 fatty acids (10, 11, 12). Since complementary foods displace breast milk, it is critical that these foods are nutrient-dense as well (13).

#### *Iron*

Iron is particularly problematic for infants and toddlers. After birth, infants receive iron through breast milk or formula. Breast milk contains only small amounts of iron; however, this iron is highly bioavailable because it is

bound to the transport protein lactoferrin, which binds strongly to iron and carries it through the digestive system. Conversely, while infant formula provides high amounts of iron, the form of iron added to formula is electrolytic and thus poorly absorbed (14, 15).

Since iron stores typically become depleted at 4-6 months after birth, the iron content of the infant's diet is even more crucial at that time. Because breast milk can no longer provide sufficient amounts of iron to meet the growing infant's needs, iron-rich foods need to be introduced at 6 months (14). Toddlers at 12 months can also be vulnerable to iron deficiency because breast milk and infant formula consumption are typically discontinued completely by this age and replaced with the consumption of cow's milk (16). While cow's milk provides many essential nutrients, it contains low amounts of iron. Furthermore, heavy consumption of cow's milk can inhibit the absorption of iron in the small intestine (14).

Recent research has established that plain meats, such as red meat, poultry and fish, are appropriate and accepted complementary foods for infants 6 months and older (17). Although very few caregivers offer plain meats to their infants (18), this practice could reduce the risk of iron-deficiency anemia because meats contain heme iron, a highly bioavailable form of iron (17). Dark green vegetables, legumes and some fruits also contain iron, albeit nonheme iron,

which is less bioavailable than heme iron. While infant cereals are fortified with iron and are very commonly and frequently offered to infants, the form of iron used in fortifying cereals is electrolytic iron and is poorly absorbed (18, 14).

Low intake of iron during infancy and toddlerhood can result in iron-deficiency anemia, with associated symptoms of irritability, fatigue and weakness, decreased appetite, light-headedness, stunting of growth, and learning and behavioral problems (15). Because many of these symptoms can be permanent if the iron deficiency is severe, it is imperative that iron-rich complementary foods be introduced to infants at 6 months and continued to be offered throughout childhood (14). Of US children ages 1-3, 12% of Hispanic, 6% of black, and 6% of white toddlers are iron-deficient (10).

*Vitamin D*

Vitamin D is another nutrient of concern for infants and toddlers. Vitamin D is found naturally in very few food sources, and humans have historically relied on production of adequate amounts in skin upon exposure to ultraviolet light. As exposure to ultraviolet light has declined in recent decades due to use of sunscreen and increased time spent indoors, it has become increasingly important that vitamin D be provided in diet (19). Consequently, many foods are now fortified with vitamin D, including cow's milk, juice and yogurt. While infant formula is fortified with vitamin D, human milk does not provide

adequate amounts. Thus, the AAP recommends that parents supplement breastfed infants with vitamin D with 400 IU/day, beginning in the first few days of life (11). The consequences of vitamin D deficiency are profound. Rickets, a disease characterized by bone malformation, can develop as a consequence of inadequate vitamin D intake in infancy. Rickets was thought to be eradicated until recent cases have emerged (19).

*Omega 3 Fatty Acids*

It has become increasingly evident that omega 3 fatty acids are important for optimal growth and development (12). Breast milk and formula provide these essential fatty acids, and complementary foods should also contain these fatty acids for brain and visual acuity development as well as other functions (20). Sources include certain species of fish, enriched eggs, and fortified foods such as juice.

Since complementary foods displace breast milk, it is critical that complementary foods provide adequate amounts of all essential micro and macronutrients especially iron, vitamin D and omega 3 fatty acids (13). A balanced diet comprised of vegetables, fruits, grains, milk, meats, and some fortified foods can ensure proper intake of these nutrients, while foods high in sugar and fat should be avoided because they displace more healthful foods (9).

### *Establishment of Food Preferences*

Along with providing essential nutrients, complementary foods can influence the establishment of dietary behaviors. A critical time for establishing taste preferences and healthful eating behaviors is before the age of 2 years (1, 2).

Many factors determine the development of taste preferences. First and foremost, many preferences are innate. For example, the first taste preference exhibited by newborn infants is the preference for sweet flavors (21). Preferences for salt and umami flavors develop around the age of 4 months (2). The preferences for sugar and salt are strongest during infancy and gradually decrease with age. Another innate food behavior in infants and toddlers is the avoidance of bitter and sour flavors (21). Although these innate preferences are moderately strong, taste preferences can be modified by feeding experiences and practices (22).

Feeding practices of infants and toddlers have a major role in establishing life-long taste preferences. Feeding practices in the first two years of life are crucial because food exposures and experiences during this stage of life determine which flavors and types of foods are preferred and avoided for years. Consequently, complementary foods high in sugar and fat, such as sweets, salty snacks and sugar-sweetened beverages (SSB) should be avoided because they contribute to the establishment of preferences for these foods in childhood and

adulthood. Overconsumption of these foods can lead to the development of obesity and associated co-morbidities (1, 2).

### *Acceptance of New Foods*

Exposing infants to a variety of healthful complementary foods with different flavors and textures can lead to acceptance and increased consumption of healthful foods during childhood and later in life (22, 23).

Neophobia, the avoidance of new foods, is typically exhibited in toddlers around the ages of 18 to 24 months. This behavior is common and believed to be genetically programmed to protect the newly mobile toddler from seeking and eating new potentially unsafe foods when they are exposed to a wider variety of surroundings (24). While infants and toddlers may exhibit neophobia, certain feeding practices can increase the acceptance of new, healthful foods. For example, some studies suggest that infants may need to be exposed to a new food item up to 15 times before they accept it. This practice is particularly helpful in enhancing acceptance of bitter flavors, like those found in certain vegetables. In fact, studies have shown that repeated exposure to vegetables can lead to acceptance, overriding the innate instinct to reject these foods (25).

Variety is also important; exposing infants and toddlers to a variety of healthful foods can also facilitate acceptance of new foods. Consuming a

balanced diet emphasizing a variety of fruits and vegetables is vital to preventing obesity and associated co-morbidities (9).

### *Self-Regulation of Intake*

Self-regulation is a genetically programmed trait demonstrated by infants and toddlers. Specifically, infants have the innate ability to adjust dietary intake according to their energy needs with respect to their frequencies of meals, portion sizes, number of foods consumed and the energy density of those foods (26). This ability protects against excess weight gain. While most children retain the ability to self-regulate intake through infancy, they begin to lose it in late toddlerhood, around the age of 15 months (13). As children continue to grow older and further lose their ability to self regulate, environmental factors influencing dietary consumption become increasingly important. Therefore, environmental factors such as parents' feeding practices can play a major role in caloric intake, especially once the child is toddler-aged (25).

### *Pediatric Obesity*

Because feeding practices affect the development of food preferences, they can have a significant impact on the development and prevention of pediatric obesity, the most crucial health-related challenge facing children today (27, 28).

Children 2-19 years are classified as overweight if their body mass index (BMI) is at or above the 85$^{th}$ percentile and are classified as obese if their BMI is at

or above the 95th percentile (29). According to 2007-2008 National Health and Nutrition Examination Survey data, 32% of children 2-19 years of age were overweight or obese. For children ages 2-19 years, Hispanic boys were significantly more likely to be overweight (BMI ≥ 85th percentile), obese (BMI ≥ 95th percentile) and have a BMI at or above the 97th percentile for age than non-Hispanic white boys, and non-Hispanic black girls were significantly more likely to be overweight, obese and have a BMI at or above the 97th percentile for age than non-Hispanic white girls (30).

While BMI percentiles are used to determine the weight status of children 2 to 19 years of age, BMI is not used for children under the age of 2 years. Instead, the weight and recumbent length of an infant or toddler is measured and plotted on sex-specific growth charts established by the Centers for Disease Control and Prevention (CDC) in 2000. If the weight-for-recumbent-length is equal to or greater than the 95th percentile, the infant or toddler is considered to have excess weight. The terms "overweight" and "obese" are not used for this age group (29). National Health and Nutrition Examination Survey data revealed that about 11% of children younger than 2 years had a weight-for-recumbent-length at or above the 95th percentile. Ethnic disparities have been reported, with more Hispanic infants and toddlers under 2 years having measurements of weight-for-recumbent-length at or above the 95th percentile,

when compared to children of other ethnicities. Non-Hispanic black infants and toddlers have the next highest rates of overweight, and non-Hispanic white infants and toddlers have the lowest rates (30).

Excess weight has a profound impact on the health of children. Some of the effects of excess weight include social stigmatization, glucose intolerance, type 2 diabetes, hypertension, hyperlipidemia, sleep apnea, orthopedic complications, and polycystic ovary disease (31, 32). High BMI in childhood is a determinant of overweight and obesity in adulthood. Research indicates that the children with the highest BMI percentiles are the most likely to retain high BMIs as adults. Children who are obese at ages 3-5 years have about a 20% chance of being obese at age 35, children 6-11 years have about a 50% chance and 12-19 years have over a 60% chance of being obese at age 35 (29). Furthermore, children who are overweight also have increased risk for obesity, metabolic syndrome, and type 2 diabetes in adulthood (33).

As the prevalence of overweight and obesity in childhood and adulthood has increased, the social environment has changed and will continue to change. First, the cost of treating obesity and its co-morbidities continues to increase. The medical expenses of an obese adult are 36% higher than the expenses of a normal-weight adult (34). One study estimated that the total health care cost of obesity is beginning to rival to that of tobacco (35). Furthermore, as Medicaid and

Medicare cover a significant portion of these expenses, public health care demands are becoming increasing challenging to meet.

Aside from health care costs, obesity and its co-morbidities can also lead to lost economic opportunity and productivity; one study estimated these costs to be approximately $23 billion (36). The quality of life is also greatly impacted by obesity, with obesity exacting a psychological toll that may be nearly impossible to assess (37). Studies have shown that children who are overweight or obese perform worse in school than their normal-weight counterparts and that they are less likely to attend college (31). This lost opportunity and productivity has the potential to profoundly damage society.

**Complementary Feeding Guidelines**

Currently, few dietary guidelines for infants and toddlers have been published. For example, the United States Department of Agriculture (USDA) has established food pyramids for the entire lifespan, including pregnant women and children 2 years of age and older, but has not included a pyramid for children from birth to 24 months (38). Experts in child nutrition have acknowledged this gap in broadly applicable official guidelines and expressed the need for dietary recommendations to provide caregivers and health care professionals with more concrete information on how to feed infants and toddlers (39).

The American Dietetic Association (ADA) does provide unofficial general recommendations, suggesting that caregivers offer a wide variety of fruits, vegetables, whole grains, legumes and plain meats and avoid offering foods high in sugar, sodium and saturated fat to infants and toddlers. The intake of a variety of fruits and vegetables is important because these foods provide essential micronutrients, fiber, complex carbohydrates and protein (9).

Additionally, a few more specific evidence-based recommendations pertaining to specific feeding practices have been established by various national and international organizations. Recommendations that apply to infants and toddlers in the US are included in Table 1.

**Table 1. Recommendations for Feeding Practices**

| **Organization** | **Recommendation(s)** |
|---|---|
| World Health Organization (WHO) | Breastfeed exclusively for 6 months and continue with complementary foods for 2 years (40) |
| American Academy of Pediatrics (AAP) | Breastfeed exclusively until 6 months and continue for 12 months (41) |
| | Introduce cow's milk only after 12 months (41) |
| | Can introduce juice after 6 months and only 4-6 ounces per day for children ages 1-6 years (42) |
| Centers for Disease Control and Prevention (CDC) | Introduce iron-rich foods at 6 months (14) |
| American Dietetic Association (ADA) Start Healthy Feeding Guidelines for Infants and Toddlers | Introduce a variety of fruits and vegetables, whole grains, legumes, and plain meats (9) |
| | Do not give infants foods high in sugar, sodium and saturated fat (9) |

**Complementary Feeding Studies**

Until recently, little attention has been given to the diets of infants and toddlers. In fact, only two comprehensive national studies have contributed insight into infant and toddler feeding practices in the US. The cross-sectional Feeding Infants and Toddlers Study (FITS), published in 2002, assessed the dietary intakes of a randomized sample of 3022 infants and toddlers ages 4-24 months by conducting 24-hour dietary recalls and administering surveys (43). This study was prompted by the rising prevalence of pediatric overweight in the US and was also used to evaluate nutrient intake using the newly developed Dietary Reference Intakes (DRIs) created in 1997 by the USDA (44). The second study, the Infant Feeding Practices Study II (IFPS II) was a national longitudinal study which evaluated the feeding patterns of 1172 infants through the first year of life. The mothers of the infants completed monthly food frequency questionnaires and other health assessment questionnaires developed by the CDC and Food and Drug Administration (FDA) for one year. Though this study contributed limited information about complementary foods, it did identify social and behavioral factors involved in feeding practices (45).

## *Types of Complementary Foods*

### *Fruits and Vegetables*

Important dietary concerns reported by FITS were the low intake of fruits and vegetables by infants and toddlers, along with the lack of variety of these foods. Twenty-seven percent of infants 9-11 months and approximately 20% of toddlers 12-24 months did not consume any vegetables in a single day. Additionally, one-quarter of infants and one-third of toddlers did not consume fruit in the day studied (18).

Infants 7-8 months were more likely than toddlers to consume deep yellow vegetables, such as squash, carrots, and sweet potatoes. Very few infants and toddlers consumed dark green vegetables such as broccoli and spinach. Importantly, researchers found that infants who consumed yellow vegetables were less likely to have an excess of energy intake. However, the percentage of children consuming these yellow vegetables dropped dramatically by the age of 15 months, probably due to the decline in consumption of commercially-prepared baby food. Compared to infants, toddlers consumed more starchy vegetables such as potatoes, green peas and corn and fewer of the more nutrient-dense green and yellow vegetables. French fries were the third most commonly consumed vegetable by infants and the most commonly consumed vegetable by toddlers (46).

*100% Fruit Juice*

While AAP recommendations state that 100% juice can be introduced at the age of 6 months or later, they stipulate that children 1-6 years of age should not consume more than 4-6 ounces per day (42). The FITS researchers found that 22% of infants consumed juice before this minimum age of 6 months. Five percent of toddlers 19-24 months consumed over 16 ounces of juice despite the AAP recommendation of 4-6 ounces maximum (16). Juice intake can also contribute to the development of preferences for sweet foods and beverages and can displace nutrient-dense beverages such as milk (42).

*Breast Milk*

Breastfeeding can impact complementary feeding practices by increasing the acceptance of new foods by infants and reducing the effect of neophobia. The mother's diet can contribute to an infant's flavor experiences. For example, in one study, breastfeeding infants of mothers who consumed carrot juice were more likely to accept carrot juice compared to infants in the control group (47).

It is also important to note that some studies have shown that infants who are breastfed are less likely to gain excess weight in infancy (48, 49, 50). While a variety of explanations regarding the effect of breastfeeding on weight gain in infancy have been proposed, some researchers have suggested that breastfed

infants are better able to retain their ability to self-regulate total energy intake than are formula-fed infants (3).

FITS reported that 30% of all infants 6 months of age consumed breast milk at least once in the day studied and 16% were breastfed at 12 months (46). FITS also found a significant difference in breastfeeding rates between participants and nonparticipants of the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). Specifically, fewer WIC infants (69%) were ever breastfed, compared to nonparticipants (84%). Additionally, only 4% of 4-6 month-old WIC participants were exclusively breastfed, compared to 17% in nonparticipants the same age (51). IFPS II also found that breastfeeding rates were lower in WIC participants compared to the general population (52). The consequences of low rates of breastfeeding for infants can include higher infant mortality rate, more illnesses for children, more sick days taken by caregivers, higher risk of gaining excess weight and of developing co-morbidities of overweight/obesity later in life (41).

Breastfeeding is an extremely important feeding practice, but because it has been and continues to be studied extensively, this study focuses instead on other less intensively studied feeding practices, including the types complementary foods offered and the age of introduction of complementary foods.

*Cow's Milk*

Even though the intake of cow's milk by children is not recommended until 12 months, FITS found that 22% of infants 9-11 months were consuming cow's milk on a daily basis (18). Because of its high renal solute load, consuming cow's milk before the age of 12 months can lead to intestinal bleeding and increased risk for anemia (41).

*Meat and Other Protein Sources*

The CDC recommends that when infants reach 6 months of age, caregivers should offer plain meats (e.g. poultry, red meat) in order to prevent iron deficiency (14). Meat in an infant's diet can provide zinc and heme iron, both of which are more bioavailable in meats compared to other foods sources such as infant cereals. Iron deficiency anemia is a serious condition that can lead to fatigue, irritability, anorexia, and permanent cognitive impairment (53).

Meat has been established as a safe and well-accepted first complementary food (17). Despite this, both FITS and IFPS II reported that very few infants before the age of 9-11months were fed meat (18, 52). FITS found that 7.5% of infants 4-11 months did not receive the Estimated Average Requirement (EAR) for iron (6.9mg/day) (54).

Among toddlers, processed meats like bacon, hot dogs, and sausage were the second most commonly consumed type of meat by toddlers (18). These meat

items are high in sodium and saturated fat and contain lower amounts of iron, zinc and other essential nutrients, when compared to plain meats (17).

*Grains*

Although no research supports the need for a specific chronological order of complementary food introduction, infant cereal is the most common first food and is the main source of grains for infants through 9-11 months. According to FITS, infants typically begin consuming other grains such as bread, crackers, and ready-to-eat cereals at 7-8 months. Roughly one-quarter of toddlers 12-24 months consumed presweetened (> 21.2 grams of sugar per 100 grams) cereals in the day studied (18). Excess intake of refined grains and grain products with added sugars can lead to excess weight gain (27, 28).

*Desserts, Sweets and Salty Snacks*

The FITS researchers also found that a high percentage of infants and toddlers consumed desserts, other sweet foods and salty snacks. At 4-6 months, 10% of infants were already consuming desserts. Furthermore, almost half of infants 7-11 months and 91% of toddlers were consuming at least one sweet-tasting food item in a day. Salty snacks were also common with 27% of toddlers consuming foods from this group at least once in a day (18). These foods are energy-dense and contain low amounts of micronutrients and can also contribute to the development of pediatric obesity (27, 28).

*Sugar-Sweetened Beverages (SSB)*

The ADA Start Healthy Guidelines recommend that infants should not be given foods or beverages high in sugar or fat (9). However, FITS reported that infants and toddlers commonly consumed sweetened items (18). Eleven percent of infants 9-11 months consumed sweetened beverages at least once in a day, 40% of all toddlers consumed fruit drinks, and 11% of toddlers 15-24 months consumed sweetened carbonated beverages in the day studied (16). The regular consumption of sweetened foods and beverages may be among the most alarming feeding practices reported by this study because of the potential to damage health. Specifically, the intake of SSB may 1) displace other beverages and foods in the diet, thereby decreasing intake of essential nutrients, 2) contribute to excessive energy intake, combating the toddler's ability to self-regulate caloric intake, 3) contribute to a heightened preference for sweet foods, and 4) increase the risk for developing pediatric overweight (55, 56, 57).

*Overall Intake*

Given the rising prevalence of obesity, FITS researchers anticipated that they would uncover problems with infants' and toddlers' diets. Nevertheless, they were surprised to find that feeding patterns exhibited even as early as 9-11 months resembled the poor dietary trends of older children and adults in the US (46).

### *Age of Introduction of Complementary Foods*

The AAP recommends initiating the introduction of complementary foods to infants at the age of 6 months with a range of 4-8 months, depending on the individual development of the infant. Infants do not require any other foods or beverages before this time, including solids, water or any other fluids (41). FITS found that 29% of infants were fed solid foods before the age of 4 months, 67% were introduced to complementary foods between 4 and 6 months, and that only 6% were given their first complementary foods at the age of 6 months or later (46).

Since infants self-regulate their total caloric intake, the early introduction of food could potentially displace intake of breast milk, which is of superior nutrient density and unmatched in quality for infants this age (13). Other implications for introducing complementary foods before 4 months include increased risk for mucosal inflammation in the intestines and diarrhea (58).

Early introduction of complementary foods can also alter the ability of infants to self-regulate, which is a vital trait to preserve in order to avoid excess weight gain in infancy and childhood. Studies have shown that when infants were introduced to complementary foods earlier than 4 months, they had a higher total energy intake compared to infants introduced to complementary foods after 4 months, which may indicate that the ability to self-regulate has been

compromised (3). Studies have also found a link between early feeding and increased risk for pediatric obesity (59, 60).

Early feeding can also have a role in the development of specific dietary behaviors; IFPS II found that infants who were introduced to solid foods early were more likely to consume foods high in sugar and fat at the age of 12 months compared to those who were introduced to solid foods at 4 months or later (52). Early introduction of complementary foods can influence health outcomes and dietary preferences later in childhood.

### *Feeding Practices by Race and Ethnicity*

#### *Types of Complementary Foods*

FITS found that Hispanic infants and toddlers consumed more sweet-tasting foods and sugar-sweetened beverages at an earlier age than non-Hispanic infants and toddlers. While fruit intake was higher among Hispanic infants, with 45% of Hispanic infants 4-5 months consuming fruits compared to 36% of non-Hispanic infants, this trend can be attributed to the high intake of 100% fruit juice, which FITS categorized in the fruit group. More than one-third of the fruit group intake was comprised of 100% fruit juice (61). While all ethnicities studied had similar mean energy intakes, Hispanic infants and toddlers consumed a higher proportion of energy from carbohydrates compared to non-Hispanics

(62). Hispanic infants and toddlers were also more likely to consume culturally-specific foods such as soups, rice, beans and tortillas (61).

**Summary of Feeding Practices**

In summary, the feeding practices of infants and toddlers have profound implications for long term health. These practices are instrumental in establishing life-long food preferences, which may directly affect the development of pediatric obesity and health throughout the lifespan (1, 2).

## II. Objectives

The dietary intake of infants and toddlers has been understudied in the field of nutrition. Clearly, given that few studies have investigated dietary practices in infants and toddlers, there is need for research investigating current feeding practices.

FITS was the first study to comprehensively investigate feeding practices of infants and toddlers in the US, and while the researchers included a nationally representative sample of infants and toddlers, they did not include specific populations with high risk for developing pediatric obesity (43).

An example of a high risk population is the infants and toddlers in WIC in San Marcos, TX. San Marcos is an important location for conducting an assessment study using FITS methodology for several reasons. First, San Marcos exhibits high rates of pediatric overweight. In 2003, 54% of 4$^{th}$ graders in San Marcos schools had BMI measurements that classified them as overweight (BMI ≥ 85$^{th}$ percentile) compared to 39% in Texas and 37% in the US (63, 64). Also, approximately 70% of the youth population in San Marcos is Hispanic (65). Since Hispanic children and adults in the US disproportionately suffer from being

overweight and obese, it is vital to study feeding practices in Hispanic populations. While FITS included a nationally representative sample, they reported that one of their limitations was including a low number of Hispanic subjects (43).

Investigating the feeding practices of a WIC population is also ideal. The WIC program serves women, infants and children up to 5 years of age by providing nutrition education, food packages intended to supplement the diets of participants, and health care referrals. In order to qualify for this program, participants must be considered at nutritional risk, e.g. anemia, obesity, and must have a total household income at or below 185% of the poverty level. Participants of WIC receive vouchers or electronic debit cards which allow them to purchase WIC approved food items from grocery stores (66). Because WIC participants are at nutritional risk and have below average household incomes, they have been subjects of many scientific research studies. Additionally, since the WIC program receives substantial government funding, the efficacy of the services provided by WIC have been studied throughout the existence of this program.

Finally, San Marcos is an ideal study site because it is home to a university with a graduate nutrition program, and therefore lends itself to follow-up

investigations, such as implementing and evaluating the efficacy of community interventions to improve feeding practices.

**Objective 1**

The first objective of this study was to investigate the feeding practices (types of complementary foods and age of introduction of these foods) of infants and toddlers participating in WIC in San Marcos, TX, to assess whether observed feeding practices met currently accepted guidelines, and to compare the observed feeding practices to trends reported by nationally representative studies.

**Objective 2**

The second objective was to identify differences in complementary feeding practices (types of complementary foods and age of introduction of these foods) in Mexican American (MA) and non-Hispanic white (NHW) infants and toddlers in WIC in San Marcos, TX.

**Hypotheses**

Based on the prevalence of pediatric overweight in Texas, we hypothesized that more infants and toddlers in WIC in San Marcos, TX were consuming high energy-dense foods and SSB and that fewer infants and toddlers in WIC in San Marcos, TX were consuming fruits and vegetables compared to the infants and toddlers in FITS. We also hypothesized that MA infants and toddlers

had higher mean numbers of exposures to high energy-dense foods and to SSB than NHW infants and toddlers. Additionally, we also hypothesized that MA infants and toddlers were introduced to these foods at an earlier age than NHW infants and toddlers.

## III. Methods

### Subjects

A convenience sample of 162 individuals was recruited from WIC nutrition education classes in San Marcos, TX for this cross-sectional and retrospective study. The San Marcos WIC clinic serves approximately 500 individuals each month, and while enrolled in WIC, participants are required to participate in nutrition education classes every three months, with the majority attending in person at the local clinic and only very few pursuing an online option (67). The number recruited (162) was chosen to attain a meaningful sample (approximately 100) from those attending WIC nutrition classes and also to compensate in advance for potential attrition (68). Criteria for eligibility included having a child who would be between the ages of 4 and 32 months during the month after recruitment when data collection occurred. Data were collected regarding only one child per family to prevent over-representation of feeding practices from one family. All procedures were compliant with both the Texas State University-San Marcos and the State of Texas Institutional Review Board guidelines for human subject research.

## Procedure

### *Training of Research Assistants*

Research assistants were recruited from undergraduate and graduate nutrition classes at Texas State and worked under the direct supervision of the lead researchers and principal investigator. These research assistants participated in subject recruitment, subject interviews, preparation of subject folders, and data entry.

Before working with human subjects in any capacity, including processing data, all researchers and research assistants completed the online Collaborative Institutional Training Initiative human research course as per the Institutional Review Board regulations.

### *Instruments*

#### *Nutrition Data System for Research*

A 24-hour recall is a record of the types and amounts of all foods and beverages consumed by an individual over the course of 24 hours. Twenty-four-hour recall data were collected using Nutrition Data System for Research (NDSR, 2008), which was developed and validated by the Nutrition Coordinating Center (NCC) at the University of Minnesota. A lead researcher attended a two-day training course on this software at the NCC in Minneapolis prior to training all research assistants to use the software. Based on the multiple pass method,

NDSR provides on-screen interview prompts that guide users through each step of the 24-hour recall. Once the interview is complete, the 24-hour recall data collected and entered into NDSR provide a detailed record of the types and quantities of every food and beverage consumed by the subject.

*The Feeding Practices Questionnaire, Demographic and Health History Forms*

The Feeding Practices Questionnaire (FPQ) was used to interview subjects about 1) breastfeeding practices, 2) certain infant and toddler feeding practices, such as the age of first introduction to certain foods (e.g. fruits, vegetables, meats and desserts), and 3) feeding skill development (see Appendix A). Questions used in this survey were adapted from questions selected from the FITS survey with permission from FITS researchers (43), from the CDC questionnaires used in IFPS II (45), and from the Texas Department of State Health Services' Infant Feeding Practices Study survey. The Demographic and Health History Forms were developed by referencing the Census Bureau (69) and the CDC questionnaires used in IFPS II (45) (see Appendix A). None of the three surveys used in this study required pre-study assessment of construct validity because they assessed only observable data.

*Interviewing Script*

The telephone interview script, used by all research assistants to ensure standardization of data collection (see Appendix A), was based on both the

sample script provided by the NCC during NDSR training and the FITS interviewing script. This script was designed to complement the interviewing prompts during collection of 24-hour recall data when using the NDSR program.

*The Food Amounts Booklet*

A Food Amounts Booklet (FAB) was provided to potential subjects during recruitment for use during the telephone interviews. The booklet depicted commonly used serving sizes of foods and beverages and images of spoons, cups, plates, and bowls to assist in determination of food and beverage portion sizes throughout the telephone interview. The NCC developed this tool to improve the accuracy of reported serving sizes of foods and beverages included in 24-hour recalls. Along with these standard images, infant and toddler appropriate serving size images, such as sippy cups, from the FITS serving size booklet were incorporated into this booklet as well (43).

All instruments and materials used in this study were translated into Spanish by expert translators. Subjects were provided with documents in English or Spanish, according to their preference.

***Recruitment***

Research assistants recruited subjects from among nutrition class attendees at the San Marcos WIC local agency, over a period of four months (June 9 through September 29, 2009). Since WIC held separate classes for English

and Spanish speakers, bilingual research assistants attended both classes on each recruitment day (generally one-two days/week). In order to maintain consistency, a standardized script was used by all research assistants for recruiting and included a brief description of the study's objectives, eligibility criteria, components of participation, and information about the incentive ($10 gift card for a local grocery store chain) offered upon completion of the telephone interview.

Immediately following the WIC nutrition class, research assistants spoke individually to each interested participant about study details and explained the consent form (see Appendix A). If participants were eligible and chose to participate, the consent form was signed, and subjects were asked to complete the screening form (see Appendix A) which contained questions about their child(ren)'s age(s), their telephone number and telephone interview availability. A copy of the consent form was given to the subjects, along with the FAB. A brief explanation of the FAB and serving size measurement information was also provided in order to ensure optimal portion size accuracy during the telephone interviews. Since an incentive was offered to the subjects, each potential participant was also asked to sign a funds release form as required by Texas State.

### *Data Collection*

Research assistants conducted telephone interviews with subjects within 10 days of recruitment at a previously unannounced time. If a subject was unavailable at the time of a call, the research assistant left a voicemail message and attempted an additional call on that day, if possible. If the call was not answered during the second attempt, researchers called on subsequent days. Lack of a successful interview after 20 attempts resulted in the subjects being dropped from the study.

The research assistants conducted the scripted telephone interviews from a private research room. During the approximately 45-minute telephone call, research assistants conducted a 24-hour recall of the infant's or toddler's dietary intake on the previous day using NDSR software. The research assistants also asked subjects questions from the FPQ, Demographic and Health History Forms during the telephone interview. Within two days of the completion of the interview, research assistants mailed a $10 grocery store gift card to the subject along with a letter expressing appreciation for participation.

### **Data Analysis**

The Statistical Package for the Social Sciences (SPSS, version 17.0) was used to conduct all data analyses. First, data from the three surveys were entered into an SPSS file. Next, the 24-hour recall data from NDSR were merged into the

SPSS data file. Quality assurance protocol developed by NCC was used to ensure accuracy of all recall data. Additionally, quality assurance was performed on the entry of the survey data to ensure accurate entry.

***Objective 1: Assessment of Feeding Practices***

*Sub-objective 1.1: Food Types*

Ninety-seven infants and toddlers were stratified into four different age groups in order to assess the frequency of consumption of different foods within groups and subgroups. These age groups included 4-6, 7-11, 12-24 and 24-32 months.

All foods and beverages from the 24-hour recalls were categorized into groups and subgroups displayed in Table 2, as per the food groupings used in FITS, which was based on the Continuing Survey of Food Intakes by Individuals (43). Regardless of the amount of each item consumed, food and beverages consumed by the infants and toddlers were categorized and counted as exposures to foods and/or beverages within food groups and subgroups. However, as per FITS, when foods were not consumed alone, but instead as ingredients in a mixed dish, the foods were not counted individually. For instance, if a child consumed a slice of cheese pizza, the individual ingredients such as the dough, tomato sauce, and cheese would not be counted, but the pizza would be counted as a mixed dish (see list of mixed dishes in Table 2). As an

exception to this, if all ingredients in a mixed dish could be categorized into the same food group (e.g. fruit cocktail), the food item was counted in that particular group (e.g. "other fruit").

**Table 2. Food Groups and Subgroups**

| Groups | Subgroups |
|---|---|
| Vegetables | dark green[a], deep yellow[b], white potatoes[c], other starchy[d], other vegetables[e] |
| Fruits | citrus fruit, apples, bananas, melons, berries, other fruit[f], dried fruit, 100% fruit juice |
| Milk | breast milk, infant formula, cow's milk, soy milk |
| Meats and other protein sources | beef, poultry, pork, fish/shellfish, processed meat[g], baby food meat, eggs, yogurt, cheese, beans, nuts/seeds/nut butters |
| Grains | infant cereals, non-infant cereals, bread, tortillas, crackers, rice/pasta, cereal/granola bars, quick breads[h] |
| Sweets and salty snacks | dairy desserts[i], other desserts[j], candy, sugar/syrups/preserves[k], sugar-sweetened beverages[l], salty snacks[m] |
| Mixed dishes | pizza, sandwiches, pasta, macaroni and cheese, meat/starch dishes, starch/vegetable dishes, meat/vegetable dishes |

[a] Includes broccoli, spinach and other green leafy vegetables
[b] Includes carrots, squash, sweet potatoes, zucchini
[c] Includes all white potatoes except potato chips
[d] Includes corn and green peas
[e] Includes green beans, tomatoes, okra, celery, iceberg lettuce, mixed vegetables
[f] Includes peaches, apricots, pears, plums, grapes, mixed fruits
[g] Includes sausage, hotdogs, bacon, cold cuts
[h] Includes cornbread, pancakes, muffins, waffles
[i] Includes ice cream, frozen yogurt, pudding
[j] Includes brownies, cake, cookies, graham crackers, animal crackers, jell-o, sherbet, toaster pastries
[k] Includes sugar, jam, syrup, caramel dip, icing
[l] Includes fruit-flavored drinks, carbonated soda, sweetened tea, sweetened sports drinks
[m] Includes potato chips, cheese puffs, popcorn, corn chips

After all foods and beverages were classified, the number of exposures to each group and subgroup were tallied for each subject. Frequency analyses of the continuous variables were used to determine the percentage of infants and toddlers that had consumed at least one item from each of these groups and subgroups. These percentages were compared to guidelines in Table 2 and to the food and beverage consumption trends found by national studies.

*Sub-objective 1.2: Age of Introduction of Foods*

The age of first introduction to any complementary food or beverage was assessed using the FPQ. Since all infants and toddlers 6 months and older had been introduced to complementary foods or beverages at the time of the study, data from all 78 of these infants and toddlers were included in this analysis. However, two subjects did not report age of introduction and these data were considered missing. These continuous variables were categorized by age of first introduction and the mean age of introduction of the food groups was determined using descriptive analyses.

The age of first introduction of the following foods and food groups was assessed using the FPQ: vegetables, fruit, 100% fruit juice and SSB, cow's milk, meat, dairy foods, cereal, sweets or desserts, and salty snacks. Data from toddlers 12-32 months were used for these analyses so that most included in the sample were past the age of introduction to these foods. If subjects in this age range had

not yet been introduced to a particular food group at the time of the study, they were excluded from the analysis (see Appendix B). Therefore, the number of toddlers included in each analysis differed according to the number already introduced to the specific foods. These continuous variables were categorized by age of first introduction and the mean age of introduction of the food groups was determined using descriptive analyses.

***Objective 2: Differences Across Race/Ethnicity***

*Sub-objective 2.1: Food Types*

Since the data were not normally distributed, Mann Whitney nonparametric tests were used to detect significant differences in the mean number of exposures to certain food groups between MA and NHW infants and toddlers. Though these tests were run for many different age categories, the age groups 4-23 and 6-32 months best represented differences between MA and NHW food exposures because they contained enough infants and toddlers needed to observe valid differences.

*Sub-objective 2.2: Age of Introduction of Foods*

Mann Whitney tests were used to detect differences in the age of introduction of certain food groups between MA and NHW infants and toddlers as well.

## IV. Results

Of the 162 subjects recruited, 97 completed interviews. The remaining 65 were not interviewed for several reasons. Eleven did not answer any of the 20 attempted calls, three declined to participate when they did answer, five had children who had became older than 32 months when called and no longer met eligibility requirements for participation, and 47 who were recruited towards the end of the data collection period were not called because researchers had collected data from the target number of subjects (approximately 100).

### Sample Characteristics

Table 3 displays the race, ethnicity, gender and ages of the infants and toddlers included in this study.

**Table 3. Characteristics of infants and toddlers**

| Characteristic | Sample size | Percentage of sample |
|---|---|---|
| **Race** | **Total (n=97)** | |
| Hispanic | 65 | 67 |
| Non-Hispanic White | 16 | 16.5 |
| Non-Hispanic Black | 3 | 3.1 |
| Pacific Islander | 1 | 1 |
| Other[1] | 9 | 9.3 |
| Missing | 3 | 3.1 |
| **Ethnicity** | **Total (n=97)** | |
| Mexican | 55 | 56.7 |
| Latin American | 4 | 4.1 |
| Puerto Rican | 1 | 1 |
| Other Hispanic[2] | 3 | 3.1 |
| Non-Hispanic | 29 | 30 |
| Missing | 5 | 5.1 |
| **Race/Ethnicity** | **Total (n=97)** | |
| Male | 53 | 54.6 |
| Female | 42 | 43.3 |
| Missing | 2 | 2.1 |
| **Age Group** | **Total (n=97)** | |
| 4-6 months | 24 | 24.7 |
| 7-11 months | 26 | 26.8 |
| 12-24 months | 36 | 37.1 |
| 25-32 months | 11 | 11.3 |

[1] Includes seven mixed race, one European, one non-specified other race
[2] Includes one mixed Hispanic ethnicity and two non-specified other Hispanic ethnicity

## Objective 1: Feeding Practices of San Marcos, TX, WIC Infants and Toddlers

### *Food Groups and Subgroups*

Tables 4-11 display food consumption reported for infants and toddlers. The top three most commonly consumed vegetables and meats are presented in Tables 5 and 9.

**Table 4: Number of infants and toddlers consuming vegetables during a 24-hour period**

| Food group/subgroup | 4-6 months (n=24) | 7-11 months (n=26) | 12-24 months (n=36) | 25-32 months (n=11) |
|---|---|---|---|---|
| **Any vegetable*** | **12** | **21** | **24** | **6** |
| **Starchy vegetables** | **4** | **8** | **18** | **4** |
| White potatoes | 1 | 6 | 15 | 4 |
| Fried potatoes | 1 | 1 | 11 | 4 |
| Other starchy vegetables | 3 | 5 | 5 | 1 |
| **Non-starchy vegetables** | **12** | **17** | **12** | **4** |
| Dark green vegetables | 0 | 1 | 0 | 1 |
| Deep yellow vegetables | 9 | 11 | 2 | 1 |
| Other vegetables | 4 | 8 | 4 | 2 |
| **Mixed dish vegetables** | **0** | **3** | **3** | **1** |
| Meat/vegetable dishes | 0 | 3 | 1 | 1 |
| Starch/vegetable dishes | 0 | 0 | 2 | 0 |

*Included all vegetables except for vegetables in mixed dishes which were counted separately

Total vegetable consumption was highest at 7-11 months and lower in the next two age groups with 33.3% of toddlers 12-24 months and 45.5% of 25-32 months having consumed no vegetables in the day studied. Infants 4-11 months consumed more non-starchy vegetables than starchy vegetables, while toddlers 12-24 months consumed more starchy vegetables than non-starchy vegetables. This trend is evidenced by the decrease in the intake of deep yellow vegetables and increase in the intake of white potatoes with age.

**Table 5: Most commonly consumed vegetables by toddlers 12-24 months**

| Vegetable | % Consuming |
|---|---|
| 1. Potatoes | 41.7% |
| 2. Corn | 11.8% |
| 3. Green beans | 10.6% |

For toddlers 11-32 months, the most commonly consumed vegetable was white potatoes, and the most common type of white potato consumed was fried. Only one child in this entire study consumed dark green vegetables, i.e. broccoli.

**Table 6: Number of infants and toddlers consuming fruit during a 24-hour period**

| Food group/subgroup | 4-6 months (n=24) | 7-11 months (n=26) | 12-24 months (n=36) | 25-32 months (n=11) |
|---|---|---|---|---|
| **Any fruit** | **9** | **19** | **27** | **8** |
| **Whole fruit** | **7** | **16** | **22** | **6** |
| Citrus fruit | 0 | 1 | 0 | 1 |
| Apples | 2 | 5 | 9 | 3 |
| Bananas | 4 | 6 | 11 | 3 |
| Melons | 0 | 0 | 6 | 2 |
| Berries | 0 | 1 | 7 | 2 |
| Other fruit | 4 | 9 | 8 | 1 |
| Dried fruit | 0 | 1 | 1 | 0 |
| **100% fruit juice** | **3** | **11** | **14** | **5** |

Over 70% of infants and toddlers 7 months and older consumed items from the fruit/100% fruit juice category on the day studied. Overall, whole fruit was consumed by more infants and toddlers than was 100% fruit juice. Toddlers 25-32 months had the highest consumption of 100% juice at 45.5%, though

approximately 40% of infants 7-11 months and toddlers 12-24 months consumed 100% juice on the day studied, as well.

Apples, bananas and fruits in the "other fruits" category such as peaches, grapes, apricots and pears were more commonly consumed than other fruits across all age groups, while berries and melons were more commonly consumed by toddlers than by infants. Citrus fruit and raisins were the least consumed fruits.

**Table 7: Number of infants and toddlers consuming milk during a 24-hour period**

| Food group/subgroup | 4-6 months (n=24) | 7-11 months (n=26) | 12-24 months (n=36) | 25-32 months (n=11) |
|---|---|---|---|---|
| **Any milk** | **24** | **25** | **33** | **11** |
| **Breast milk** | **10** | **4** | **3** | **1** |
| Formula | 17 | 23 | 4 | 1 |
| Soy milk | 0 | 0 | 1 | 0 |
| **Cow's milk** | **0** | **2** | **30** | **10** |
| Whole | 0 | 0 | 23 | 5 |
| 2% milk | 0 | 1 | 6 | 2 |
| 1% milk | 0 | 0 | 1 | 1 |
| Skim milk | 0 | 1 | 0 | 1 |
| Lactose-free | 0 | 0 | 0 | 1 |
| Unflavored | 0 | 1 | 27 | 8 |
| Flavored | 0 | 1 | 3 | 2 |

Almost all infants and toddlers studied consumed some type of milk on the day studied. More infants 4-6 months (41.7%) consumed breast milk than infants 7-11 months (15.4%) and toddlers 12-24 months (9.1%). More infants 7-11

months (88.5%) than 4-6 months (70.8%) consumed formula, and approximately 10% of toddlers (12-32 months) consumed formula.

The consumption of cow's milk increased with age, with 83.3% of toddlers 12-24 months and 90.9% of toddlers 25-32 months having consumed cow's milk on the day studied. Most of the cow's milk consumed was whole or 2%, and only a few infants and toddlers consumed low-fat or fat-free milk. While most of the cow's milk consumed was unflavored, flavored cow's milk was consumed by 18.2% of toddlers 25-32 months.

**Table 8: Number of infants and toddlers consuming meat and other protein sources during a 24-hour period**

| Food group/subgroup | 4-6 months (n=24) | 7-11 months (n=26) | 12-24 months (n=36) | 25-32 months (n=11) |
|---|---|---|---|---|
| **Any meat/other protein source*** | **1** | **15** | **32** | **8** |
| **Meat** | **1** | **11** | **25** | **4** |
| Beef | 0 | 3 | 4 | 1 |
| Poultry | 1 | 7 | 16 | 1 |
| Pork | 0 | 0 | 1 | 0 |
| Fish, shellfish | 0 | 0 | 1 | 0 |
| Processed meat | 0 | 3 | 7 | 2 |
| Baby food meat | 0 | 0 | 1 | 0 |
| **Other protein sources** | **1** | **8** | **30** | **7** |
| Eggs | 1 | 1 | 22 | 6 |
| Yogurt | 0 | 4 | 11 | 2 |
| Cheese | 0 | 2 | 9 | 2 |
| Beans | 0 | 2 | 8 | 3 |
| Nuts, seeds, nut butters | 0 | 2 | 1 | 1 |
| **Protein in mixed dishes** | **0** | **9** | **18** | **5** |
| Taco/burrito | 0 | 0 | 4 | 0 |
| Pizza | 0 | 0 | 4 | 2 |
| Sandwich | 0 | 0 | 4 | 1 |
| Meat soup/stew | 0 | 2 | 6 | 2 |
| Meat/starch | 0 | 4 | 1 | 0 |
| Meat/vegetable | 0 | 3 | 1 | 1 |

*Included all meats/other protein sources except for meats/other protein sources in mixed dishes which were counted separately

Overall, more toddlers 12-32 months (approximately 80%) consumed meat/other protein sources than did infants 4-11 months (approximately 30%). More infants 7-11 months consumed meat (42.3%) than other protein sources such as beans and eggs (30.8%). Conversely, the number of toddlers 12-32 months consuming other protein sources was higher than the number

consuming meat. Eighty-three percent of toddlers 12-24 months consumed other protein sources while 69% consumed meat.

**Table 9: Most commonly consumed meats by toddlers 12-24 months**

| Meat | % Consuming |
|---|---|
| 1. Chicken | 44.4% |
| 2. Processed meat | 19.4% |
| 3. Beef | 11.1% |

The most commonly consumed meats for all infants and toddlers were poultry, processed meats and beef; only a few toddlers consumed pork, fish and baby food meat. Poultry was the most commonly consumed meat for all age groups except toddlers 25-32 months, who consumed more processed meats. Forty-four percent of toddlers 12-24 months consumed poultry, and 19.4% consumed processed meats. About 10% of infants and toddlers 7-32 months consumed beef.

Yogurt was the most commonly consumed protein food in the "other protein sources group" among infants 7-11 months, and eggs were the most commonly consumed among toddlers 12-32 months. Toddlers 12-24 months were more likely to consume eggs, yogurt and cheese than any other age group.

With respect to mixed dishes containing protein, toddlers were more likely to consume pizza, sandwiches, tacos/burritos, soups and stews than

infants, and infants were more likely to consume meat/starch dishes and meat/vegetable dishes.

**Table 10: Number of infants and toddlers consuming grains during a 24-hour period**

| Food group/subgroup | 4-6 months (n=24) | 7-11 months (n=26) | 12-24 months (n=36) | 25-32 months (n=11) |
|---|---|---|---|---|
| **Any grain*** | **13** | **23** | **35** | **11** |
| Infant cereals | 13 | 13 | 2 | 1 |
| Non-infant cereals | 0 | 5 | 18 | 7 |
| Hot cereal | 0 | 2 | 3 | 0 |
| Ready-to-eat cereal | 0 | 3 | 14 | 7 |
| Not pre-sweetened | 0 | 2 | 10 | 3 |
| Pre-sweetened | 0 | 1 | 4 | 4 |
| Breads | 0 | 2 | 10 | 2 |
| Tortillas | 1 | 0 | 2 | 3 |
| Crackers | 0 | 11 | 11 | 1 |
| Cereal/granola bars | 0 | 0 | 0 | 1 |
| Quick breads | 0 | 1 | 7 | 0 |
| Rice, pasta | 0 | 3 | 12 | 5 |
| **Grains in mixed dishes** | **1** | **8** | **19** | **6** |
| Taco/burrito | 0 | 0 | 4 | 0 |
| Pizza | 0 | 0 | 4 | 2 |
| Sandwich | 0 | 0 | 4 | 1 |
| Noodle soup | 1 | 1 | 1 | 0 |
| Pasta | 0 | 1 | 7 | 3 |
| Macaroni and cheese | 0 | 3 | 4 | 0 |
| Meat/starch dishes | 0 | 4 | 1 | 0 |
| Starch/vegetable dishes | 0 | 0 | 2 | 0 |

*Included all grains except for grains in mixed dishes which were counted separately

Grains and grain products were consumed by about half of infants 4-6 months, by 88.5% of infants 7-11 months and by almost all toddlers on the day studied. Infant cereal was more commonly consumed by infants than by

toddlers, and ready-to-eat cereals were more commonly consumed by toddlers than by infants. Toddlers 12-24 months consumed more non-presweetened than presweetened ready-to-eat cereals, while toddlers 25-32 months consumed more presweetened than non-presweetened cereals.

More toddlers 12-32 months consumed bread, tortillas, quick breads, and rice and pasta compared to other age groups, while more infants 7-11 months consumed crackers compared to other age groups. With 33.3% and 45.5% of toddlers 12-24 and 25-32 months, respectively, consuming foods in the rice and pasta subgroup and 42.3% and 30.6% of infants 7-11 months and toddlers, respectively, consuming crackers, rice, pasta and crackers were the most commonly consumed non-cereal grain products. Additionally, 19.4% of toddlers 12-24 months and 27.3% of toddlers 25-32 months consumed mixed dishes made with pasta, which was counted separately from the rice/pasta grain group. Other commonly consumed mixed dishes containing grains included pizza (18.2% of toddlers 25-32 months) and meat/starch dishes such as chicken noodle baby food dinner (15.4% of infants 7-11 months).

**Table 11: Number of infants and toddlers consuming sweets and salty snacks during a 24-hour period**

| Food group/subgroup | 4-6 months (n=24) | 7-11 months (n=26) | 12-24 months (n=36) | 25-32 months (n=11) |
|---|---|---|---|---|
| **Any desserts/sweets/SSB** | **1** | **11** | **28** | **8** |
| Dairy desserts | 0 | 0 | 1 | 2 |
| Other desserts | 0 | 6 | 8 | 3 |
| Candy | 0 | 0 | 3 | 1 |
| Sugar, syrups, preserves | 0 | 1 | 7 | 2 |
| **SSB** | **1** | **7** | **21** | **6** |
| Soda | 0 | 1 | 5 | 2 |
| Fruit-flavored drinks | 1 | 7 | 16 | 5 |
| Other | 0 | 0 | 2 | 0 |
| **Salty snacks** | **0** | **4** | **6** | **3** |

Toddlers were more likely to consume products from the desserts/sweets/SSB category than infants, with 77.8% of 12-24 months and 72.7% of 25-32 months consuming these products. One infant 4-6 months and 42.3% of infants 7-11 months consumed desserts, sweets and/or SSB on the day studied. SSB were most commonly consumed items in this category by all age groups. In fact, almost twice as many toddlers 12-32 months consumed SSB as those who consumed desserts and sweets.

Twenty-seven percent of infants 7-11 months, 58.3% of toddlers 12-24 months, and 54.5% of toddlers 25-32 months consumed SSB on the day studied. Fruit-flavored drinks were the most popular beverages in the SSB group. Within the SSB subgroup, few infants and toddlers in this study consumed non-diet

sodas, but over one-third of infants 7-11 months and almost half of toddlers 12-32 months consumed at least one fruit-flavored beverage in the day studied. Salty snacks were consumed by about 15% of both infants 7-11 months and toddlers 12-24 months, and by over one-quarter of toddlers 25-32 months.

***Consumption of Food Groups Compared to FITS***

Tables 12-17 show comparisons of food group consumption between infants and toddlers in San Marcos WIC and those studied in FITS 2002. While age groups from both studies are matched, the age group of 25-32 months from this study is not displayed in these tables because FITS sampled toddlers only up to the age of 24 months (18).

**Table 12: Percentage of infants and toddlers consuming vegetables during a 24-hour period, San Marcos, TX, WIC compared to FITS 2002 (18)**

| Food group/subgroup | 4-6 months (n=24) | FITS (4-6 months) | 7-11 months (n=26) | FITS (7-8, 9-11 months)* | 12-24 months (n=36) | FITS (12-14, 15-18, 19-24 months)* |
|---|---|---|---|---|---|---|
| **Any vegetable** | **50** | **39.9** | **80.8** | **66.5-72.6** | **66.7** | **76.5-81.6** |
| Dark green vegetables | 0 | 0.1 | 3.8 | 2.9-4.2 | 0 | 5-10.4 |
| Deep yellow vegetables | 37.5 | 26.5 | 42.3 | 29-39.3 | 5.6 | 13.4-24 |
| White potatoes | 4.2 | 3.6 | 23.1 | 12.4-24.1 | 41.7 | 33.2-42 |
| Fried potatoes | 4.2 | 0.7 | 3.8 | 2.9-8.6 | 30.6 | 12.9-25.5 |
| Other starchy vegetables | 12.5 | 6.5 | 19.2 | 10.9-16.9 | 13.9 | 17.3-24.2 |
| Other vegetables | 16.7 | 11.2 | 30.8 | 25.9-35.1 | 10.6 | 39.1-45.6 |

*FITS percentages are shown as ranges because FITS further stratified age groups

Slightly more infants 4-6 months and 7-11 months in San Marcos WIC consumed vegetables than in FITS, while slightly fewer toddlers 12-24 months in this study consumed vegetables than in FITS. More toddlers in FITS consumed dark green vegetables and other vegetables such as green beans and tomatoes than the toddlers in this study. No toddlers consumed dark green vegetables in this study compared to FITS, and fewer toddlers in this study consumed deep yellow vegetables compared to FITS. The number of toddlers consuming white potatoes was similar in this study and FITS. However, slightly more toddlers in this study consumed fried white potatoes than the toddlers in FITS (18).

**Table 13: Percentage of infants and toddlers consuming fruit during a 24-hour period, San Marcos, TX, WIC compared to FITS 2002 (16, 18)**

| Food group/subgroup | 4-6 months (n=24) | FITS (4-6 months) | 7-11 months (n=26) | FITS (7-8, 9-11 months)* | 12-24 months (n=36) | FITS (12-14, 15-18, 19-24 months)* |
|---|---|---|---|---|---|---|
| **Any fruit** | **37.5** | **41.9** | **73.1** | **75.5-75.8** | **75** | **67.3-77.2** |
| Citrus fruit | 0 | 0.2 | 3.8 | 0.4-1.6 | 0 | 4.9-7.3 |
| Apple | 8.3 | 18.6 | 19.2 | 31.6 | 25 | 19.8-27.5 |
| Banana | 16.7 | 16 | 23.1 | 30.6-34.5 | 30.6 | 30-37.8 |
| Melons | 0 | 0.6 | 0 | 1-4.4 | 16.7 | 7.2-9.6 |
| Berries | 0 | 0.1 | 3.8 | 0.6-4.3 | 19.4 | 6.6-11.3 |
| Dried fruit | 0 | 0 | 3.8 | 0.4-2.1 | 2.8 | 3.5-9.4 |
| **100% fruit juice** | **12.5** | **21.3** | **42.3** | **45.6-55.3** | **38.9** | **56.2-61.6** |

*FITS percentages are shown as ranges because FITS further stratified age groups

The percentage of infants and toddlers consuming fruit in this study was similar to that reported in FITS. Fewer infants in this study consumed apples, bananas and citrus fruits than in FITS, and more toddlers in this study consumed

melons and berries than in FITS. Another difference detected was in the consumption of 100% fruit juice; fewer toddlers 12-24 months in this study (38.9%) consumed 100% fruit juice than toddlers the same age in FITS (56.2-61.6%), while similar percentages of infants 7-11 months in both studies consumed this beverage (18).

**Table 14: Percentage of infants and toddlers consuming milk during a 24-hour period, San Marcos, TX, WIC compared to FITS 2002 (18)**

| Food group/subgroup | 4-6 months (n=24) | FITS (4-6 months) | 7-11 months (n=26) | FITS (7-8, 9-11 months)* | 12-24 months (n=36) | FITS (12-14, 15-18, 19-24 months)* |
|---|---|---|---|---|---|---|
| **Any milk** | **100** | **100** | **96.2** | **99.7-100** | **91.7** | **93.4-98.8** |
| **Breast milk** | **41.7** | **39.6** | **15.4** | **21.3-25.7** | **8.3** | **4.2-13.6** |
| Formula | 70.8 | 74.1 | 88.5 | 75-82.2 | 11.1 | 1.5-21.2 |
| Soy milk | 0 | 0 | 0 | 0.5-1.7 | 2.8 | 1.5-3.9 |
| **Cow's milk** | **0** | **0.8** | **7.7** | **2.9-20.3** | **83.3** | **84.8-88.3** |
| Whole | 0 | 0.5 | 0 | 2.4-15.1 | 63.9 | 58.8-71.1 |
| Unflavored | 0 | 0.8 | 3.8 | 2.9-19.5 | 75 | 84-87 |
| Flavored | 0 | 0 | 3.8 | 0-0.9 | 8.3 | 1.8-5.6 |

*FITS percentages are shown as ranges because FITS further stratified age groups

The trends in milk consumption by infants and toddlers in this study were similar to those of FITS. The number of infants 7-11 months consuming breast milk was slightly lower than in FITS. Another slight difference was that more toddlers 12-24 months consumed flavored milk and fewer consumed unflavored milk in this study compared to the toddlers in FITS (18).

**Table 15: Percentage of infants and toddlers consuming meat and protein sources during a 24-hour period, San Marcos, TX, WIC compared to FITS 2002 (18)**

| Food group/subgroup | 4-6 months (n=24) | FITS (4-6 months) | 7-11 months (n=26) | FITS (7-8, 9-11 months)* | 12-24 months (n=36) | FITS (12-14, 15-18, 19-24 months)* |
|---|---|---|---|---|---|---|
| **Any meat/other protein source**** | **4.2** | **14.2** | **57.7** | **54.9-79.2** | **88.9** | **91.3-97.2** |
| **Meat** | **4.2** | **1.5** | **42.3** | **8.4-33.7** | **69.4** | **60.3-83.7** |
| Beef | 0 | 0.9 | 11.5 | 2.6-7.7 | 11.1 | 16.1-19.3 |
| Poultry | 4.2 | 2 | 26.9 | 7.3-22.4 | 44.4 | 33-47.3 |
| Pork | 0 | 0.3 | 0 | 1.7-4 | 2.8 | 9.7-13.9 |
| Fish, shellfish | 0 | 0 | 0 | 0.5-1.9 | 2.8 | 5.5-8.7 |
| Processed Meat | 0 | 0 | 11.5 | 2.1-7.1 | 19.4 | 16.4-27 |
| Baby food Meat | 0 | 1.7 | 0 | 3.1-4 | 2.8 | 0-1.1 |
| **Other protein Sources** | **4.2** | **2.7** | **30.8** | **9.7-36.1** | **83.3** | **59.2-68.9** |
| Eggs | 4.2 | 0.7 | 3.8 | 2.9-7.3 | 61.1 | 17-25.2 |
| Cheese | 0 | 0.4 | 7.7 | 2.1-18.5 | 25 | 34-41.1 |
| Yogurt | 0 | 1.2 | 15.4 | 4.1-15.7 | 30.6 | 14.9-20.2 |
| Beans | 0 | 0.6 | 7.7 | 1.3-3.3 | 22.2 | 6.6-9.9 |
| Nuts, seeds, nut butters | 0 | 0 | 7.7 | 0.5-1.9 | 2.8 | 8.8-11.6 |
| **Protein in mixed dishes** | **0** | **11** | **34.6** | **43.3-46.3** | **50** | **20.5-30.1** |

*FITS percentages are shown as ranges because FITS further stratified age groups
**Included all meats/other protein sources except for meats/other protein sources in mixed dishes which were counted separately

The percentage of infants and toddlers in this study consuming any meat or other protein source was similar that reported in FITS, except for infants 4-6 months; fewer infants this age consumed meat and other protein sources in San Marcos WIC compared to FITS. More infants 7-11 months consumed meat and

more toddlers 12-24 months consumed other protein sources and meat in mixed dishes in this study than in FITS. Processed meat was consumed by more infants 7-11 months and pork was consumed by fewer toddlers 12-24 months in this study compared to FITS (18).

Beans, eggs and yogurt were consumed by more toddlers 12-24 months in this study. More toddlers 12-24 months consumed tacos and burritos and fewer consumed sandwiches in this study compared to FITS (18).

**Table 16: Percentage of infants and toddlers consuming grains during a 24-hour period, San Marcos, TX, WIC compared to FITS 2002 (18)**

| **Food group/subgroup** | **4-6 months (n=24)** | **FITS (4-6 months)** | **7-11 months (n=26)** | **FITS (7-8, 9-11 months)*** | **12-24 months (n=36)** | **FITS (12-14, 15-18, 19-24 months)*** |
|---|---|---|---|---|---|---|
| **Any grain**** | **54.2** | **65.8** | **88.5** | **91.5-97.5** | **97.2** | **97.8-99.2** |
| Infant cereals | 54.2 | 64.8 | 50 | 63.8-81.2 | 5.6 | 3.1-23.9 |
| Non-infant cereals | 0 | 0.6 | 19.2 | 18.3-44.3 | 50 | 51.9-60.5 |
| Not pre-sweetened | 0 | 0.5 | 7.7 | 17-37 | 27.8 | 31.9-44.5 |
| Pre-sweetened | 0 | 0 | 3.8 | 1.8-9 | 11.1 | 17.7-26.4 |
| Breads | 0 | 0.6 | 7.7 | 9.9-24.5 | 27.8 | 47.3-53.1 |
| Crackers | 0 | 3 | 42.3 | 16.2-33.4 | 30.6 | 44.7-46.4 |
| Cereal/ granola bars | 0 | 0 | 0 | 1.1-3.4 | 0 | 9.8-10 |
| Quick breads | 0 | 0.1 | 3.8 | 0.8-7.5 | 19.4 | 15.1-16.1 |
| Rice, pasta | 0 | 2.3 | 11.5 | 4.5-18.2 | 33.3 | 26.2-39 |
| **Grains in mixed dishes** | **4.2** | **0.4** | **30.8** | **5.3-24.1** | **52.8** | **48.3-55.1** |

*FITS percentages are shown as ranges because FITS further stratified age groups
**Included all grains except for grains in mixed dishes which were counted separately

Fewer infants 4-6 months and a similar percentage of infants 7-11 months and toddlers 12-24 months consumed grains in this study compared to the percentage of infants and toddlers in FITS. Infant cereals and non-presweetened ready-to-eat cereals were consumed by fewer infants 7-11 months in this study compared to FITS. More infants 7-11 months and fewer toddlers 12-24 months consumed crackers in this study than in FITS. Also, fewer toddlers consumed breads and cereal/granola bars in this study compared to FITS. More infants 7-11 months consumed macaroni and cheese, more toddlers 12-24 months consumed tacos and burritos, and fewer infants and toddlers 7-24 months consumed sandwiches in this study compared to FITS (18).

**Table 17: Percentage of infants and toddlers consuming sweets and salty snacks during a 24-hour period, San Marcos, TX, WIC compared to FITS 2002 (18)**

| Food group/subgroup | 4-6 months (n=24) | FITS (4-6 months) | 7-11 months (n=26) | FITS (7-8, 9-11 months)* | 12-24 months (n=36) | FITS (12-14, 15-18, 19-24 months)* |
|---|---|---|---|---|---|---|
| **Any type of desserts/sweets/ SSB** | **4.2** | **10.4** | **42.3** | **45.8-61.1** | **77.8** | **78.8-90.5** |
| Dairy desserts | 0 | 0.7 | 0 | 3.2-6.7 | 2.8 | 10.5-16.5 |
| Candy | 0 | 0 | 0 | 1.1-3.2 | 8.3 | 10.2-20 |
| Sugar, syrups, preserves | 0 | 1.7 | 3.8 | 3.6-7.3 | 19.4 | 20.7-28.3 |
| **SSB** | **4.2** | **0.6** | **26.9** | **7.5-11.2** | **58.3** | **28.2-44.3** |
| Soda | 0 | 0 | 3.8 | 1.1-1.4 | 13.9 | 4.1-11.4 |
| Fruit-flavored drinks | 4.2 | 0.6 | 26.9 | 6.6-9.2 | 44.4 | 23-37.5 |
| Other | 0 | 0 | 0 | 0.6-1 | 5.6 | 2.9-4 |
| **Salty snacks** | **0** | **0** | **15.4** | **2-5.8** | **16.7** | **15.6-26.6** |

*FITS percentages are shown as ranges because FITS further stratified age groups

Overall, consumption of items in the total desserts/sweets/SSB category was similar in this study and FITS. However, differences in SSB consumption were found. In San Marcos, more infants and toddlers in all age groups consumed SSB, specifically fruit-flavored drinks compared to FITS. The most profound difference in fruit-flavored beverage consumption was found between infants 7-11 months in this study (27%) compared to FITS (6.6-9.2%) (18).

Salty snacks were consumed by more infants 7-11 months than in FITS, and similar percentages of infants 4-6 months and toddlers 12-24 months consumed salty snacks in this study and in FITS (18).

*Age of Introduction of Complementary Foods*

Infants and toddlers 6-32 months were introduced to complementary foods and/or beverages around the age of 4.5 months with a range of 2 weeks to 11 months (see Table 18).

**Table 18: Mean age of introduction of first complementary foods or beverages for infants and toddlers ages 6-32 months**

| | N | Mean age in months | Age range in months | SD | Median age in months |
|---|---|---|---|---|---|
| Any food | 78 | 4.5 | 0.05-11 | 1.7 | 4.5 |

About 70% of infants and toddlers were introduced to complementary foods and/or beverages between 4 and 6 months, which is compliant with the AAP and WHO guidelines for age of first introduction to complementary foods and beverages. Of the six children reported as having been introduced after 6 months, only one was introduced after eight months (at 11 months); therefore, five children in this group were introduced to foods within the recommended age range as well. Twenty percent of infants and toddlers were introduced to complementary foods before the age of 4 months. In total, 61 infants and toddlers (78.2%) were introduced to complementary foods and/or beverages at an age recommended by the AAP and WHO, and 17 (21.8%) were introduced outside the recommended age.

**Table 19: Number of infants and toddlers (6-32 months) introduced to first complementary foods/beverages before 4 months, between 4 and 6 months and after 6 months**

| Age of introduction | Number (n=78) | % |
|---|---|---|
| Under 4 months | 16 | 20.5 |
| 4-6 months | 56 | 71.8 |
| Over 6 months | 6 | 7.7 |

The mean ages of consumption of certain food groups and subgroups on a daily basis are displayed in Table 20. Toddlers were first fed cereal, fruit and vegetables on a daily basis around the mean age of seven to eight months and 100% fruit juice/SSB on a daily basis around the mean age of nine months. Meat, dairy foods, and sweets/desserts were the next foods to be introduced and were first fed to toddlers on a daily basis at approximately 11 months. Cow's milk and salty snacks were the last foods to be introduced to toddlers on a daily basis at 12 months and 14 months, respectively.

**Table 20: Mean age of consumption of foods on a daily basis for toddlers ages 12-32 months**

| Food group/subgroup | n | Mean age in months | Age range in months | SD | Median age in months |
|---|---|---|---|---|---|
| Vegetables[3] | 45 | 7.5 | 3-24 | 3.7 | 6 |
| Fruit | 46 | 7.7 | 3-24 | 3.9 | 6.3 |
| 100% juice/SSB[2] | 42 | 9.1 | 4-20 | 3.9 | 8.8 |
| Cow's milk[1] | 43 | 12.1 | 0.5-27 | 3.4 | 12 |
| Meat[3] | 42 | 11.2 | 6-21 | 2.8 | 12 |
| Dairy foods | 46 | 11.0 | 4-24 | 4.0 | 12 |
| Cereal[3] | 45 | 7.0 | 2-17 | 3.4 | 6 |
| Sweets/desserts | 30 | 11.2 | 4-19 | 3.5 | 12 |
| Salty snacks | 39 | 13.7 | 5-24 | 4.4 | 12 |

[1] cow's milk should not be introduced until 1 year of age (AAP ref)
[2] 100% juice should not be introduced until 6 months (AAP ref)
[3] iron-rich foods should be introduced at 6 months (CDC ref)

*Age of Introduction to Cow's Milk*

Eighty-four percent of caregivers reported that their toddlers (6-32 months) first consumed cow's milk on a daily basis at the age of 12 months or later, which is compliant with the AAP guidelines for cow's milk introduction; 16% reported that their toddler first consumed cow's milk before the recommended age of 12 months (see Table 21).

**Table 21: Number of toddlers introduced to cow's milk before or after 12 months**

| Age of introduction | Number (n=43) | % |
|---|---|---|
| Under 12 months | 7 | 16.3 |
| 12 months and older | 36 | 83.7 |

*Age of Introduction to 100% Fruit Juice or SSB*

When caregivers were asked when 100% juice or SSB were first fed to their toddlers (6-32 months) on a daily basis, 81% responded that their toddlers were fed at least one of these beverages at the age of 6 months or later (see Table 22). Nineteen percent responded that their toddlers were fed juice or SSB before the AAP's recommended age of 6 months. Five toddlers had not been introduced to juice/SSB at the time of the study.

**Table 22: Number of toddlers consuming juice or SSB on a daily basis before or after 12 months**

| Age of introduction | Number (n=42) | % |
|---|---|---|
| Under 6 months | 8 | 19 |
| 6 months and older | 34 | 81 |

*Age of Introduction to Iron-rich Foods*

Although the average age of introduction to meat to toddlers 12-32 months was 11.2 months, most were introduced to other iron-rich foods such as fortified cereals at the mean age of 7 months, which is close to the recommended age of 6 months. Certain vegetables containing iron were introduced at the mean age of 7.5 months. However, infants did not consume green vegetables, the types highest in iron.

## Objective 2: Differences Across Race/Ethnicity

### *Food Groups and Subgroups*

Significant differences in consumption were identified between MA and NHW infants and toddlers for several of the food groups. While all groups and subgroups were compared, only the significant differences across race/ethnicity are presented in Table 23.

In both age groups (4-23 and 6-32 months), the mean number of exposures of MA infants and toddlers to eggs and to any food in the meats/other protein sources category was significantly higher than the mean number of exposures to NHW infants and toddlers. Furthermore, MA infants and toddlers 4-23 months and 6-32 months had a significantly higher mean number of exposures to 100% fruit juice and beans, respectively, compared to NHW infants and toddlers the same age.

NHW infants and toddlers in both of these age groups (4-23, 6-32 months) had a significantly higher mean number of exposures to non-starchy vegetables, deep yellow vegetables, fruit in the "other fruit" category, infant cereal, and pasta mixed dishes compared to MA infants and toddlers. Additionally, the mean number of exposures to formula was significantly higher for NHW infants and toddler 6-32 months than for MA the same age.

**Table 23: Differences in number of food groups and subgroups exposures during a 24-hour period between MA and NHW infants and toddlers**

| Age group | MA n | NHW n | Food group/subgroup | MA mean | NHW mean |
|---|---|---|---|---|---|
| **4-23** | 47 | 14 | non-starchy vegetables | 0.51 | **1.21*** |
| | | | deep yellow vegetables | 0.19 | **0.93**** |
| | | | other fruit | 0.21 | **0.71*** |
| | | | 100% fruit juice | **0.55*** | 0.14 |
| | | | meat or other protein source | **1.62*** | 0.57 |
| | | | Eggs | **0.36*** | 0.00 |
| | | | infant cereal | 0.28 | **1.00**** |
| | | | pasta mixed dishes | 0.00 | **0.29**** |
| **6-32** | 46 | 13 | non-starchy vegetables | 0.52 | **1.31*** |
| | | | deep yellow vegetables | 0.17 | **0.85*** |
| | | | other fruit | 0.24 | **0.77*** |
| | | | Formula | 1.43 | **2.85*** |
| | | | meat or other protein source | **1.98*** | 0.92 |
| | | | Eggs | **0.48**** | 0.00 |
| | | | Beans | **0.30*** | 0.00 |
| | | | infant cereal | 0.26 | **0.92**** |
| | | | pasta mixed dishes | 0.04 | **0.31*** |

*significantly different at P<.05
*significantly different at P<.01

### *Age of Introduction of Complementary Foods*

No significant differences were detected in the age of introduction of any complementary food or in the age of introduction of specific food groups between MA and NHW infants and toddlers within any age group.

## V. Discussion

This study assessed the feeding practices of infants and toddlers participating in WIC in San Marcos, TX. While many studies have investigated the dietary patterns and behaviors of children and adults, very few have targeted children younger than 2 years of age until recently (18). Several findings of this study raise concerns about the feeding practices of infants and toddlers in this population.

While we had predicted that infants and toddlers in San Marcos WIC would consume fewer fruits and vegetables than infants and toddlers assessed in FITS, the produce intake observed in both studies was actually similar (18). In San Marcos WIC, about one-quarter of the infants and toddlers did not consume any fruit and one-third did not consume any vegetables on the day studied. This practice of omitting produce in the diets of infants and toddlers is not in line with any of the dietary recommendations currently available. For example, the ADA's Start Healthy Feeding Guidelines for Infants and Toddlers states that a variety of whole fruits and vegetables are recommended to achieve optimal growth and development (9). This makes sense since fruits and vegetables are rich sources of

micronutrients. And, while no specific guidelines for children from birth to two years have been established by the USDA, the 2005 Dietary Guidelines for Americans clearly state that children ages two and over should be consuming a diet rich in fruits and vegetables (70). Since many food preferences are established before the age of two, it is logical that infants and toddlers should be exposed daily to appropriate foods to prepare them to meet the dietary guidelines for children ages two and over. This is especially important for vegetables, given that many vegetables are bitter and that infants may require as many as 12-15 exposures in order to readily accept them (22, 23).

Also troubling were the types of vegetables that were consumed by the infants and toddlers in this study. With the exception of a single child who ate broccoli, dark green vegetables were not consumed at all on the day studied. Again, children under the age of two should be offered a variety of fruits and vegetables on a daily basis in order to broaden their palates. Infants did consume nutrient-dense yellow vegetables (such as butternut squash). This appropriate practice can likely be attributed to the fact that yellow vegetables are commonly available as commercial baby food. Unfortunately, toddlers did not consume yellow vegetables, probably because they were no longer offered baby foods. In fact, in this study, white potatoes, especially fried potatoes, were the most commonly consumed vegetable by toddlers. Given that fried potatoes provide

fewer nutrients than non-starchy vegetables and also contribute excess sodium, fat and calories, this feeding practice is particularly harmful for toddlers (9). Importantly, regular consumption of fried potatoes may reinforce taste preferences for salty fried foods, which can in turn lead to poor health outcomes such as obesity, hypertension and hyperlipidemia in childhood and adulthood (32, 33). While we categorized potatoes as vegetables in order to align our methodology with that of FITS, it would perhaps be more appropriate to count potatoes as salty snacks.

We also followed the FITS methodology of grouping 100% fruit juice with fruit. However, this categorization is inappropriate from a nutritional standpoint. Specifically, 100% fruit juice is distinctly different from whole fruit. In particular, whole fruit contains fiber and elicits stronger satiety cues than does juice (42). In fact, the AAP clearly states that consumption of whole fruit (rather than juice) is more conducive to establishing healthful dietary choices throughout the lifespan (42). If we remove 100% fruit juice from the fruit group, the number of infants and toddlers consuming fruit on the day studied would decrease considerably to 61% of infants and toddlers 7-24 months (from approximately 75%) and to 55% of toddlers 25-32 months (from 73%). Given the high sugar content of 100% fruit juice, it would perhaps be more reasonable to group 100% juice with sugar-sweetened beverages (42).

In short, with respect to produce, the feeding practices of infants and toddlers in San Marcos WIC are not in line with current dietary recommendations and are not commensurate with promoting good health. The diets of infants and toddlers should be rich in produce in order to establish lifelong food preferences for fruits and vegetables (1, 2). Produce benefits health not only because it provides micronutrients and fiber, but also because it displaces other harmful food items such as sugary and salty snacks (9).

Another finding of concern was the low intake of plain meats by the infants and toddlers in this study. Iron-deficiency anemia is one of the few micronutrient deficiencies that is still common today in the US, and participants of WIC have a higher prevalence of iron-deficiency than the general population (14). Plain meats, such as beef, pork, poultry and fish, provide bioavailable heme iron and are appropriate and accepted complementary foods. Therefore, the CDC recommends they be introduced at 6 months (14, 17). However, the mean age of introduction of meats in this study was 11 months. Moreover, the types of meats offered to the majority of infants and toddlers were not plain meats, but instead were processed, and included sausage, hot dogs and cold cuts. Not only do these meats contain less iron and other essential micronutrients, but they also contain greater amounts of saturated fat and sodium compared to plain meats (14).

In general, salty snacks, including such items as potato chips, cheese puffs and corn chips, which are also high in fat and calories, should not be offered to infants and toddlers at all (9). Based on the pediatric obesity rates in San Marcos, we expected that more infants and toddlers in this study were consuming high energy-dense foods, such as salty snacks, compared to the infants and toddlers in FITS. We found, however, that approximately 25% of toddlers in San Marcos WIC were consuming salty snacks, which is similar to the results of FITS (18). Perhaps the most shocking example in our study was of a toddler dipping cheese puffs in ketchup. Of most concern was the salty snack intake by infants in San Marcos WIC. Disconcertingly, 15% of infants 7-11 months in San Marcos WIC consumed salty snacks on the day studied, compared 2-5.8% of infants in FITS (18).

The negative impact of the practice of feeding salty snacks to infants and toddlers is magnified when we consider that many other foods included in their diets were also high in sodium and fat, including processed meats, crackers, fried potatoes, and mixed dishes such as pizza and tacos. These feeding practices are likely to promote the development of taste preferences for foods high in sodium. In addition to learning to prefer salty foods, infants and toddlers may concurrently learn to reject more healthful foods, such as whole fruit and non-starchy vegetables (22). Should these taste preferences continue to guide food

choices through childhood and beyond, the risk for chronic diseases such as obesity, hypertension, cardiovascular disease and type 2 diabetes mellitus will likely be increased (32).

The intake of sweet foods is also of concern. While we had anticipated that the rates of consumption of sweet foods (i.e., desserts, sweets, SSB) would be higher in this study compared to FITS, the overall rate of consumption of the these foods was similar to FITS (18). Over 75% of toddlers in this study consumed at least one item from these categories on the day studied. However, as we anticipated, more infants and toddlers in this study consumed SSB than in FITS, with 27% of infants 7-11 months in this study consuming SSB compared to 7.5-11.2% in FITS, and almost 60% of toddlers in this study consuming SSB, compared to 28-44% of toddlers in FITS (18). The desserts, sweets, and SSB groups were not the only sugary foods included in the diets of infants and toddlers. Other foods high in sugar included quick breads (e.g. waffles, pancakes) and pre-sweetened ready-to-eat cereals.

There are several ramifications related to this common practice of offering sweet foods and beverages to infants and toddlers. Not only are these foods and beverages high energy-dense, but they may promote excess consumption and shape taste preferences (22). The intake of SSB is particularly noteworthy. Because SSB may also contribute to health problems in childhood and adulthood,

the ADA and AAP recommend that these beverages not be offered to infants and toddlers at all, or to older children (9, 42). Current research supports a link between SSB consumption and the development of pediatric obesity (55, 56, 57). Like desserts and sweets, these beverages are high energy-dense and provide little or no essential nutrients, and they can also contribute to the preferences for sweet foods later in life (1, 2). One concern unique to SSB is that satiety signals for liquids are different than for solid foods. SSB have a low satiety value and though infants may be able to self-regulate energy intake according to energy density of liquids, toddlers may not be able to do this. Therefore the excess energy provided by these beverages may contribute to pediatric obesity (28).

Another objective of this study was to compare the feeding practices of MA and NHW infants and toddlers. While we expected to find that MA infants and toddlers consumed more desserts and SSB than NHW infants and toddlers, no differences in the consumption of these foods and beverages were detected. This finding has profound implications for future interventions and suggests that the entire San Marcos WIC population is at risk for developing health problems associated with poor feeding practices regardless of race or ethnicity. One explanation is that socioeconomic status may have more impact than race and ethnicity on the feeding practices of infants and toddlers. In order to qualify for WIC, families are required to have an income at or below 185% of the poverty

level (66); therefore income levels were similar across this sample and the influence of this on feeding practices may have superseded racial and ethnic differences, like those found in FITS. Another possible explanation of the lack of differences detected between MA and NHW infant and toddler feeding practices is that acculturation may play a more important role in the determination of feeding practices than race and ethnicity alone. Further studies should investigate the role of acculturation on the feeding practices of infants and toddlers among MA, comparing nativity and language preference.

In summary, the results of this study suggest that feeding practices among participants of San Marcos WIC are not conducive to developing taste preferences and dietary practices which promote health. Future research should investigate factors which influence these feeding practices in order to reveal their root causes. Understanding these factors is essential in developing meaningful interventions. For example, prior to designing and implementing an intervention to improve feeding practices it is necessary to first determine why foods and beverages high in sugar and salt are commonly offered to infants and toddlers. Regardless of the causes of poor feeding practices, it is clear that participation in WIC is not resulting in actualization of proper feeding practices of its participants. Immediately following the collection of 24-hour recall data for this study, there was a nationally implemented change in WIC benefits. Specifically,

plain meats are now included in the food package for infants 6 months of age and older, and more fresh produce is included for all age groups. Given the timing of the data collection for this study, the results reported herein can serve as a pre-assessment for a follow-up study using the same methodology with the aim of testing the impact of the changes in foods provided by WIC. Finally, this type of research is important in informing policy. For example, based on the results of this study, a primary focus of WIC education should address appropriate feeding practices for infants and toddlers.

Several strengths contributed to the success of this study. The most prominent strength was the utilization of rigorous methodology that was closely aligned with that of FITS thus allowing us to compare our results to the results of this nationally representative study. The use of NDSR software, which was also used in FITS, is recognized as the gold standard for collection of dietary recall data. NDSR is an interviewing system linked to a vast food and nutrient database. On-screen interview prompts allow researchers to implement the multiple pass method, which is the most reliable type of 24-hour recall interviewing. During the protocol development phase of this study, Texas State University-San Marcos sponsored the attendance of a lead researcher at a two-day NDSR training session held at the NCC in Minneapolis, Minnesota. Another strength of this study was the involvement of approximately 25 undergraduate

nutrition students, which necessitated extensive training. All research assistants completed human subjects training and received thorough and standardized training on the use of NDSR and on all other aspects of this research. In order to verify accuracy of data collection, the data were subject to thorough routine quality assurance which entailed monitoring phone interviews, reviewing each recall for reliability, and double checking the accuracy of all data entry.

As with all studies, there are limitations to this research study. The length of the telephone interviews, which lasted 45-60 minutes, may have resulted in respondent fatigue, thus potentially increasing reporting errors. To minimize this risk, research assistants assessed the perceived level of interest the subject had during the interview, and deemed that almost all subjects seemed at ease with the length of the interview. While the 24-hour recall is viewed by researchers as one of the best methods of dietary data collection, the recall has inherent flaws, as does any other type of dietary assessment tool. Because the recall relies on the memory of the subject, accuracy of reporting foods and portion sizes can be compromised. Additionally, as suspected in FITS, over-reporting may be an issue when caregivers report the diets of their children, especially young children (54). We used the FAB in order to assist the caregiver in remembering accurate portion sizes, and the multiple pass method, used by NDSR enhances the subject's ability to remember diets with accuracy. Perhaps the most important

limitation of this study was the sample size. While it would benefit any study to have a larger sample size, it was not reasonable given our limited resources, such as time, funding, and research assistant availability.

## VI. Conclusion

While this study found that feeding practices of infants and toddlers in San Marcos WIC were not substantially worse than those reported in the nationally representative sample in FITS, we can say with confidence that feeding practices in San Marcos WIC should be improved. Feeding experiences during the first two years of life, including the types of foods consumed and the age of introduction of foods, have the potential to shape life-long dietary practices and impact health during childhood and throughout the lifespan. Given that pediatric and adult obesity affect a substantial sector of the population, it is critical that parents learn how to appropriately feed their children. While future research should strive to identify reasons why the diets of young children are so poor, it is paramount that we act immediately to improve feeding practices. Responsibilities lies with policymakers, researchers, the food industry, retail establishments, communities, families and individuals to change our current environment into one that enhances the health of infants, toddlers, children and adults of all ages.

## APPENDIX A

## INSTRUMENTS

# Feeding Practices Questionnaire

**Feeding Patterns of Infants and Toddlers at WIC in San Marcos, Texas**

**Section A**

1. Was your child ever breastfed or fed breast milk?

   Yes **(go to section C)** No **(go to section B, skip C and D)**

**Section B**

2. What reasons led to your decision not to breastfeed your child **(check all that apply)**?

   ***I am going to read you some answers. Please let me know which ones you agree with.***

   - ☐ A. My child was sick and could not breastfeed
   - ☐ B. I thought I would not have enough milk
   - ☐ C. A health professional said I should not breastfeed for medical reasons
   - ☐ D. I was sick or had to take medicine
   - ☐ E. I believe that formula is as good as breastfeeding or that formula is better
   - ☐ F. I thought that breastfeeding would be too inconvenient
   - ☐ G. I tried breastfeeding before and didn't like it or it didn't work out
   - ☐ H. I wanted to be able to leave my child for several hours at a time
   - ☐ I. I wanted to go on a weight loss diet
   - ☐ J. I wanted to go back to my usual diet
   - ☐ K. I wanted to smoke again or smoke more than I should while breastfeeding
   - ☐ L. I had too many household duties
   - ☐ M. I planned to go back to work or school
   - ☐ N. I wanted or needed someone else to feed my child
   - ☐ O. Someone else wanted to feed my child
   - ☐ P. I wanted my body back to myself
   - ☐ Q. The child's father didn't want me to breastfeed
   - ☐ R. The child's grandmother didn't want me to breastfeed
   - ☐ S. I wanted to use contraception that can't be used while breastfeeding
   - ☐ T. Other (specify) _____

**Section C**

3. Did you breastfeed in the hospital after delivery?

   Yes No

4. Are you currently breastfeeding or pumping milk?

   Yes **(go to section E)** No **(go to section D)**

**Section D**

5. How old was your child when you completely stopped breastfeeding and pumping milk?

   _____ days _____ weeks _____ months

6. What reasons led to your decision to stop breastfeeding **(check all that apply)**?

   ***I am going to read you some answers. Please let me know which ones you agree with.***

   - A. My child had trouble sucking or latching on
   - B. My child became sick and could not breastfeed
   - C. My child began to bite
   - D. My child lost interest in nursing and began to wean him/herself
   - E. My child was old enough that the difference between breast milk and formula no longer mattered
   - F. Breast milk alone did not satisfy my child
   - G. I thought that my child was not gaining enough weight
   - H. A health professional said my child was not gaining enough weight
   - I. I had trouble getting the milk flow to start
   - J. I didn't have enough milk
   - K. My nipples were sore, cracked, or bleeding
   - L. My breasts were overfull or engorged
   - M. My breasts were infected or abscessed
   - N. My breasts leaked too much
   - O. Breastfeeding was too painful
   - P. Breastfeeding was too tiring
   - Q. I was sick or had to take medicine
   - R. Breastfeeding was too inconvenient
   - S. I did not like breastfeeding
   - T. I wanted to be able to leave my child for hours at a time

- ☐ U. I wanted to go on a weight loss diet
- ☐ V. I wanted to go back to my usual diet
- ☐ W. I wanted to smoke again or more than I did while breastfeeding
- ☐ X. I had too many household duties
- ☐ Y. I could not or did not want to pump or breastfeed at work
- ☐ Z. Pumping milk no longer seemed worth the effort it required
- ☐ AA. I was not present to feed my child for reasons other than work
- ☐ BB. I wanted or needed someone else to feed my child
- ☐ CC. Someone else wanted to feed my child
- ☐ DD. I did not want to breastfeed in public
- ☐ EE. I wanted my body back to myself
- ☐ FF. I became pregnant or wanted to become pregnant again
- ☐ GG. Other (specify) _____

7. Did any of the following people want you to stop breastfeeding **(check all that apply)**?
   - ☐ A. The child's father
   - ☐ B. Your mother
   - ☐ C. Your mother-in-law
   - ☐ D. Another family member
   - ☐ E. A doctor or other health professional
   - ☐ F. Your employer or supervisor
   - ☐ None of these

**Section E**

8. How old was your baby when he or she was first fed anything other than breast milk or formula?

   weeks _____ or months _____ never fed anything other than breast milk/formula _____
9. How old was your baby when he or she was first fed formula?

   days _____ or weeks _____ or months _____ or never fed formula _____
10. Has your baby ever had tea or herbal drinks?

    yes _____ or no _____
11. Have you ever added cereal or other solids to your baby's bottle?

    yes _____ or no _____

12. Did your child consume any foods before 4 months, including teas, water, juice, infant cereal besides breast milk or infant formula?

    Yes _____ No _____ Don't know _____

13. How old was your child when he/she was first fed infant formula *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

14. How old was your baby when he or she first had cow's milk or any other milk (rice, soy, goat, or other)?

    a. before 4 months ____

    b. 4-6 months

    c. 7-11 months

    d. 12 months or older

    e. never had it

    14.b. How old was your child when he/she was fist fed cow's milk (not breast milk or formula) *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

15. How old was your baby when he or she first had 100% fruit or vegetable juice?

    a. before 4 months

    b. 4 months

    c. 5 months

    d. 6 months or more

    e. never had it

16. How old was your baby when he or she first had cereal?

    a. before 4 months

    b. 4 months

    c. 5 months

    d. 6 months or more

    e. never had it

17. How old was your child when he/she was first fed cereal, including baby cereal, *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

18. How old was your child when he/she was first fed fruit, *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

19. How old was your child when he/she was first fed juice or sweetened beverages, *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

20. How old was your child when he/she was first fed vegetables, *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

21. How old was your child when he/she was first fed sweet foods or desserts, *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

22. How old was your child when he/she was first fed meats, *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

23. How old was your child when he/she was first fed dairy foods such as cheese, yogurt, or eggs, *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

24. How old was your child when he/she was first fed salty snacks such as chips or popcorn, *on a daily basis*?

    weeks _____ or months _____ or not on a daily basis _____

**Section F**

25. Were you breastfed when you were an infant or toddler?

    yes _____ no _____ don't know _____

    25.b. If so, how long were you were breastfed?

    weeks _____ or months _____ or don't know _____

**Section G**

**Ask the questions below if child is between 4-8 months**

26. Does your child lift and support his/her head without help?

    yes _____ no _____

27. Does he/she roll over on his/her own?

    yes _____ no _____

28. Is he/she rolling over from front to back or back to front or both?

    a. back to front _____ b. front to back _____ c. both _____

**Ask the questions below if child is between 4-11 months**

29. Does your child sit alone without support?

    yes _____ no _____

30. Does he/she grasp food with his/her hand?

    yes _____ no _____

**Ask the questions below if child is between 4-14 months**

31. Does your child crawl when left lying on his/her stomach?

    yes _____ no _____

**Ask the questions below if child is between 4-24 months**

32. When he/she is being fed, does your child usually remove food from a spoon using his/her top lip or do you usually have to scrape the spoon into his/her mouth?

    a. uses top lip _____ b. have to scrape food _____

**Ask the questions below if child is between 7-24 months**

33. Does your child feed himself/herself with a spoon without spilling much?

    yes _____ no _____

34. Does he/she feed himself/herself with a fork without spilling much?

    yes _____ no _____

35. Does your child drink from a sippy cup without help? (If asked, a sippy cup is a cup with a plastic cover that has a spout)

    yes _____ no _____

36. Does he/she drink from a regular cup without help – that is, a cup without a lid?

    yes _____ no _____

37. Does your child eat foods that require chewing?

    yes _____ no _____

38. Does your child pull himself/herself to a standing position without help from another person?

    yes _____ no _____

39. Does your child walk at least 2 steps with one hand held by someone or holding onto something?

    yes _____ no _____

40. Does he/she walk at least 2 steps WITHOUT holding on to anything or another person?

    yes _____ no _____

41. Does he/she walk across the room WITHOUT holding on to anything or another person?

    yes _____ no _____

42. Do you consider your child: **(read the options)**

a. A very picky eater

b. a somewhat picky eater

c. not a picky eater

43. How many times do you offer a new food before you decide your child does not like it? **(read the options)**

    a. once

    b. twice

    c. 3-5 times

    d. 6-10 times

    e. more than 10 times

    f. likes everything

44. Does your child show a strong preference to using his/her right or left hand or does he/she show no preference?

    a. No preference _____ b. shows preference/right or left _____

45. Does your child usually feed himself/herself?

    a. Yes, child feeds self _____ b. no, adult feeds ____ c. both/switch off _____

# Demographics Form

Feeding Patterns of Infants and Toddlers at WIC in San Marcos, Texas

**Contact Information of Caregiver**

1. First name _____
2. Last name _____
3. Caregiver Age _____
4. Street Address _____
5. City _____
6. ZIP _____
7. Main Phone _____
8. Alternate Phone _____
9. Relationship to child

    a. Mother

    b. Father

    c. Grandmother

    d. Other _____ **(specify)**

**Infant or Toddler Information**

10. Gender of child M F
11. First name of child _____
12. DOB of child **(month, date, year)** _____
13. Age of child **(at time of interview)** _____

**Marital Status**

14. What is your marital status?

a. Now married

b. Living with partner

c. Widowed

d. Divorced

e. Separated

f. Never married

***Ask the following question only if subject has a spouse/partner:***

What is your spouse's name? (to be used during interview) _____

**15.** Age of Spouse _____

**Acculturation**

**16.** What language do you most often speak when you are at home?

a. English

b. Spanish

c. Both

d. Other

**17.** Where were you born?

a. U.S.

b. Mexico

c. Other

**17.B.** If born outside the U.S., how long have you lived in the United States? _____ **(years)**

***Ask the following questions only if subject has a spouse/partner:***

**18.** Where was your spouse/partner born?

a. U.S.

b. Mexico

c. Other

**18.B.** If born outside the U.S., how long has your spouse/partner lived in the United States? _____ **(years)**

**Education**

**19.** What is the highest degree or level of school that you have completed? **(If currently enrolled, mark the previous grade or highest degree received)**.

a. Elementary school

b. Middle school

c. High school

d. Associates degree

e. Bachelors degree

f. Post-graduate degree

***Ask the following question only if subject has a spouse/partner:***

**20.** What is the highest degree or level of school that your spouse/partner has completed? **(If currently enrolled, mark the previous grade or highest degree received)**.

a. Elementary school

b. Middle school

c. High school

d. Associates degree

e. Bachelors degree

f. Post-graduate degree

**Employment**

**21.** Are you employed? Yes No

**21.B.** Is your employment part-time or full-time? PT FT

***Ask the following questions only if subject has a spouse/partner:***

**22.** Is your spouse/partner employed? Yes No

**22.B.** Is your spouse/partner's employment part-time or full-time? PT FT

**Race/Ethnicity**

**23.** Race of caregiver

a. Non-Hispanic black/African American

b. Non-Hispanic white

c. Hispanic **(if Hispanic, ask next question)**

d. American Indian or Native Alaskan

e. Asian

f. Native Hawaiian or Other Pacific Islander

g. Other _____ **(specify)**

***Ask the following question only if subject is Hispanic***

**23.B.** Ethnicity of caregiver

a. Mexican

b. Central and South American (Latino)

c. Puerto Rican

d. Cuban

e. Other _____ **(specify)**

***Ask the following questions only if subject has a spouse/partner:***

**24.** Race of spouse/partner

a. Non-Hispanic black/African American

b. Non-Hispanic white

c. Hispanic **(if Hispanic, ask next question)**

d. American Indian or Native Alaskan

e. Asian

f. Native Hawaiian or Other Pacific Islander

g. Other _____ **(specify)**

***Ask the following question only if spouse/partner is Hispanic***

**24.B.** Ethnicity of spouse/partner

a. Mexican

b. Central and South American (Latino)

c. Puerto Rican

d. Cuban

e. Other _____ **(specify)**

**25.** Race of child

a. Non-Hispanic black/African American

b. Non-Hispanic white

c. Hispanic **(if Hispanic, ask next question)**

d. American Indian or Native Alaskan

e. Asian

f. Native Hawaiian or Other Pacific Islander

g. Other _____ **(specify)**

***Ask the following question only if child is Hispanic***

**25.B.** Ethnicity of child

a. Mexican

b. Central and South American (Latino)

c. Puerto Rican

d. Cuban

e. Other _____ **(specify)**

# Health History Form

**Feeding Patterns of Infants and Toddlers at WIC in San Marcos, Texas**

**1.** Do you have any of the following conditions **(list all conditions)**?

**A.** Diabetes Yes No

**B.** Cardiovascular Disease Yes No

**C.** Lung Disease Yes No

**D.** Kidney Disease Yes No

**E.** Liver Disease Yes No

**F.** Asthma Yes No

**G.** Allergies Yes No

**2.** What is your weight? **(ask subject to guess if unknown) _____ pounds**

**3.** What is your height? **(ask subject to guess if unknown) _____ feet/ inches**

**4.** BMI **(calculate after interview) _____**

***Ask the following questions only if subject has a spouse/partner:***

**5.** Does your spouse have any of the following conditions **(list all conditions)**?

**A.** Diabetes Yes No

**B.** Cardiovascular Disease Yes No

**C.** Lung Disease Yes No

**D.** Kidney Disease Yes No

**E.** Liver Disease Yes No

**F.** Asthma Yes No

**G.** Allergies Yes No

**6.** What is your spouse's weight? **(ask subject to guess if unknown) _____ pounds**

**7.** What is your spouse's height? **(ask subject to guess if unknown) _____ feet/inches**

**8.** Spouse/partner BMI **(calculate after interview)** _____

**Medical Insurance**

**9.** Does your child have medical insurance? Yes No

**10.** Do you have medical insurance? Yes No

**Child Information**

**11.** How many weeks were you pregnant before giving birth to this child? _____ **weeks**

**12.** What was your child's **weight *at birth***? _____ **pounds/ounces**

**13.** What is your child's ***current*** **weight**? _____ **pounds**

**14.** What is your child's current height/length? _____ **inches**

**15.** Has your child been sick in the past 2 weeks? Yes No

**16.** Does your child have any dietary restrictions or any special dietary needs?

Yes No

**16.A.** Have any of the following foods caused a problem for your child **(read all categories)**?

**1.** Cow's milk, other dairy products (including formula made with cow's milk)

Y N

**2.** Soy milk or other soy foods (including infant formula made with soy) Y N

**3.** Eggs Y N

**4.** Peanuts, peanut butter, or peanut oil Y N

**5.** Nuts (such as almonds, pecans, walnuts) Y N

**6.** Sesame seeds, tahini, or sesame seed oil Y N

**7.** Fish, shellfish, or other seafood Y N

**8.** Beef, chicken, or turkey Y N

**9.** Wheat, gluten, or wheat starch Y N

**10.** Other grain or cereal (such as oats, barley) Y N

**11.** Fruit or fruit juice Y N

**12.** Vegetable Y N

**13.** Other foods _____ **(specify)**

**Interview Script**

"Hello (  ), my name is (  ). I'm calling about the study you agreed to participate in through the local WIC clinic. Is this a good time for you?"

> **If it is not a good time, reschedule the call. Ask a time and day of the week it would be convenient to receive a call, and make sure you have the best phone number to use at that time.*

"How are things going today?"

> **Pause, wait for their response, spend a minute or so to establish rapport, and proceed:*

"Thanks again for agreeing to participate in this study. There isn't much information known about what babies and toddlers eat, and we hope this study will help a lot of kids and families. After we complete the call, I'll make sure we have your correct address, and your $10 HEB card will go out to you today."

"Keep in mind that your participation is totally voluntary, and that all the information you give is completely private. This study is separate from WIC, and no one there will know about the answers you give today."

"For this interview, we want to ask about your (  *age of child*)-old child. That child's name is (  ), is that correct?"

"During this part of the call, I'm going to be asking you about what (  ) ate and drank yesterday, and I'll enter the information in my computer. This is easy, because it's just about what (*he*/*she*) ate yesterday, and there are no right or wrong answers. Whatever (*he*/*she*) ate is okay. It's really important that you try to give complete and accurate answers so that our study gets information we can use. Do you have any questions for me?"

> **Pause, wait for their questions, respond briefly, and then say:*

"Feel free to ask questions at any time. Are you ready? I'm sure you'll do a great job of helping me!"

## Recording the 24-hour Recall

"What we'll do first is to make a list of the foods and beverages ( *child's name*) had from midnight of the day before yesterday, which was ( *day of the week*), until 12 pm last night. Were you with ( *child's name*) during that whole time yesterday?"

**If someone else provided childcare for part of the time during the 24-hour recall period, say:*

"Would it be okay if we called ( *childcare provider name*) to find out what ( *child's name*) ate and drank during that time?"

**After receiving their permission to call, record the childcare provider's contact information and make a note of the time(s) the child was in their care.*

"Okay, now we will record the list of all the things (*he*/*she*) ate and drank yesterday. This includes all meals, snacks, beverages, breastfeeding, and tap water, as well as tastes or samples of foods. It's really easy to forget little snacks and drinks, so try to pay special attention to remembering things like juice, fruit, or crackers that you gave between meals."

"I'll need you to tell me about what time your child had each item. For example, 'At 6am (*he*/*she*) had this, and at 8 am (*he*/*she*) had that.' We'll make a general list at first, and then we'll go back and fill it in with more detail. Then we'll go through the list once more to make sure we haven't missed anything."

## Explaining the Food Amounts Booklet

"We have some ways to help estimate the amounts of food your child had yesterday, and I want to take a minute to explain them to you."

"We'll mostly use the Food Amounts Booklet that you got at WIC when you signed up. Do you have the booklet with you?"

**When they have the booklet with them, say:*

"These drawings will help estimate the amounts of foods and beverages your child had yesterday. For instance, on page 2, you can use the graph paper to tell me how big a square or rectangular food was, like a brownie, a cracker, or a piece of cake."

"There are also pages for circles and other shapes that we can use as necessary, for things like tortillas or slices of pizza."

"Page 5 will help you tell me how tall a food was, like a pancake or a cookie."

"Pages 6 and 7 show how to estimate amounts of things that come in spoonfuls, like jelly, peanut butter, or sugar. You can see the difference between a level spoonful and a heaping spoonful, for instance."

"Page 8 shows measuring cups.

"Starting on page 9, you can see different sizes of drinking glasses and cups. First choose the size of cup or glass you used, and then think about how much was in the glass. For example, you might say, 'Yesterday my child had milk in a glass about like C3 and it filled the glass to Line D.'"

"Then there are some pictures of typical servings of foods that are served in mounds or scoops, like mashed potatoes or refried beans, and you just tell me the number that looks like the amount you served."

"There are also pictures of bowls that we can use. As you see on pages 17 and 18, Bowl 1 is very small and might be used to give your child their own serving of cereal or fruit. Bowl 4 might be used for foods that are often shared with others, like popcorn, chips, or salad. Just like with the cups, first tell me the size of bowl you used, and then choose the letter that shows how much you served your child."

"At the end are some drawings of cuts of meat, like a chicken leg or piece of fish. Just choose the one that looks most like what you served your child, and let me know how much of it (*he*/*she*) ate."

**Reassure the participant by saying:*

"I will be helping you with describing amounts when we get to this part of the interview. Any questions?"

**Respond to questions as needed before you get started.*

"Okay, let's begin! Take a moment to think about yesterday, what you did, where you went, and so forth. Thinking about yesterday and what you did can help you to remember when you ate or drank."

## Entering the Quick List

"After 12 midnight on ( *day of the week*), the day before yesterday, when was the first time ( *child's name*) had something to eat or drink?"

**Wait for a response and as needed follow up with:*
"What did (*he*/*she*) have at that time?"
"Did (*he*/*she*) have anything else at that time?"

**Repeat until the client has listed all reported meals and snacks. After completing the Quick List, say:*
"Now we will review what we have so far."

## Reviewing the Quick List

"If you think of anything else your child ate or drank yesterday, or if I have missed anything, let me know."

"At (*insert time*) your child had (*read all foods*). Can you think of anything else your child had at that time?"

**As needed, say:*
"I don't have anything between midnight the night before last and (*insert time*) yesterday morning. Do you remember if your child got up during the night and had anything to eat or drink?"
"Did (*he*/*she)* have a beverage with that meal?"
"Did (*he*/*she*) have any snacks between meals or did your child sample food as you prepared for the meal?"

**Repeat until you have listed all foods for all meals and snacks. After completing the Quick List review, say:*

"Now we will fill in your list with more detail."

## Collecting Meal Information Detail

"Now, we'll go over our list and I will ask you some questions about each food. You can use any of the drawings we talked about before to tell me how much ( *child's name*) had."

**Complete the Meal Information window (ask the following according to what the participant said before):*

"What would you call the meal you had at (*insert time*)?"
"Was this (*his/her*) (*insert obvious meal name*)?"
"Where were you when (*he/she*) ate (*insert the meal name*)?"

**Asking About Additions (ask the additions question until you receive a "no" response):*

"The first thing on your list is (*insert the name of the food*). Did you add anything to the (*insert the name of the food*)?"

**Collecting Complete Food and Amount Detail (refer to the label image packet as necessary, and ask, depending on the food):*

"What brand or type of (*insert name of the food*) was it?

**Continue to describe the food, selecting food variables as required on each screen. Ask about the amount of food (how much or how many, depending on the food). As needed, refer to the Food Amounts Booklet and the serving size visual references sheet:*

"How much did your child (*eat/drink*)?"

**After quantification, <u>be sure</u> to confirm that the child finished the amount described.*

"Was your child able to finish that?"

**Provide positive reinforcement during the interview by saying:*

"You are doing a good job!"

*Or*

"Thanks for remembering that!"

**If it is necessary to ask the participant to repeat what he/she said, say:*

"Sometimes it's hard for me to hear things. Could you please tell me that again?"

**If the participant can't remember details and unknowns/defaults are available, say:*

That's okay, I have an option to pick when people can't remember.

## Reviewing the 24-hour Recall:

"Now we will review, and tell me if I missed anything."

"The first thing I have is at (*insert meal name and time*) when your child had (*insert food names*). Is this correct?"

**At the end of each meal ask:*

"Did (*he/she*) have anything else at that time?"

**When the interviewer notices a large gap, he/she should ask:*

"Did your child have anything to eat or drink between (*insert names of meals*)?"

*Or ask:*

"Anything (*before/after*) your child's (*insert name of the meal*)?"

**Additional foods and meals are inserted at any time. If the participant hesitates and can't remember eating anything for a long period of time, ask:*

"Can you think of what you were doing (*after work, at dinner/supper time, etc*.)? Sometimes if we think about where we were or with whom, it helps to remember what we ate."

## Collecting Supplement Information:

"Did your child consume any type of supplement and/or supplemental vitamins?"

*If supplement is listed in NDSR, enter it in the food log. If you cannot locate it or it is unavailable, enter the information in the notes of the trailer tab*

## Completing the Trailer Tab:

"Now (*insert name of participant*), in terms of the amount of food your child ate, would you say this was close to the amount that (*he*/*she*) usually eats, a lot more, or a lot less than (*he*/*she*) usually eats?"

> **This question refers to the overall amount of food for the day, not the type of food. If the participant reports a lot more, check "considerably more than usual" or a lot less than usual, check "considerably less than usual". In either case, NDSR requires a note that briefly states why the intake was not usual. For example, a celebration meal with lots of food or a participant not feeling well and not eating much can result in eating a lot more or less than usual.*

> **If needed, the interviewer can ask:*

"What makes you say it's a lot more or less than usual?"

> **Determine the reliability of the food and beverage information provided. If the dietary recall is unreliable because the participant was unable to recall one or more meals or for some other reason they were unreliable, select the appropriate NDSR button and add the required note. Do not ask the participant this question, or share your response.*

## Completing the Demographic and Feeding Practices Surveys

"Okay (*insert participant's name*), we are done with the food list. Now I just need to ask you some questions about your child's health and usual diet, and some household information."

**ASK QUESTIONS AND RECORD ANSWERS FOR*

- *FEEDING PRACTICES QUESTIONNAIRE*
- *DEMOGRAPHIC QUESTIONNAIRE*
- *HEALTH HISTORY QUESTIONNAIRE*

## Finishing the Interview

"( *participant's name*), this completes the interview. Thanks for your participation and time. You did a great job! Your $10 HEB card will go out in the mail today, so I need to confirm your address. Is it (*insert address*)?"

"I also want to let you know that you have the option of completing a second phone interview within the next two weeks, and receiving a second $10 HEB card. It wouldn't have the survey questions again, just the information about the things your child ate and drank the day before. You will receive the card for today's interview whether you do the second one or not. Are you interested in doing that?"

> **(If they want to do the second interview, verify the best phone number to use and the best time to call. Let them know to expect the second call within 3-14 days of this interview.) Say:*

"You should expect the second call within two weeks, so be sure to keep your Food Amounts Booklet near the phone."

"Thank you so much for your help today! It was nice to talk with you. Goodbye!"

**Consent Form**

**Title: Feeding Patterns of Infants and Toddlers at WIC in San Marcos, Texas**

**Principal Investigator and Contact Information:**

*Texas State University – Department of Family & Consumer Sciences*

- Dr. Sylvia Crixell, Professor
  Phone: 512-245-2482 Email: scrixell@txstate.edu
- Julia Von Bank, Graduate Student
  Phone: 512-245-4685 Email: jv1210@txstate.edu

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**Information**

This form gives you information about the research. Please read this form and ask questions about anything you do not understand. Please ask questions before deciding if you would like to help in this research study. You will get a copy of this form.

**Why we are asking you to help in this study:**

We are asking you to help in a research study because:

- You are the mother of at least one child between the ages of 4 months and 5 years
- You use the WIC services in San Marcos

Your participation in this study is voluntary – that means you are volunteering to help, and can leave the study at any time. Participation in this study will not affect your current or future services received from WIC.

**Why are we doing this research study?**

The reason for this study is to learn about the way mothers feed their infants and toddlers in San Marcos, Texas.

**How many people will be involved?**

There will be about a minimum of 130 and up to 500 people, all women with children who use WIC services in San Marcos, TX.

**What will happen if you help us in this research study?**

1. We will call you on the telephone and ask 40 – 70 questions. It will take

about 45 minutes. We will you send information through the mail before the interview, and we will call you when it is a good time for you.

2. When we call you, we will ask you questions about the foods your child ate on the day before the interview. We will ask you to tell us everything your child ate and drank for 24 hours, and it will be important to try to remember exactly what and how much your child ate. We will give you a packet that will help you figure out portion sizes when you talk to us.
3. When we call you, we will ask you general questions about breastfeeding or formula feeding or the foods your child ate.
4. When we call you, we will ask you questions about your personal and family medical history. For example, we will ask you about your child's medicines, vitamins, if your child has any food allergies. We will also ask about your family's health problems. We want to ask these questions to figure out the state of your health and the risk for disease. You do not have to answer any question(s), for any reason, if you do not want to.
5. When we call you, we will ask you questions about personal things like income and education level. You do not have to answer any question(s), for any reason, if you do not want to.
6. At the end of the phone call, we will ask you if you'd like to be called again for a second phone interview 3-14 days after the first one. This phone call will be shorter and will last about 20-30 minutes. We will ask you about 20-30 questions about what your child ate in one day. This is completely up to you. If you do not want to be called a second time, we will send you your gift. If you do want to be called again, we will send you your gift, and you will receive a second gift after completing the second interview.

**What are the possible risks?**

- There are no known risks in this study other than nervousness or slight anxiety in telling us your personal information.
- It is important to know that we are researchers from Texas State University, and are not affiliated with WIC.

**What are the possible benefits to you or to other people?**

- The knowledge gained from this study will help us understand how young children are fed. Researchers do not know how many children are fed.
- If you are interested, you can receive a report after the study is completed.

If you would like to receive this report, please check here: _____.

- If you are interested, we will call you by telephone to give you the results of this study.

**How will we protect your privacy and your records?**

- All the records and information we get from you in this study will be kept in a locked file cabinet, in a locked room in the Family and Consumer Sciences Building at Texas State University. Only certain people will have keys to the file cabinets.
- All electronic information will be kept on a secure computer located within the Family and Consumer Sciences Building at Texas State University. A password must be used to access the information. Only certain people will have passwords to access the electronic data.
- Only certain people from Texas State University and the Institutional Review Board have the legal right to look at your records. These people must protect those records by law. Your records will not be released unless you give consent, and unless required by law or a court order.
- If the results of this research study are published or presented at a scientific meeting or with WIC, we will not identify any person who gave us their personal information.
- When the data is analyzed for research purposes, it will be shredded and discarded at Texas State University.

**Will the researchers get anything from your help in this study?**

The researchers will not benefit from the study except to publish or present the results.

**Will you receive compensation for your participation in this study?**

After the phone call, you will receive a $10 gift certificate to the HEB grocery store. It can be used at any HEB location. If you choose to be called again for a second phone call 1-2 months later, you will receive an additional $10 gift certificate to the HEB grocery store.

**If you have any questions about this study**

- Call Dr. Sylvia Crixell at 512-245-2482.
- If you have any questions about your rights in this research study, you may call the Department of State Health Services Institutional Review Board #1 Office at 1-888-777-5037.

**What if you don't want to continue in the study?**

- If you decide to help in this study, it is on a volunteer basis.

- You have the right to refuse to be in this study.
- You can stop at any time after giving your consent. This decision will not affect in any way your current or future status with WIC or Texas State University.
- The study investigator may stop you from taking part in this study at any time if they decide it is in your best interest, or if you do not follow study instructions.

**We will give you a copy of this consent form to keep.**

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**If you're willing to volunteer for this research, please sign below.**

**Statement of Consent:**
I have read the above information and clearly understand my role as a participant in the study. I have asked questions and have received answers. I, _____, consent to participate in the study.

Signature: _____ Date: _____

Signature of Investigator: _____ Date: _____

# Screening Form

**Feeding Patterns of Infants and Toddlers at WIC in San Marcos, Texas**

What is your name? _____ Relationship to child: _____

How many children do you have? _____

How old is/are your child/children? (gender and age; first name if eligible)

1. _____
2. _____
3. _____
4. _____
5. _____

Are you able to receive a phone call from us for an interview? _____

Is your child cared for by someone else during the day? _____

Are you able to report what he/she eats throughout the day even if cared for by someone else?

_____

Can we contact your child's day care provider about their diet? _____

When is the best day and time of the day to reach you? days _____ time

_____

What phone number can we reach you at? _____

What is your address? _____

***Thank you for your time and contribution to this research study!***
***We will contact you within the next 3-5 days.***
***Do with participant:***

1. ***Consent form – 2 copies: keep a copy and give them a copy***
2. ***FAB and explain***
3. ***Receipt of Funds Form***

---

***Complete Later:*** Child to be studied: Name _____ Age _____
Sex ____ Race _____

***Language preferred for interview:***
***Researcher:***
***Date:***
***Class time:***
***Class type:***
***Class language:***

## APPENDIX B

## LIST OF SUBJECTS EXCLUDED IN AGE OF INTRODUCTION ANALYSES

| Food group | Number of toddlers not included in analysis | Ages of these toddlers |
|---|---|---|
| Vegetables | 2 | 20, 31 |
| Fruit | 1 | 20 |
| 100% juice/SSB | 5 | 13, 20, 22, 24, 28 |
| Cow's milk | 4 | 12, 15, 16, 20 |
| Meat | 5 | 12 (2), 15, 20, 28 |
| Dairy foods | 1 | 12 |
| Cereal | 2 | 14, 31 |
| Sweets/desserts | 16 | 12, 13, 15 (2), 15 (2), 15 (2), 17, 18 (2), 20, 25, 27, 28, 31 |
| Salty snacks | 7 | 12, 13, 15, 16, 20, 22, 28 |

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**VITA**

Julia Ann Von Bank was born in New Prague, Minnesota, on March 11, 1977, the daughter of Constance Mae Von Bank and Gregory James Von Bank. After completing her high school education at Montgomery-Lonsdale High School, Montgomery, Minnesota, in 1995, she attended the University of Wisconsin in River Falls. She transferred to The College of Saint Scholastica in Duluth, Minnesota in 1999 and graduated with her B.S. in Biology with a minor in Chemistry in 2000. Upon graduation, she was employed as an electrophoresis analyst at BioDiagnostics, Inc in Ellsworth, Wisconsin. She then worked for Haagen-Dazs R&D in Minneapolis, Minnesota as a product developer where she developed over 15 frozen dessert products. She also worked as a product developer for Dairy Queen International in Minneapolis, Minnesota. In August 2008, she entered the Graduate College of Texas State University-San Marcos.

Permanent Address: 2235 East 6th St. Apt. 401

Austin, Texas 78702

This thesis was typed by Julia Ann Von Bank.