

IMPACT OF POLICY CHANGE ON FEEDING PRACTICES OF INFANTS AND
TODDLERS IN THE SPECIAL SUPPLEMENTAL NUTRITION PROGRAM
FOR WOMEN, INFANTS, AND CHILDREN (WIC) IN
SAN MARCOS, TX

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

Amanda M. Reat, B.S.

San Marcos, Texas
December 2012

IMPACT OF POLICY CHANGE ON FEEDING PRACTICES OF INFANTS AND
TODDLERS IN THE SPECIAL SUPPLEMENTAL NUTRITION PROGRAM
FOR WOMEN, INFANTS, AND CHILDREN (WIC) IN
SAN MARCOS, TX

Committee Members Approved:

Sylvia Crixell

BJ Friedman

Toni Watt

Approved:

J. Michael Willoughby
Dean of the Graduate College

COPYRIGHT

by

Amanda Reat

2012

FAIR USE AND AUTHOR'S PERMISSION STATEMENT

Fair use

This work is protected by the Copyright Laws of the United States (Public Law 94-553, section 107). Consistent with fair use as defined in the Copyright Laws, brief quotations from this material are allowed with proper acknowledgement. Use of this material for financial gain without the author's express written permission is not allowed.

Duplication Permission

As the copyright holder of this work I, Amanda M. Reat, authorize duplication of this work, in whole or in part, for educational or scholarly purposes only.

ACKNOWLEDGEMENTS

I would like to thank my committee members; Dr. Sylvia Crixell, Dr. BJ Friedman, and Dr. Toni Watt for their continuous support, encouragement, and guidance. I would also like to thank the research assistants who worked relentlessly to carry out this research, especially Sarajane Morris, Nicole Fendley, Cici Munoz, Min Kwon, and Michelle Duer. I also need to thank Julia Von Bank for sharing her data, collaborating in research, and providing personal support throughout my thesis journey. Lastly, I would like to thank my family, friends, and graduate colleagues for their encouragement and understanding.

This manuscript was submitted on October 26, 2012.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES.....	ix
CHAPTER	
I. LITERATURE REVIEW	1
Introduction.....	1
Nutritional Concerns for Infants and Toddlers	3
Energy Imbalance	4
Specific Nutrients.....	7
Current Intake of Infants and Toddlers	10
Feeding Infants and Toddlers Study	10
Feeding Practices of Infants and Toddlers Participating in WIC in San Marcos, TX	11
The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)	12
History and Background	13
Eligibility	14
Food Package Benefits.....	15
A Necessary Change in WIC Food Packages	17
Justification for Food Package Revisions	22

II. OBJECTIVE	28
Assessing Feeding Practices	28
Hypotheses	29
III. METHODS	32
Procedure	32
Training of Research Assistants.....	32
Recruitment.....	32
Instruments.....	33
Data Collection	35
Data Analysis	35
IV. MANUSCRIPT.....	36
Introduction.....	36
Methods.....	39
Participants.....	39
Data Collection and Instruments.....	39
Data Analysis	40
Results and Discussion	41
Subject Characteristics.....	41
Breastfeeding and Formula Use.....	42
Grains	47
Baby Food Meat.....	48
Fruits and Vegetables.....	48
Juice	49

Strengths and Limitations	51
Conclusion	51
Manuscript References.....	53
APPENDIX A: INSTRUMENTS.....	61
LITERATURE CITED	95

LIST OF TABLES

Table	Page
1. Current feeding recommendations for infants and toddlers.....	7
2. Foods included in WIC food packages I-III before 2009	16
3. Foods included in WIC food packages IV-VII before 2009	17
4. New WIC food package allowances for infants 0-5.9 m (implemented in 2009)	19
5. New WIC food package allowances for infants 6-11.9 m (implemented in 2009)	20
6. New WIC food package allowances for children and women (implemented in 2009).....	21
7. Comparison of previous and current food packages for infants and toddlers ages 4-24 months	27
8. Rationale, action, and methods for measuring hypothesis.....	30
9. Comparison of characteristics of infants and toddlers	42
10. Comparison of feeding practices	45
11. Comparison of 24-hour recall results.....	46

CHAPTER I – LITERATURE REVIEW

Introduction

While proper nutrition is important for individuals across the lifespan, it is particularly important during times of rapid growth and development, such as pregnancy, infancy, and early childhood. Early experiences with food are especially important for infants and toddlers, not only because food provides nutrients, but also because very young children are developing taste preferences and eating habits that may influence food choices throughout their lives (1-3). Recognizing the importance of diet during gestation and early development, the federal government permanently established the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in 1975 (4). Since that time, WIC has played an important role in providing food for low-income women, infants, toddlers, and children who are at nutritional risk. WIC provides direct assistance by issuing supplemental food packages in the form of vouchers that participants can use to purchase specific foods. The original food packages for infants and toddlers included such items as juice, infant cereals and sweetened cereal, milk, eggs, and infant formula. These foods were chosen to provide nutrients that were thought to be lacking in the diets of low-income populations during the 1970's, such as vitamin A, vitamin C, calcium, iron, and protein (5). While the food packages may have been appropriate for infants and toddlers at that time, the nutritional issues of very young children in the nation have since changed. Specifically, young children in the US are not

eating healthful foods (6) and are experiencing increased incidence of overweight and obesity. Currently, nearly 10% of US children under the age of 2 years have excess weight, and 23 million children ages 2-19 years are overweight or obese (7). Given that approximately 50% of infants and nearly 25% of children in the US are enrolled in WIC, this program has the potential to substantially affect the diets of young children (8). Improved dietary intake could decrease the risk of obesity and improve overall nutritional status.

In 2009, the US government mandated a policy change to update the food packages so that they would be more closely aligned with current dietary recommendations (5). The new packages include items such as fresh produce and whole grains for children over 12 months and baby food meats for breastfeeding infants and omit infant formula for breastfeeding infants and juice for infants younger than 6 months of age. Ideally, recipients of the new packages will consume more foods that are nutrient dense and age appropriate and fewer foods that may promote obesity.

Prior to the 2009 policy change, we investigated feeding practices among infants and toddlers (ages 4 to 24 months) participating in the WIC program in San Marcos, Texas (9). We found that many feeding practices among San Marcos WIC participants were not aligned with current guidelines for feeding infants and toddlers, such as those of the American Academy of Nutrition and Dietetics (formerly the American Dietetic Association) recommending diets low in saturated fat, sugar, and sodium (10). Indeed, some local feeding practices were even less healthful than those reported in the nationally representative Feeding Infants and Toddlers Studies (6, 11). For example, consumption of

sugar sweetened beverages (SSB) and salty snacks was more common among San Marcos WIC children than among participants in the 2002 FITS.

The goal of the study described herein was to investigate the feeding practices of infants and toddlers in San Marcos WIC in 2011 and assess whether the practices were different than those observed in 2009 and more aligned with current recommendations as per the intent of the package changes. We anticipated that feeding practices positively associated with pediatric overweight (e.g. formula feeding, early consumption of juice, early consumption of complementary foods) would be less prevalent in 2011, while practices that support healthy weight and improved nutrition (e.g. breastfeeding, consumption of fruits and vegetables and baby food meats) would be more common among infants and toddlers receiving the new food packages. The results of this study assess the efficacy of the federal 2009 WIC policy change on feeding practices of infants and toddlers at a local level.

Nutritional Concerns for Infants and Toddlers

Nutritional concerns for infants and toddlers have changed over the past several decades. During the 1970's, it was recognized that low-income populations were at risk for consuming diets low in protein, vitamin C, vitamin A, calcium, and iron (12). The original WIC food packages were designed to provide these nutrients by offering such items as iron-fortified infant formula and infant cereal, peanut butter, milk, beans, eggs, and juice. In the past few decades, the incidence of pediatric obesity has increased, especially among low-income populations. At the same time, feeding practices associated with increased risk of obesity, early introduction of complementary foods (13), increased intake of processed foods, and decreased intake of nutrient dense whole foods, have

become more common. Current research has shown that US diets may also be low in nutrients that play a crucial role in times of rapid development, such as vitamin D and essential fatty acids (14, 15). Since nutritional concerns have shifted, the WIC food packages developed in the 1970's have become antiquated and no longer meet the nutrient needs of low-income populations. While the WIC policy change is overdue, the new food packages do support general dietary recommendations commensurate with good health (e.g. providing fruits, vegetables, and whole grains). Importantly, the revised food packages are also more consistent with current recommendations for infant and toddler feeding (e.g. promoting breastfeeding, appropriate age of introduction to complementary foods, and less juice).

Current guidelines for infants and toddlers differ from guidelines for the general population. While the 2010 Dietary Guidelines for Americans (16) and MyPlate (17) provide comprehensive recommendations for individuals older than 2 years, recommendations for children younger than 2 years have been developed by several organizations, such as the American Academy of Nutrition and Dietetics (AND), the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the American Academy of Pediatrics (AAP). The recommendations are important because they are crafted to encourage feeding practices that provide appropriate nutrients while avoiding excess weight gain (see Table 1).

Energy Imbalance

Data from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) revealed that 9.5% infants and toddlers under 2 years of age had excess weight. The term “excess weight” is used for infants and toddlers who fall at or above the

95th percentile on the 2000 CDC sex-specific weight-for-length growth charts (7). Among 2-19 year olds, 31.7% were overweight or obese, having a body mass index (BMI) greater than or equal to the 85th percentile on the 2000 CDC sex-specific BMI growth charts. While obesity is a concern across all socioeconomic levels, low-income populations exhibit higher prevalence than the general population (7, 18).

The early onset of obesity is associated with a multitude of negative effects. Metabolic consequences include increased risk for developing glucose intolerance, dyslipidemia, hypertension, non-alcoholic fatty liver disease, polycystic ovarian syndrome, and gallstones (19). Orthopedic conditions, breathing complications, and psychological problems such as depression, are also more common among obese children (19). Importantly, overweight and obesity during childhood increases risk for overweight and obesity in adulthood. Considering these consequences, it is imperative that infants and children receive healthful diets and adequate physical activity in order to prevent excess weight gain.

Exclusively breastfed infants, from birth to 6 months, receive enough calories to support normal growth. Several studies have shown that breastfeeding may also protect against pediatric overweight by providing dietary satiety signals, such as leptin, and promoting self-regulation during feeding (20-22). The AND, the AAP, the WHO, and the CDC recommend that infants be exclusively breastfed until the age of six months (23-26). The WHO recommends that complementary foods be introduced at six months of age in concurrence with breast milk or formula (25). Introduction of complementary foods prior to 4 months of age, especially in formula fed infants, is associated with overweight during infancy (13). The American Dietetic Association's (now AND) *Start*

Healthy Feeding Guidelines for Infants and Toddlers recommends adding a variety of fruits, vegetables, legumes, plain meats, and whole grains to the diet of infants and toddlers, while avoiding foods high in sugar, saturated fat, and sodium (26). Consuming such nutrient dense foods supports weight maintenance.

It is unfortunate that many infants and toddlers are not consuming healthful diets. Results of two nationally representative studies of infant and toddler feeding practices, FITS 2002 and FITS 2008, revealed that consumption of sweetened cereals, sweet foods such as desserts and candies, as well as SSBs, were common practices. Conversely, fruit and vegetable consumption was less common among all age groups. When vegetables were included in the diet, they were more often starchy and frequently fried (e.g. fried potatoes) (6). These feeding practices reflect the ready availability of inexpensive, highly processed foods and beverages that overwhelm today's food markets. Indeed, the low cost energy dense foods such as cookies, bread, chocolate, sugar, margarine, and SSBs, especially compared with the cost of fresh fruits and vegetables (18), may be an important factor driving early onset obesity. Thus, a major goal of the changes implemented by WIC is to promote healthful eating habits in children despite the unhealthy food environment in the US.

Table 1 - Current feeding recommendations for infants & toddlers	
Organization	Recommendations
World Health Organization (WHO)	<ul style="list-style-type: none"> • Exclusive breastfeeding for 6 months and continue with complementary foods for 2 years or longer (23)
American Academy of Pediatrics (AAP)	<ul style="list-style-type: none"> • Exclusive breastfeeding for 6 months and continue at least for 12 months (24) • Introduce cow's milk only after 12 months (24) • Acceptable to introduce juice after 6 months, limited to 4-6 ounces/day for children ages 1-6 years (25) • Vitamin D supplementation of 400 IU/day for all infants and toddlers (26)
Centers for Disease Control and Prevention (CDC)	<ul style="list-style-type: none"> • Exclusive breastfeeding for 4-6 months (27)
American Dietetic Association (now the American Academy of Nutrition and Dietetics) <i>Start Healthy Feeding Guidelines for Infants and Toddlers</i>	<ul style="list-style-type: none"> • Introduce a variety of fruits and vegetables, whole grains, legumes, and plain meats (28) • Avoid introducing foods high in sugar, sodium and saturated fat (28)

Specific Nutrients

Proper intake of nutrients remains a concern for infants and toddlers. Although all nutrients are essential, there are several nutrients that are paradoxically crucial for development yet lacking in the diets of infants and toddlers. In the early 1970's, around the time that WIC was first launched, it was recognized that intakes of iron, calcium, vitamin A, and vitamin C, all of which are important in development, were often low in

the diets of low-income populations (13). At present, while iron continues to be a nutrient of concern, recent research has suggested that vitamin D, a fat-soluble vitamin, and docosahexaenoic acid (DHA), an omega 3 fatty acid, are particularly important for development and found in limited amounts in the US diet, especially among infants and toddlers.

Iron

Poor iron status, which is particularly associated with premature delivery, low birth weight, and anemia in pregnancy, continues to be of concern for infants and toddlers (29). Many studies have shown that iron deficient children have reduced motor skills, achieve lower test scores on standardized cognitive development tests, and exhibit poor social and emotional skills (30-33). Importantly, the negative consequences of iron deficiency during infancy and toddlerhood may not be fully attenuated by later iron therapy (34, 35). Therefore, considering that early childhood is a crucial time of development and that iron absorption is particularly high during this time, it is critical that infants and toddlers be offered adequate amounts of iron-rich foods at the recommended age.

Infants receive small amounts of iron through breast milk. However, because iron in breast milk is transported by lactoferrin, it is very bioavailable, and is likely to meet the needs of breastfeeding infants born at full-term, generally until 4 to 6 months of age (36). In contrast, while infant formula is fortified with higher levels of iron, the iron is not very bioavailable. At around the age of 4 to 6 months, the infant's iron stores begin to deplete and breast milk can no longer provide adequate amounts of iron. The CDC recommends that iron-rich foods be introduced at this time (27). Appropriate sources of

iron include plain baby-food meats (i.e., red meat, poultry, and fish), dark green vegetables, legumes, and some fruits (27, 37). Meats contain heme iron, which is highly bioavailable. In contrast, whereas iron fortified cereals, vegetables, legumes and fruits contain non-heme iron, the iron in these foods is less bioavailable. Nevertheless, because they are often consumed in large amounts, food sources of non-heme iron are important contributors of dietary iron. Children who are not breastfed should be offered iron-fortified formula. No infants should be offered cow's milk, which is low in iron, until after one year of age (38).

Vitamin D

Vitamin D is essential for proper bone growth, and vitamin D deficiency is recognized as the primary cause of rickets in children (39). Recent studies have also shown that vitamin D deficiency may also be linked to increased risk for respiratory infections and type 1 diabetes in children, and to heart disease and certain cancers later in life (40-42). Vitamin D is formed in the skin upon exposure to sunlight, and for some individuals, sun exposure may provide adequate amounts of vitamin D. However, regular exposure to sunlight is not recommended for infants and children due to concerns about sunburn and skin cancer. Unfortunately, human milk, along with most other foods, does not contain enough vitamin D for infants and toddlers. Therefore, the AAP recommends that all children receive vitamin D supplementation of 400 IU per day beginning in the first few days after birth and continuing throughout adolescence (14). Food sources of vitamin D, such as fish oils, egg yolk, and fortified foods (e.g. milk and cheese) should also be introduced to infants and/or toddlers. However, most infants do not consume these foods often enough to receive sufficient amounts of vitamin D (42). According to

2000-2004 NHANES data, 9% of US children are vitamin D deficient and 60% had insufficient levels of vitamin D (43).

Docosahexaenoic Acid (DHA)

DHA is an omega 3 fatty acid that is renowned for its role in brain development. Specific brain regions accumulate high concentrations of DHA during gestation and also after birth. DHA status has been linked to neurological functioning including sensory input, motivational behaviors, attention, and memory, as well as to motor development in infants and toddlers (15, 44). The last trimester of pregnancy and the first two years of life are crucial times for DHA accumulation (45). DHA is supplied to the fetus via the placenta and to the infant via breast milk. Therefore, maternal intake of DHA during pregnancy and lactation is important, followed by the introduction of DHA-rich complementary foods for infants and toddlers. Good food sources of DHA include fish, fish oils, eggs, and other fortified products. While there is an Adequate Intake level of 0.5g/day for alpha linoleic acid (a shorter chain omega 3 fatty acid), at present there is no specific recommendation for DHA intake for infants.

Current Intake of Infants and Toddlers

Feeding Infants and Toddlers Study

The FITS studies conducted in 2002 and again in 2008 (6, 11) provided the first national assessments of feeding practices among infants and toddlers. FITS 2008 found that 42.5% of infants ages 4 to 6 months and 36.7% of infants 9 to 12 months received breast milk on the day studied. A small yet concerning number of infants 6 to 9 months and 9 to 12 months consumed cow's milk (5% and 17%, respectively). Cow's milk should not be provided to infants younger than 1 year as it is associated with

gastrointestinal bleeding and iron deficiency. FITS 2008 also reported that grains, particularly cereal, were the most commonly consumed food group among all infants and toddlers. Among 2 to 3 year-olds, 30% of cereal consumed was pre-sweetened. Intake of fruits and vegetables was disappointingly low, with 28% of 6 to 24 month-olds consuming no vegetables and 36% of 12 to 24 month olds consuming no whole fruits on the day studied. While consumption of fruit, vegetable, and baby food meat was low, consumption of desserts, sweets, sugar sweetened beverages, or candy was high. For example, 80% of 12 to 24 month-olds consumed at least one of these items on the day studied (6).

Feeding Practices of Infants and Toddlers Participating in WIC in San Marcos, TX

Prior to the 2009 WIC policy change, our research team investigated feeding practices among infants and toddlers (ages 4 to 24 months) participating in the WIC program in San Marcos, TX (9). We found that breastfeeding rates were highest among infants 4 to 6 months, with 41% receiving at least some breast milk on the day studied. Conversely, only 15% of infants 7 to 11 months and 8% of toddlers 12 to 24 months received any breast milk. While no infants 4 to 6 months received cow's milk, 7% of infants 7 to 11 months did consume cow's milk. Grains were the most commonly consumed type of food, with infant cereals and ready-to-eat cereals being the most common source. Intake of fruits and vegetables among San Marcos infants and toddlers was disappointingly low, with 50% of infants 4 to 6 months and 33% of toddlers 12 to 24 months consuming no vegetables, and only a single infant consumed a dark green vegetable on the day studied. Vegetable consumption was higher among infants 7 to 11 months, with 80% consuming a vegetable on the day studied. Among toddlers 12 to 24

months, potatoes were the most commonly consumed vegetable, and the majority of the potatoes were fried. Fruit consumption was even less common, with 31% of infants 4 to 6 months and 38% of infants and toddlers 7 to 24 months not consuming a fruit on the day studied. Meat consumption was highest among toddlers 12 to 24 months and lowest among infants 4 to 6 months. Poultry and processed meats were the most commonly consumed types of meat. Finally, consumption of SSB's and salty snacks were high in this population. One infant in the 4 to 6 months category, 27% of infants 7 to 11 months, and 58% of toddlers 12 to 24 months consumed an SSB on the day studied. Salty snacks were consumed by 15% children ages 7 to 24 months.

The 2002/2008 FITS and the WIC 2009 study in San Marcos provide valuable information to an important yet understudied field of research. Results of these studies helped identify areas of specific concern regarding feeding practices in the US, such as low fruit and vegetable consumption, high sweets and salty snack consumption, and low rates/short duration of breastfeeding. Because the WIC 2009 study in San Marcos was completed a few months prior to the 2009 WIC package changes, the results provide preliminary data against which we can assess the efficacy of the policy change on feeding practices observed in a local population.

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)

WIC is a federally funded program aimed at improving the health of at-risk individuals (46). Low-income, at risk, pregnant, postpartum, and breastfeeding women, along with their infants and young children through the age of 5 years are eligible to receive WIC benefits. Unlike other food programs, WIC is specifically intended to

provide appropriate nutrition during times of rapid growth and development, such as pregnancy, lactation, infancy, and childhood, in order to improve early nutrition and prevent future medical or developmental issues. The WIC program strives to improve health by providing supplemental food packages in the form of vouchers, nutrition education, breastfeeding consultations, and health care referrals.

History and Background

During the 1960's, physicians noted that malnutrition among women, many of whom were pregnant, was associated with poor health. The initial response was to place food commissaries in health clinics to provide supplemental foods to low-income patients as prescribed by their physicians. Continued concern about low-income pregnant women and their children led the United States Department of Agriculture (USDA) to establish the Commodity Supplemental Food Program (12). However, the USDA realized that this program was not adequate to meet the specific needs of pregnant women and their children. In 1972, as an amendment to the Child Nutrition Act of 1966, WIC was established as a two year pilot program (4). WIC was permanently established in 1975, serving approximately 88,000 women, infants, and children with a budget of \$10.4 million that year (46). In 2010, WIC served 9,175,000 participants (47) at a cost of \$6.7 billion (2010 budget). Currently, over 50% of infants and 25% of children in the US participate in WIC (8).

As WIC evolved, more services, including mandatory nutrition education and health care referrals, were introduced (12). The first supplemental food packages were extended to eligible pregnant and breastfeeding women along with infants and children younger than 4 years. These population groups were deemed to be “at special risk” with

respect to physical and mental health. However, soon after WIC was permanently established, the WIC food packages were extended to non-breastfeeding, post-partum women along with children under 5 years of age. Food packages included vouchers for supplemental amounts of infant formula, milk, cheese, eggs, infant and adult cereals, and fruit juices. These foods were chosen because they provided specific nutrients such as vitamin C, vitamin A, calcium, iron, and protein. Nutritional research in the 1970's determined that these nutrients were likely to be lacking in the diets of low-income women, infants, and children (5). The food packages remained largely unchanged over the next thirty years except for the addition of dry beans, peas, and peanut butter to the children and women's package in 1980 and carrots and canned tuna to the breastfeeding mother's package in 1992 (12). It was not until 2009 that WIC implemented a significant policy change that substantially revised the food packages.

Eligibility

To be eligible for WIC, an applicant's household income must be below 185% of the national poverty guideline (e.g. under \$41,348 for a household of 4 as per 2011-2012 guidelines) (48) and the applicant must be deemed to be at nutritional risk (as per a health care professional). Nutritional risk include conditions that may be detected by biochemical/anthropometric measurements such as anemia, underweight, overweight; diseases that are caused by nutrient deficiency (e.g. metabolic disorders or poisoning); inadequate eating patterns; alcoholism or drug abuse; and conditions that are often associated with inadequate nutrient intake, such as homelessness. Except for pregnant women who receive benefits for the duration of the pregnancy, WIC participants receive

benefits for a period of six months, after which they must be recertified to continue receiving benefits.

Food Package Benefits

Supplemental food packages are perhaps the most well-known benefits provided by WIC. During the pilot program, WIC provided only two food packages, one for infants and one for children and all women. Later, a third food package was added for children with special dietary needs. During the 1980's, the three packages were modified and expanded to include seven packages broken down by age, pregnancy, and postpartum status. Infants 0 to 3 months received infant formula; infants 4 to 11 months received infant formula, juice, and infant cereal; children 1 to 5 years received juice, cereal, milk, eggs, and dried beans/peas or peanut butter; and women and children with special needs received formula, juice, and cereal. Pregnant and partially breastfeeding women received juice, cereal, milk, eggs, and dried beans/peas or peanut butter. Fully breastfeeding women received an "enhanced" food package that included juice, cereal, milk, eggs, cheese, dried beans/peas or peanut butter, tuna, and carrots. Non-breastfeeding women received the most limited food package, which contained juice, cereal, milk, and eggs (5). Tables 2 and 3 show the types and amounts of foods included in each food package prior to 2009. Food packages remained largely unchanged during the 80's, 90's, and most of the early 2000's despite the shifts in health concerns in the US and also despite interest from program administrators, medical and scientific professionals, advocacy groups, and congressmen in updating the food packages (12). In 2007, the USDA published an Interim Rule that would substantially revise the food packages. The Interim Rule took effect as of October of 2009.

Table 2 - Foods included in WIC food packages I-III before 2009 (5)			
Foods	I Formula-fed infants 0 - 3.9 m	II Formula-fed infants 4-11.9 m	III Children and women with special dietary needs
Infant Formula	806 fl oz	806 fl oz	806 fl oz
Juice		96 fl oz (24 4-oz servings)	144 fl oz (36 4-oz servings)
Infant Cereal		24 oz (~ 3 18-oz boxes)	n/a
Breakfast Cereal			36 oz (~ 2 18-oz boxes)
Milk			24 qt (6 gallons) (48 2-cup servings or 32 3-cup servings)

Table 3 - Foods included in WIC food packages IV-VII before 2009 (5)				
	IV	V	VI	VII
Foods	Children 1-4.9 y	Pregnant or partially breastfeeding women up to 1 y postpartum	Non breastfeeding postpartum women up to 6 m postpartum	Breastfeeding women enhanced package up to 1 y postpartum
Juice	288 fl oz (72 4-oz servings)	288 fl oz (72 4-oz servings)	192 fl oz (48 4-oz servings)	336 fl oz (84 4-oz servings)
Adult Cereal	36 oz	36 oz	36 oz	36 oz
Milk	28 qt (7 gallons or 56 2- cup servings)	24 qt (6 gallons or 32 3- cup servings)	28 qt (7 gallons or 56 2- cup servings)	28 qt (7 gallons or 56 2- cup servings)
Cheese				1 lb
Eggs	2-2.5 dozen	2-2.5 dozen	2-2.5 dozen	2-2.5 dozen
Dried beans/peas and/or peanut butter	1 lb Or 18 oz	1 lb Or 18 oz		1 lb And 18 oz
Tuna (canned)				26 oz (4-5 cans)
Carrots				2 lb

A Necessary Change in WIC Food Packages

Prior to October 2009, the WIC food packages were not aligned with current infant and toddler feeding recommendations or the 2005 Dietary Guidelines for Americans (the most current recommendations at the time). Furthermore, the food

packages did not address current nutrition related concerns such as pediatric obesity. Food packages failed to align with recommendations by 1) not encouraging the consumption of fresh fruits and vegetables, meats, or grains (none of these were provided by the pediatric packages except grains in the form of cereal); 2) not encouraging a low sugar, low fat diet (too much juice and full fat milk were provided); 3) not encouraging intake of iron-rich foods at 6 months of age (no iron rich food sources were provided except iron fortified cereal, a less bioavailable form of iron); 4) not encouraging appropriate age of introduction of complementary foods (young infant packages contained solid foods and juice); and 5) not promoting exclusive breastfeeding for at least six months (infant formula was provided to all infants regardless of feeding mode). The previous food packages did not align with the 2005 Dietary Guidelines for Americans, which suggested consuming a variety of nutrient dense foods from all food groups while lowering consumption of sugar and fat (49). The 2005 Dietary Guidelines for Americans encouraged consumption of fruits and vegetables, whole grains, and fat free or reduced fat milk and milk products. The food packages prior to 2009 had very little variety and did not provide a range of foods from all food groups. They also facilitated overconsumption of calories in the form of juice, full fat milk, cheese, and eggs.

The USDA Interim Rule that revised the food packages was founded primarily upon a review conducted by the Institute of Medicine (IOM) in 2006 (8). This review suggested appropriate changes that would bring the food packages more in line with current trends, health issues, and dietary recommendations. The IOM review also considered the 2005 Dietary Guidelines for Americans. Overall, the IOM called for 1) a reduction of infant formula in certain packages; 2) the addition of baby food fruits and

vegetables for all infants and baby food meats for breastfed infants; 3) the deletion or reduction of juice; 4) the addition of fresh fruits and vegetables for children over 11.9 months and for all women; 5) limited amounts of milk and restrictions on milk fat; 6) a decrease in eggs; 7) the addition of whole grain options; 8) a generally wider variety of options and increased food diversity. Nearly all recommendations suggested by the IOM report were incorporated into the USDA Interim Rule that enacted the WIC policy change in 2009. Tables 4 and 5 show the specific revisions of infant and children packages. Package III (for women and children with special needs) is not shown but exhibits similar changes.

	Fully breastfed infants food package I-BF	Partially breastfed infants food package I-BF/FF			Fully formula fed infants food package I-FF	
	0-5.9 m	0-1.9 m	1-3.9 m	4-5.9 m	0-3.9 m	4-5.9 m
Formula	none	104 fl oz reconstituted powder	364 fl oz reconstituted liquid concentrate	442 fl oz reconstituted liquid concentrate	806 fl oz reconstituted liquid concentrate	884 fl oz reconstituted liquid concentrate
BF: Breastfed BF/FF: Breastfed/Formula-fed FF: Formula-fed						

Table 5 - New WIC food package allowances for infants 6-11.9 m (implemented in 2009)			
Foods	Fully formula food package II-FF & III- FF 6-11.9 m	Partially breastfed food package II-BF/FF & III-BF/FF 6-11.9 m	Fully breastfed food package II-BF 6-11.9 m
Infant formula	624 fl oz reconstituted liquid concentrate or 640 oz ready-to-feed or 696 fl oz reconstituted powder	312 fl oz reconstituted liquid concentrate or 320 oz ready-to-feed or 384 fl oz reconstituted powder	None
Infant cereal	24 oz	24 oz	24 oz
Baby food fruits and vegetables	128 oz (32 4-oz jars)	128 oz (32 4-oz jars)	256 oz (64 4-oz jars)
Baby food meats			77.5 oz (31 2.5-oz jars)
BF: Breastfed BF/FF: Breastfed/Formula-fed FF: Formula-fed			

	Children	Women		
Foods	Food package IV 1-4.9 y	Pregnant and partially breastfeeding food package V	Postpartum (up to 6 m) food package VI	Fully breastfeeding (up to 1 y postpartum) food package VIII
Juice	128 fl oz 32 4-oz servings	144 fl oz 36 4-oz servings	96 fl oz 24 4-oz servings	144 fl oz 36 4-oz servings
Milk	16 qt 32 2-cup servings	22 qt 29 3-cup servings	16 qt 21 3-cup servings	24 qt 32 3-cup servings
Breakfast cereal	36 oz	36 oz	36 oz	36 oz
Cheese	n/a	n/a	n/a	30 oz
Eggs	1 dozen	1 dozen	1 dozen	2 dozen
Fruits and Vegetables	\$6 in cash value vouchers	\$8 in cash value vouchers	\$8 in cash value vouchers	\$10 in cash value vouchers
Whole wheat bread or other whole grains	2 lb	1 lb	n/a	1 lb
Fish (canned)	n/a	n/a	n/a	36 oz (5-6 cans)
Dried beans/peas and/or peanut butter	1 lb beans/peas Or 18 oz peanut butter	1 lb beans/peas AND 18 oz peanut butter	1 lb beans/peas Or 18 oz peanut butter	1 lb beans/peas AND 18 oz peanut butter
BF: Breastfed BF/FF: Breastfed/Formula-fed FF: Formula-fed				

Justification for Food Package Revisions

In the comprehensive report “WIC Food Packages: Time for a Change”, the IOM provides justification for the changes recommended for WIC food packages. In general, the food package changes were intended to align the diets of all WIC participants with the AAP and 2005 Dietary Guidelines for Americans recommendations. In general, fruits, vegetables, whole grains, baby foods and more fish were included in the food packages while juice, infant formula, cheese, milk, and eggs were removed or reduced to align with recommendations and/or to allow for the addition of the above mentioned foods.

Breastfeeding and Introduction of Complementary Foods

Several changes were made to previous packages in order to encourage breastfeeding and appropriate timing of introduction of complementary foods among WIC participants. As stated previously, packages for breastfed infants 6 to 11.9 months are enhanced in comparison with those for formula fed infants because they provide baby food meats and more baby food fruits and vegetables. In addition to providing important nutrients such as iron and zinc, these enhancements will hopefully encourage mothers to breastfeed their infants. The packages for breastfeeding mothers also provide more food than those for non-breastfeeding mothers. Additionally, the new packages for partially breastfed infants provide less formula in order to promote breastfeeding.

The previous packages provided infant cereal and juice for infants 4 to 5.9 months. In compliance with recommendations of the AAP, the AND, the CDC, and the WHO, the new packages do not provide any complementary foods for infants until 6 months. Additionally, juice has been removed from packages for infants 6-11.9 months, and has been replaced by baby food fruits, vegetables, and meats. The addition of these

foods is also consistent with AND guidelines that recommend introducing a variety of foods to infants older than 6 months.

Infant Formula

For formula fed infants birth to 3.9 months, the new packages contain the same amount of formula as the previous packages, since the calories provided are based on the Estimated Energy Requirements of infants (8). The amount of infant formula in the new packages was increased slightly for 4 to 5.9 month old formula fed infants to account for calories lost through the removal of infant cereal and juice. The new packages for older formula fed infants (6 to 11.9 months) and partially breastfed infants provide less infant formula than the previous packages to balance calories added by the addition of complementary baby foods. Partially breastfed infants, birth to 5.9 months, previously received the same amount of infant formula as fully breastfed infants. The revised food package provides a reduced amount of infant formula in order to help ensure that partially breastfed infants are indeed receiving half of their energy through breast milk.

Baby Food Meats

Breastfed infants 6 to 11.9 months were identified by the IOM as being at risk for iron and zinc deficiency (8). Thus, baby food meats were added to package II-BF (fully breastfed infants 6-11.9 months). Baby food meats must be single foods (e.g. not pre-mixed with any other food). This extra provision to breastfed infants might provide further incentive for mothers to breastfeed their infants.

Fruits and Vegetables

The revised food packages provide for fruits and vegetables. For children over 12 months of age, pre-cut or packaged single fruit or vegetables may be purchased using vouchers (packaged fruits and vegetables may not contain sweeteners, salts, fats, or oils). However, dried fruits or vegetables, white potatoes, and spices and herbs may not be purchased with vouchers. For infants 6 to 11.9 months, single baby food fruits and vegetables may be purchased. The addition of fruits and vegetables (except for infants younger than 6 months) aligns with the 2005 Dietary Guidelines for Americans and AND recommendations that encourage consuming a variety of fruits and vegetables (28, 49). Introducing fruits and vegetables to infants provides many key nutrients in addition to introducing a variety of flavors and textures (8). The IOM rationale also noted that diets rich in fruits and vegetables might reduce the risk of heart disease, hyperglycemia, obesity, and some cancers (8). Additionally, fruits and vegetables are low in saturated and total fat and may displace high energy-dense foods and thus contribute to healthier weights among WIC participants. Finally, fruit and vegetable consumption may also displace juice, which provides less fiber and no additional nutritional benefits compared to fruits and vegetables (25).

Whole Grains

Prior to implementation of the revised packages, cereal was the only grain product provided to WIC participants. There were no stipulations that the cereal had to be made of whole grain. The revised packages for children 12 months and older provide only whole grain cereals, along with one pound of whole grain bread, which can be substituted with other whole grain products (e.g. brown rice, oatmeal, whole wheat or corn tortillas)

(5). This change is consistent with the 2005 Dietary Guidelines for Americans which encourages children and women/adults to consume at least 3 servings of whole grains per day and infants younger than 2 years to consume half of their daily grains as whole grains. Diets rich in whole grains are associated with decreased risk for heart disease and type 2 diabetes. In addition, whole grains are a good source of fiber, a nutrient lacking in many low-income diets (8).

Fruit Juice

Fruit juice was either eliminated or reduced in all revised food packages. Infants under the age of 6 months no longer receive juice while infants 6 to 11.9 months old, children 1 to 5 years old, and all women receive less juice in the revised packages (see Table 6). These changes are consistent with AAP recommendations that juice should not be introduced before 6 months of age, and should be limited to 4 to 6 ounces for older children (31). Also, the reduction of juice in infant (6 to 11.9 months), children, and women's packages is consistent with the 2005 Dietary Guidelines for Americans, which recommend that whole fruit, rather than juice, provide the majority of fruit calories. Finally, the reduction or elimination of juice allowed for other healthful foods, such as whole fruits and vegetables, to be added without increasing daily calorie intake.

Milk

The amount of milk and milk products (e.g. cheese) were reduced in packages for women and children (Table 7) in order to reduce saturated fat, total fat, and cholesterol intake and to discourage overconsumption of calories. The 2005 Dietary Guidelines for Americans states that children over the age of 2 years should consume 2 cups of milk per day and women/adults should consume 3 cups per day (49). Similarly, the AAP

recommends that children between the ages of 1 and 5 years consume less than 24 fluid ounces of milk per day (24, 53). Previous packages provided an overabundance of milk and cheese and there were no restrictions on milk fat. This is contrary to recommendations in the 2005 Dietary Guidelines for Americans that state that children over the age of 2 and women/adults should receive reduced fat or skim milk instead of whole milk. In the revised packages, infants over the age of 1 year receive whole milk, while infants over the age of 2 years and all women receive reduced fat milk. These changes should facilitate reduced intake of milk by children 1 to 5 years, along with reduced intake of saturated fat, total fat, and cholesterol for children over the age of 2 years and women. Finally, milk substitutes such as lactose free milk, smaller amounts of cheese, tofu, and soy beverages are allowed in the revised packages, providing a greater variety of food choices and meeting the dietary needs of participants who do not or cannot consume cow's milk.

Eggs

The new packages for children over 1 year and for women provide only one instead of two dozen eggs per month. Although the primary reason for decreasing the amount of eggs was to control cost and allow room for other nutrients to be added into children and women's packages, concern about cholesterol intake was also cited as a reason (5). Also, since protein intake is no longer a primary nutritional concern in the US, a decrease in eggs in WIC packages is appropriate.

In summary, many changes were made among the WIC food packages, all of which are intended to encourage appropriate dietary intake and feeding practices. The

revised packages are more aligned with current dietary guidelines and infant and toddler feeding recommendations.

Age group (months)	Previous food packages (before 2009)	Current food packages (after 2009)
4 – 5.9	<ul style="list-style-type: none"> ✓ 806 fl. oz. formula ✓ Infant cereal ✓ 96 fl. oz. fruit juice 	<ul style="list-style-type: none"> ✓ 806 fl. oz. formula for fully formula fed infants ✓ 442 fl. oz. formula for partially breastfed infants
6 – 11.9	<ul style="list-style-type: none"> ✓ 806 fl. oz. formula ✓ Infant cereal ✓ 96 fl oz. fruit juice 	<ul style="list-style-type: none"> ✓ 624 fl. oz. formula for fully formula fed infants ✓ 312 fl. oz. formula for partially breastfed infants ✓ Infant cereal ✓ 32 4-oz jars of baby fruit & vegetables for formula fed infants ✓ 64 4-oz jars of baby fruit & vegetables for breastfed infants ✓ 31 2.5-oz jars of baby food meats for breastfed infants
12 – 24	<ul style="list-style-type: none"> ✓ 288 fl. oz. fruit juice ✓ 2 boxes cereal ✓ 7 gallons milk ✓ 2-2.5 dozen eggs ✓ 1 lb. beans or 18 oz. peanut butter 	<ul style="list-style-type: none"> ✓ 128 fl. oz. juice and \$6.00 for whole fruits & vegetables ✓ 2 boxes of iron fortified cereal ✓ 2 lbs whole wheat bread ✓ 4 gallons milk ✓ 1 dozen eggs ✓ 1 lb. beans or 18 oz. peanut butter

CHAPTER II – OBJECTIVE

Assessing Feeding Practices

In 2009, WIC altered food packages in order to improve feeding practices of participants, including infants and toddlers. For example, the packages for new mothers may improve the rates and duration of breastfeeding because women who choose to breastfeed receive substantially more food than women who choose to feed formula to their infants. Additionally, packages for infants younger than 6 months of age no longer include vouchers for juice or cereal, which may result in fewer infants consuming these items before the age of 6 months. Furthermore, the breastfed infant packages no longer contain any formula, and after the age of 6 months, breastfed infants are provided with baby food meats. All infants over the age of 6 months are provided with less juice and more baby food fruits and vegetables, which may increase usual intake of these items. Additionally, packages for toddlers, ages 12 to 24 months, include vouchers for whole fruits and vegetables and less juice.

The purpose of this study was to assess the feeding practices of infants and toddlers (4 to 24 months) participating in the San Marcos, TX WIC program in order to determine if the practices observed after the WIC policy change are different than those observed by our research team in 2009 when the older food packages were in use. We expected that practices observed in 2011 would be more closely aligned with current recommendations.

Hypothesis

We hypothesized, based on the changes in the new WIC packages, when compared with practices observed in 2009, prior to the WIC policy change, that in 2011:

- More infants ages 4 to 5.9 months and 6 to 11.9 months would be breastfed;
- Fewer infants < 6 months of age would consume complementary foods;
- More breastfed infants, ages 6 to 11.9 months, would consume baby food meats;
- Fewer infants, ages 6 to 11.9, months would consume juice;
- More infants, ages 6 to 11.9 months, would consume baby food fruits and vegetables;
- More toddlers, ages 12 to 24 months, would consume whole fruits, vegetables, and whole grains;
- Fewer toddlers, ages 12 to 24 months, would consume juice;
- Fewer toddlers, ages 12 to 24 months, would consume > 24 fl. oz. of milk; and
- Fewer toddlers, ages 12-24 months, would consume eggs.

See Table 8 for hypothesis rationale, action, and method of measurement.

Table 8 - Rationale, action, and methods for measuring hypothesis			
Hypothesis	Rationale	Action	Methods
More infants ages 4 to 11.9 months would be breastfed	<ul style="list-style-type: none"> Enhanced food packages for breastfeeding mothers Breastfed infants receive enhanced package and no formula 	<ul style="list-style-type: none"> Compared incidence and duration of breastfeeding among infants ages 4-5.9 months and 6-11.9 months in 2009 to 2011 	<ul style="list-style-type: none"> Using data from the Feeding Practice Questionnaire and the 24-hour recall
Fewer infants < 6 months of age would consume complementary foods	<ul style="list-style-type: none"> Omission of fruit juice and infant cereal for all infants < 6 months 	<ul style="list-style-type: none"> Compared number of infants introduced to complementary foods before 6 months in 2009 to 2011 	<ul style="list-style-type: none"> Using data from the Feeding Practice Questionnaire and the 24-hour recall
More breastfed infants, ages 6 to 11.9 months, would consume baby food meats	<ul style="list-style-type: none"> Baby food meats are provided to breastfed infants 6-11.9 months 	<ul style="list-style-type: none"> Compared exposure and frequency of exposure to baby food meats among infants 6-11.9 months in 2009 to 2011 	<ul style="list-style-type: none"> Using data from the 24-hour recall
Fewer infants, ages < 6 months would consume juice	<ul style="list-style-type: none"> Omission of fruit juice for all infants 4-5.9 months 	<ul style="list-style-type: none"> Compared exposure, frequency of exposure, and amount of juice consumed by infants 4 to 5.9 months in 2009 to 2011 	<ul style="list-style-type: none"> Using data from the 24-hour recall

More infants, ages 6 to 11.9 months, would consume baby food fruits and vegetables	<ul style="list-style-type: none"> • Baby food fruits and vegetables are provided to infants 6-11.9 months 	<ul style="list-style-type: none"> • Compared exposure and frequency of exposure to baby food fruits and vegetables among infants 6-11.9 months in 2009 to 2011 	<ul style="list-style-type: none"> • Using data from the 24-hour recall
More toddlers, ages 12 to 24 months, would consume whole fruits, vegetables, and whole grains	<ul style="list-style-type: none"> • Whole fruits and vegetables and a variety of whole grains are provided to toddlers 12-24 months 	<ul style="list-style-type: none"> • Compared exposure and frequency of exposure to whole fruits, vegetables, and grains among toddlers 12-24 months in 2009 to 2011 	<ul style="list-style-type: none"> • Using data from the 24-hour recall
Fewer toddlers, ages 12 to 24 months, would consume juice	<ul style="list-style-type: none"> • Reduced amounts (compared to 2009) of fruit juice are provided to toddlers 12-24 months 	<ul style="list-style-type: none"> • Compared exposure, frequency of exposure, and amount of juice consumed by toddlers 12-24 months 	<ul style="list-style-type: none"> • Using data from the 24-hour recall
Fewer toddlers, ages 12 to 24 months, would consume > 24 fl. oz. of milk	<ul style="list-style-type: none"> • Reduced amounts (compared to 2009) of milk provided to toddlers 12-24 months 	<ul style="list-style-type: none"> • Compared exposure, frequency of exposure and amount of milk consumed by toddlers 12-24 months 	<ul style="list-style-type: none"> • Using data from the 24-hour recall
Fewer toddlers, ages 12 to 24 months, would consume eggs	<ul style="list-style-type: none"> • Reduced amount of eggs (compared to 2009) provided to toddlers 12-24 months 	<ul style="list-style-type: none"> • Compared exposure and amount of eggs consumed by toddlers 12-24 months 	<ul style="list-style-type: none"> • Using data from the 24-hour recall

CHAPTER III – METHODS

Procedure

Training of Research Assistants

Senior nutrition students were recruited and trained to serve as research assistants. Training included completion of the Collaborative Institutional Training Initiative (CITI) course, practice using Nutrition Data Systems for Research (NDSR 2008) software, and practice following all aspects of the study protocol including data collection and quality assurance. Research assistants were supervised directly by the principal investigator and the lead graduate student researcher.

Recruitment

Subjects

Caregivers of infants (4 to 11.9 months) and toddlers (12 to 24 months) were recruited during the biweekly nutrition classes and in the waiting room of the San Marcos WIC clinic from July 1, 2011 through November 24, 2011. Research assistants introduced the study using a script, which briefly explained the objectives of the study, eligibility, requirements for participation, and provided information about a \$10 incentive offered for completion of the study. Because San Marcos WIC serves many Spanish-speaking participants and because nutrition classes are conducted in Spanish and English, at least one Spanish speaking research assistant was present during each session. After introducing the study, research assistants spoke personally with those who expressed

interest. Eligibility was determined using a screening form (Appendix A). A consent form (Appendix A) was explained by the research assistant and signed by eligible and willing subjects. Potential participants were given a copy of the consent form along with a Food Amounts Booklet (FAB). A brief explanation of the FAB was given in order to facilitate accurate use during interviews. Finally, potential participants were asked to sign a funds release form (Appendix A) required by Texas State University - San Marcos. Our goal was to recruit approximately 140 participants, which allowed for a final subject count of approximately 100 individuals when attrition was taken into account. Data were collected from caregivers regarding only one child in order to avoid over-representation of one family's feeding practices. All procedures were compliant with the Texas State and the Texas Department of State Health Services Institutional Review Board guidelines (IRB).

Instruments

Nutrition Data Systems for Research

24-hour recalls were collected during a phone call interview using Nutrition Data System for Research (NDSR) software developed by the Nutrition Coordinating Center (NCC) at the University of Minnesota. NDSR uses a multiple pass method to collect a detailed record of types and amounts of foods and beverages consumed by the subject during the 24-hours prior to a recall. The program provides prompts and reminders throughout the recall and guides users during each step. This helps to minimize user error and ensure that data is recorded accurately.

Feeding Practices Questionnaire and Demographic and Health History Forms

The Feeding Practices Questionnaire (FPQ) (Appendix A) was used during phone interviews to collect information about breastfeeding, infant and toddler feeding practices

(e.g. age of introduction to specific foods), and family/home environment (e.g. number of meals consumed at home, television viewing). Additionally, a few open-ended questions were included asking why a caregiver did or did not initiate certain feeding practices (e.g. why he or she did/did not introduce cow's milk to the child before 1 year of age). The FPQ was originally adapted from the FITS survey (51), the Infant Feeding Practice Study II (IFFPS II) (52), and the Texas Department of State Health Services' Infant Feeding Practice's Study survey (53) for use in the 2009 San Marcos WIC Study.

The Demographic and Health History (Appendix A) forms were also developed for the 2009 San Marcos WIC study, and include information and references from the Census Bureau and the CDC questionnaires used for the Infant Feeding Practice Study II (IFFPS II) (52). Since the questionnaire and forms were used to assess observational data, assessment of construct validity was not required.

Interview Script

An interviewing script (Appendix A) was used by all research assistants to ensure consistency during interviews and data collection. The script was developed from a sample script provided by Nutrition Coordinating Center and also from the FITS interviewing script and was designed to correspond directly to NDSR, the FPQ, and the Demographic and Health History forms.

The Food Amounts Booklet

The Food Amounts Booklet (FAB) was used to provide a visual aid for both interviewers and subjects during telephone interviews. The FAB contains images of common serving objects and amounts of foods (e.g. bowls, spoons, plates, cups, chicken pieces, fish fillets, etc.). Research assistants asked subjects to refer to the booklet when

estimating portion sizes of foods and beverages during the 24-hour recalls. The FAB was developed by the Nutrition Coordinating Center (NCC). Additional images such as sippy cups were included from the FITS serving size booklet (51).

Both Spanish and English versions of the FPQ, Health History and Demographic forms, interview script, and FAB were used during this study according to the language spoken by the subject.

Data Collection

Research assistants attempted to call participants 3 to 10 days after they were recruited. If a subject was not reached, research assistants left a message and/or called back at a later time or on a different day. Subjects were removed from the study if they failed to complete an interview after 20 call attempts. If a subject was reached and agreed to talk, the research assistant conducted a 30 to 45 minute scripted interview. During the interview, the researcher collected 24-hour recall data using NDSR software regarding the child's dietary intake the preceding day, and then administered the Feeding Practices, Demographic and Health History questionnaires. At the end of the interview, the research assistant confirmed the subject's address. Within 2 business days, a \$10 grocery store gift card along with a thank you letter was sent to the participant.

Data Analysis

All statistical analysis (univariate and bivariate) was conducted using Statistical Packages for the Social Sciences (version 20.0). Descriptive statistics were conducted for each variable and Mann-Whitney statistical tests were used to compare feeding practices between the two study years.

CHAPTER IV – MANUSCRIPT

Introduction

Early feeding practices are of critical importance not only for their immediate impact on nutrient intake, but also because they may shape dietary patterns and have a sustained effect on body weight. Early exposures to food may have a lasting effect on taste preferences (1, 2). For example, Stein et. al demonstrated that early exposures to sodium-containing starchy table foods was associated with affinity for plain salt among preschoolers (3). Some research has suggested that consumption of sweet foods stimulates physiological reward systems in a manner similar to that demonstrated for addictive drugs, and may thereby drive cravings for sweets (4-6). On a more positive note, exposure to fruit and vegetables early in life has shown to be a strong predictor of fruit and vegetable consumption later in childhood (1,7,8). Practices such as formula feeding and early introduction of complementary foods to formula-fed infants have been implicated to be risk factors for obesity (9-11). Since low-income populations experience higher rates of obesity (12), it is paramount that appropriate early feeding practices, such as breastfeeding and offering healthful complementary foods after 6 months become more commonplace. As approximately half of US infants are born to women enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), this program may be an important point of influence for low-income populations. Since its inception in 1975, WIC has provided direct assistance to low-income women, infants,

and young children in the US at nutritional risk by issuing vouchers in federally defined food packages that can be used to purchase specific foods. In the 1970s, the food packages for infants and toddlers were designed to provide nutrients that were potentially lacking in the diets of low-income populations, such as vitamin A, vitamin C, calcium, iron, and protein. Consequently, the packages included such items as juice, infant cereals, sweetened cereals, milk, eggs, and infant formula (13). Although WIC food packages remained largely unchanged since the 1970s, the nutritional issues of very young children have changed dramatically. Today, US children are consuming more processed foods and sodas, fewer fruits and vegetables, (14-16) and experiencing unprecedented rates of overweight and obesity, with nearly 10% of US children under the age of 2 having excess weight, and 31.8% of children ages 2-19 classified as overweight or obese (12).

In October 2009, the US government changed the WIC food packages to improve diet composition and health outlook of participants while continuing to address nutrient needs. The new packages are aligned with current guidelines that recommend breastfeeding until at least 6 months, introducing fruits, vegetables, and iron rich foods to infants at around 6 months (17), offering produce and whole grains to toddlers, and limiting juice (13, 18, 19). For example, while the original food packages for 4 to 6 month olds included infant cereal (24 oz), juice (96 fl oz) and 806 fl oz infant formula to both breastfed and formula-fed infants, the new packages omit cereal and juice for all infants under 6 months, provide different amounts of formula to fully formula-fed (960 fl oz) and partially formula-fed (522 fl oz) infants, and omit formula for fully breastfed infants. In addition, the package for breastfeeding mothers includes more food than the package for those who are formula feeding. The previous packages for 6 to 12 month olds

provided infant cereal (36 oz), juice (96 fl oz) and infant formula (806 fl oz), while the new packages provide less infant cereal (24 fl oz), omit juice, and allocate infant formula and baby food based on feeding practices. Specifically, the packages provide 696 fl oz of formula to fully formula-fed infants and 384 fl oz to partially formula fed-infants, along with 32 4-oz jars of baby food fruit or vegetables. The packages for breastfed infants omit infant formula and include more baby food fruits and vegetables (64 4-oz jars) along with 31 2.5-oz jars of plain baby food meats to support iron status. For 1-2 year old children, the new food packages provide less milk (4 gallons vs. 6 gallons), the same amount of cereal (2 boxes), less juice (128 vs 288 fl oz), fewer eggs (1 vs 2 dozen) and the same amount of dry beans or peanut butter (1 lb or 18 oz, respectively). Finally, a \$6 voucher for fresh or frozen fruits and vegetables is included in the new food packages, along with 2 lb of whole grain products.

While larger studies will be able to assess the broader impact of the WIC package changes, it is important to determine whether the new packages are associated with improved feeding practices in local populations that may differ substantially from national averages. The population in San Marcos, Texas, is especially at risk, with over half of middle school children being overweight or obese (20), and over 53% of the children receiving free or reduced meals (21). The goal of this study was to compare feeding practices of infants and toddlers participating in the San Marcos Texas WIC program before and after the policy change to determine if practices observed after the policy change were more aligned with current recommendations, as was the intent of the policy change. This study was designed to closely follow the procedures of the nationally representative Feeding Infants and Toddlers Study (14, 22) so that the results could be

viewed within the context of nationally observed practices. We expected that in 2011, more infants would be breastfed, fewer would consume cereals and juice before the age of 6 months, and that juice intake would be lower among 12 to 24 month olds. In addition, we predicted that in 2011, more infants and toddlers would consume more fruits and vegetables, more whole grains, more baby food meats, less juice, and less infant cereal.

Methods

Participants

Caregivers with a young child between the ages of 4 and 24 months enrolled in the San Marcos WIC program were recruited in English and Spanish from either the biweekly nutrition classes or from the waiting room during the summer/early fall of 2009 and 2011. Caregivers who expressed interest in participating were informed about the study and the \$10 grocery card incentive for participating. Those who agreed to participate were asked to sign a consent form and provided with a study packet. All procedures and materials were approved by the Institutional Review Boards of the university and of the Texas Department of State Health Services.

Data Collection and Instruments

Caregivers were called within 3-10 days of recruitment. Those who answered and agreed to talk were interviewed immediately. Caregivers who did not answer or were unable to talk were called up to 19 additional times before being removed from the study. During the 30 to 45-minute phone interview, a 24-hour recall was administered and feeding practices and demographic data were collected using a scripted interview adapted from the University of Minnesota Nutrition Coordinating Center (NCC) and FITS (23).

Interviews were conducted in either English or Spanish as per the language preference of the caregiver. Trained researchers conducted the 24-hour recall regarding the child's dietary intake the preceding day using Nutrition Data System for Research (NDSR) (24). A Food Amounts Booklet, adapted from both the FITS methodology and NDSR resources, was provided in the study packet at recruitment and used during the call to provide a common visual aid for the interviewers and caregivers (22). Questions regarding feeding practices were adapted from the FITS survey (22, 23), the Infant Feeding Practice Study II (IFFPS II) (25), and from the Texas Department of State Health Services' Infant Feeding Practice's Study survey (26). Questions asked about breastfeeding and about when and why certain foods such as cow milk, infant cereal, and juice were introduced. Demographic and health history information was collected using questions adapted from the Centers for Disease Control and Prevention (CDC) surveys used in the Infant Feeding Practice Study II and information from the US Census Bureau (25, 27).

Data Analysis

All statistical analysis was conducted using Statistical Packages for the Social Sciences (SPSS version 20.0). Percentages and means were calculated to report demographic information such as age, sex, race, and language. Mann-Whitney U tests for non-parametric data were used to compare feeding practices, demographics, and food consumption information. In order to evaluate food consumption using the results of the 24-hour recalls, it is important to note that all foods and beverages consumed by the children were categorized and counted as "exposures", as per the FITS protocol, and to

understand that individual foods consumed as part of a mixed dish (i.e. infant cereal mixed with applesauce) were not counted as individual exposures.

Results and Discussion

Subject Characteristics

Of the 162 caregivers recruited in 2009 and 171 in 2011, 97 and 121 completed the interviews, respectively. Characteristics of the infant and toddler participants are shown in Table 9. There were no significant differences in age, sex, language spoken, and race between 2009 and 2011. The majority of participants were Hispanic, followed by non-Hispanic whites, and African Americans. More than half of all participants reported English as the primary language spoken and a total of 161 interviews were conducted in English.

Table 9 - Comparison of characteristics of infants and toddlers		
Characteristic	2009	2011
	(n=97)	(n=121)
Age group (m)		
4-5.9	17%	21%
6-11.9	34%	44%
12-24	48%	33%
Child's sex		
Female	43%	51%
Male	57%	49%
Language spoken at home		
English	58.8%	51.2%
Spanish	27.8%	30.6%
Both	11.3%	17.4%
Child's race		
African American	3%	3%
Non-Hispanic White	16%	15%
Hispanic	67%	65%
Pacific Islander	1%	1%
Other	9%	15%

Breastfeeding and Formula Use

Breastfeeding practices and formula use in 2009 and 2011 were assessed by reviewing caregiver responses to questions about feeding practices and by analyzing the number of exposures to breast milk and formula reported during the 24-hour recalls

(Table 10). As per FITS 2002, an exposure refers to any time a child consumes a particular food or beverage (28). The rate of breastfeeding initiation was similar in both study years, with 80% and 89% of infants ever breastfed in 2009 and 2011, respectively. These rates compare favorably to national data as observed by FITS 2008 (14) and as revealed in the 2012 CDC Report Card (29), which reported initiation of breastfeeding in 79.5% and 76.9% of infants, respectively. There was little difference in breastfeeding duration for the San Marcos WIC children sampled during the two study years, with 30.9% of infants in 2009 and 33.9% in 2011 being breastfed until at least 3 months, and 21.6% of infants in 2009 and 19.8% of infants in 2011 being breastfed until at least 6 months. Only 7% of children in the 2009 sample and 6% in the 2011 sample were still breastfed at 12 months. The duration of breastfeeding among San Marcos WIC infants was dramatically lower than the national rates reported by the CDC, with 47.2% and 25.5% breastfed until 6 months and 12 months, respectively, and by 2008 FITS, with 49.4% and 24.2% of infants reportedly breastfed until 6 months and 12 months, respectively (14, 29).

In San Marcos, there were some positive trends in breastfeeding practices in 2011 compared to 2009, although they were not significant. For example, in 2011, 53% of infants, ages 4 to 12 months, had at least one exposure to breast milk on the day studied, compared to only 41% of infants in 2009. Additionally, in 2011, only 50% of infants received formula on the day studied, compared to 58% in 2009. The only significant difference observed between the two study years was the average age of introduction to formula, which was earlier in 2009 (7.1 weeks) than in 2011 (9.3 weeks, $P < 0.05$).

Because the new WIC packages provided different amounts of formula to infants based on breastfeeding status, we compared the amount of formula consumed on the day studied among fully breastfed, partially formula-fed, and fully-formula fed infants in the 2011 sample. For infants 4 to 6 months, there were no significant differences in formula intake between infants receiving the fully formula-fed and partially formula-fed packages or between infants receiving the partially formula-fed and fully breastfed packages. However, predictably, there was a significant difference in formula intake between infants receiving the fully formula fed and fully breastfed packages ($P < 0.05$). Furthermore, infants 6 to 12 months receiving the fully formula-fed package consumed significantly more formula on the day studied than their counterparts receiving the partially formula fed ($P < 0.05$) or fully breastfed packages ($P < 0.05$), and infants receiving the partially formula-fed packages consumed significantly more formula on the day studied than fully breastfed infants ($P < 0.05$). While these results cannot show intent and should be interpreted with caution, it is possible that omitting formula from the fully breastfed infant's package is an example of the policy change working as intended by supporting the mother's decision to breastfeed. According to the most recent AAP's Breastfeeding and the Use of Human Milk article, the preponderance of literature supports breastfeeding, and suggests that any breastfeeding reduces the risk of overweight, obesity, and type 2 diabetes in childhood and later in life, and that longer durations of breastfeeding may further reduce risk of overweight, type 1 diabetes, celiac disease, upper respiratory tract infections, asthma, leukemia and Sudden Infant Death Syndrome (17). While the results of this study indicate that the amount of formula provided may affect how much formula is fed to infants, there were no differences in

breastfeeding initiation and duration evident between the two study years, suggesting that caregivers participating in WIC may need further support in their efforts to breastfeed.

Table 10 - Comparison of feeding practices		
Feeding Practice	2009	2011
	N=97	N=121
Ever breastfed	80%	89%
Breastfed in hospital	72%	83.5%
Breastfeeding duration		
≥ 3 m	30.9%	33.9%
≥ 6 m	21.6%	19.8%
≥ 12 m	7%	5.8%
Age of first formula in weeks*	7.11±10.51	9.25±12.24
Age of daily formula in weeks	9.42±12.15	9.92±10.89
Age category of daily cereal		
Before 4m	25.8%	21.5%
4-6m	42.3%	38%
After 6m	18.6%	19.8%
Never added cereal to infant bottles*	38.1%	19.8%
No food before 6 months	18.5%	10%
Age category of first juice		
Bf 4m	3.8%	10.7%
@4m	11.5%	9.5%
5m	10.3%	10.7%
6m+	69.2%	69%
Never had it	19.6%	30.6%
Infants 4 to 6m (24 hour recall data)	N= 17	N=26
Received breast milk	41%	53%
Received formula	58%	50%
Average formula (fl. oz.)	27.52±11.6	24.42±9.09
Infants 6 to 12m (24 hour recall data)	N=33	N=54
Received breast milk	21%	27%
Received formula	90%	75%
Average formula (fl. oz.)	24.65±11.6	21.44±10.7
* Mean 2009 and 2011 are significantly different at P<0.05		

Table 11 - Comparison of 24-hour recall results		
	2009	2011
4-5.9 mo	n=17	n=26
Any infant cereal	47%	27.9%
Any juice (fl. oz.)	17%	11%
≤ 6	66%	66%
> 6	33%	33%
6-11.9 mo	n=33	n=54
Any infant cereal	54.4%	46.3%
Any baby food meat	0	5.5%
Any milk	6%	5.5%
Any baby food fruit	42.4%	48%
Any baby food vegetables	51.5%	48%
Any juice (fl. oz.)	48.5%	53.7%
≤ 6	81.3%	69%
> 6	18.8%	31%
12-24 mo	n=47	n=41
Any whole grain	21.3%	24.4%
Any fresh fruit	57.4%	53.7%
Any fresh vegetable*	46.8%	22%
Any juice (fl. oz.)	76.6%	80.5%
≤ 6	41.6%	42.4%
> 6	58.3%	57.6%
Any milk (fl. oz.)	85%	75.6%
≤ 24	87.5%	93.5%
> 25	12.5%	6.5%
*Mean 2009 and 2011 are significantly different at P<0.05		

Grains

The introduction of cereal to the diets of young infants is commonplace in the US (14, 30) and caregivers who introduce solid foods earlier than recommended generally offer infant cereal first. Although the removal of infant cereal from the WIC food packages for infants 4 to 6 months was intended to discourage introduction of infant cereal and *any* complementary foods before 6 months, there was no significant difference in either of these practices between 2009 and 2011 (Table 10). However, on a positive note, significantly fewer caregivers in 2011 reported adding infant cereal to their child's bottle (19.8% in 2011 vs. 38.1% in 2009; $P < 0.05$), a change that could be related to the lack of infant cereal in the new package for infants in this age group. While the amount of infant cereal in the new WIC packages for infants 6 to 12 months was less than that provided in the older package, there was no significant change in infant cereal exposures between the two study years, with approximately half of infants 6 to 12 months receiving infant cereal on the day studied (Table 11).

While infant cereal is offered as a potentially good source of iron and zinc, in reality, infant cereal may not be an ideal first food. For example, recent literature suggests that intake of rice cereal may expose infants to concerning levels of arsenic (31-33). Furthermore, while infant cereals are often fortified with elemental iron, which has poor bioavailability, they are infrequently fortified with zinc. Although iron and zinc fortified infant cereals improve nutrient status (34), baby food meats, compared to infant cereals, provide comparable amounts of zinc and heme iron. Additionally, zinc and iron from baby food meat has shown to have higher absorption rates compared with infant cereal (35-37). Unfortunately, baby food meat intake in the US is low despite its potential

to improve iron and zinc status in young infants (14). More education may help shift the current paradigm of infant feeding away from infant cereal and more toward baby food meats.

Baby Food Meat

None of the infants 6 to 11 months in 2009 and only 3 in 2011 received any baby food meat on the day studied (Table 11). We had expected to find that exposures to baby food meat would be more common in 2011 since the new food packages for infants in this age group provide 31 2.5-oz jars of plain baby food meats per month. This low intake was disconcerting because meat is an important dietary source of heme iron for breastfed infant and was added to augment iron stores that generally become depleted at around 6 months of age. Of further concern is the fact that the amount of iron-fortified infant cereal was decreased in the 2011 packages for infants 6 to 12 months at least in part to make way for the meats. These results suggest that infants in the 2011 cohort may experience greater challenges to their iron stores. Early iron deficiency can be detrimental to cognitive development and motor, social, and emotional skills (38-41) and may not be attenuated by later iron therapy (42, 43). Results of this study suggest that additional education should be given to caregivers of breastfed infants regarding the importance of appropriate sources of iron for infants.

Fruits and Vegetables

There were no significant differences in intake of fruits and vegetables among infants 6 to 12 months between the two study years, with approximately half receiving no baby food fruit and half receiving no baby food vegetables on the day studied (Table 11). These results were surprising given the generous allotment of 32 jars of baby food fruits

and vegetables for formula-fed infants and 62 jars for breast-fed infants. While it is possible that there may be community-specific barriers to using the vouchers, such as limited availability, several studies have shown that food availability for package related items has significantly increased among many low-income area grocery stores and convenient stores in several states (44-47). Furthermore, there are two large, well-stocked grocery stores in San Marcos. Intake of fresh fruits and vegetables among toddlers 12 to 24 months was lower in 2011, with significantly fewer receiving fresh vegetables on the day studied (46.8% in 2009 vs 22% in 2011; $P < 0.05$). These findings may reflect the fact that the \$6 allowance for fresh produce is not sufficient to actually affect produce intake.

Low produce among infants and toddlers intake is of concern because fruits and vegetables are important for promoting healthy weight among children and adults alike. Also, introducing a variety of fruits and vegetables to the diets of infants and toddlers is paramount since early food exposure impacts food preferences (48-53) and, more specifically, that early exposure to fruits and vegetables may drive consumption and acceptance of those foods later in life (1, 7, 8, 51). Since the change in packages did not translate to increased produce intake in this population, further research is needed to determine barriers of produce consumption and effective strategies to overcome those barriers.

Juice

Given the removal of juice from food packages for infants younger than 1 year and the reduction of juice for infants older than 1 year, we expected to see fewer infants receiving juice before 1 year of age and fewer toddlers receiving excessive amounts of

juice. However, juice consumption remained similar between both study years. Among 4 to 6 month olds, 17% and 11% received juice on the day studied in 2009 and 2011 respectively. Among, infants 6 to 12 months, approximately half consumed any juice in both study years (Table 11). Lastly, the majority of toddlers 12 to 24 months (77% in 2009 and 80.5% in 2011) received juice on the day studied and nearly half (44.7% in 2009 and 46.3% in 2011) consumed more than 6 fl. oz. These practices are not aligned with recommendations of the AAP, which state that: (1) fruit juice is not beneficial for infants less than 6 months of age (19); (2) children 1 to 6 years old should consume no more than 4 to 6 fl. oz. of juice per day; and (3) fruit juice is inferior to whole fruit for children older than 6 months because it lacks fiber and is a poor source of specific nutrients such as iron, calcium, and zinc (19). Of particular concern, early juice consumption may displace the crucial sources of specific nutrients (i.e. breast milk, infant formula, cow's milk, or water) and may increase a child's risk of becoming malnourished. Excessive juice intake is strongly associated with dental caries (54) and may contribute to overweight among young children (55).

Participants of WIC may be unaware of the negative ramifications associated with juice intake. In a study conducted prior to the package change, McElligott et al (56) reported that more caregivers participating in WIC believed that fruit juice was equally or even more beneficial than milk or water, compared to caregivers who did not participate in WIC. When the 2011 San Marcos WIC caregivers were asked why they offered juice before 6 months, they reported a variety of reasons, including doctor recommendations, belief that juice would prevent constipation, and their desire to offer another flavor of beverage besides formula or milk. Because low-income populations are more at risk for

malnutrition (57) and obesity (12), it is imperative that caregivers participating in WIC become aware of the appropriate use of juice for their infants and toddlers.

Strengths and Limitations

The primary limitation of this study was the relatively small sample size. A larger sample would have increased statistical power. Additionally, while using 24-hour recalls to determine daily food consumption limits information gathered to the day studied, 24-hour recalls collected using NDSR are among the most validated and frequently used measures of determining dietary intake. Strengths include the use of sound methodology that mirrors that of the FITS studies, allowing for comparison of results to a nationally representative population.

Conclusion

Despite the limited sample size for this study, we expected to observe changes that clearly reflected the WIC package changes. Indeed, there were some positive trends between the two study years, including fewer infants receiving cereal, more infants receiving breast milk, and more infants being ever breastfed, as well as positive changes that were significant, including later introduction of formula and fewer caregivers adding cereal to infant bottles. These changes may reflect that package changes excluding or reducing infant cereal and formula influenced feeding practices as intended.

However, there were also findings that were in the reverse direction of the WIC package changes, including the trend towards more infants receiving complementary foods before 6 months, and more infants receiving juice before 4 months. A surprising significant outcome was the fact that fewer toddlers consumed fresh vegetables. Nonetheless, it is clear that, overall, very little has changed with regards to feeding

practices among young WIC participants in San Marcos, TX since the 2009 WIC food package modifications. Although WIC plays a crucial role in the health of our nation, environmental, familial, cultural, and religious factors along with socioeconomic status are strong determinants of health and dietary habits. Indeed, there is more to the equation than simply offering an individual the opportunity to buy healthful foods. Cultural norms, beliefs about food, and health literacy may need to be overcome before individuals begin to incorporate positive lifestyle changes. Further research is needed to determine the barriers that exist among WIC participants with regards to buying and consuming the foods offered by the WIC food packages. Additionally, further education is needed to inform WIC caregivers of effective ways to incorporate healthful foods in the diets of young infants and toddlers.

Manuscript References

1. Beauchamp GK, Mennella JA. Early flavor learning and its impact on later feeding behavior. *J Ped Gastroenter Nutr.* 2009;48:S25-S307.
2. Forestell CA, Mennella JA. Early determinants of fruit and vegetable acceptance. *Pediatrics.* 2007;120:1247-1254.
3. Stein LJ, Cowart BJ, Beauchamp GK. The development of salty taste acceptance is related to dietary experience in human infants: a prospective study. *Am J Clin Nutr.* 2012;94:123-129.
4. Volkow ND, Wang GJ, Fowler JS, Telang F. Overlapping neuronal circuits in addiction and obesity: evidence of systems pathology. *Phil Trans R Soc B.* 2008;363:3191-3200.
5. Blumenthal DM, Gold MS. Neurobiology of food addiction. *Curr Opin Clin Nutr Metab Care.* 2010;13:259-365.
6. Avena NM, Rada P, Hoebel BG. Evidence for sugar addiction: behavioral and neurochemical effects of intermittent, excessive sugar intake. *Neur Biobehav Rev.* 2008;32:20-39.
7. Cooke LJ, Wardle J, Gibson, Sapochnik M, Sheiham A, Lawson M. Demographic, familial and trait predictors of fruit and vegetable consumption by pre-school children. *Pub Health Nutr.* 2004;7(2):295-302.
8. Coulthard H, Harris G, Emmett P. Long-term consequences of early fruit and vegetable feeding practices in the United Kingdom. *Pub Health Nutr.* 2010;12(12):2044-2051.

9. Huh SY, Rifas-Shiman SL, Taveras EM, Oken E, Gillman MW. Timing of solid food introduction and risk of obesity in preschool-aged children. *Pediatrics*. 2011;127:e544-e551.
10. Ong KK, Emmett PM, Noble S, Ness A, Dunger DB. Dietary energy intake at the age of 4 months predicts postnatal weight gain and childhood body mass index. *Pediatrics*. 2006;117:e503-508.
11. Grote V, Schiess SA, Closa-Monasterolo R, Escribano J, Giovannini M, Scaglioni S, Stolarczyk A, Gruszfeld D, Hoyos J, Poncelet P, Xhonneux A, Langhendries JP, Koletzko B. The introduction of solid food and growth in the first 2 y of life in formula-fed children: analysis of data from a European cohort study. *Am J Clin Nutr*. 2011;94(suppl):1785S-1793S.
12. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007-2008. *JAMA*. 2010;303(3):242-249.
13. The Federal Register. 7 CFR Part 246: Special Supplemental Nutrition Program for Women, Infants and Children (WIC): Revisions in the WIC Food Packages; Interim Rule. Available at <http://frwebgate.access.gpo.gov/cgi-bin/multidb.cgi>. Accessed on September 15, 2011.
14. Siega-Riz AM, Deming DM, Reidy KC, Fox MK, Condon E, Briefel RR. Food consumption patterns of infants and toddlers: where are we now? *J Am Diet Assoc*. 2010;110(Suppl 12):S38-51.
15. Briefel RR, Wilson A, Gleason PM. Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants. *J Am Diet Assoc*. 2009;109:S79-S90.

16. Wang YC, Bleich SN, Gortmaker SL. Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juice among US children and adolescents, 1998-2004. *Pediatrics*. 2008;121:e1604-1614.
17. American Academy of Pediatrics. Breastfeeding and the use of human milk. *Pediatrics*. 2012;129(3):e827-841.
18. Butte N, Cobb K, Dwyer J, Graney L, Heird W, Rickard K. The start healthy feeding guidelines for infants and toddlers. *J Am Diet Assoc*. 2004;104(3):442-454.
19. American Academy of Pediatrics. The use and misuses of fruit juice in pediatrics. *Pediatrics*. 2001;107:1210-1213.
20. Hays Free Press. Hays CISD hosts obesity summit: district services in the area offer ideas for battling the bulge. Available at <http://haysfreepress.com/2012/07/25/hays-cisd-hosts-obesity-summit-district-services-in-the-area-offer-ideas-for-battling-the-bulge/>. Accessed on November 7, 2012.
21. Data Center. Percentage of students eligible for free/reduced meals (percent) – 2010. Available at:
<http://datacenter.kidscount.org/data/bystate/Rankings.aspx?state=TX&ind=3144>.
Accessed on November 7, 2012.
22. Ziegler P, Briefel R, Clusen N, Devaney B. Feeding infants and toddlers study: development of the FITS survey in comparison to other dietary survey methods. *J Am Diet Assoc*. 2006;106(Suppl 1):S12-27.
23. Devaney B, Kalb L, Briefel R, Zavitsky-Novak T, Clusen N, Ziegler P. Feeding infants and toddlers study: overview of the study design. *J Am Diet Assoc*. 2004;104:S8-S13.

24. Schakel SF, Sievert YA, Buzzard IM. Sources of data for developing and maintaining a nutrient database. *J Am Diet Assoc.* 1988;88:1268-1271.
25. Fein SB, Labiner-Wolfe J, Shealy KR, Li R, Chen J, Grummer-Strawn LM. Infant feeding practices study II: study methods. *Pediatrics.* 2008;122:S28-S35.
26. Texas Department of State Health Services. Texas WIC Infant Feeding Practices Survey. (2009)
27. U.S. Census Bureau. Racial and ethnic classifications used in Census 2000 and beyond. Available at:
<http://www.census.gov/population/www/socdemo/race/racefactcb.html>. Accessed October 5, 2012.
28. Fox MK, Pac S, Devaney B, Jankowski L. Feeding infants and toddlers study: what foods are infants and toddlers eating? *J Amer Diet Assoc.* 2004;104(Suppl 1):s22-30.
29. Centers for Disease Control and Prevention. Breastfeeding report card – United States, 2012. Available at: <http://www.cdc.gov/breastfeeding/data/reportcard.htm>. Accessed on October 22, 2012.
30. Grummer-Strawn LM, Scanlon KS, Fein SB. Infant feeding and feeding transitions during the first year of life. *Pediatrics.* 2008;122(Suppl 2):S36-S42.
31. Burlo F, Ramirez-Gandolfo A, Signes-Pastor AJ, Haris PI, Carbonell-Barrachina AA. Arsenic contents in Spanish infant rice, pureed infant foods, and rice. *J Foos Sci.* 2012;77(1):T15-9.
32. Jackson BP, Taylor VF, Karagas MR, Punshon T, Cottingham KL. Arsenic, organic foods, and brown rice syrup. *Environ Health Perspect.* 2012: Epub ahead of print.

33. Meharg AA, Guoxin S, Williams PN, Adomako E, Deacon C, Yong-Guan Z, Feldmann J, Raab A. Inorganic arsenic levels in baby rice are of concern. *Environ Pollut.* 2008;152(3):746-749.
34. Gera T, Sachdev HS, Boy E. Effect of iron-fortified foods on hematologic and biological outcomes: systematic review of randomized controlled trials. *Clin Nutr.* 2012;96:309-324.
35. Jalla S, Westcott J, Steirn M, Miller LV, Bell M, Krebs NF. Zinc absorption and exchangeable zinc pool sizes in breast-fed infants fed meat or cereal as first complementary food. *J Ped Gastroenterol Nutr.* 2002;24:35-41.
36. Krebs NF. Food choices to meet nutritional needs of breast-fed infants and toddlers on mixed diets. *J Nutr.* 2007;137:S511-517.
37. Krebs NF, Westcott JE, Butler N, Robinson C, Bell M, Hambidge KM. Meat as a first complementary food for breastfed infants: feasibility and impact on zinc intake and status. *J Ped Gastroenterol Nutr.* 2006;42:207-214.
38. Lozoff B, Wolf AW, Jimenez E. Iron-deficiency anemia and infant development: effects of extended oral iron therapy. *J Pediatr.* 1996;129(3):382-389.
39. Shafir T, Angulo-Barroso R, Su J, Jacobson SW, Lozoff B. Iron deficiency anemia in infancy and reach and grasp development. *Infant behavior and development.* 2009;32:366-375.
40. Lozoff B, Jimenez E, Smith JB. Double burden of Iron deficiency in infancy and low socioeconomic status. *Arch Pediatr Adolesc Med.* 2006;160:1108-1113.

41. Akman M, Cebeci D, Okur V, Angin H, Abali O, Akman AC. The effects of iron deficiency on infants' developmental test performance. *Acta Paediatr.* 2004;93:1391-1396.
42. Lozoff B. Iron deficiency and child development. *Food and Nutrition Bulletin.* 2007;28(4):S560-568.
43. Lukowski AF, Koss M, Burden MJ, Jonides J, Nelson CA, Kaciroti N, Jimenez E, Lozoff B. Iron deficiency in infancy and neurocognitive functioning at 19 years: evidence of long-term deficits in executive function and recognition memory. *Nutr Neurosci.* 2010;13(2):54-70.
44. Zenk SN, Odoms-Young A, Powell LM, Campbell RT, Block D, Chavez N, Krauss RC, Strode S, Armbruster J. Fruit and vegetable availability and selection: federal food package revision, 2009. *Am J Prev Med.* 2012;43(4):423-428.
45. Andreyeva T, Luedicke J, Middleton AE, Long MW, Schwartz MB. Positive influence of the revised special supplemental Nutrition Program for women, infants and children food packages on access to healthy foods. *J Acad Nutr Diet.* 2012;112(6):850-858.
46. Ayala GX, Laska MN, Zenk SN, Tester J, Rose D, Odoms-Young A, Gittelsohn J, Foster DG, Andreyeva T. Stocking characteristics and perceived increases in sales among small food store managers/owners associated with the introduction of new food products approved by the special supplemental nutrition program for women infants and children. *Public Health Nutr.* 2012;14:1-9.

47. Hillier A, McLaughlin J, Cannuscio CC, Chilton M, Krasny S, Karpyn A. The impact of WIC food package changes on access to healthful food in 2 low-income urban neighborhoods. *J Nutr Educ Behav*. 2012;44(3):210-216.
48. Howard AJ, Mallan KM, Byrne R, Magarey A, Daniels LA. Toddler's food preferences. The impact of novel food exposure, maternal preferences and food neophobia. *Appetite*. 2012;59:818-825.
49. Drewnoski A. Taste preferences and food intake. *Annual Rev Nutr*. 1997;17:273-253.
50. Gibson EL, Wardle J, Watts CJ. Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. *Appetite*. 1998;31:205-228.
51. Skinner JD, Carruth BR, Wendy B, Zielger PJ. Children's food preferences. A longitudinal analysis. *J Am Diet Assoc*. 2002;102(11):1638-1647.
52. Savage JS, Fisher JO, Birch LL. Parental influence on eating behavior. Conception to adolescence. *J Law Med Ethics*. 2007;35(1):22-34.
53. Scaglioni S, Salvioni M, Galimberti C. Influence of parental attitudes in the development of children eating behavior. *British J Nutr*. 2008;99(S1):S22.
54. Marshal TA, Levy SM, Broffitt B, Warren JJ, Eichenberger-Gilmore JM, Burns TL, Stumbo PJ. Dental caries and beverage consumption in young children. *Pediatrics*. 2003;112(3):e184-191.
55. Welsh JA, Cogswell ME, Rogers S, Rockett H, Mei Z, Grummer-Strawn LM. Overweight among low-income preschool children associated with the consumption of sweet drinks: Missouri, 1990-2002. *Pediatrics*. 2005;115:e223-229.

56. McElligott JT, Robers JR, Varadi EA, O'Brien ES, Freeland KD, Basco WT.

Variation in fruit juice consumption among infants and toddlers: associations with WIC participants. *Southern Med Journ.* 2012;105(7):364-369.

57. Schneider JM, Fujii ML, Lamp CL, Lonnerdal B, Zidenberg-Cherr S. The prevalence of low serum zinc and copper levels and dietary habits associated with serum zinc and copper in 12 to 36 month old children from low-income families at risk for iron deficiency. *J AM Diet Assoc.* 2007;107(11):1924-1929.

APPENDIX A – INSTRUMENTS

Feeding Practices Questionnaire.....	62
Demographic Form.....	72
Health History Form.....	77
Screening Form.....	79
Consent Form to Participate in Research.....	81
Funds Form.....	87
Phone Interview Script.....	89

Feeding Practices Questionnaire

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

Texas – PART II

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
- 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. Was there a period of time when your child was fed only breast milk?

Yes No

4b. If yes, how long?

_____ days _____ weeks _____ months

5. Are you currently breastfeeding or pumping milk?

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

Section D

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

_____ days _____ weeks _____ months

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

- 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)

8. Did any of the following people want you to stop breastfeeding (**check all that apply**)?

- A. The child's father
- B. Your mother
- D. Another family member
- E. A doctor or other health professional
- F. Your employer or supervisor
- G. Anybody else _____

Section E

9. 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 _____
10. How old was your baby when he or she was first fed formula?
days _____ or weeks _____ or months _____ or never fed formula _____
11. Have you ever added cereal or other solids to your baby's bottle?
yes _____ or no _____
12. 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 _____
- 12.b. How old was your child when he/she was first fed cow's milk (not breast milk or formula) *on a daily basis*?
weeks _____ or months _____ or not on a daily basis _____
12. 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

13. 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 _____

14. 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 _____

15. 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 _____

16. 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 _____

17. 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 _____

18. 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 _____

19. 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 _____

20. 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

21. 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

22. How much time per day does your child watch television?

Hours _____ Minutes _____

23. Do you have a television in your living room? Yes _____ No _____

24. Does your child have a television set in his/her bedroom? Yes _____ No _____

25. How often does your child eat while watching television (including snacks)?

- a. 0-2 times per day
- b. 2-4 times per day
- c. 4-6 times per day
- d. 6 or more times per day

26. Does your family eat any meals together on a usual basis? Yes _____ No _____

27. If yes, which meals do you usually eat together?

- a. Breakfast
- b. Lunch
- c. Dinner

28. How many times per week does your family eat together at the table?

- a. 0-2 times per day
- b. 2-4 times per day
- c. 4-6 times per day
- d. 6 or more times per day

29. Where else does your family eat their meals? _____

30. How many meals per week does your family eat out?

- a. 0-2 times per day
- b. 2-4 times per day
- c. 4-6 times per day
- d. 6 or more times per day

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

- a. A very picky eater
- b. a somewhat picky eater
- c. not a picky eater

32. 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

Section H

33. Do you think your child's weight is

- a. Very healthy
- b. Somewhat healthy
- c. Undecided
- d. Somewhat unhealthy
- e. Unhealthy

34. Do you think your child's diet is

- a. Very healthy
- b. Somewhat healthy
- c. Undecided
- d. Somewhat unhealthy
- e. Unhealthy

35. Which of the following influenced your choices about feeding your child

- a. Doctor or nurse
- b. WIC
- c. Family member
- d. Friend
- e. Media

Section I

36. What reasons led to your decision to offer/not offer your baby sodas or fruit

drinks? _____

37. What reasons led to your decision to offer/not offer your baby 100% juice before 6 months?_____

38. What reasons led to your decisions to offer/not offer your baby cow's milk before 1 year?_____

39. What reasons led to your decision to introduce/not introduce anything other than breast milk or formula before 6 months?

Demographic Form**Evaluation of Feeding Patterns of Infants and Toddlers at WIC in San Marcos,****Texas - PART II****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)
10. Which WIC package are you receiving? _____

Infant or Toddler Information

11. Does your child attend daycare?
12. Gender of child M F
13. First name of child _____

14. DOB of child (**month, date, year**) _____

15. Age of child (**at time of interview**) _____

Marital Status

16. What is your marital status? – make this match with last study

- a. Now married
- b. Widowed
- c. Divorced
- d. Separated
- e. Never married

17. How many people are living in your household?

Acculturation

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

- a. English
- b. Spanish
- c. Both
- d. Other

19. 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)

Education

20. 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

Employment

21. Are you employed? Yes No

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

Income

22. What is your average yearly income?

- a. 5,000 – 10,000
- b. 11,000 – 20,000
- c. 21,000 – 40,000
- d. 41,000 – 60,000
- e. 60,000 – 80,000
- f. 80,000 and over

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)

24. 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

Title: Does the 2009 WIC Package Impact Feeding Practices of Infants and Toddlers 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**) _____

Medical Insurance

5. Does your child have medical insurance? Yes No
6. Do you have medical insurance? Yes No

Child Information

7. How many weeks were you pregnant before giving birth to this child?
_____ **weeks**
8. What was your child's **weight at birth**? _____ **pounds/ounces**
9. What is your child's **current weight**? _____ **pounds**
10. What is your child's current height/length? _____ **inches**

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

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

Yes No

12.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**)

Screening Form

Evaluation of Feeding Patterns of Infants and Toddlers in WIC in San Marcos,

Texas – PART II

To be completed by recruiter/interviewer in person at WIC or during a phone call

What is your first and last name? _____

How many children do you have? _____

List your child/children's name(s) and age(s)?

1. _____

2. _____

3. _____

4. _____

What WIC package are you receiving? _____

Are you able to receive a phone call from us asking about what your child ate in the past 24 hours? _____

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? _____

Do you prefer to be called by someone who speaks Spanish? Y N

You will be contacted in the next couple days by telephone.

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

time _____

What phone number can we reach you at? _____

What address would you like your gift card sent to?

Child to be studied: Name _____ Age _____ Sex

_____ D.O.B. _____

Thank you for your time and contribution to this research study!

Consent Form to Participate in Research

**Title: Evaluation of Feeding Patterns of Infants and Toddlers in WIC in San
Marcos, Texas – PART II**

Principal Investigator and Contact Information:

Texas State University – Department of Family & Consumer Sciences

- Dr. Sylvia Crixell, Professor
Phone: 512-245-2155 Email: scrixell@txstate.edu
- Dr. BJ Friedman, Professor
Phone: 512-245-2155 Email: bf04@txstate.edu
- Amanda Reat, Graduate Student
Phone: 512-245-2155 Email: ar1697@txstate.edu

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 2 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 130 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 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.

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 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.

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: _____

Funds Form

Department of Family & Consumer Sciences

College of Applied Arts

Texas State University-San Marcos

Distribution of Payment

Complete following section during recruiting:

By signing this form and accepting this payment, I verify that I am not an employee of Texas State University-San Marcos.

By signing this form I am acknowledging that upon completion of the phone call, I will receive payment of \$10.00 from Dr. Sylvia Crixell, from the Department of Family & Consumer Sciences, as compensation for participation in research.

I also understand and acknowledge that should I receive a total of \$600 in incentive pay for participating in other research projects offered through Texas State it will be reported to the Internal Revenue Service and a 1099 form will be issued.

Printed Name

Signature

Date:

As a representative of this study, I am acknowledging that I distributed a payment of
\$10.00 to the above named participant.

Signature of Investigator

Date:

Principal Investigator

Date

Phone 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.”

LITERATURE CITED

1. Beauchamp GK, Mennella JA. Early flavor learning and its impact on later feeding behavior. *J Ped Gastroenter Nutr.* 2009;48:S25-S307.
2. Menella JA, Jagnow CP, Beauchamp GK. Prenatal and postnatal flavor learning by human infants. *Pediatrics.* 2001;107:e88-95.
3. Forestell CA, Mennella JA. Early determinants of fruit and vegetable acceptance. *Pediatrics.* 2007;120:1247-1254.
4. U.S. Department of Agriculture. Public law 108-265 108th Congress an Act. Available at http://www.fns.usda.gov/cnd/governance/legislation/historical/pl_108-265.pdf. Accessed on September 14,2011.
5. The Federal Register. 7 CFR Part 246: Special Supplemental Nutrition Program for Women, Infants and Children (WIC): Revisions in the WIC Food Packages; Interim Rule. Available at <http://frwebgate.access.gpo.gov/cgi-bin/multidb.cgi>. Accessed on September 15, 2011.
6. Siega-Riz AM, Deming DM, Reidy KC, Fox MK, Condon E, Briefel RR. Food consumption patterns of infants and toddlers: where are we now? *J Am Diet Assoc.* 2010;110(suppl 12):S38-51.
7. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007-2008. *JAMA.* 2010;303(3):242-249.
8. The Institute of Medicine. WIC food packages: time for a change. Consensus report. 2005.

9. Von Bank JA. The special supplemental nutrition program for women, infants, and children in San Marcos, Texas. Graduate thesis. 2009. Texas State University- San Marcos.
10. American Dietetic Association. Food and nutrition information you can trust. Available at <http://www.eatright.org/Public/>. Accessed on November 11, 2011.
11. Fox MK, Pac S, Devaney B, Jankowski L. Feeding infants and toddlers study: what foods are infants and toddlers eating? *J Am Diet Assoc.* 2004;104(Suppl 1):s22-30.
12. Oliveira V, Frazao E. The WIC program: background, trends, and economic issues, 2009 edition. USDA Economic Research Report. 2009;73:1-82.
13. Huh SY, Rifas-Shiman SL, Taveras EM, Oken E, Gilman MW. Timing of solid food introduction and risk of obesity in preschool-aged children. *Pediatrics.* 2011;127:e544-551.
14. Wagner CL, Greer FR. Prevention of rickets and vitamin D deficiency in infants, children, and adolescents. *Pediatrics.* 2008;122(5):1142-1152.
15. McCann JC, Ames BN. Is docosahexaenoic acid, and n-3 long-chain polyunsaturated fatty acid, required for development of normal brain function: An overview of evidence from cognitive and behavioral tests in humans and animals. *Am J Clin Nutr.* 2005;82:281-295.
16. U.S. Department of Agriculture (USDA). Dietary Guidelines for Americans 2010. Available at: www.dietaryguidelines.gov. Accessed August 27, 2011.
17. U.S. Department of Agriculture. Choosemyplate.com. Available at www.myplate.com. Accessed on November 11, 2011.

18. Drewnoski A. Obesity and the food environment: dietary energy density and diet costs. *Am J Prev Med.* 2004;27(3s):154-162.
19. Lee YS. Consequences of childhood obesity. *Ann Acad Med Singapore.* 2009;38:75-81.
20. Grummer-Strawn L, Mei Z. Does breastfeeding protect against pediatric overweight? Analysis of longitudinal data from the center for disease control and prevention pediatric nutrition surveillance system. *Pediatrics.* 2004;113:e81-e86.
21. Gillman MW, Rifas-Shiman SL, Camargo CA, Berkey CS, Frazier AL, Rockett HRH, Field AF, Colditz GA. Risk of overweight among adolescents who were breastfed as infants. *JAMA.* 2001;285:2461-2467.
22. Von Kries R, Koletzko B, Sauerwald T, Von Mutius E, Barnert D, Grunert V, Von Voss H. Breast feeding and obesity: cross sectional study. *BMJ.* 1999;319:147-150.
23. World Health Organization. Complementary Feeding: report of the global consultation: A summary of guiding principles. Available at: http://www.who.int/nutrition/publications/Complementary_Feeding.pdf. Accessed September 6, 2011.
24. American Academy of Pediatrics. Breastfeeding and the use of human milk. *Pediatrics.* 2012;129(3):e827-841.
25. American Academy of Pediatrics Committee on Nutrition. The use and misuse of fruit juices in pediatrics. *Pediatrics.* 2001;107:1210-1213.
26. Wagner CL, Greer FR. Prevention of rickets and vitamin D deficiency in infants, children, and adolescents. *Pediatrics.* 2008;122(5):1142-1152.

27. Centers for Disease Control and Prevention. Nutrition for everyone: iron deficiency. Available at <http://www.cdc.gov/nutrition/everyone/basics/vitamins/iron.html#Iron%20Sources>. Accessed on September 6, 2011.
28. Butte N, Cobb K, Dwyer J, Graney L, Heird W, Rickard K. The start healthy feeding guidelines for infants and toddlers. *J Am Diet Assoc*. 2004;104(3):442-454.
29. Centers for Disease Control and Prevention. Iron and iron deficiency. Available at: <http://www.cdc.gov/nutrition/everyone/basics/vitamins/iron.html>. Accessed on September 6, 2011.
30. Lozoff B, Wolf AW, Jimenez E. Iron-deficiency anemia and infant development: effects of extended oral iron therapy. *J Pediatr*. 1996;129(3):382-389.
31. Shafir T, Angulo-Barroso R, Su J, Jacobson SW, Lozoff B. Iron deficiency anemia in infancy and reach and grasp development. *Infant behav devel*. 2009;32:366-375.
32. Lozoff B, Jimenez E, Smith JB. Double burden of Iron deficiency in infancy and low socioeconomic status. *Arch Pediatr Adolesc Med*. 2006;160:1108-1113.
33. Akman M, Cebeci D, Okur V, Angin H, Abali O, Akman AC. The effects of iron deficiency on infants' developmental test performance. *Acta Paediatr*. 2004;93:1391-1396.
34. Lozoff B. Iron deficiency and child development. *Food and Nutrition Bulletin*. 2007;28(4):S560-568.

35. Lukowski AF, Koss M, Burden MJ, Jonides J, Nelson CA, Kaciroti N, Jimenez E, Lozoff B. Iron deficiency in infancy and neurocognitive functioning at 19 years: evidence of long-term deficits in executive function and recognition memory. *Nutr Neurosci*. 2010;13(2):54-70.
36. World Health Organization. Nutrient adequacy of exclusive breastfeeding for the term infants during the first six months of life. Available at: <http://whqlibdoc.who.int/publications/9241562110.pdf>. Accessed on November 3, 2012.
37. Krebs NF, Westcott JE, Butler N, Robinson C, Bell M, Hambridge KM. Meat as a first complementary food for breastfed infants: feasibility and impact on zinc intake and status. *J Pediatr Gastroenterol Nutr*. 2006;42:207-214.
38. ESPGHAN Committee on Nutrition. Complementary feeding: a commentary by the ESPGHAN committee on nutrition. *J Pediatr Gastroenterol Nutr*. 2008;46(1):99-110.
39. Thacher TD, Fischer PR, Strand MA, Pettifor JM. Nutritional rickets around the world: causes and future direction. *Annals Tropical Paediatrics*. 2006;26:1-16.
40. Walker VP, Modlin RL. The vitamin D connection to pediatric infections and immune. *Pediatr Res*. 2009;65:106R-113R.
41. Hypponen E, Laara E, Reunanen A, Jarvelin MR, Virtanen SM. Intake of vitamin D and risk of type 1 diabetes: a birth-cohort study. *The Lancet*. 2001; 358(9292):1-8.
42. Perrine CG, Sharma AJ, Jefferds MED, Serdula MK, Scanlon KS. Adherence to vitamin D recommendations among US infants. *Pediatrics*. 2010;124:626-632.

43. Kumar J, Muntner P, Kaskel FJ, Hailpern SM, Melamed ML. Prevalence and associations of 25-hydroxyvitamin D deficiency in US children: NHANES 2001-2004. *Pediatrics*. 2009;124(3):362-370.
44. Carleson SE. Early determinants of development: a lipid perspective. *Am J Clin Nutr*. 2009;89:1523S-9S.
45. Judge MP, Harel O, Lammi-Keefe J. Maternal consumption of a docosahexaenoic acid-containing functional food during pregnancy: benefit for infant performance on problem-solving but not on recognition memory tasks at age 9 mo. *Am J Clin Nutr*. 2007;85:1572-1577.
46. U.S. Department of Agriculture. About WIC: how WIC helps. Available at <http://www.fns.usda.gov/wic/aboutwic/howwichelps.htm>. Accessed on September 21, 2011.
47. U.S. Department of Agriculture. Program data: WIC program. Available at <http://www.fns.usda.gov/pd/wicmain.htm>. Accessed on September 19, 2011.
48. U.S. Department of Agriculture. How to Apply for WIC. Available at <http://www.fns.usda.gov/wic/howtoapply/incomeguidelines.htm>. Accessed on November 21, 2011.
49. U.S. Department of Agriculture. Dietary Guidelines for Americans, 2005. Available at <http://www.health.gov/dietaryguidelines/dga2005/document/default.htm>. Accessed on September 19, 2011.
50. American Academy of Pediatrics. Dietary recommendations for children and adolescents: a guide for practitioners. *Pediatrics*. 2006;117:544-559.

51. Devaney B, Kalb L, Briefel R, Zavitsky-Novak T, Clusen N, Ziegler P. Feeding infants and toddlers study: overview of the study design. *J Am Diet Assoc.* 2004;104:S8-S13.
52. Fein SB, Labiner-Wolfe J, Shealy KR, Li R, Chen J, Grummer-Strawn LM. Infant feeding practices study II: study methods. *Pediatrics.* 2008;122:S28-S35.
53. U.S. Census Bureau. Racial and ethnic classifications used in Census 2000 and beyond. Available at:
<http://www.census.gov/population/www/socdemo/race/racefactcb.html>. Accessed October 5, 2011.

VITA

Amanda Reat was born in Houston, Texas, on March 17, 1987, the daughter of Gina and Kelly Reat. After completing her high school education through homeschool in 2005, she attended the University of Houston and graduated with her B.S. in Nutrition in 2009. Upon graduation, she was employed as a nutrition educator in Austin, TX. In January 2011, she entered the Graduate College of Texas State University-San Marcos and in August 2012, she was accepted into the Dietetic Internship at Texas State University-San Marcos.

Permanent Address: 3300B Robinson Ave

Austin, Texas 78722

This thesis was typed by Amanda Reat.