THE RELATIONSHIP BETWEEN PARENTING STYLES, DIETARY MACRONUTRIENT INTAKE, AND BMI IN TODDLERS

By

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Abstract:

The purpose of this study is to determine the relationship between parenting style, dietary macronutrient intake, and growth in toddlers, aged 2.5- to 4-years-old. This study is a continuation of a prior longitudinal study examining the relationship of maternal micronutrients/toxicants and infant cognitive development during infancy. Forty-seven mother-toddler pairs returned to be re-evaluated.

At the returning visit, mothers filled out a demographic and parenting style dimension questionnaire, anthropometric measurements were taken, and a 24-hour recall of the toddler's diet was completed. Toddler anthropometrics were taken at the returning visits. Two additional 24-hour recalls of the toddler's diet were completed over the telephone with a primary caregiver.

Descriptive statistics showed mothers were predominately white, well-educated, and married. Additionally, the majority of children were of normal weight and mothers had a mean BMI of 25.36. Toddler diet revealed children consumed slightly over recommendations with a mean caloric intake of 1559 calories per day.

A significant positive correlation was found between permissive parenting style scores and toddler fat, carbohydrate, and total calorie intake. A negative correlation was found between permissive parenting style score and protein calorie intake percentage. Additionally, it was found that permissive parenting style score, not maternal BMI, is a predictor of toddler BMI, when using total calories as an outcome variable in a linear regression model. No correlation was found between any category of parenting style and toddler growth or between toddler BMI groups and maternal demographic variables.

In conclusion, though the sample consisted of toddlers from mothers who were well educated, middle to high income status, and married; a correlation was seen among permissive parenting style subscales scores with toddler dietary intake and a predictor of toddler BMI. Further research is called for using a larger sample size and following children for a longer period of time to examine whether the relationship between parenting style and later growth emerges.

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CHAPTER I

INTRODUTION

The prevalence of obesity among children aged 2 to 5 years old has more than doubled from 5% to 12.1% between 1976-1980 and 2009-2010 (Ford, Slining & Popkin, 2013). Though trends show a slight decrease within the past few years, obesity still remains an area of concern for both school-aged children and adolescents. Though childhood obesity is related to a number of factors, the role of parents may have a non-direct influence on child weight in a number of ways. A few influences include parental body mass index (BMI), food preferences, parental education, income, and marital status. Moreover, research suggests specific feeding practices, behaviors, and styles are associated with childhood overweight and obesity. However, the relationship between general parenting style and child weight status is not well established due to incongruity in methodology to assess parenting style and food intake, limited studies among young children, and the current challenges of using BMI-for-age to measure weight status (Rhee, Lumeng, Appulgliese, Kaciroti & Bradley, 2006).

Current literature in relation to child food intake among 2 to 6 year olds from 1989 to 2008 has shown dietary changes that may contribute to the rise in children's BMI. Results indicate an increase in added sugars, saturated fats, and sodium (Ford et al., 2013). Moreover, children are not meeting the intake recommendations for vegetables or fruits. Skinner, Carruth, Bounds, and Ziegler (2002) present the importance of understanding dietary trends by revealing that the number of foods liked among children at age 2 and 3 years old have not changed significantly at age 8. Also, new foods were more accepted at a young age versus older. Thus, it

is crucial for caregiver's to pursue the responsibility of offering children a wide variety of food options at an early age. Skinner et al. (2002) found children consume foods that are most often consumed by their mothers. Additionally, foods disliked or never tried by children were also disliked by the mother. Thus, food preferences among mothers have an impact on the foods offered and consumed by the child at an early age.

It is well known that parents and primary caregivers play a fundamental role in the cognitive, socio-emotional, and psychological development of children. Starting at birth, parents can exert a strong influence over their child's feeding environment and food-related behaviors (Blissett, 2011). These eating habits, behaviors, and food-related preferences can persist into adolescence and adulthood. Young children are dependent on their parents for food. Parents have the responsibility of determining availability, accessibility, food choice and portion, feeding practices that are used to promote or discourage eating, and have control over the child's food setting, both emotionally and physically. Thus, parents are able to play a critical role in the development of young children's environment and experiences around food and eating (Ventura & Birch, 2014). Caregivers can play a substantial role in the development of children's risk of becoming overweight through influencing dietary behavior and the development of food habits (Rhee et al., 2006).

With parents playing a potential role in the child's dietary consumption and weight outcomes, the majority of research uses parenting styles first classified by Baumrind (1971) and later modified by Maccoby and Martin (1983). Baumrind (1971) first classified 3 styles: authoritarian, authoritative, and permissive. Then, Maccoby and Martin (1983) introduced another style known as uninvolved or neglectful. There are some studies that look specifically at general parenting styles; yet, many researchers describe different behaviors or characteristics involved within each parenting style in order to describe how parents interact with their child in the context of feeding (Patrick, Nicklas, Hughes, & Morales, 2004). Thus, though the terms parenting style and feeding practices and feeding styles are used interchangeably throughout

research, there are major differences between the terms. Parenting style is based on the attitudes and beliefs on how parents should shape their child's daily activities; thus, creating a framework between parent-child interaction to further describe the emotional climate presented by the parent (Hennessy, Hughes, Goldberg, Hyatt, & Economos, 2010; Rhee et al., 2006). Feeding style refers to the same classifications as the traditional parenting styles described above; yet, describes specific types of feeding interactions and focuses solely on the context of eating. Additionally, feeding practices can be described as specific behaviors or techniques used by the parent in order to limit or facilitate a child's eating. Practices may include pressure to eat, monitoring or restriction of food intake, and/or use of punishments or rewards for child's intake or lack of intake (Blissett, 2011; Hennessey et al., 2010). Though specific feeding styles and practices have found a greater link between dietary intake and weight gain, Rhee et al. (2006) states due its broad definition general parenting styles might have a greater impact on shaping dietary behaviors, emotional functional, and overweight risk among children.

There is a growing body of evidence looking at the relationship between general parenting style, children's dietary weight, and dietary habits. However, many studies are primarily focused on older school-aged children and adolescents (De Bourdeauhuij et al., 2009; Kremers, Bruga, de Vries, & Engels, 2003; Pearson, Atkin, Biddle, Gorely, & Edwardson, 2009; Rodenburd, Oenuma, Kremers, & van de Mheen, 2012, & Vereecken, Rovner, & Maes, 2010; Berge, Wall, Loth, & Neumark-Sztainer, 2010). There are fewer studies conducted among children under the age of 10 years (Blissett and Haycraft, 2008; Lohaus, Vierhaus, & Ball, 2009; Rhee, et al., 2006; Chen & Kennedy, 2005; Agras, Hammer, McNicholas, & Kraemer, 2004). Of these, there is even a smaller number among 2 to 4 year olds (Rhee et al., 2006; Blissett & Haycraft, 2008). Studies have revealed mixed findings in relation to parenting styles and child weight status. For instance, some research reveals no significant relation between child weight status and parenting style (Blissett & Haycraft, 2008; Agras et al., 2004; Wake, Nicholson, Hardy, & Smith, 2007); whereas, other studies have shown a significant correlation between

specific parenting styles and weight status (Rhee et al., 2006; Xu et al., 2013; Chen & Kennedy, 2005; Olvera & Power, 2010). Additionally, there is a lack of research specifically over parenting style and dietary intake among young children (Xu et al., 2013; Chen & Kennedy, 2005; Arrendondo et al, 2006).

Reasons for variance in results may depend on how researchers define parenting style and the various assessment tools to determine parenting style and food intake. When measuring maternal sensitivity, Rhee et al. (2006) conducted videotape interactions; on the other hand, the majority of other studies use a questionnaire such as Parenting Styles Dimension Questionnaire (Blissett & Haycraft, 2008; Brann & Skinner, 2005), Child Rearing Practices Report (Chen & Kennedy, 2005), or the Parenting Dimension Inventory (PDI) (Olvera & Power, 2010). Though all forms of measurements have the same intentions, outcomes are likely to be different, which may lead to inconsistent findings. Despite the differences in methodology, the ultimate problem is the lack of research among young children in relation to dietary intake and parenting style. Since food habits start at a young age and young children are much more dependent on their parents than school-aged children and adolescents, it is beneficial to look at younger children, specifically toddlers.

The results of this study may add to the body of literature by focusing purely on children aged 2.5 to 4 years old. Additionally, it may help fill in the gap of knowledge by strengthening other relevant findings by relating traditional parenting styles, food intake, and growth within a healthy sample. Lastly, the project may potentially further demonstrate the overall importance of parents and parental impact on a child's food, eating environment, and overall growth at a young age.

Research Questions

This study intends to contribute to previous studies that focus on the relationship among parenting style, toddler growth, and macronutrient intake. Previous research has provided conflicting results due to the variance in methodology and assessment techniques. The results

intend to clarify the mixed results and contribute to what is already known.' The questions the research is aiming to answer are:

1. What is the relation between parenting style and toddler BMI?

   Null hypothesis: Parenting style is not related to toddler BMI.

2. What is the relation between parenting style and macronutrient and caloric intake?

   Null hypothesis: Parenting style is not related to macronutrient and caloric intake.

3. Using results from question 1 and 2, the specific regression model tested was to see if permissive parenting style and total calories predicted toddler BMI-for-age z-score.

Research Design and Recruitment

This study assessed parenting style in relation to child macronutrient and caloric intake, and growth of children aged 2.5 to 4.5 years old. Maternal parenting style was assessed through the PSDQ to determine if mothers were considered authoritarian, authoritative, or permissive. Growth was measured through using specific equipment to measure height and weight of toddlers to determine BMI-for-age. Dietary intake was estimated by averages of 3 days of 24 hour recalls. To determine dietary trends among toddlers, 2 to 4.5 years of age, the study focused specifically on percentage of carbohydrate, protein, and fat as well as total calorie intake.

The data collected is based on a prior longitudinal study to see if nutrients or toxicants measured at 3 months of age were to be related to children's cognitive development. For the current study, data will be specifically from returning mothers and toddlers. The original sample began with 132 mothers and infants. However, only 47 pairs returned to be reevaluated. Of the original sample, 10 were older than 4 years when the study began and 12 were less than 2.5 years old when the funding expired. Of the remaining eligible pairs, 43% returned. Incentives were

given for both infant and toddler data collection sessions, equaling $120. This study, as well as the original one, was approved by the Oklahoma State University Institutional Review Board (IRB).

Inclusion criteria in the original study consisted of infants that were born full term, a single birth, and a birth weight between 6.5 to 9.5 pounds and were primarily breastfed at 3 months. Infants were excluded if formula intake was more than 28 ounces per week, if the infant was born preterm, low birth weight, or infants born under the 10^{th} percentile of weight for age. Recruitment of the sample population consisted of going to hospitals by visiting prenatal and breastfeeding class, hanging up signs around Stillwater, attending different social events that mothers commonly attend, and by word of mouth.

CHAPTER II

LITERATURE REVIEW

Overview

To fully understand the role of parenting style in relation to toddler macronutrient intake and weight, it is beneficial to review literature over the current statistics of both national and state obesity rates, the challenges of BMI as an assessment tool, food trends among young children, and parenting styles. Because general parenting style, feeding style, and feeding practices seem to overlap in the literature, it is also useful to clearly define each term. Overall, current research over the relation between parenting styles and child BMI as well as parenting styles, child BMI, and food intake will be reviewed.

Childhood Obesity

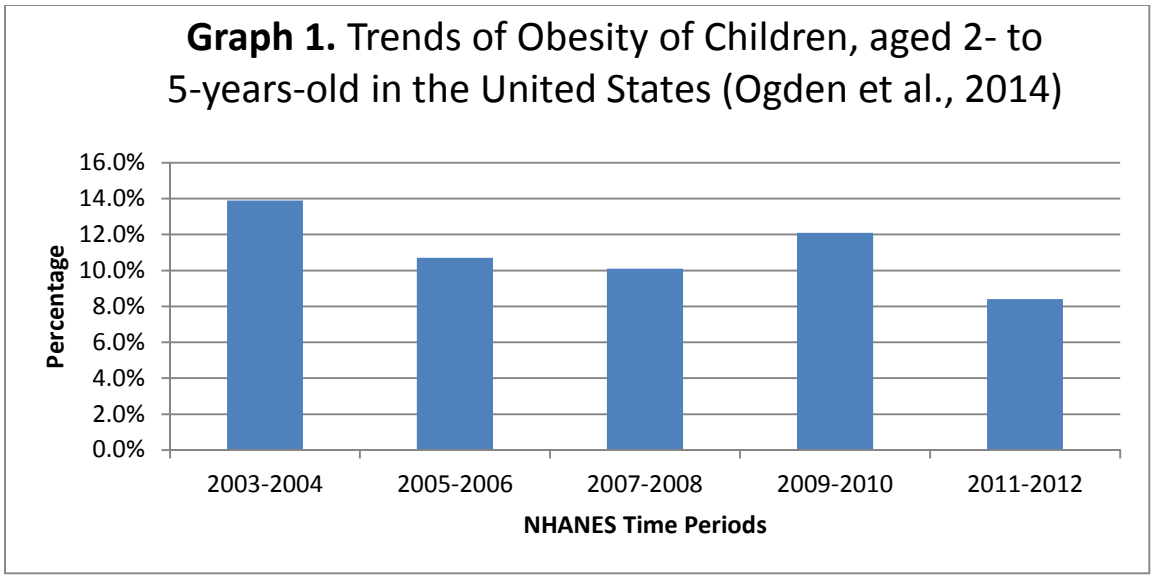
The obesity epidemic has a major impact on young children in terms of their health continuing into adulthood. Ogden et al. (2014) analyzed the trends in childhood obesity by using data from the National Health and Nutrition Examination Survey (NHANES) over five time periods (2003-2004, 2005-2006, 2007-2008, 2009-2010, and 2011-2012). For children, weight status was determined by using BMI-for-age. Overweight status is defined by a BMI between the 85th and 95th percentile; whereas, obesity is defined as BMI at or above the 95th percentile of the sex-specific CDC BMI-for-age growth charts. Overall, 22.8% of children aged 2 to 5 years old across all racial groups are considered overweight or obese. Yet, when considering only rates of

obesity among 2- to 5-years-old children, 8.4% of all racial groups fell into this category. When looking at gender differences, boys were more likely than girls to be overweight and/or obese. As seen in **Table 1**, Hispanic and Non-Hispanic Blacks are at the highest rate of overweight/obese or obesity. The prevalence of obesity was much lower among Non-Hispanic Asian youth than any other racial group (Ogden et al., 2014).

Table 1. Prevalence of High BMI for children aged 2 to 5 years old (n=871), by race/Hispanic origin in the United States from 2011-2012 (Ogden et al., 2014).

Race	Overweight or Obese	Obese
• All Groups**	22.8%	8.4%
• Non-Hispanic White	20.9%	3.5%
• Non-Hispanic Black	21.9%	11.3%
• Non-Hispanic Asian	9.0%	3.4%
• Hispanic	29.8%	16.7%
**Includes all Racial and Ethnic groups		

When considering all youth (children aged 2 to 18 years old), there is not a significant change in obesity from 2003 to 2012 (Ogden et al., 2014). The percentage barely decreased from 17.1% to 16.9% indicating the prevalence of obesity remains a high concern for all children. However, children aged 2 to 5 years old are the only age group to reveal a 5.5% significant decrease in obesity from 13.9% in 2003 to 8.4% in 2012. **Graph 1** further shows the percent change over the five time periods by age in the United States. The downward trend suggests a stabilization of obesity rates among 2- to 5-years-old only. Yet, despite the importance of this downward trend, there are many considerations to be aware of such as overweight and obesity rates specifically in each state and the use of BMI to measure overweight or obesity.

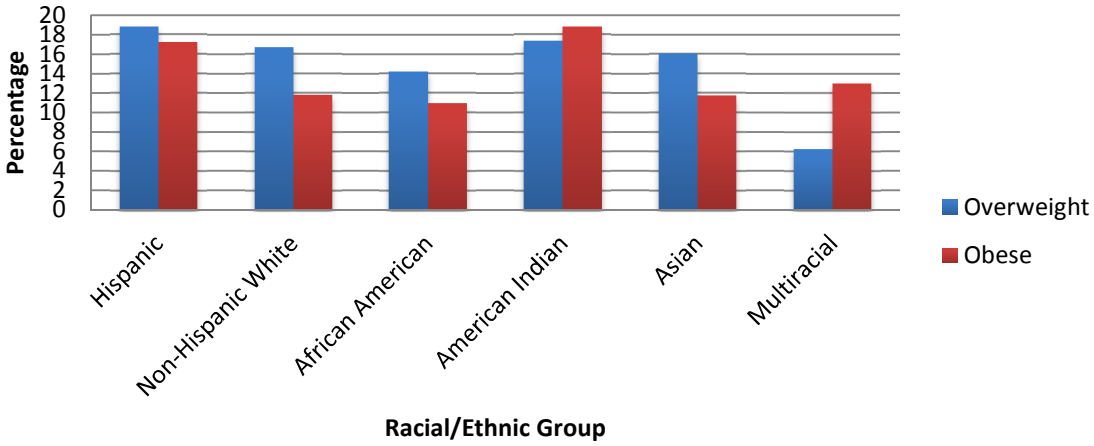


Child Obesity in Oklahoma

Nationally, there is documented evidence showing the racial disparities among children who are obese. However, the NHANES data lacks information on American Indian children. This is a crucial consideration in that Oklahoma has the second highest proportion of American Indians in the United States. Results indicate 17.03% of children are overweight and 13.7% are obese when using BMI-for-age measurements from 39,151 Oklahoma WIC children, aged 2- to 4-years-old in 2009 (Weedn, Ang, Zeman, & Darden, 2012). Specifically, 16.7% of 2 –year-olds and 17.1% of 3-year-olds are overweight; on the other hand, 12.8% of 2-year-olds and 14.4% of 3-year-olds are considered obese. As seen in **Graph 2**, Hispanic children have the highest rate of overweight and American Indian children had the highest rate of being obese. When combining overweight and obesity categories, American Indian children have the highest rate of 36.10%, followed closely by Hispanic children with 35.95%, then multiracial (29.24%), non-Hispanic white (28.49%), Asian (27.76%), and lastly, African American children (25.08%). Oklahoma results are congruent with national data, with one third of Oklahoma population considered overweight and obese. One major incongruity is the prevalence of overweight and obesity among African American children in Oklahoma. National data reveals African American children have a high prevalence of overweight and obesity, while the Oklahoma data shows the complete

opposite. Despite the differences, these findings are important to consider since they give a general idea of the prevalence of overweight and obesity in low-income children in the state of Oklahoma.

Graph 2. Racial/Ethnic Differences in Overweight and Obesity among Oklahoma children, aged 2 to 4 years old. (Weedn et al., 2012)



Benefits and Challenges of using Body Mass Index

BMI is a simple, inexpensive, and non-invasive screening measurement of body fat for both children and adults (CDC, n.d.). BMI is considered a measure of body fatness; though, it measures excess weight rather than excess fat. Though BMI is calculated the same way for adults and children, results are interpreted differently. Specifically, for children aged 2 to 20 years old, BMI is specific to a child's age and sex since the amount of body fat changes with age and differs between boys and girls. Age- and sex-specific BMI is most often referred to as BMI-for-age.

Once BMI is calculated, BMI is plotted on the CDC BMI-for-age growth charts (CDC, n.d. & CDC 2014). The percentile assesses the size as well as growth patterns of children aged 2 to 20 years old and indicates the position of the child's BMI among other children of the same sex and age. The percentile categories include less than the 5th percentile (underweight), 5th to 85th

percentile (healthy weight), 85th to 95th percentile (overweight), and equal to or above the 95th percentile (obese). In contrast, in adults, BMI weight classifications are not based on age or sex

There are multiple factors that can influence the relationship between BMI and body fat in children. Factors include age, height and level of maturation, gender, and ethnicity, (Daniels & Khoury, 1997; Freedman et al., 2009). Additionally, BMI does not differentiate between excess fat or muscle mass, and does not indicate where body fat is distributed among individuals (CDC, n.d.). For children, the accuracy of BMI varies according to the child's degree of fatness. For instance, Freedman et al. (2009) found the majority of children (77%) who had a BMI-for-age at or above the 95th percentile had an elevated level of body fatness indicating BMI as a good indicator of excess body fat for obese children. On the other hand, levels of body fatness among children who had a BMI-for-age between the 85th and 94th percentile was more variable. Within the 85th and 94th BMI-for-age percentile, half of the children had moderate levels of body fatness; while, 30% of children had a normal level of body fat and 20% had an elevated level of body fatness. Similarly, misclassification occurred among relatively thin children; due to limited categories of normal body fatness and differences in fat free mass. For instance, though 42% of the children who had a BMI-for-age less than the 25th percentile had a low level of body fatness, none had a moderate or elevated level of body fatness (Freedman et al., 2009; Freedman & Sherry, 2009). Furthermore, Freedom et al. (2009) found racial/ethnic differences among children who had a BMI-for-age between the 85th and 94th percentile. The prevalence of normal body fat reached 50% among black children; yet, only 20% among Asian children (Freedman et al., 2009). Thus, race/ethnic groups have different levels of body fat with the same BMI category. This further indicates BMI is not a perfect measure of body fatness, especially among children with different ethnic backgrounds.

Overall, BMI is a simple and reasonable screening measurement of body fat for children; however, it should not be used as a diagnostic tool since it does not assess body fat directly. Other potential measurements may more accurately determine body fatness than BMI-for-age since

BMI solely focusing on height and weight (Freedman & Sherry, 2009). These measurements include skinfold thicknesses, dual energy x-ray absorption, and circumference measurements. Though these measures can provide a more accurate indicator of body fatness, they can be expensive, intrusive, may rely on more complex technologies that may not be available, and are difficult to standardize. Additionally, other assessments such as physical activity, dietary intake, and family history can be completed to further determine if excess fat is a concern for the child. One benefit of BMI is health professionals are able to make comparisons over time, regions, and population subgroups due to the widespread and long-standing use of BMI within a variety of published data (CDC BMI for Practitioners, n.d.). On the other hand, the accuracy of BMI as an indicator of adiposity among children varies due to the degree of fatness. Research shows BMI is a good indicator for children with excess adiposity; however, problems due to fat-free mass are seen most among thinner children. Overall, based on the challenges and benefits of BMI measurement, it is good screening tool; yet, results should be taken with caution due to racial, age, sexual maturation, and gender differences among children.

Toddler Dietary Recommendations

Dietary recommendations are set for both children and adults. Specifically, **Table 2** indicates recommended macronutrient portions for children 2 to 3 years old and 4 to 8 years old. Additionally, half of the total consumption of carbohydrates for all children is recommended to be whole grain (USDA, n.d.). These recommendations from the USDA are based on children who get less than 30 minutes of daily moderate physical activity. Thus, children who are more physically active may be able to consume additional calories.

Table 2. Dietary Recommendations for Children (USDA, n.d.).

Age Group	**2 to 3 years old**	**4 to 8 year old**
Food Group	**Portion**	**Portion**
• Fruit	1 Cup	1 to 1.5 Cup
• Vegetable	1 Cup	1 to 1.5 Cup
• Carbohydrate	3 ounce equivalent	5 ounce equivalent
• Protein	2 ounces	4 ounces
• Dairy	2 Cup	2 ½ Cup
• Fat/Oil	3 tsp	4 tsp

Calorie differences are larger between genders as age increases. **Table 3** helps illustrate the estimated caloric needs of children 2 to 3 years old and boys and girls aged 4 to 8 years old in relation to physical activity level. However, the only calorie difference for older children is for boys who are highly active.

Table 3. Estimated Calorie Recommendations for Young and Older Children (IOM, 2002).

		Physical Activity Level		
Gender	**Age**	**Sedentary**	**Moderately Active**	**Active**
	2 to 3 years old	1,000 to 1,200	1,000 to 1,400	1,000 to 1,400
Female	4 to 8 years old	1,200 to 1,400	1,400 to 1,600	1,400 to 1,800
Male	4 to 8 years old	1,200 to 1,400	1,400 to 1,600	1,600 to 2,000

The estimated needs are based on Estimated Energy Requirement (EER) equations, using average reference heights and healthy reference weights for each specific age group (Institute of Medicine [IOM], 2002). From both **Table 2** and **Table 3**, portion sizes of macronutrient groups and total amount of calories recommended in relation to physical activity slightly increase with age and are independent of sex in older children. Furthermore, children 1 to 3 years old are recommended to consume 45 to 65% of calories from carbohydrates, 5 to 20% from protein, and 30 to 40% from fat (IOM, 2002). Older children, aged 4 to 18 years old are recommended to consume the same percentage from carbohydrates as younger children; yet, have differences

minor differences in fat and protein needs. Thus, protein increases to 10 to 30% and fat slightly decreases to 25 to 35%. These current recommendations are important to consider when analyzing toddler food trends.

Toddler Food Trends

Over the past 20 years, there has been an increase in foods high in fat, sodium, and added sugars including savory snacks, pizza/calzones, sweet snacks and candy, mixed Mexican dishes, and fruit juice consumed by children aged 2 to 6 years old. One positive trend is the increase in fruit intake from 43% to 62%. Overall total energy increased by 109 calories, from 1475 calories to 1584 calories (Ford et al., 2013). In comparison to current caloric needs, the study reveals children are consuming too many calories, especially the younger age group. Study findings were based on five nationally representative surveys of the dietary intakes of 10,647 children aged 2 to 6 years old between the years of 1989 to 2008. To ensure comparability among the five studies, a single 24-hour recall was used for participants (Ford et al., 2013).

Across a broader age range, dietary intake was collected through a single 24-hour recall of children aged 2 to 18 years old (n=7332) in the 2003-2006 NHANES (Keast, Fulgona, Nicklas, & O'Neil, 2013). In relation to macronutrient intake, the top protein sources consisted of milk, poultry, beef, and cheese. Soft drinks, breads and rolls, sugary foods or candy, dessert items, and fruit drinks are the top consumed carbohydrates. Top choices for fat intake consist of cheese, crackers/popcorn/pretzels/chips, milk, oils and other fats, and dessert items. Overall, the two most common sources of energy came from milk including whole, reduced fat, and fat free and dessert items; specifically, cake/cookies/quick bread/pastry/pie.

More specifically, food consumption patterns of over 1,400 children aged 2 and 3 years old were evaluated from a 24-hour recall collected from the Feeding Infants and Toddlers Study (FITS) in 2008 (Fox, Condon, Briefel, Reidy, Deming, 2010). In comparison to Ford et al. (2013) and Keast et al. (2013), the age range is more specific to the projected topic. The article examined all foods group but did not address protein intake specifically.

As seen in **Table 4**, the majority of milk consumed was 2%, followed by whole, 1%, and skim (Fox et al., 2010). Though not shown, patterns reveal a decrease in whole milk to a low-fat or fat-free choice from 21 to 48 months. This coincides with the recommendation to switch from whole milk to lower fat milk choices with an increase in age (Gidding et al., 2006). Moreover, **Table 4** reveals the top five fruit and vegetables consumed among children. About 70% of toddlers consume vegetables at least once a day with the top vegetable in a fried form (i.e. French Fries). About 87% of children consume one fruit portion or 100% juice per day. From the data, the level of fruit consumption is consistent with current recommendations; however, vegetable consumption ranges between 50 to 80% of recommended intake. Finally, children consume a wide variety of grains. Based on **Table 4,** children consume more whole grain breakfast cereal than not whole grain; yet, the opposite is shown for bread and roll choices. Other common sources of grains consist of pastas, grains in mixed dishes such as sandwiches, pizza, or spaghetti, crackers, etc.

About one quarter of children consume salty snacks including potato chips, cheese puffs, tortilla chips, and other chips or snack options. Similarly from Keast et al. (2013) a large amount of energy is from nutrient-dense choices. Based on the information from **Table 4,** 46% of children, overall, consume sweetened beverages with fruit-flavored drinks being the most common. Nearly 68% of 2 year olds and 74% of 3 year olds consumed some type of dessert or candy every day. Of the desserts consumed, 50% of children consumed some type of cake, pie, cookie, or pastry. To put into a greater perspective, any type of sweetened beverage, dessert or other sweet was more commonly consumed than vegetables (Fox et al., 2010).

Table 4. Food groups consumed by children, aged 2 and 3 years old (n=1,461) (Fox et al., 2010).

Food Group	Percentage
MILK	
• Whole	32.6%
• 2%	39.6%
• 1%	14.6%
• Skim	9.3%
VEGETABLES	
Any Vegetable	***70%***
1. French Fries	18.5%
2. Cooked Green Beans	10%
3. Cooked Corn	9.9%
4. Cooked Broccoli	9.5%
5. Mashed/Whipped Potatoes	7.7%
FRUIT	
Any Fruit or Juice	***86.5%***
1. Fresh Apple	23.4%
2. Fresh Banana	22.6%
3. Fresh Grapes	17.3%
4. Fresh Strawberries	9.3%
5. Canned Applesauce	6.8%
GRAINS	
Any Grain or Grain product	***97.7%***
Breakfast Cereal	54.9%
• Whole Grain	39.3%
• Not Whole Grain	17.5%
Breads/Rolls	35.6%
• Whole Grain	9.2%
• Not Whole Grain	27.8%
SWEETS, BEVERAGES, DESSERTS, SALTY SNACKS	
Any type of sweetened beverage, dessert or sweet	***85.8%***
• Sweetened Beverages	46.1%
• Cake, pies, cookies, & pastries	49.6%
• Salty Snacks	20.5%

Over the past two decades there are trends that may reflect some of the changes seen in children's food and beverage intake such as the increase in the number of meals consumed

outside the home (Keast et al., 2013). Currently, based on research, toddler's diets are lacking in fruits and vegetables and they are consuming too many sweetened beverages, savory snack foods, and dessert items (Ford et al, 2013; Keast et al., 2013; Fox et al., 2010; Xu et al., 2013). Xu et al. (2013) found that it is likely children are not meeting the recommendation for fruit and vegetable consumption even though fruit intake is higher and closer to meeting recommendations than vegetables. Thus, children consume a large portion of their total energy intake primarily from energy-dense, low-nutrient food groups. Overall, this can lead to poor diets and promote excess weight gain and potentially lead to childhood overweight and obesity.

Parenting Styles

General parenting styles (or parenting styles) refer to various attitudes and beliefs that depict the environmental and emotional climate between the parent and child across different contexts (Darling & Steinberg, 1993; Rhee et al., 2006; Blissett, 2011). Overall, parenting styles help describe how parents interact with their children as well as help display how receptive a child is to their parents demands (Hennessy et al., 2010). Authoritative, authoritarian, permissive are the first three parenting styles first described by Baumrind (1971). Maccoby and Martin (1983) later modified the construct by adding another category (i.e. uninvolved) as well as two other dimensions: warmth (responsiveness) and control (demandingness). Responsiveness refers to the amount of emotional warmth, affection, acceptance, and involvement parents portray; whereas, demandingness refers to parental control, demands relating to maturity, and parental supervision. Some common measurements to assess parenting styles are the Parenting Style Dimensions Questionnaire (PSDQ) (Blissett & Haycraft, 2008), Parenting Dimension Inventory (PDI) (Olvera & Power, 2010), Child Rearing Practices Report (Chen and Kennedy, 2005), and maternal sensitivity measured through videotapes (Rhee et al., 2006).

Authoritative

Authoritative parenting (high demandingness/high responsiveness) is characterized by parental involvement, affection, and nurturance as well as high expectations within a structured

and respectful setting, and is correlated with increased child self-control and maturity (Darling & Steinberg, 1993; Maccoby & Martin, 1983). In consideration to each style, the majority of research (Rhee et al., 2006; Blissett & Haycraft, 2008) indicates parents with an authoritative parenting style acknowledge the child's needs as well as maintaining clear limits and boundaries with their child. This is considered the most ideal parenting style and associated with the most positive and improved developmental outcomes in self-esteem, social-cognitive skills, academic achievement, risk-taking behaviors, and dietary health habits such as increased self-regulatory ability of children (Rhee et al., 2006; Wake et al., 2007; Blissett & Haycraft, 2008).

Authoritarian

Authoritarian parenting style (high demandingness/low responsiveness) is characterized by strict discipline, restriction, and provides low emotional support as these parents are relatively insensitive to their child's developmental needs (Darling & Steinberg, 1993; Maccoby & Martin, 1983; Rhee et al., 2006; Blissett & Haycraft, 2008). In contrast to authoritative parents, authoritarian parents are typically described as 'strict discipliners' and are associated with poorer child outcomes such as lower academic grades. Parents tend to set defined boundaries in relation to what and when their children eat due to their high expectations for self-control (Rhee et al., 2006). Additionally, authoritarian parents may not be sensitive to the child's emotional needs and use high levels of control around feedings such as using forceful and coercive tactics. This could lead the child to learn to eat through external cues versus internal cues.

Permissive

Permissive parenting style (low demandingness/high responsiveness) may have or set low expectations for self-control and discipline in the context of displaying high warmth, sensitivity, and acceptance (Darling & Steinberg, 1993; Maccoby & Martin, 1983). Typically, children of parents with permissive parents have been found to have higher levels of self-confidence but have lower level of self-control in a variety of contexts (Rhee et al., 2006). Contexts may include substance abuse problems, aggressive behavior, and impulsivity (Wake et al., 2007).

Additionally, permissive parents are less restrictive and do not provide as many expectations or guidance to develop effective self-regulation skills allowing the child to have more freedom within their feeding environment, which may lead to poor eating behaviors in the future (Rhee et al., 2006).

Neglectful

Lastly, neglectful parents (low demandingness/low responsiveness), refers to low levels of expectations and sensitivity and little to no involvement with the child (Maccoby & Martin, 1983; Rhee et al., 2006; Darling & Steinberg, 1993). Typically, neglectful parenting is associated with poor and unfavorable child outcomes such as impulsivity, behavioral and emotional problems, high rates of depression, smoking, substance abuse, poor school achievement, and delinquency (Wake et al., 2007; Rhee et al., 2006). Parents tend to not follow through on disciplinary actions and do not provide a healthy level of support and structure for children. Thus, children are in an environment that is less strict, which may allow them more freedom to develop poor self-regulatory skills. Without expectations or limitations, the child may lack the overall guidance needed to develop an effective self-regulation system within an eating context (Rhee et al., 2006).

Parenting Styles and Child BMI

Parenting styles create a framework for children by shaping daily activities, eating behaviors, and emotional functioning. Thus, the ultimate risk of child overweight can potentially be associated with parenting styles. However, research regarding the role of maternal parenting style and risk of childhood overweight and obesity has been mixed among a healthy sample of toddlers and school-aged children. For instance, Agras, Hammer, McNicholas, and Kraemer (2004) did not find a significant relationship between risk of childhood overweight and parenting style among a sample of children (n=150) followed from birth to 9.5 years. Also, Blissett and Haycraft (2008) did not find a significant relationship between maternal or paternal parenting style and child BMI in a small sample of children (n=48). Hennessy et al. (2010) did not find an

association between parenting style and child BMI z-score among 99 parent-child dyads, with children, aged 9-years-old while controlling for multiple demographic variables. Wake et al., (2007) found fathers, not mother behaviors were associated with an increased risk of overweight and obesity among a sample of 4,983 children, aged 4 to 5 year old. In contrast to authoritative parenting style, children had higher odds of being overweight or obese who had fathers with a permissive style and low control; whereas, fathers with higher control were associated with lower odds of childhood overweight or obesity.

On the other hand, Rhee et al. (2006) found a positive association between mothers of an authoritarian, permissive, or uninvolved parenting style and overweight and obesity among 872 children, aged 4.5 years old. Results further indicate of the 11% of children who were overweight, 17.1% of the children were of parents with an authoritarian style, 9.8% of the children were of parents with a permissive style, 9.9% of the children were of parents with a neglectful style, and 3.9% of children were parents with an authoritative mother. Thus, children of authoritarian mothers demonstrated the greatest odds of becoming overweight which may be due to the insensitivity and high demands from the mothers leading to a negative impact on the child (Rhee et al., 2006). Yet, Chen and Kennedy (2005) found a positive relation between BMI and 'democratic' or permissive parenting style among a small sample (n=68) of Chinese-American children, aged 8 to 10 years old. Additionally, there was not any association found between children of mothers with an authoritarian parenting style and childhood overweight or obesity. Additionally, Olvera and Power (2010) examined how parenting styles, at baseline, predicted childhood overweight and obesity 3 years later among a group of low income, Mexican-American children aged 4 to 8 years old. Results indicated children of mothers with 'indulgent' or permissive parenting styles were more likely to be overweight 3 years later than authoritative or authoritarian mothers. In summary, Chen and Kennedy (2005) and Olvera and Power (2010) found a permissive parenting style or low parental control is related to a higher risk of childhood overweight and obesity; whereas, Rhee et al. (2006) found children of mothers of an

authoritarian parent styles were most likely to be overweight or obese. A major difference between these studies is the racial/ethnic group. In Rhee et al. (2006) the majority of children were of a 'white' race; while Chen and Kennedy (2005) focused on Chinese-American children, and Olvera and Power (2010) studies Mexican-American children. Racial and ethnic differences could account for mixed results due to differences in obesity rates and parenting behaviors between the groups.

Though results should be taken with caution, it can be concluded that permissive, uninvolved, and authoritarian parents may be associated with childhood overweight and obesity compared to children of mothers with authoritative parenting styles. As only one study involved toddlers between the ages of 2 to 4 years old, the current research may help emphasize the role of parenting on children's weight outcome.

Parenting Styles, Food Intake, and BMI

When focusing solely on parenting styles, food intake, and BMI, there is a small amount of evidence among younger children, specifically toddlers. The majority of research is found among adolescent children (De Bourdeaudhuij et al., 2009; Kremers et al., 2003; Pearson et al., 2009; Rodenburd et al., 2012; Vereeken, Legiest, De Bourdeaudhuij, & Maes, 2009 & Vereecken et al., 2010; Berge et al., 2010). These studies indicate fruit consumption is highest among adolescents with authoritative parents and authoritative parents make fruits and vegetables more available in the home than neglectful parents. Many studies look at both general parenting style and food-related parenting practices in relation to child dietary outcomes. Among these studies, associations are only found among food-related parenting practices and styles, not general parenting styles possibly due to the broad definition of general parenting styles (Vereecken, et al., 2009; Vereecken et al., 2010). However, there has been research showing a significant overlap between parent feeding practices and parenting styles (Hubbs-Tait et al., 2008; Hennessy et al., 2010). Thus, the research among parenting style, dietary intake, and BMI is both limited among younger children as well as inconsistent among older children.

A 3 year longitudinal study conducted by Lohaus et al. (2009) revealed children of parents with an authoritative parenting style versus any other parenting style had higher levels of positive health behaviors such as higher fruit and vegetable consumption and lower levels of negative health behaviors including poor food choices (i.e. low-grade nutrition), low physical activity, television viewing time, and nicotine and alcohol intake. Chen and Kennedy (2005) found significant correlations among a permissive parenting style and higher sugar intake and poor responsiveness and higher fat intake among Chinese-American children. However, children's BMI was not found to be related to any dietary intakes including higher sugar intake and high-fat. Blissett and Haycraft (2008) found permissive parenting style among mothers and fathers is related to lower monitoring of children's unhealthy food intake. Additionally, Arredondo et al. (2006) wanted to see if parenting style was related to kindergarten to second grade children's healthy eating among Latino families. Results indicate parents who monitor and reinforced healthy behaviors have children who ate more healthy food and less unhealthy foods. The study further shows children of parents who used appropriate disciplinary styles were found to eat healthier foods. Lastly, children of parents who engage in controlling parenting style were found to eat more unhealthy foods.

Moreover, other studies focus on a specific dimension of parenting style such as responsiveness (level of warmth) and demandingness (hostility or level of control). Xu et al. (2013) measured the dimension of responsiveness by focusing on parenting warmth or parental hostility in relation to dietary intake among 2-year-old children. In relation to responsiveness, a parent with high warmth and low hostility is related to greater child self-efficacy; whereas, a parent with low warmth and high hostility is related to lower self-efficacy. Results show the proportion of children consuming at least two servings of vegetables per day is higher among mothers with a high level of parental warmth. Additionally, the proportion of children consuming two or more servings of fruit per day is higher among mothers with a low level of parental hostility. In relation to soft drink and snack consumption at least once per week, children of

mothers with a high parental hostility consumed a higher proportion. Greater self-efficacy revealed a positive association with fruit and vegetable intake and negative association with soft drink consumption. In contrast, Brown et al. (2008) focused on the demandingness dimension; specifically, the role of parental control and pressure to eat among 4- to 7-year-old children. Parental control (overt and covert) was assessed through previously designed tools by Ogden, Reynolds, & Smith (2006) and pressure to eat was assessed by the Child Feeding Questionnaire (CFQ). Overt control can be detected by the child such as how firm or how often the child should eat; whereas, covert control cannot be detected by the child such as not buying 'unhealthy' foods or bringing them into the house. Unhealthy snack intake is related to an increased pressure to eat and decreased level of covert control. Fruit and vegetable intake is related to higher level of covert and overt control over meals and less pressure to eat. In relation to meals, 86% of caregivers use overt control; which is associated with 'unhealthy' eating patterns and increased levels of pressure to eat; on the other hand, covert control is associated with a healthier diet among children versus pressure to eat. Overall, though these two studies focused on one dimension of parenting styles, the studies suggests parenting characteristics (i.e. responsiveness and demandingness) may have an impact on a child's development of dietary behaviors at an early age (Xu et al., 2013; Brown et al., 2008).

Overall, the majority of studies do not indicate a strong link between parenting style, child BMI, and dietary intake. The evidence does lead to the idea that positive environmental predictors such as making fruits and vegetables more available in the home may be related to parenting style (Blissett 2011). Additionally, though the majority of research is among adolescent children, Sleddens, Gerards, Thijs, De Vries, & Kremers (2011) suggest children raised in authoritative homes eat healthier foods, are more physically active, and have lower BMI compared to authoritarian, permissive, and neglectful parenting. Of the longitudinal studies reported in the review, four out of six indicate general parenting at a young age can impact child weight outcomes at a later age as well as support the positive role of authoritative parents on

healthy weight-related behaviors (Rhee et al., 2006; Lohaus et al., 2007; Berge et al., 2010; Olvera & Power, 2010). The measurements used to assess dietary intake and parenting style vary across the literature. For instance, measurements used to assess parenting style look at only certain dimensions and use different terms to assess parenting style; thus, making it difficult to compare results with other studies (Sleddens et al., 2010). Other limitations include sample characteristics and sample size. Despite the lack of consistency, the parent may play a critical role by shaping and molding specific eating behaviors of a child and influencing children's attitude and beliefs about food within their eating environment.

Feeding Styles

Feeding styles refers to the specific emotional climate during feeding situations and how parents interact with their child during feeding and are described as a specific subtype of parenting styles (Hennessy et al., 2010; Blissett, 2011). Similarly, feeding styles are referred to as authoritative, authoritarian, indulgent, and uninvolved and are based on the same dimensions of responsiveness and demandingness, just in the context of eating (Hughes, Power, Fisher, Mueller, & Nicklas, 2005). There is a wide range of feeding characteristics described in each parenting style (Hughes et al., 2008; Blissett, 2011; Patrick et al., 2005; Boucher 2014). For instance, authoritative feeding style is characterized by high expectations of child's dietary and eating habits in combination with parental modeling, communication, providing a warm emotional feeding interaction, and negotiation. Authoritarian feeding style refers to the parent providing strict rules about food intake, high levels of control, using punishments and rewards to get the child to eat, and restriction and forcing the child to eat. Indulgent feeding style is characterized by a 'lax' parent as they do not provide structure, rules or expectations about food and diet but provide high level of nondirective support. Lastly, uninvolved feeding style was less likely to follow through on disciplinary actions, less organized, and a lack of structure and support in an eating context. A common measurement is the Caregiver Feeding Styles Questionnaire (CSFQ) developed by Hughes et al. (2005). Research indicates feeding style may be more predictive of

child's weight status and food intake at a young age (Hennessy et al., 2010; Blissett, 2011; Patrick et al., 2005; Worobey & Trytko, 2014; Hughes et al., 2005; Hughes, Shewchuk, Baskin, Nicklas & Qu, 2008; Boucher, 2014; Frankel et al., 2014).

Feeding Practices

Feeding practices refers to the specific techniques and behaviors used by parents to aid or limit dietary intake of children. Though this may vary by the concern and goals the parent has for their child, behaviors typically include pressure to eat, monitoring of food intake, and use of control and restriction of foods and diet, and using food as a reward or vice versa, parents giving rewards for food intake (Blissett, 2011). Moreover, feeding practices are more responsive to contexts; thus, specific practices may differ among children within the same family depending on gender, age, weight status, and eating habits (Birch & Ventura, 2008). Typically, feeding practices are measured through the Child Feeding Questionnaire (CFQ) developed by Birch et al. (2001). Feeding practices have been found to be associated with dietary intake among children (Blissett & Haycraft, 2008; Wardle, Carnell, & Cooke, 2005). Also, there has been a link between feeding practices, child BMI, and dietary intake. For instance, mothers with an overweight child were found to use more restrictive and pressure to eat practices (Eneli, Trlka, Watowicz, & Lumeng, 2014).

Parenting Styles, Feeding Practices, and Feeding Styles

When reviewing the literature, the definitions of parenting style, feeding practices, and feeding styles can begin to blend together. However, each term has specific measurements and definitions. Specifically, parenting styles focus on the emotional climate that underlies a broad number of parent-child interactions; on the other hand, feeding practices focus on primarily on feeding behaviors and feeding styles focus on specific food-related domains (Darling & Steinberg, 1993). Throughout the literature, there is a significant overlap between parenting style, feeding style, and feeding practices (Blissett, 2011; Blissett & Haycraft, 2008; Hubbs-Tait et al., 2008).

It is most commonly seen that in relation to child development, measures focus on parent-child interaction through general parenting styles; whereas, in relation to nutrition, parent-child food interactions are assessed through parental feeding styles or practices. Hubbs-Tait et al. (2008) aimed to identify how parental feeding practices link to general parenting styles by using the PSDQ and CFQ to assess parental influence on child fruit and vegetable intake, from the child's perspective. Results indicate the measurements used to assess parenting feeding practices (CFQ) predict general parenting styles (PSDQ) in a regression model. These behaviors predict an authoritative parenting style (R^2= 0.21, p=0.000): 3 positive predictors are responsibility, monitoring, and modeling and negative predictors include restriction. Restricting, pressure to eat, and negatively monitoring behaviors significantly predict an authoritarian parenting style (R^2= 0.15, p=0.000). Lastly, restricting and negative modeling and monitoring behaviors predict a permissive parenting style (R^2= 0.08, p=0.000) (Hubbs-Tait et al., 2008).

Likewise, Blissett & Haycraft (2008) assessed the relationship of feeding practices, general parenting styles, and child BMI. The CFQ, PSDQ, and BMI were measured among both mother and fathers of children aged 2 to 5 years old. Interestingly, authoritarian parenting style was not found to be related to feeding practices among mothers or fathers. Authoritative parenting style was related to lower use of pressuring in fathers only. Permissive parenting style was related to lower monitoring of children's unhealthy food intake, greater use of restrictive feeding practices from mothers, and greater pressure to eat by fathers. In the context of eating, Blissett & Haycraft (2008) indicate parents with permissive parenting style are associated with less adaptive feeding practices that can impede the child's development of self-regulation. Further, the best predictor of child BMI is from lower paternal use of pressuring to eat and greater paternal drive for thinness rather than a specific parenting style. Like Hubbs-Tait et al. (2008), the study demonstrates the link between parenting styles and feeding practices.

Most recently, Blissett (2011) reviewed literature examining the relationship between parenting style, feeding style, and feeding practices and fruit and vegetable consumption in early

childhood. The review helps strengthen Blissett and Haycraft (2008) and Hubbs-Tait et al. (2008) results. The review suggests that parenting style may not directly predict parenting practices but may moderate the effect of specific practices among child outcomes. Additionally, the report suggests an overlap between feeding styles and feeding practices in the relation between fruit/vegetable intakes (Blissett, 2011). Overall, there is a constant overlap in terminology among parenting styles, feeding styles, and feeding practices. Thus, terminology needs to be considered carefully when interpreting studies relating parenting styles, feeding styles, or feeding practices to child weight and dietary outcomes among young children.

Summary

Overall, there is a small amount of research over the relationship between parenting style, child BMI, and food intake. The research regarding food intake and BMI is primarily done with adolescents, not toddlers or young school-aged children (De Bourdeauhuij et al., 2009; Kremers, Bruga, de Vries, & Engels, 2003; Pearson, Atkin, Biddle, Gorely, & Edwardson, 2009; Rodenburd, Oenuma, Kremers, & van de Mheen, 2012, & Vereecken, Rovner, & Maes, 2010; Berge, Wall, Loth, & Neumark-Sztainer, 2010). Additionally, research more commonly examines relations among child weight status and parenting style, not including dietary intake (Blissett & Haycraft, 2008; Agras et al., 2004; Wake, Nicholson, Hardy, & Smith, 2007; Rhee et al., 2006; Olvera & Power, 2010). Though parenting style, feeding practices, and feeding style have very different meanings, they are often used interchangeably across the literature. Inconsistencies in results exist due to the confusion between terminology (i.e. parenting styles, feeding practices, feeding styles) and multiple measurements used to assess parenting styles and dietary intake. Overall, the inconsistencies make it difficult to interpret and compare results, especially for young children. What is known is parents do play an important role in shaping a child's health related behaviors associated with risk of overweight and obesity starting at a young age. The current project will explore solely general parenting styles using the PSDQ in the possible association between dietary intake and child BMI. The research intends to clarify what is already

known, focus on parenting style not specific feeding practices and styles, and provide insight among a younger population of children.

CHAPTER III

METHODOLOGY

Research Design

This study assessed parenting style in relation to child macronutrient and caloric intake as well as growth, measured through BMI-for-age of children aged 2.5 to 4 years old. This study was a continuation of a prior longitudinal study that was designed to see if nutrients or toxicants measured at 3 months of age were related to infant's cognitive development at 3, 6, 9 months of age. Families were called back when children were of 2.5 to 4 years of age for the current study. Incentives were given for both infant and toddler data collection sessions, equaling $120. However, data being used for this study was specifically from the toddler visit. This study, as well as the original one, was approved by the Oklahoma State University Institutional Review Board (IRB). The approval copy can be found in Appendix 1.

Sample and Subject Recruitment

There were 132 mother infant pairs in the original sample. Between May 2012 and March 2013, 47 pairs returned to be re-evaluated. Of the original sample, 10 were older than 4 years when the study began and 12 were less than 2.5 years old when the funding expired. Of the remaining eligible pairs, 43% returned. The primary inclusion criteria were infants that were born full term single births with a birth weight between 6.5 to 9.5 pounds and a current weight for age

between the 10th and 90th percentile. Infants must have been primarily breastfed at 3 months when recruited. Infants were excluded if formula intake was more than 28 ounces per week, if the infant was born preterm, low birth weight, or infants born under the 10th percentile of weight for age. Mothers and infants were recruited by researchers going to hospitals to visit breastfeeding classes, by hanging up signs around Stillwater, and by researchers attending social events that mothers of infants commonly attend, and by word of mouth.

Procedures

At the toddler visit, both mother and child's weight and height were measured. Then, the children completed the cognitive and language tests with a research assistant; while, the mother completed the demographic questionnaire and PSDQ. After these were completed, an initial 24-hour recall was completed by a research assistant and arrangements were made for an additional two days to be completed by telephone.

Assessments and Questionnaires

Demographics

Questions included the parent and child's age, parent education for self as well as for partners, household income per month before taxes, marital status, ethnicity of self and biological father, and perception of child's health. Lastly, questions were asked in regards to receiving any federal financial assistance such as WIC. In relation to the demographic data collected, toddler age ranged between 2.55 and 4.11 years, with an average age of 3.22. It should be noted that only one toddler was above 4 years of age. Education data were used from the infant visit versus the toddler visit.

Anthropometrics

Anthropometric data included measuring the height (cm) and weight (kg) of children and mothers to find BMI of each participant. To assess and find BMI of the toddlers, height and

weight were measured by trained research assistants following the methods described in Lohman, Roche, and Martorell, (1988). Height and weight of toddlers were taken twice and averaged to ensure accuracy. Height was measured using a portable stadiometer (Shorr Production, Olney MD, accuracy to 0.1 cm). Both height measurements were recorded twice and were averaged to create a single measure of height. Weight was obtained through a battery powered digital scale (Model 770, Seca, Columbia, MD, accuracy of 100 grams) that automatically averaged multiple measurements. Then, height and weight for the children were converted to age- and gender-specific BMI z-scores by using the WHO Anthro calculator (version 3.2.2, World Health Organization, Geneva, Switzerland). Children under the 5th percentile were categorized as underweight, children between the 5th and 85th percentile were considered 'healthy' or normal weight, children between the 85th and 95th percentile were categorized as overweight, and children over the 95th percentile were categorized as obese (Freedom & Sherry, 2009). A child at the 50th percentile is equal to a z-score of 0. Thus, if above the 50th percentile, there will be higher value than 0.0. The method used to measure child anthropometrics and calculate BMI is the same as used in a multitude of studies (Chaidez, McNiven, Vosti, & Kaiser, 2013; Hughes et al., 2005; Patrick et al,. 2005; Rhee et al., 2006; Hughes et al., 2008; Blissett & Haycraft, 2008; Frankel et al., 2014; Worobey & Trytko, 2014); thus, making it an efficient and consistent way to measure BMI among children. During the returning visit, one toddler was not cooperative and researchers were unable to obtain height and weight. Maternal anthropometrics were gathered at the toddler follow-up visit using the same equipment as was used for the children. Heights and weights of mothers were converted into BMI and classified in the proper BMI category. A BMI less than 18.5 were categorized as underweight, 18.5 and 24.9 were categorized as normal, 25 to 29.9 were categorized as overweight, and over 30 was considered obese (CDC, n.d.). Two mothers were not present at the toddler visit in order to record height and weight.

3-Day Food Recall

Mothers were interviewed at the project visit about what their child ate within the last 24-hour period. To assist with determining portion sizes, visual aids were available. Information obtained from the 24-hour recall was meal or snack time, the specific food item, and different characteristics of the food such as the portion, preparation method, anything extra added to the food item, and where the food was eaten. After the completion of the interview, mothers were asked for permission to contact any other potential caregiver who was responsible for providing food to the child for breakfast, lunch, snacks, or dinner, if needed. The research assistant asked for two additional times to call in order to get an additional two days of recalls. Thus, there was a total of three recalls; one done in person and two done over the phone covering two days within the week and one weekend day within a seven day period. Out of a total of 44 food recalls that were averaged, 4 sets of recalls were averaged based on two 24-hour recalls, versus 3. This was due to researchers not able to contact the caregiver for a third time. If necessary, additional calls were made to other caregivers who may have provided food to the child. To obtain the most accurate results, mothers were sent home with a set of visual aids to help determine the adequate portion size. Mothers were also asked to bring any bottle of medications, vitamins, or oral supplements the child takes on a regular basis. Scans were made of the labels and were used to determine nutrient intakes and help identify any potential food/drug interaction. Dietary data were assessed using the Food Processor Database program (version 10.11.0 ,2012, ESHA Research Salem Oregon) Once trained researchers (master's level dietetic interns students) entered in each food recall, data from the computerized analysis were compared on both individual and group basis to the Dietary Recommended Intakes (IOM, 2002; USDA, n.d.). Percentage of carbohydrate, protein, and fat and percent total calories consumed were assessed. Multiple studies (Chaidez et al., 2013; Ford et al., 2013; Fox et al., 2010; Keast et al., 2013; Worobey & Trytko, 2014) use 24-hour food recalls which were shown to be an effective measure to reflect intake and toddler caloric intake.

Parenting Styles and Dimensions Questionnaire (PSDQ)

To investigate and determine the parenting style among mothers, the PSDQ was administered to all mothers within the study. The PSDQ is composed of 32 questions and parents can fall into 1 of 3 different categories: authoritarian, authoritative, or permissive. This particular PSDQ is a shortened version (Robinson, Mandleco, Olsen, & Hart, 2001) in comparison to the original 62-item questionnaire (Robinson, Mandleco, Olsen, & Hart, 1995). Of the 32-items within the PSDQ, there are 15 authoritative items, 12 authoritarian items, and 5 permissive items. The authoritative items assessed reasoning/instruction (e.g., "I emphasize the reason for rules"), and warmth and support such as if parents are responsive to child's emotional needs, autonomy parenting, and participation (e.g., "I allow my child to give input into family rules"). Authoritarian measures were reflective of verbal hostility, physical coercion such as physical punishments, and non-practical and unreasonable disciplinary actions (i.e. "I use threats as a punishment with little or no justification"). Permissive items all reflect indulgence (e.g., "I give into my child when the child causes commotion about something,") and failure to follow through on disciplinary actions or giving into the child to avoid any unnecessary commotion among the child (e.g., "I find it hard to discipline my child"). All of the questions were answered and based on a five-point scale (1=Never, 2=Once in a while, 3=About half of the time, 4=Very often, to 5=Always). Lastly, the PSDQ has been shown to demonstrate both reliability and validity among preschool and school-aged children (Porter, Hart, & Yang, 2005; Topham et al., 2009; Hubbs-Tait et al., 2008). Internal consistency of the original shortened version authoritarian, authoritative, and permissive subscales was .82, .86, and .64 (Robinson et al., 2001). In the current study, Cronbach's α for authoritarian, authoritative, and permissive subscales were .80, .78, and .42. An additional reliability analysis was ran using the scale if item deleted and use scale item deleted with a standardized *alpha* and the Cronbach α was substantially still lower than the original scale; thus, we did not pursue any further analysis.

Statistical Analysis

For all analysis, IBM® SPSS® Statistics version 20.0.0 was used. Descriptive statistics include frequencies for categorical variables such as maternal income or toddler BMI categories as well as mean and standard deviation (SD) for ordinal variables such as parenting styles, macronutrient groups, and percent of total calories. To analyze the relation between parenting style and toddler growth (question 1) as well as parenting style and toddler macronutrient intake (question 2), parenting style will be assessed using the PSDQ. BMI will be assessed using BMI-for-age and gender z- scores and percentiles. Macronutrient and caloric intake will be assessed using results from a three-day food record. To answer question 1 and 2, bivariate correlations will be performed between each PSDQ subscale scores and toddler BMI as well as each PSDQ subscale scores and total calories, calories per kilogram, and percent carbohydrates (CHO), protein, and fat. To answer question 3, a parenting style identified in questions one and macronutrient and/or caloric intake will be the independent variables and BMI will be the dependent variable. A possible control variable consists of maternal BMI. Significance was set at $p<0.05$.

CHAPTER IV

RESULTS

The data are based on the returning 47 pairs from the original study. This section will describe the sample including demographics, anthropometrics, parenting style subscales scores, and toddler dietary data. Then, the section will report over the two main research questions which were to see if there was a relation between parenting style and toddler BMI and if there was a relation between parenting styles and toddler macronutrient and caloric intake. Lastly, a regression model using parenting style and dietary intake to predict child BMI was tested. Additionally, relations were explored between other cofounding variables and /or possible controls that may help explain toddler's growth and/ or dietary intake.

Demographics

Table 5 summarizes demographic information of the toddler-mother pairs. Just over half of the toddlers were females at 59.6% and 40.4% are males. The majority of toddlers were white (n=41), with the remaining either Native American (n=4) or Asian (n=1). Toddler ages ranged from 2.54 years (929 days) to 4.1 years (1500 days), with an average age of 3.22 years (1176.23 days).

Maternal demographics in **Table 5** consisted of mother's education level, employment status, income level, and marital status. Maternal education was based on the infant visit, not the toddler visit. In regards to education, the majority of mothers had at least some college or higher

level of education with only 2 mothers who had less than a college education. About 1/3 of mothers were employed full time. Level of income varied within the sample: 43.2% of mothers earned between $31K and $60K with the remaining 43.2% earning between $61K and $150K, and only 13.6% earned less than $30K. Essentially, all mothers were married within the sample with a percentage of 97.8 when combining both remarried and first time married mothers. Maternal age, in whole years, ranged from 24 years to 45 years, with an average age of 31.7. Whole years were calculated by mother's date of birth and date of the returning visit.

Table 5. Toddler and Maternal Demographic Results

	n	Percentage
Toddler Gender		
• Female	28	59.6%
• Male	19	40.4%
Toddler Race/Ethnicity		
• Native American	4	8.7%
• Asian	1	2.2%
• White	41	89.1%
Maternal Education		
• Less than High School	1	2.2%
• High School Graduate	1	2.2%
• Some College	16	34.8%
• College Graduate	13	28.3%
• Post Graduate or Above	15	32.6%
Maternal Employment		
• Unemployed	13	28.3%
• Employed- Part Time	17	37.0%
• Employed- Full Time	16	34.8%
Income Level		
• Under 10K-30K	6	13.6%
• 31K-60K	19	43.2%
• 61K-90K	10	22.7%
• 91K-150K	9	20.5%
Marital Status		
• Married, 1st time	41	87.2%
• Single/Separated	1	2.1%
• Remarried	5	10.6%
*Note: 2 mothers did not indicate income level; Other missing toddler and maternal data (race/ethnicity, maternal education, and employment) occurred because father or other caregiver was present		

Anthropometrics

Table 6 summarizes the anthropometric data as both a z-score and BMI percentile taken at the toddler visit. A child at the 50th percentile is equal to a z-score of 0. Thus, if above the 50th percentile, there will be higher value than 0.0. The majority of toddlers in the study were considered healthy or normal weight. This can be further supported by **Table 7**, which shows toddler BMI groups.

Table 6 also summarizes the maternal anthropometric data. As stated in the methods, a BMI less than 18.5 was categorized as underweight, 18.5 through 24.9 were categorized as normal, 25 to 29.9 were categorized as overweight, and over 30 was considered obese (CDC, n.d.). Our results indicate maternal BMI ranged from 17.2 to 46.0, with an average BMI of 25.4. When looking specifically at what BMI group each mother falls into, almost half (46.7%) were considered to be in the normal BMI range. Data of maternal BMI groups can be seen in **Table 7**.

Table 6. Toddler and Maternal Anthropometric Data

	N	Minimum	Maximum	Mean	Standard Deviation
Birth weight (kilograms)	47	2.55	4.14	3.43	.40
Toddlers					
• BMI-for-age z-score	46	-1.18	2.75	.55	.91
• Weight-for-age z-score	46	-1.63	2.96	.06	.99
• Height-for-age z-score	46	-2.81	3.19	-.52	1.11
• BMI percentile	46	11.90	99.70	65.07	25.74
Mothers					
• Weight (kilograms)	45	43.40	115.75	68.39	16.12
• Height (centimeters)	45	149.80	190.20	164.39	7.54
• BMI	45	17.22	46.02	25.36	6.13
Note: one toddler did not assent to measurements; two mothers were not at in-person visit to complete height and weight, father or other caregiver was present					

Table 7. Toddler and Maternal BMI Groups

BMI Groups	N	Percentage
Toddlers		
• Normal Weight	30	65.2%
• Overweight	12	26.1%
• Obese	4	8.7%
Mothers		
• Underweight	4	8.9%
• Normal	21	46.7%
• Overweight	12	26.7%
• Obese	8	17.8%

A correlation was conducted to look at the relation between maternal BMI and toddler BMI z-score and revealed a positive, significant correlation of .324 and a *p*-value of .030. Additionally, looking at the correlation between maternal age and toddler BMI z-score, there was no relationship found with a correlation of .076 and a *p*-value of .614.

The relation between maternal and toddler BMI groups was significant (*Chi Square* =15.413 and *p*-value=.017).Only the mothers who fell into the overweight and obese category had children who were also found to be in the overweight and obese category. Mothers within the underweight category had children who fell into the normal weight category. Maternal BMI was positively correlated (.308) with only toddler carbohydrate calories (*p*-value= .048), but not with any other dietary variable.

Table 8. Contingency Table for Maternal BMI Groups and Toddler BMI Groups

	Maternal BMI Group (N)			
	Underweight	Normal	Overweight	Obese
Toddler BMI Group				
• Normal	4	18	4	3
• Overweight	0	3	6	3
• Obese	0	0	2	2

Toddler Dietary Intake

Table 9 presents toddler average dietary intake data based on 24-hour recalls completed by mothers and other relevant caregivers. There was a wide range of calories consumed (791.1 to 2897.6 calories), with an average of 1559.2 calories. Since only one child was above 4 years-old, toddler dietary intake was compared to Institute of Medicine (IOM) recommendations for children aged 2 to 3 years old versus 4 to 8 years old. IOM (2002) recommends a range of 1,000 to 1,400 calories for children aged 2 to 3 years old, dependent on level of physical activity.

Table 9. Toddler Dietary Intake

	N	Minimum	Maximum	Mean	Standard Deviation
Total Calories (kcal)*	44	791.1	2897.6	1559.2	545.2
Fat	44				
• Calories		233.9	1066.4	512.1	236.2
• Percentage		24.3%	45.1%	31.6%	5.2%
Protein	44				
• Grams		27.4	466.4	62.8	64.5
• Calories		109.7	1865.7	251.2	257.9
• Percentage		8.4%	18.7%	13.9%	2.7%
Carbohydrates (CHO)	44				
• Grams		115.85	491.2	213.4	76.7
• Calories		463.4	1964.9	853.6	306.8
• Percentage		41.06%	65.6%	54.4%	5.3%
*Total calories are based on a 3-day average of 3 separate 24-recalls					

Thus, the 3-day calorie average is slightly higher than the IOM recommendation for 2- to 3-year-old children as 45.5% of toddler consumed over 1,400 calories; while, 9.1% consumed less than the recommended 1,000 calorie recommendation. Also seen in **Table 9** are the range and mean of calories and percentage from fat, protein, and carbohydrates within the children's diet. All mean macronutrient percentages are consistent with IOM (2002) dietary recommendations for children 1 to 3 years old. IOM (2002) recommendations include 45 to 65% of calories from carbohydrates, 5 to 20% from protein, and 30 to 40% from fat (IOM, 2002). However, when looking at each individual toddler, not all met the recommendation for fat intake

with 45.5% of toddlers consuming less than 30% and 9.1% consuming higher than the recommendation of 40% fat. All children met the recommendations for protein percentage and only 2 did not meet recommendations for carbohydrates percentage; however, the percentage was close to 45%. Lastly, there was no relationship found between maternal age and toddler total calorie intake with a correlation of -.108 and *p*-value of .486. An additional analysis of variance was done to look at toddler dietary intake and toddler BMI groups to look at if there was any relationship between groups. However, there was no relationship among any categories of toddler dietary intake and toddler BMI groups. See **Appendix 2, Table 15** for statistical values.

Parenting Style Dimensions Questionnaire

Table 10 summarizes the PSDQ subscale scores completed by mothers at the toddler visit. Subscale scores were based on a scale of 1 to 5, with 1=Never, 2=Once in a while, 3=About half of the time, 4=Very often, and 5=Always. Mothers scored highest on authoritative parenting style, with a mean score of 4.08. Following was permissive parenting style with a mean score of 1.97, then authoritarian parenting style mean score of 1.56. Theoretically, the higher the mother scores reflect a greater frequency of specific behaviors related to each parenting style. Additionally, an analysis of variance was completed to look at parenting style scores between toddler BMI groups. Paired sample t-tests were conducted for each pair of parenting styles and indicated a significant difference for each comparison of parenting style mean scores. Authoritative parenting style subscale scores were statistically higher than permissive and authoritarian style subscale scores ($p < .000$) and authoritarian parenting style subscale scores were statistically lower than permissive subscale scores ($p < .000$). There was no significant relationship found between BMI groups in mean authoritative parenting style scores ($f = 1.069$, p-value =.352), authoritarian parenting style scores ($f=2.239$, p-value = .119), or permissive parenting style scores ($f=.704$, p-value= .500).

Table 10. PSDQ Scores

Parenting Style	N	Minimum	Maximum	Group Average	Standard Deviation
Authoritative	47	3.27	4.87	4.08	.37
Authoritarian	47	1.00	2.50	1.56	.32
Permissive	47	1.20	3.20	1.97	.40

Correlation between Parenting Style and Toddler Growth

Table 11 summarizes the correlations between parenting style and child BMI. As seen in **Table 11**, there were no significant relations between any of the three parenting style categories, BMI-for-age z-score, and BMI percentiles. It should be noted that there was a positive, significant correlation of .324 with a *p*-value of .030 between maternal BMI and toddler BMI-for-age z-score.

Table 11. Parenting Style and Toddler Growth Correlations

Parenting Style		BMI-for-age z-score	BMI percentile
Authoritative	Pearson Correlation Sig. (2-tailed) N	.024 .875 46	.055 .716 46
Authoritarian	Pearson Correlation Sig. (2-tailed) N	-.121 .422 46	-.227 .130 46
Permissive	Pearson Correlation Sig. (2-tailed) N	.134 .376 46	.055 .715 46

Relations between Toddler BMI groups and Demographic Variables

Maternal marital status, employment, and education level data were examined to see if there was any relation with toddler BMI groups. There was no relationship found between toddler BMI groups and marital status (*Chi Square* = 4.347 and *p*-value- = .630). Additionally, there was no relationship between toddler BMI groups and maternal employment status (*Chi Square*=4.688 and a *p*-value=.321). Lastly, there was no relationship found between toddler BMI group and maternal education (*Chi Square* =6.470 and *p*-value=.595).

Correlation between Parenting Style and Toddler Dietary Intake

Table 12 summarizes the correlations between each parenting style, total calories, and fat, protein, and carbohydrate calories. A significant, positive correlation was found between mothers who scored higher on the permissive scale and toddler intake of fat, carbohydrate, and total calories. There was no significant correlation found between either authoritative or authoritarian parenting style subscale scores or total or individual macronutrient calorie intake. Additionally, when looking at the relation between each permissive subscale item, macronutrient variables, and toddler BMI z-score and percentile, only one permissive item was found to be positively correlated (.611) with protein calories (*p*-value=.020). The permissive item was "threatens child with punishment more often than actually giving it" (Robinson et al., 2001).

Table 13 summarizes the correlations between each individual parenting style and macronutrient percentages. There was no significant correlation found between authoritative and authoritarian parenting style in relation to fat, protein, and carbohydrate percentage of intake. However, parents with a higher permissive parenting style subscale score had children who ate less protein as a percentage of total intake.

Table 12. Parenting Style and Toddler Macronutrient Intake Correlations

Parenting Style		Total kcal	Fat kcal	Protein kcal	CHO kcal
Authoritative	Pearson Correlation Sig. (2-tailed) N	-.146 .344 44	-.142 .357 44	.134 .386 44	-.188 .221 44
Authoritarian	Pearson Correlation Sig. (2-tailed) N	.192 .212 44	.250 .102 44	-.246 .107 44	.178 .248 44
Permissive	Pearson Correlation Sig. (2-tailed) N	**.422*** **.004** **44**	**.401*** **.007** **44**	-.107 .488 44	**.456*** **.002** **44**
*Correlation is significant at the .05 level (2-tailed)					

Table 13. Parenting Style and Toddler Macronutrient Percentages

Parenting Style		Fat %	Protein %	CHO %
Authoritative	Pearson Correlation Sig. (2-tailed) N	-.014 .930 44	.277 .069 44	-.130 .40 44
Authoritarian	Pearson Correlation Sig. (2-tailed) N	.187 .224 44	-.193 .210 44	.084 .587 44
Permissive	Pearson Correlation Sig. (2-tailed) N	.147 .340 44	**-.405*** **.006** **44**	.065 .676 44
*Correlation is significant at the .05 level (2-tailed)				

Linear Regression Model predicting Toddler BMI and Macronutrient Intake

Several linear regression models were tested based on the significant results found between permissive parenting style score and macronutrient intake. First, a linear regression model was created to look at if permissive parenting style and total calories predicted toddler BMI-for-age z-score. However, no significance was found with a *p*-value of .575. Other linear regression models were created to look at potential relationships. For instance, a linear regression model was created using toddler BMI z-score as the dependent variable and each parenting style score and maternal BMI as predictors and still no significance was found ($p = .210$). Another linear regression was created with total calories as the dependent variable and each parenting style score and maternal BMI as the predictors. The model was not found to be significant with a *p*-value of .066.

Finally, significance was found when creating another linear regression with total calories as the dependent variable and only permissive parenting style scores and maternal BMI as predictors with a p-value of .014. Yet, as seen in **Table 14**, only permissive parenting style score was a significant predictor of total calorie intake of toddlers, not maternal BMI.

Table 14. Linear Regression Predicting Toddler BMI and Macronutrient Intake

Outcome Predictors				Coefficients			
	ΔR^2	**Df**	***P***	**β**	**B**	**SE**	***P***
Total Calories	.197	2, 39	**.014***				
Maternal BMI				.151	13.36	12.99	.310
Permissive Parenting				.385	522.22	199.46	**.013***

CHAPTER V

DISCUSSION

Summary

The objective of this study was to examine the relations among maternal parenting style, macronutrient and total calorie intake, and growth in toddlers, aged 2.5 to 4 years old. The toddlers had mothers who were white, and well-educated, 54% earned more than $41K, were employed either part- or full-time, and were married. Over half (59.6%) of the toddlers were females. Moreover, toddler age ranged from 2.54 years to 4.1 years, with a mean age of 3.22 years. Even though the majority of children had a normal BMI, 26.1% were classified as overweight and the remaining 8.9% were classified as obese. Toddlers consumed, on average, 1559 calories per day. The majority of toddlers met percentage recommendations for carbohydrate and protein intake; however, not all toddlers met the percent recommendation for fat. Almost half of toddlers met the recommendation for fat consuming between 30 to 40% of calories as fat.. Overall, though there were few significant correlations found within the study; there were very interesting findings between permissive parenting style subscale scores, toddler dietary intake, and growth.

Research Questions

The questions the research is aiming to answer include:

1. What is the relation between parenting style and toddler BMI?

2. What is the relation between parenting style and macronutrient and caloric intake?
3. Using results from question 1 and 2, the specific regression model tested was to see if permissive parenting style and total calories predicted toddler BMI-for-age z-score.

Hypothesis Number 1

The first null hypothesis was parenting style subscale scores and toddler growth measured in BMI-for-age z-score and percentile are not related. For BMI-for-age z-score, there was no significant correlation found among authoritative, authoritarian, or permissive parenting style score with a *p*-value of .875, .422, and .376. Moreover, there was no correlation found between BMI percentile and authoritative, authoritarian, or permissive parenting style with *p*-values of .716, .130, and .715. Thus, the non-significant findings fail to reject the null hypothesis.

Hypothesis Number 2

The second null hypothesis was parenting style subscale scores and toddler macronutrient and total calorie intake are not related. Results indicated no correlation between authoritative parenting scores and fat, protein, carbohydrate, or total calories (*p*-value=.36, .39, .22, .34) and calories represented in percentage for fat, protein, or carbohydrate intake (*p*-value=.93, .07, .40). Additionally, there was no correlation seen among authoritarian parenting style scores and fat, protein, carbohydrate, or total calories (*p*-value=.10, .10, .29, .21) and calories represented in percentage for fat, protein, or carbohydrate intake (*p*-value=.22, .21, .59). However, the permissive parenting style subscale score was positively correlated with toddler intake of fat, carbohydrate and total calories with *p*-values of .007, .002, and .004 and a negative correlation between permissive parenting style scores and protein percentage with a *p*-value of .006. Based on the results, we reject the second null hypothesis.

Hypothesis Number 3

Lastly, a final hypothesis was developed and tested using regression modeling to see if permissive parenting style subscale scores and toddler total calorie intake will predict toddler

growth measured in BMI-for-age z-score. However, we fail to reject the null hypothesis, as the linear regression model was not significant with a *p*-value of .575. Additional linear regression models were created with multiple predictors utilized and only permissive parenting style scores were an important predictor of toddler total calorie intake, not maternal BMI or other parenting style subscale scores.

Discussion: Relationship of Findings to the Literature

Parenting Style and Toddler Growth

No correlation was found between any parenting style subscale score and toddler BMI z-score within our study. In relation to other research, Agras et al. (2004) and Blissett and Haycraft (2008) did not find a significant relationship between parenting style and toddler weight possibly due to the small sample size. Yet, Rhee et al. (2006) did find a significant relationship between parenting style, specifically authoritarian and permissive parenting style and increase risk of overweight or obesity, with a relatively larger sample (n=872) than both Agras et al. (2004) (n=150), Blissett and Haycraft (2008) (n=48), and the current study (n=47). In terms of specific parenting styles, Chen and Kennedy (2005) found permissive parenting style was positively related to childhood overweight/obesity and Olvera and Power (2010) found children with mothers with a permissive parenting style were more likely to be overweight 3 years later. Though sample size has a large effect on power, there are also other possible reasons as to why no relationship was found such as the young age of the children in the current study as well as possible demographic variables discussed later.

Parenting Style and Toddler Dietary Intake

In relation to parenting style, many studies focus on specific dimensions of child's dietary intake such as looking at a specific food group (i.e. fruits, vegetables, or sugar intake) or focus on a specific dimension of the parenting style which may reflect a significant relationship. Despite the small sample size and low risk group in this study, permissive parenting scores were found to be positively correlated with toddler dietary intake of fat, carbohydrate, and total calories and

negatively correlated with protein percentage. Moreover, permissive parenting in previous studies was also found to be related to child dietary intake (Chen and Kennedy, 2005; Blissett and Haycraft, 2008). Chen and Kennedy (2005) found permissive parenting style was correlated with higher sugar and fat intake in 8- to 10- year-old children,; while, Blissett and Haycraft (2008) found permissive parenting style was related to lower monitoring of children's unhealthy food intake in children aged 24 to 59 months, or 2 to 5 years old. Overall, despite the age differences in each of these studies and concerns for reliability and consistency of measurements, a common trend is still found with permissive parenting style and dietary intake among young children. Further, it is a possibility that a correlation between parenting style and child weight status may emerge at a later age since a significant correlation was found between dietary intake and permissive parenting style.

Parenting Style, Toddler Dietary Intake, and BMI

To answer the last question, a linear regression model was created to see if permissive parenting style and total calories predicted toddler BMI-for-age z-score. However, no significance was found with a *p*-value of .575. From there, other regression models were created. From this, our study found only permissive parenting style subscale scores was a significant predictor of total calorie intake of toddlers, not maternal BMI. Maternal BMI was used as a control variable since our study revealed mothers who were listed in the overweight or obese category also had children in the same category. Interestingly, when looking at the relation between maternal BMI and each macronutrient variable, only carbohydrate calories was positively correlated with maternal BMI. Thus, maternal BMI may not be a strong indicator of child's total calories like permissive parenting style subscales were; yet, maternal BMI does relate with one part of the child's diet. Though discussed later, the specific foods and carbohydrate foods consumed play a major role.

Lastly, when looking at the relation between each permissive subscale item, macronutrient variables, and toddler BMI z-score and percentile, only one permissive item was

found to be positively correlated (.611) with protein calories (*p*-value=.020). The permissive item of significance was "threatens child with punishment more often than actually giving it" (Robinson et al., 2001). Though this is a broad statement, it could possibly mean 'threatening' the child in an eating environment but not actually following through on the food-related punishment. It is possible parents threatened children in terms of the types of 'protein' foods such as milk, cheese, or meat items. Overall, the relation between parenting style, toddler macronutrient intake, and toddler BMI remains unclear and inconsistent, despite the interesting findings within the current study. In a study by Skinner et al. (2001), caregivers were found to play a substantial role in their child's food intake, habits, and preferences beginning at a young age. The significant correlations in the current study between parenting style and dietary variables also suggest mothers do, in fact, play a role in their child's eating environment at an early age.

Demographic Variables

There was no relation found between other potential covariates including marital status, employment, and education level and toddler BMI groups. There was very little variability among ethnic or racial groups within this sample. The majority (89%) of the participants were white with the remaining Asian or Native American. When looking at differences in toddler BMI group and ethnic/racial group, only white toddlers were found to be in the obese group. Although given the racial distribution, this is not surprising due to the lack of race and ethnic groups within the sample Chen and Kennedy (2005) focus on Chinese-American children, Olvera and Power (2010) focuses on Mexican-American children, and Rhee et al. (2006) studies predominately white children. Though each study varies upon race and ethnic differences, permissive parenting style was found to be associated with increased overweight in children.

Moreover, the sample was considered low risk due to the strict inclusion criteria and mothers were found to be well educated, middle to high income, and married. As stated previously, our sample size was small (n=47). In addition to the small sample size, the age of the children could have been too young to see any correlation. It is possible that a correlation may

emerge between parenting style and toddler growth at a later age. Though these demographic findings make it difficult to relate to the general population or to specific minority groups; it may also be beneficial to look at a low-risk sample since most research over toddler weight status is typically based off of high-risk populations.

In relation to overweight and obesity rates, our sample found 26.1% were classified as overweight and 8.7% were classified as obese. Child obesity rates in Oklahoma were based on children, aged 2 to 5 years old, participating in the WIC program (Weedn et al., 2012). Specifically, in Oklahoma, 17.03% of children were overweight and 13.7% were obese when using BMI-for-age measurements (Weedn et al., 2012). Nationally, 22.8% of children 2 to 5 years old were considered overweight and 8.4% were considered obese (Ogden et al., 2014). Despite the differences among each sample, the overweight and obesity rates are very similar; thus, indicating both low- and high-risk groups are at risk for overweight or obesity at a young age. Moreover, though Weedn et al. (2012) presents growth rates among a high-risk sample participating in WIC throughout Oklahoma, it is also valuable to see where healthy toddler and mother pairs fall in terms of growth and dietary intake when considering public health concerns or implications.

Toddler Dietary Recommendations

The study adds to previous studies done looking specifically at the child's diet. Among the sample, 45.5% of toddler consumed over the IOM recommended caloric intake of 1,400 calories for toddler 2- to 3-years-old. Ford et al. (2013) also concluded that children from 2 to 6 year old were also consuming above the recommended calories, especially the younger aged children in the sample. Interestingly, mean average intake for our sample was 1559 calories per day, Ford et al. (2013) found mean caloric intake to be 1584 per day among children 2 to 6 years old, and Reedy and Krebs-Smith (2010) found mean caloric intake to be 1471 among children 2 to 3 years old. However, even though 60% of mothers had a college education or above, 55% made above $41,000, and were employed, children were still exceeding the total calorie

recommendations. When looking specifically at percent recommendations, children met the recommendation for protein and carbohydrate percentage; yet, almost half did not meet the total fat percentage recommendation of 30%. Though our study did not look specifically into food and food groups, other studies did look at specific food groups consumed by young children. It is possible that mothers limited fat intake; yet, did not think about high calorie carbohydrates such as sweetened beverages, fruit drinks, desserts, pastries, sweets and candy, and salty snacks or think about different protein sources. Based on the FITS 2008 data, 86% of children 2 to 3 years old consumed some type of sweetened beverage, dessert, sweets, or salty snack on a daily basis (Fox et al., 2010). Moreover, the top carbohydrates consumed among children 2- to 18-year old consisted of soft drinks or fruit drinks, candy, pastries, pies, and cookies, and yeast breads and rolls. Top protein sources among children 2 to 18 years old consisted of milk, poultry, beef, and cheese (Keast et al., 2013). Additionally, the FITS 2008 found that whole milk consumption decreased from 61% at 21 to 23.9 months to 34% at 24 to 29.9 months. Whole milk consumption decreased further to 27% among 3-year-old children with a transition to 2% milk (Fox et al., 2010). Thus, the transition from whole milk to lower fat milk may possibly contribute to not meeting fat percent recommendations. As seen, there are multiple reasons for not meeting the percent fat recommendations but easily exceeding total calories if energy sources lack nutritional value.

Impact of PSDQ

Lastly, when examining the reliability among each parenting style by using Cronbach's *alpha* (α), permissive parenting style score was low in reliability compared to the range of Cronbach's α scores. Our reliability analysis revealed a Cronbach's α of.42, compared to the original version with a Cronbach's α of .64 (Robinson et al., 2001). Though an additional reliability analysis was run, it still was substantially lower than the original Cronbach α score; thus, permissive parenting style lacks reliability, which makes interrupting the significant data difficult. Even though permissive parenting style subscale scores lacked reliability, this lower

reliability may be due to only 5 items when both authoritative and authoritarian included 10 items or more. Factors that may increase the low reliability include using the PSDQ on such a young age group. One other possibility is this was a self-report, which could play a role in the reliability. It also should be noted that mean permissive parenting style subscale scores were statistically lower than authoritative, yet similar to authoritarian parenting style score; meaning, permissive and authoritarian parenting style behaviors were reported less frequently. Blissett and Haycraft (2008) also used the PSDQ but did not mention their reliability scores, making it difficult to interrupt the results.

Implications for Practice

Toddler Dietary Recommendations

Although the study did not look specifically into specific foods and food groups, the study did show toddlers were consuming, on average 1559 calories per day. Even with a small, well-educated sample of mothers, children were still consuming over the IOM calorie recommendations. Additionally, carbohydrate and protein percent recommendations were met, but not fat percentage recommendations. Also, even though a correlation was not found between parenting style and growth possibly due to the small sample size and age of the toddlers, dietary intake should not be ignored due to its implication for the future health of children. Many studies examining the child's diet conclude with children exceeding calories recommendations and not meeting recommendations for fruit and vegetable consumption (Ford et al., 2013; Keast et al., 2013; Fox et al., 2010; Xu et al., 2013). Nutrition educators should be aware that even a low-risk group of children are consuming, on average, too many calories per day and not meeting fat percentage intake. Educators should provide information on appropriate calorie intake for children and differences within each macronutrient group to teach the nutritional value in different foods. In consideration to parenting, Ellyn Satter (2000) states an important 'Division of Responsibility' between both parent and child. Satter (2000) highlights the importance that "parents are responsible for what, when, and where of feeding" and "children are responsible for

how much and whether he/she eats" (p. 40). Additionally, Skinner et al. (2002) showed that the number of foods liked among children at 2 and 3 years old did not change significantly at age 8 and that new foods were more accepted at a young age versus older. Thus, it is crucial for caregivers to pursue the responsibility of offering children a wide variety of food options at an early age. Well-educated or not, the role of the caregiver on the child's diet plays a crucial role in the development of child dietary preferences and habits starting at a young age.

Limitations

Sample Size and Distribution

The study sample can be seen as a strength in that it represented a low-risk group of mother-toddler dyads and the sample was similar, which allows for ease of interpretation. As previously stated, the sample was healthy with no pregnancy complications, born full-term, and exclusively breastfed. The majority of our toddlers were from mothers that were well educated and high income. However, the small sample size may have contributed to the lack of significant correlations reported in the study. Additionally, the size and characteristics of the sample lacks generalizability to a society as a whole.

Parenting Style Dimension Questionnaire

There are a few limitations with the measurement used to assess parenting style in this study. Firstly, the PSDQ is not a good indicator for toddlers. It is more commonly used among by parents of preschoolers and children in the early elementary school years. Moreover, the PSDQ does not specifically indicate which parenting style a caregiver falls into. Rather, it measures each of the three parenting styles as continuous measures. Lastly, parenting styles were self-reported by the mothers; thus, making it hard to determine if behaviors occurred more or less often. Possibly using other valid parenting style measurements aimed for toddler-parent relationships, focusing on responsiveness or demandingness dimension of parenting style, or observing parents interacting with their child may give a better indication of which parenting style the caregiver most likely presents. Furthermore, significant correlations were found between the continuous

permissive parenting style score and toddler dietary intake; however, permissive parenting style scores had the lowest internal consistency scores; thus, this measure may be lacking reliability during the toddler age range.

Future Research

Further research includes following a larger sample of children for a longer period of time to see if the relationship between parenting style and toddler growth emerges as children get older. Dietary intake was based on calories and percentage from each macronutrient group and total average calories. Further research looking at the specific foods and food groups that are most commonly consumed in each of the macronutrient groups may be beneficial to further understanding the toddler's diet and to see if any additional correlations exist among specific food groups. Moreover, IOM recommendations are based on level of physical activity (sedentary, moderately active, and active), thus, making it beneficial to assess toddlers' level of activity in the future. With permissive parenting style correlated with and a predictor of toddler total calorie intake, more research can be investigated into specific permissive parenting behaviors since the PSDQ permissive subscale consisted of only five items. Additionally, only the PSDQ was used to assess parenting styles among mothers. Observational methods or a more detailed self-report may be more beneficial in predicting parenting styles.

Conclusion

There is a possibility that the sample of young toddlers was a reason why no significant correlations were found within the study, which is consistent with current literature finding parenting style, growth, and dietary intake to be related among adolescents and inconsistent among toddler or school aged children. In conclusion, though the sample was small and consisted of toddlers from mothers who were well educated, middle to high income status, and married, a correlation was seen among permissive parenting style subscales scores with toddler dietary intake. Looking into the relation of parenting style, toddler growth, and dietary intakes among a

low-risk sample gives guidance to public educators that even well-educated mothers need information on appropriate calorie intake for their children.

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APPENDICES

Appendix 1: Original IRB Approval

Oklahoma State University Institutional Review Board

Date	Friday, September 28, 2012	Protocol Expires:	9/27/2013
IRB Application No:	AS0783		
Proposal Title:	Maternal Dietary Nutrients and Neurotoxins in Infant Cognitive Development		
Reviewed and Processed as:	Expedited (Spec Pop) **Continuation**		

Status Recommended by Reviewer(s): **Approved**

Principal Investigator(s) :

David Thomas
116 N. Murray
Stillwater, OK 74078

Jennifer Byrd-Craven
116 North Murray
Stillwater, OK 74078

Laura Hubbs-Tait
341 HS
Stillwater, OK 74078

Tay Seacord Kennedy
301 HES
Stillwater, OK 74078

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

X The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

Signature: Shelia M. Kennison

Shelia Kennison, Chair, Institutional Review Board

Friday, September 28, 2012
Date

Appendix 1 continued: IRB Approval for Continuation of Project

Oklahoma State University Institutional Review Board

Date:	Tuesday, April 03, 2012	Protocol Expires:	10/9/2012
IRB Application No:	AS0783		
Proposal Title:	Maternal Dietary Nutrients and Neurotoxins in Infant Cognitive Development		
Reviewed and Processed as:	Expedited (Spec Pop) **Modification**		

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s):

David Thomas
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Stillwater, OK 74078

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Laura Hubbs-Tait
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The requested modification to this IRB protocol has been approved. Please note that the original expiration date of the protocol has not changed. The IRB office MUST be notified in writing when a project is complete. All approved projects are subject to monitoring by the IRB.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

The modification request to add a question about pregnancy to the mother's anthropometrics data collection is approved.

Signature :

Shelia Kennison, Chair, Institutional Review Board

Tuesday, April 03, 2012
Date

Appendix 2:

Table 15. Analysis of Variance between Toddler Dietary Intake and Toddler BMI Groups

Dietary Intake	F	P-value
Calories		
• Total	2.283	.115
• Fat	2.774	.074
• Protein	.486	.619
• Carbohydrates	1.121	.336
Percentage		
• Fat %	1.485	.239
• Protein %	.142	.868
• Carbohydrate %	1.401	.258

VITA

Mallory Ann Crutchfield

Candidate for the Degree of

Master of Science

Thesis: THE RELATIONSHIP BETWEEN PARENTING STYLES, DIETARY MACRONUTRIENT INTAKE, AND BMI IN TODDLERS

Major Field: Nutritional Sciences

Biographical:

Education:

- Graduated from Tulsa Memorial High School, in Tulsa, OK, May 2009.
- Completed the requirements for the Bachelor of Science in Nutritional Sciences with an emphasis in Dietetics at Oklahoma State University, Stillwater, Oklahoma in 2013.
- Completed the requirements for the Master of Science in Nutritional Sciences at Oklahoma State University, Stillwater, Oklahoma in May, 2015.

Experience:

- Employed by Oklahoma State University, College of Human Sciences as a teaching assistant for Management in Dietetics, Fall 2013 & 2014; Science of Food Preparation, Spring 2014 & 2015; Professional Careers in Dietetics Spring 2014 & 2015; and Food in the Human Environment, Fall 2014.
- Employed by Oklahoma State University, College of Human Sciences, as a research assistant for Oklahoma National Core Indicators Adult Consumer Survey, Fall 2013-Spring 2015
- Dietetic intern for Diabetes Solutions of Oklahoma, Camp Endres, Summer 2013; St. Francis Hospital (management), OSU Medical Center Diabetes Education, Tulsa Health Department, Women, Infants, and Children, and Tulsa Public School, Summer 2014
- Employed by Oklahoma State University Dining Services as a food service student supervisor and employee for Jamba Juice, Fall 2012-Spring 2013; cook and cashier for Johnny Rockets, Fall 2011-Spring 2012 in Stillwater, Oklahoma.

Professional Memberships:

- Academy of Nutrition and Dietetics (AND), AND Behavioral Health Nutrition Practice Group, Oklahoma Student Dietetic Association, North Central District Dietetics Association