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Consumer Perceptions of Child-Friendly Shaped Healthy Fruit and Vegetable Snacks

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CONSUMER PERCEPTIONS OF CHILD-FRIENDLY SHAPED HEALTHY FRUIT AND VEGETABLE SNACKS

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I feel blessed to have been able to achieve this degree and wish everyone who pursues their goals and dreams persistence, perspective, and the ability to take joy in the milestones along the way.

TABLE OF CONTENTS

Page

Page

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

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Fruits and vegetables (FV) are widely recognized as healthful foods by the public, and most individuals are aware of dietary guidance recommendations to consume more FV. However, actual consumption of FV has been and continues to be low in the United States and many other countries, despite public health efforts to change this trend. The sub-optimal intake of FV among children and adolescents is of particular concern due to high nutrient requirements for proper growth and development during these life stages. Fruit and vegetable intake patterns in childhood have been shown to track into later life and may affect individuals' risk for the development of overweight and obesity, as well as risk for chronic diseases such as cardiovascular disease, diabetes, and some cancers.

Children's food intake behaviors are guided by their likes and preferences, which are influenced by many factors such as the taste, appearance, and familiarity of foods. The food industry has capitalized on the direct and indirect purchasing power of children (e.g. children's purchase of items using their own money versus the influence they exert on their caregivers' purchasing decisions) by targeting a large number of foods to children via child-friendly (CF) packaging and "fun" attributes of the foods themselves, such as attractive shapes and colors. The vast majority of these foods are less healthy options such as sweet and salty snack foods and entrees that are high in fat and sodium. To date, a very limited number of healthy fruit and vegetable options targeted specifically to children have been available in the marketplace. Providing ready-to-eat fruit and vegetable snacks in CF shapes may positively influence children's liking of these foods,

which could in turn lead to increased consumption. Also, ready-to-eat CF-shaped fruit and vegetable snacks are a convenient, readily accessible food form that would require no kitchen skills or preparation on the part of the child, all of which are factors that are positively associated with fruit and vegetable intake in children. Price is another important factor in the purchase and consumption of FV; therefore, parents' and caregivers' willingness to pay slightly more for CF-shaped FV as compared to produce items currently available in the marketplace might be an important factor as processing costs would increase the purchase price at least marginally.

A consumer behavior survey and optional taste-test procedure were developed in order to explore children's and adults' consumer perspectives regarding CF-shaped foods, adults' purchasing habits pertaining to CF-shaped foods and pre-cut FV, and participants' sensory assessment of CF-shaped fruit and vegetable snacks. To quantify children's self-reported liking of CF-shaped foods and to examine their sensory perceptions (appearance, taste and texture) of CF-shaped and regular-shaped fruit and vegetable snacks, a child survey was developed and conducted in a large (n=365) convenience sample of children in an urban area of northwest Indiana. Children were asked how much they liked fun-shaped foods, and how fun the shapes of the sample foods were. Next, child participants were offered an optional taste-test of a CF-shaped fruit and/or vegetable or a regular-shaped fruit and/or vegetable, (shape and fruit/vegetable combination were randomly selected by day). Likewise, adults (n=298) were invited to participate in a consumer behavior survey that assessed family demographics, purchasing habits regarding CF-shaped foods and pre-cut FV, and perceived sensory appeal of the CF- and regular-shaped fruit and vegetable snacks. Individuals who declined to taste-test the study foods were asked to visually rate them.

Study results demonstrated that children self-reported a high level of liking for fun-shaped foods, and that children who assessed the CF-shaped FV rated their shape as significantly more "fun" than participants who received and rated the regular-shaped fruit and vegetable samples. Girls reported higher ratings for how "fun" the shapes of the foods were compared to boys (for both CF- and regular-shaped samples). Girls also

reported higher visual appeal and taste ratings for the samples. Parents consistently recognized the CF-shaped fruit and vegetable snacks as CF-shaped foods and adults' average ratings of the visual appeal, but not the taste or texture, of the CF-shaped FV were higher as compared to visual appeal ratings for the regular-shaped FV. Furthermore, a greater percentage of adults stated they were willing to pay extra for the CF-shaped FV as compared to adults who were willing to pay extra for the regular-shaped pre-cut produce. A number of independent variables, including female gender, the presence of children in the home, and frequent self-reported purchase of pre-cut produce and CF-shaped foods were positive predictors of one or more of the aforementioned outcomes. Notably, CF-shaped fruit and vegetable samples were 34% more likely to be selected for taste-test than regular-shaped FV and fruits were more frequently selected than vegetables. Sensory ratings were high among adults and children for both the CF- and the regular-shaped fruit and vegetable snacks.

In summary, CF-shaped FV were perceived as having a "fun" shape by children and were seen as highly visually appealing by adults; they were more likely to be selected for taste-test than regular-shaped pre-cut produce; and, they received high sensory appeal ratings. Furthermore, adults reported willingness to pay a little extra for CF-shaped produce as compared to fruit and vegetable options currently available in the marketplace. These findings indicate that providing CF-shaped fruit and vegetable snacks in grocery stores may be a promising approach for increasing children's purchase requests for FV and their consumption of these foods, contributing to overall diet quality and long-term health benefits.

CHAPTER 1. INTRODUCTION AND REVIEW OF THE LITERATURE

1.1 Objectives

The objective of this research was to explore children's and adults' responses to child-friendly (CF) shaped fruit and vegetable snacks, children's self-reported level of liking of fun-shaped foods, adults' shopping habits regarding CF-shaped foods and pre-cut produce, and adults' willingness to pay a little extra for CF-shaped fruits and vegetables (FV). It was hypothesized that children would report a high level of liking of fun-shaped foods that are currently on the market and that providing FV in CF shapes would increase children's liking of FV, (as measured by ratings of appearance, taste and texture). Among adult participants, it was hypothesized that adults (particularly parents) would be willing to pay extra for CF-shaped produce as compared to produce options that are currently available in grocery stores, and that this would be influenced by their current purchasing habits. In this study, a consumer behavior field survey, actual consumption of FV was not measured. Reported liking served as an antecedent of potential future intake.

1.2 Organization

This thesis begins with a review of the current literature regarding fruit and vegetable intake recommendations for children and adolescents and compares actual intake levels with these recommendations. The nutritional content and health benefits of FV are discussed, as well as potential implications of fruit and vegetable intake on weight status. Predictors of fruit and vegetable intake in children are reviewed. Marketing strategies for foods targeted to children are explored, and the types of foods currently

most often advertised to children are discussed. Finally, the limited body of published research examining the potential and measured effects of using the shaping of foods (e.g. presenting foods in CF shapes or visually appealing arrangements) to promote consumption of FV in children will be discussed.

Chapter two presents a manuscript that summarizes the child-focused data from this research project. These data focus largely on children's attitudes toward CF-shaped foods and their sensory perceptions regarding the study foods sampled. Chapter three presents a second manuscript, currently in review, addressing results of the adult consumer behavior survey. This manuscript includes adults' sensory perceptions of the study foods, discusses consumers' purchasing habits regarding CF-shaped foods and pre-cut produce, and identifies market segments that responded most favorably to the CF-shaped FV that were offered in this study. Detailed methodology is included in both chapters two and three, and a flow chart reflecting the study methodology is presented in Appendix A.

Chapter four provides over-arching conclusions regarding the findings presented in chapters two and three, and a discussion of directions for future research as identified in the process of completing this study.

1.3 Fruit and Vegetable Intake Recommendations for Children and Adolescents

Fruit and vegetable intake is inadequate among children and adolescents in the United States. The disparity between the intake levels that are recommended by the Dietary Guidelines for Americans (DGA) 2010 (1) and actual average consumption becomes increasingly pronounced as children progress from toddlerhood into the school years, and is more prominent for vegetable intake than for fruit (2). The DGA recommendations for FV are translated into specific, quantified guidelines in the United States Department of Agriculture (USDA) Food Patterns (3), and are communicated to the public via MyPlate (formerly MyPyramid) (4). Recommended fruit and vegetable intake levels vary by children's estimated energy requirements, which are based on an

individual's gender, age, and activity level (5). The fruit and vegetable intake recommendations set forth in the USDA Food Patterns specify the total daily quantities of fruits and of vegetables that children should consume (3). Due to the distinct nutritional contributions of different types of vegetables, total vegetable intake recommendations are divided into five sub-categories, namely: dark green vegetables, red and orange vegetables, legumes, starchy vegetables, and other vegetables. Table 1.1 and 1.2 show the DGA's USDA Food Patterns for fruit and vegetable intake for girls and boys ages 2 – 18 years, respectively, accounting for activity level. The Centers for Disease Control and Prevention (CDC) provides a convenient online fruit and vegetable calculator that computes users' recommended number of cups per day of FV according to gender, age and activity level (6). The CDC also provides visual examples of one cup and one-half cup servings of a number of FV to assist individuals in estimating appropriate serving sizes (7).

1.4 Health Benefits of Fruits and Vegetables

Many fruits and vegetables are nutrient-dense foods, rich in vitamins, minerals and fiber yet low in calories (8). The DGA cites the fact that "most vegetables and fruits are major contributors of a number of nutrients that are underconsumed in the United States, including folate, magnesium, potassium, dietary fiber and vitamins A [as beta carotene], C and K" (USDA & HHS, 2010, p. 35) as a primary reason for Americans to increase their intake of FV (1). With the exception of folate, average intake of each of these nutrients is found to be lacking among large proportions of the child and/or adolescent population in the United States (9-11). To illustrate the potential contribution of FV to dietary intake of these nutrients and the important concept of nutrient density, Table 1.3 lists the kilocalorie (kcal), fat, dietary fiber and selected micronutrient content of a number of items from food categories that are top contributors to children's daily energy intake (e.g. yellow cake as an example of a grain-based dessert, spaghetti and marinara sauce as an example of a pasta dish), with the nutritional content of several of the most commonly consumed FV (excluding French fries and 100% fruit juices) (8, 12).

Table 1.1 USDA Food Patterns for Fruit and Vegetable Intake for Girls Ages 2 – 18 Years, by Activity Level

Activity Level	Age	Fruit (cups/day)	Vegetables (cups/day)	Dark-Green Vegetables (cups/week)	Red and Orange Vegetables (cups/week)	Beans and Peas (cups/week)	Starchy Vegetables (cups/week)	Other Vegetables (cups/week)
Less Active	2 – 3	1	1	½	2 ½	½	2	1 ½
	4 – 8	1 – 1 ½	1 ½	1	3	½	3 ½	2 ½
	9 – 13	1 ½	1 ½ - 2	1 – 1 ½	3 – 4	½ - 1	3 ½ - 4	2 ½ - 3 ½
	14 – 18	1 ½	2 ½	1 ½	5 ½	1 ½	5	4
Moderately Active	2 – 3	1	1 – 1 ½	½ - 1	2 ½ - 3	½	2 – 3 ½	1 ½ - 2 ½
	4 – 8	1 ½	1 ½ - 2	1 – 1 ½	3 – 4	½ - 1	3 ½ - 4	2 ½ - 3 ½
	9 – 13	1 ½ -2	2 – 2 ½	1 ½	4 – 5 ½	1 – 1 ½	4 - 5	3 ½ - 4
	14 – 18	2	2 ½	1 ½	5 ½	1 ½	5	4
Active	2 – 3	1 -1 ½	1 – 1 ½	½ - 1	2 ½ - 3	½	2 – 3 ½	1 ½ - 2 ½
	4 – 8	1 ½	1 ½ - 2 ½	1 - 1 ½	3 - 5 ½	½ - 1 ½	3 ½ - 5	2 ½ - 4
	9 – 13	1 ½ -2	2 ½ - 3	1 ½ - 2	5 ½ - 6	1 ½ - 2	5 - 6	4 - 5
	14 – 18	2	3	2	6	2	6	5

Estimated calorie needs per day and USDA Food Patterns data are available at:
http://www.cnpp.usda.gov/USDAFoodPatterns.htm

Table 1.2 USDA Food Patterns for Fruit and Vegetable Intake for Boys Ages 2 – 18 Years, by Activity Level

Activity Level	Age	Fruit (cups/day)	Vegetables (cups/day)	Dark-Green Vegetables (cups/week)	Red and Orange Vegetables (cups/week)	Beans and Peas (cups/week)	Starchy Vegetables (cups/week)	Other Vegetables (cups/week)
Less Active	2 – 3	1	1 – 1 ½	½ - 1	2 ½ - 3	½	2 – 3 ½	1 ½ - 2 ½
	4 – 8	1 – 1 ½	1 ½	1	3	½	3 ½	2 ½
	9 – 13	1 ½ -2	2 – 2 ½	1 ½	4 – 5 ½	1 – 1 ½	4 - 5	3 ½ - 4
	14 – 18	2	2 ½ - 3	1 ½ - 2	5 ½ - 6	1 ½ - 2	5 – 6	4 - 5
Moderately Active	2 – 3	1 -1 ½	1 – 1 ½	½ - 1	2 ½ - 3	½	2 – 3 ½	1 ½ - 2 ½
	4 – 8	1 ½	1 ½ - 2	1 – 1 ½	3 – 4	½ - 1	3 ½ - 4	2 ½ - 3 ½
	9 – 13	1 ½ -2	2 ½ - 3	1 ½ - 2	5 ½ - 6	1 ½ - 2	5 - 6	4 - 5
	14 – 18	2 -2 ½	3 – 3 ½.	2 – 2 ½	6 - 7	2 – 2 ½	6 - 7	5 – 5 ½
Active	2 – 3	1 -1 ½	1 – 1 ½	½ - 1	2 ½ - 3	½	2 – 3 ½	1 ½ - 2 ½
	4 – 8	1 ½ -2	2 – 2 ½	1 ½	4 – 5 ½	1 – 1 ½	4 - 5	3 ½ - 4
	9 – 13	2	2 ½ - 3 ½	1 ½ - 2 ½	5 ½ - 7	1 ½ - 2 ½	5 - 7	4 – 5 ½
	14 – 18	2 ½	3 ½ - 4	2 ½	7 – 7 ½	2 ½ - 3	7 - 8	5 ½ - 7

Estimated calorie needs per day and USDA Food Patterns data are available at:
http://www.cnpp.usda.gov/USDAFoodPatterns.htm

Table 1.3 Select Nutrients Provided By One Serving of Foods Commonly Consumed by Children and Adolescents

Food	Serving Size	Kcal	Fat (g)	Dietary Fiber (g)	Magnesium (mg)	Potassium (mg)	Vitamin A (IU)	Vitamin C (mg)	Vitamin K[1]
Foods from groups that are top contributors to energy intake									
Pizza, Cheese	1 slice (81 g)	**217**	**10.0**	1.8	19	123	277	1.0	5.3
Cake, Yellow (iced)	1 slice (67 g)	**391**	**17.9**	0.3	6	53	108	0.0	6.9
Bread, White	1 slice (28 g)	74	0.9	0.8	7	32	0	0.0	0.1
Spaghetti with Marinara	½ c. (132 g)	65	2.0	2.4	**24**	**421**	**858**	2.6	**18.3**
Cheese Puffs	1.25 oz. (35 g)	**197**	**12.8**	0.6	6	66	56	0.0	0.5
Commonly consumed fruits and vegetables									
Apple (with skin)	1 c. chopped (125 g)	65	0.2	3	6	134	68	5.8	2.8
Banana	1 c. sliced (150 g)	134	0.5	**3.9**	**40**	**537**	96	13.0	0.8
Orange	1 c. sections (180 g)	85	0.2	**4.3**	18	326	405	**95.8**	0.0
Carrots, Raw	1 c. chopped (128 g)	52	0.3	**3.6**	15	410	**21,384**	7.6	**16.9**
Potato, Boiled (w/o skin)	1 cup (156 g)	136	0.2	2.8	**34**	**591**	5	**20.3**	3.3
Broccoli, Raw	1 c. chopped (91 g)	31	0.3	2.4	19	288	**567**	**81.2**	**92.5**

Data available at: http://ndb.nal.usda.gov/ndb/foods.

Note: The top three contributors of each individual nutrient, within the foods listed, are in bold font.

[1]As phylloquinone

Not only do FV serve as rich sources of nutrients necessary for growth, development and optimal health, but they have also been shown to protect against the development of metabolic syndrome, cardiovascular disease, and several different types of cancer (13-19). Individual nutrients that are commonly found in FV, including potassium, beta-carotene, magnesium, vitamin C and fiber have also been identified as having an inverse association with cancer incidence (14). Specific groups of FV may be particularly beneficial in the prevention of certain diseases. For example, dark green and deep yellow vegetables are more strongly associated with an inverse risk of cancer compared to other vegetable sub-groups (16). Some of the beneficial health outcomes of fruit and vegetable intake, such as prevention of metabolic syndrome, are measureable during childhood and adolescence (15, 18). Greater fruit and vegetable intake during childhood also decreases disease risk in adulthood, independent of adult fruit and vegetable consumption habits (17). In light of these findings, and because fruit and vegetable intake tracks moderately through childhood into adolescence and adulthood (17, 20-23), establishing adequate intake of a balanced variety of FV early in life is vital for both short-term dietary adequacy and long-term disease prevention.

Despite a recent plateau in the prevalence of obesity among some subgroups of Americans ages 2 – 19 years and a promising downward trend among children ages 2 – 5 years (24), prevalence estimates are still alarmingly high. Currently, 16.9% of children and adolescents are obese (gender-specific BMI-for-age $\geq 95^{th}$ percentile (25)) and 14.9% are overweight (gender-specific BMI-for-age 85^{th} to $<95^{th}$ percentile) (26). The role of fruit and vegetable intake in the development of overweight and obesity during childhood and adolescence is unclear, and much of the available literature reports correlation-based evidence due to a lack of controlled, longitudinal studies. Objectively quantifying fruit and vegetable consumption relative to the fruit and vegetable intake recommendations and estimated energy needs of the individual is an important factor in assessing this relationship as well. For example, Lorson et al. noted significantly higher total fruit intake among overweight (formerly referred to as at-risk-for-overweight) 2 – 18 year-olds as compared to healthy weight and obese (formerly referred to as overweight) children

and adolescents (27). However, when intake was quantified as the percentage of the MyPlate total fruit intake recommendation, it was noted that obese subjects in this study achieved a significantly lower percentage of their recommended fruit intake as compared to youth in both of the lower weight classification categories.

A review of 23 experimental and longitudinal studies conducted by Ledoux et al. examined the relationship between fruit and vegetable intake and adiposity in children, adolescents, and adults (28). Enhanced interventions (e.g. interventions that incorporated dietary counseling to promote decreased total energy intake (EI) and/or increased physical activity (PA)) were most often successful in achieving weight loss in adult populations. Although the majority of studies in adults indicated at least a weak inverse relationship between fruit and vegetable intake and adiposity, results in children were inconclusive. The authors noted that the impact of fruit and vegetable intake may be mediated by total EI, dietary fiber intake or displacement of energy-dense foods. Additionally, effects are frequently (but inconsistently) observed to differ between males and females, normal-weight and overweight individuals, and by fruit vs. vegetable intake (28).

Dietary energy density and the type of FV consumed (e.g. the influence of 100% fruit juice and white potatoes) are additional factors that appear to be influential when examining the relationship between fruit and vegetable intake and adiposity in childhood (29). When these factors were taken into account, it was reported that children 2 – 8 years old who consumed diets in the lowest quartile of energy density (defined as kcal/g of food) were not only less likely to be obese than children who consumed high energy density (ED) diets, but that they also consumed less fat, less added sugar, and roughly twice as many servings of FV when compared to their highest ED counterparts (29). When 100% fruit juice intake was excluded from the analysis of fruit and vegetable servings consumed, children 4 – 8 years old who consumed the lowest ED diet were found to eat nearly 10 times as many servings of fruit as children who consumed a high ED diet (1.9 cups vs. 0.2 cup) (29).

Due to the fact that food preferences are strong predictors of intake, fruit and vegetable preferences (measured as level of liking for individual FV) and risk for elevated BMI-for-age have been examined and were found to be negatively associated in African-American children (30). Evidence of this nature suggests that efforts to increase children's preference for and liking of FV are potentially highly effective approaches to reduce childhood overweight and obesity.

The development of overweight and obesity is a multi-factorial process and involves many aspects of dietary intake. Dietary patterns that are low in fiber and high in energy-dense foods have been associated with the development of obesity in children (31); as noted above, these energy-dense dietary patterns have also been shown to be low in FV (29). Fruit and vegetable intake tracks over time, in fact, lower fruit and vegetable consumption may track more strongly (32). Therefore, if increased fruit and vegetable consumption – which is known to be associated with numerous health benefits such as reduced risk of certain cancers, metabolic syndrome and heart disease (13, 15-19) – has even moderate potential to decrease the risk for overweight and obesity in children it is prudent to pursue efforts that promote fruit and vegetable intake. Developing positive habits of high fruit and vegetable consumption in children could translate into future generations of adults who are high fruit and vegetable consumers and who in turn have a lower risk of developing overweight, obesity, and chronic disease across the life span.

1.5 Fruit and Vegetable Intake Levels in Children and Adolescents

In light of the governmental recommendations for increased fruit and vegetable intake and the health benefits associated with greater fruit and vegetable consumption, the question at hand becomes "why are children and adolescents not meeting intake recommendations for FV?" Average fruit intake is sub-optimal in children and adolescents, and vegetable intake falls even further from recommended levels. Krebs-Smith et al. utilized dietary intake data from the 2001-2004 National Health and Nutrition Examination Survey (NHANES) to determine the percentage of Americans (by age and

gender) who met the minimum MyPyramid (now MyPlate) recommended intake levels for FV (2). The authors reported that 31.5% of 2 – 3 year-old children failed to meet the minimum recommended intake for total fruit. The prevalence of inadequate intake increased to a startling 86.6% among 14 – 18 year-old males and was only slightly lower, at 84.8%, among 14 – 18 year-old females. The disparity between actual and recommended total vegetable intake levels was even more pronounced – 80.3% of 2 – 3 year-olds, 97% of 14 – 18 year-old males, and 98.6% of 14 – 18 year-old females did not meet recommendations. When vegetable intake was examined by sub-group, this trend of decreasing adequacy of intake among older children was observed for each sub-group as well, with the exception of the "other vegetable" category (e.g. avocados, cabbage, green beans, lettuce and onions) (2, 4).

Low consumption of FV is not unique to children in the United States. Canada's Food Guide recommends four servings/day of FV for children 2 – 3 years old, five servings/day for 4 – 8 year-olds, 6 servings/day for 9 – 13 year-olds, and 7 or 8 servings/day, respectively, for females and males ages 14 – 18 years (33). Canada's Food Guide defines one serving as a medium-sized piece of fruit; ½ cup fresh, frozen or canned fruits or vegetables; or, one cup of leafy vegetables (33, 34). Fruit and vegetable consumption trends, estimated using data from the 2004 Canadian Community Health Survey, indicate that these recommendations were met by just 22.3% - 54.2% of children ages 2 – 18 years. Similar to the aforementioned trends observed in the United States, younger children were more likely to have adequate intake (34). Consumption of dark green vegetables and orange fruits and vegetables was low compared to the Canada's Food Guide recommendation of one serving from each of these groups per day, (mean actual consumption of 0.34 – 0.55 serving/day of dark green vegetables and 0.27 – 0.37 serving/day of orange FV). Juice intake ranged from approximately 1.5 to two servings per day and was highest among 2 – 3 year-old children and 14 – 18 year-old males. White potato intake increased with age, contributing just 6% of total fruit and vegetable intake among 2 – 3 year-olds but more than doubling to 13% among 14 – 18 year-old males, (fried potatoes were excluded from the analysis) (34). Fruit and vegetable intake accounted for just 13.9% of total energy intake for Canadians ages 4 – 18 years (35).

Absolute average intake levels are useful in determining how closely children's and adolescents' diets approximate national recommendations. However, diet quality indices, which typically assess the over-all quality of the diet by determining if desirable dietary components meet adequate intake levels and, conversely, if dietary components that should be limited are consumed in moderation, are useful in determining the impact of fruit and vegetable intake on over-all diet quality. Because the total diet quality score is composed of the summed scores of each of the component groups, diet quality indexes can also be used as indicators of the adequacy of individual food groups, such as FV. The Healthy Eating Index (HEI) is one of the most frequently used diet quality indexes; it is designed to assess population-level diets based on adherence to the USDA Food Patterns and DGA recommendations, and has been updated periodically since its development in 1995 to reflect the most current DGA recommendations (36, 37). The HEI specifically accounts for 12 dietary components, nine of which are adequacy components (e.g. total fruit, total vegetables, whole grains and dairy) and three of which are moderation components (e.g. refined grains, sodium, and "empty calories") (37). HEI scores for children ages 2 – 17 years, based on NHANES intake data from 2003-2004 and calculated using the HEI 2005, were low for FV (38). Among children ages 2 – 17, the mean HEI 2005 score, (as a percentage of the maximum possible score) was just 64 for total fruit, 56 for whole fruit, 47 for total vegetables and 12 for dark green and orange vegetables and legumes. The dark green and orange vegetables and legumes group has been replaced in the HEI 2010 to reflect the DGA 2010 guidelines and to focus on vegetable sub-groups which are most acutely under-consumed. This group is now the "greens and beans" component (37). Total fruit and whole fruit scores were significantly lower among 6 – 11 year-olds compared to 2 – 5 year-olds, and decreased further among children ages 12 – 17 years. Total vegetable scores increased slightly among older children (likely due to increased intake of fried potato products), and scores for dark green and orange vegetables and legumes remained relatively stable across age groups. Girls' HEI scores were significantly higher than boys' for total fruit, whole fruit, and total vegetable intake. Hispanic children consistently achieved the highest scores across all fruit and vegetable categories, followed by non-Hispanic blacks and finally non-Hispanic

whites, with the exception of whole fruit intake, for which non-Hispanic blacks received the lowest scores. Interestingly, for total fruit and whole fruit intake, children in the highest family income bracket (≥500% of the federal poverty level) received the highest scores, followed by children in the lowest family income bracket, (≤130% federal poverty level). For total vegetables and dark green and orange vegetables and legumes, HEI scores tended to decrease progressively with increasing family income level. (Note that NHANES uses the U.S. Department of Health and Human Services poverty guidelines which were defined as $8,980 for the first person in a household and $3,140 for each additional person in 2003; in 2004 the guidelines were increased to $9,310 for the first person and $3,180 for each subsequent individual (39).) Similar trends by age, gender, and race were reflected in the total HEI scores (38), suggesting that fruit and vegetable intake influences and indicates over-all diet quality.

The Revised Children's Diet Quality Index (RC-DQI) is a diet quality index that was developed to specifically assess the unique nutritional needs of young children (40). When a nationally representative sample of preschool-age children's diet quality was assessed using the RC-DQI, mean scores (± SE) for fruit intake were 7.1 ± 0.06 and mean scores for vegetable intake were 6.9 ± 0.05, (both out of a maximum of 10 points) (40). In this study population fruit and vegetable scores were much greater in the highest quartile of total RC-DQI scores as compared to the lowest quartile, again supporting the adequate consumption of FV as an important factor in achieving high-quality total dietary intake (40).

Data from the nationally representative Continuing Survey of Food Intakes of Individuals (CSFII) and NHANES have been analyzed to determine trends in children's fruit and vegetable intake over the past 20 years. Interpretation of these data indicate an over-all decrease in fruit juice and vegetable intake among children ages 2 – 18 years between 1989 and 2010 (12). Notably, fried potato consumption declined during this time as well. Fruit intake, which initially contributed 2.5% (mean kcal ± SE = 43 ± 2.7) of total daily caloric intake in 1989-1991, fell to just 1.9% (37 ± 3.2) of intake in 2003-2004 and then rose to 3.1% (53 ± 2.7) in 2009-2010. Most recently, in 2009-2010, fruit

juice contributed an average of 2.6% (47 ± 3.8) of total daily calories, vegetables 0.7% (10 ± 1.3), starchy vegetables and starchy vegetable dishes 1.3% (23 ± 1.0) and fried potatoes 2.1% (mean ± SE 41 ± 4.2). Despite the encouraging upward trend in fruit intake, the significant contribution of energy from fried potatoes and fruit juice are very apparent (12). In fact, Lorson et al. identified French fries and 100% fruit juice as the top contributors to total vegetable and total fruit intake, respectively, among children ages 2 – 18 years (27).

Together, these studies illustrate the fact that fruit and vegetable intake among children and adolescents is poor and that low fruit and vegetable intake plays an important role in the sub-optimal over-all diet quality of American children. Thus, inadequate consumption of FV is a persistent public health issue, with no consistent signs of improvement.

1.6 Determinants of Fruit and Vegetable intake in Children and Adolescents

Rasmussen et al. and Krolner et al. suggest that the cultural, physical, and social environment play roles in influencing children's and adolescents' consumption of FV (41, 42). In a 2006 review of 98 quantitative studies that elucidated determinants of fruit and vegetable intake in children 6 – 18 years old, Rasmussen et al. identified age, gender, socio-economic position, preferences, parental intake, and the availability and accessibility of FV in the home as determinants of intake that have been consistently reported by a substantial number of studies (41). These relationships are supported by the majority of findings from more recent studies as well. Before addressing the influence of each of these factors, it should be emphasized that a number of other factors were found to be impactful – many of which align with theoretical constructs of health behavior, such as nutrition knowledge, attitudes, self-efficacy and subjective norms. However, the number of studies supporting the positive effect of each of these determinants was limited (42). Age was typically found to have either a negative effect (particularly in European children) or no effect on fruit and vegetable intake, although the

authors note that measurement methodology, (such as the use of food frequency questionnaires) could bias these findings. For example, young children may consume FV more frequently throughout the day than older children, but serving sizes may be much smaller. Girls were more often observed to have higher fruit and vegetable intake than boys, a finding that was particularly prevalent in European populations and to a lesser extent in the United States (41). The lack of consistent differences in consumption by gender among children in the United States has also been underscored by NHANES analysis of fruit and vegetable intake among males and females ages 9 – 18 years (2). The average percentage of males and females that fall below minimum MyPlate recommended intake levels varies by age group (e.g. 9 – 13 vs. 14 – 18 years of age) and by the subcategory of fruit and vegetable intake analyzed (e.g. whole fruit or fruit juice and orange vegetables or starchy vegetables) (2). In populations where differences in fruit intake by gender exist, these differences may be mediated by food preferences. Young girls have reported greater liking of fruit than young boys and their intake patterns are congruent with self-reported preferences (43). Indicators of socioeconomic position (SEP) such as family income, parental occupation and parental education level tended to be positively associated with fruit and vegetable intake such that children of lower SEP reported consuming fewer FV. Higher family income is less clearly connected to greater fruit and vegetable intake among children than it is among adults (44). In fact, low-income children may have fruit, vegetable and legume intakes that match or exceed the levels consumed by children from higher-income households (27, 45). Preference for FV is consistently associated with intake in studies that examine this factor (41, 46). Parental intake of FV positively impacts children's consumption across the majority of studies that evaluate this factor (41), as does parental food involvement (e.g. parents' level of enthusiasm for and involvement in food purchasing, preparation and cooking) (47). Availability (e.g. the presence of the food in the home) and accessibility (e.g. food being available in a readily consumable form such as pre-washed and pre-cut produce) of FV generally has a positive effect on consumption (48, 49). However, results may differ based on whether the child or the parent reports availability and accessibility, suggesting that a closer examination of what children deem "available" and "accessible" might

improve the effectiveness of interventions targeting these determinants (41). Children with lower fruit and vegetable preferences also appear to be more profoundly influenced by accessibility than children with high fruit and vegetable preferences (50). Making FV readily available and convenient may prompt intake in this population. Although an inconsistent influence of the availability of FV in the school environment was observed (41), approaches as simple as re-labeling cafeteria-line FV with fun names such as "x-ray vision carrots" may substantially increase intake (51).

A systematic review performed by Krolner et al. focused on determinants of intake that were identified in qualitative studies, and reported preference (e.g. choosing one fruit or vegetable over another), liking, sensory properties (e.g. appearance, taste and texture), positive health-related outcome expectancies, preparation skills, convenience, price, and availability (at home, at school, and in the community) as potential determinants of intake (42). Determinants of intake may also vary by the child's or adolescent's gender and by food type (e.g. fruit or vegetable) (52). This reinforces the need to tailor interventions to specific populations, and to assess independent and dependent variables regarding fruit intake and vegetable intake separately, when possible.

1.7 Consumer Trends in the Produce Market

Americans are spending less time on food preparation and are highly motivated by convenience when making food purchasing decisions (53, 54). Despite a dramatic increase in the proportion of food expenditures allocated to food consumed away from home (55), food purchased for home consumption (e.g. grocery store purchases) still accounts for a greater percentage of total food-dollar expenditures (56). Pre-cut (or "value-added") produce meets the needs of busy consumers by providing convenient, time-saving and healthful side dish and snack options, and has become an in-demand product category in grocery stores (57). Initially, pre-cut produce options consisted primarily of bagged salads; however, the variety of products offered has expanded to include a wide range of FV offered in bags, clamshell-style packaging, overwrap, and single-portion cups. From 2005 - 2010 average weekly sales of pre-cut vegetables grew

by 34.8%, followed by growth in sales of pre-cut fruit of 23.3% (58). From 2012 to 2013 fresh-cut fruit experienced the greatest percent growth within the value-added fruit category and snacking vegetables experienced the second-greatest growth in the value-added vegetables category, following side dish vegetable options (57).

Married mothers spend more time grocery shopping than do married men (53), and more mothers than fathers are observed to grocery shop with their children (59, 60). Pre-cut fruit and vegetable options that appeal to parents (particularly mothers) and children would be expected to be a well-accepted addition to the pre-cut market and are expected to appeal to busy parents who are looking for healthier snack options for their children.

1.8 Marketing to Children: Current Climate and Healthful Directions

Children have become an increasingly targeted consumer market in the area of food advertising, so much so that the ethical and health implications of promoting foods of poor nutritional value to children have come into question (61-63). Children impact product sales directly (e.g. through their own purchasing habits) and indirectly (e.g. through their influence on parents' purchases) (64). In the grocery environment, the majority of children who accompany their parent(s) or caregiver(s) are engaged, either actively or passively, in making food selection decisions (60). When children request foods at the grocery store, roughly half of their requests are typically met (59, 60). Many of children's requests are for sweet foods and snacks (60), a finding that is likely driven in part by advertising. Hundreds of food items in a typical store may be targeted specifically to a child audience through the use of attractive packaging, front-of-package characters, fun food shapes and bright colors (65); additionally, retailers may place items at children's eye-level to promote sales (66). Unfortunately, most of the foods promoted to children are high in fat, sodium, and/or added sugars (65). Young children may demonstrate difficulty in identifying healthful packaged foods as the cues they rely on (such as front of package advertising) can be misleading (67). Despite the fact that many

produce departments offer a range of pre-cut produce, from baby carrots to fresh melons and pineapple, very few of these healthy options are specifically targeted to children (65).

Grocery store efforts to combat the obesity epidemic through product-, price-, placement- and promotion-focused initiatives suggest that the availability of FV in stores is a factor in children's consumption levels, much as the availability of FV in the home has been found to be influential (68). Product price is also important in determining fruit and vegetable purchasing behavior (69). Based on the factors that have been identified, conveniently packaged, affordably priced CF fruit and vegetable snacks would be positioned to succeed in the marketplace, and may provide competition for the less-healthy food choices that are currently targeted to children. Not only could these products encourage increased fruit and vegetable intake, they may help to displace consumption of less desirable choices as well. The concept of displacement is important because, ideally, absolute increases in fruit and vegetable intake should be achieved by replacing energy-dense foods with nutrient-dense fruit and vegetable options that are low in added fats and sugars. In this way, children can achieve the short- and long-term health benefits afforded by increased dietary intake of FV while avoiding increasing their total energy intake. Market research highlights the challenge of simultaneously promoting healthful foods and decreasing the consumption of less healthful foods (69). To date, the application of child-targeted marketing techniques to healthy fruit and vegetable options has been minimally utilized; thus, the promotion of CF FV warrants investigation.

1.9 Child-Friendly Shaped Foods: Effects on Children's Liking and Intake

Providing foods in CF shapes (e.g. teddy bear-shaped graham crackers, dinosaur-shaped chicken nuggets and fruit-shaped gummy snacks) is one marketing technique that is frequently employed. A small number of studies have been conducted to explore the impact of offering foods in CF shapes on children's liking and consumption of foods (70-75). Branen et al. reported that providing "cute" versus standard versions of grain-, fruit-,

tuna-, and dessert-based snacks to preschool-age children did not increase the quantity of the snack consumed, but did significantly increase the duration of the snacking occasion for the majority of the foods offered (71). The authors note that the cute snack foods, (e.g. biscuit "snakes" with cheese stripes instead of standard biscuit and cheese melts, and "apple smiles" composed of apple slices, peanut butter and miniature marshmallows as opposed to these ingredients served separately) required significantly more preparation time than the standard snacks, an observation that may be relevant for the final price of fresh fruit and vegetable snacks, even those that are industrially prepared.

Similar results were reported by Boyer et al., who conducted a crossover intervention in a small (n=21) group of preschool-age children (72). Subjects received repeated randomized exposures to three different high-fiber grain-based snack foods; the foods were offered in either CF shapes (hearts, hands, animals) or regular shapes (squares, circles) over the course of a 3-week intervention. Food shape did not influence the quantity of kilocalories consumed. However, among Caucasian children, the sweetest of the three snack options (banana bread) was consumed in significantly greater amounts than the less-sweet snack options (pancakes and sandwiches). In this study, the gram weight of the CF- and regular-shaped portions of each food was equal; however, the number of items that comprised one portion (and therefore the size of the different shapes) varied. The CF-shaped foods were generally smaller than the regular-shaped foods, so a greater number of individual items were offered, (e.g. seven banana bread hearts as compared to two rectangular slices of banana bread). This is a salient point as the size of snack foods may have an effect on children's liking of the foods (both initially and over the course of repeated exposures), whether due to ease of eating (e.g. less bite force required for young children who may have difficulty chewing larger pieces that may be harder or tougher) or a visually-based affinity for smaller foods (76).

Both studies reported no difference between results in younger children (2 – 3 years old) and older children (4 – 5 years old) and concluded that, in a predominantly Caucasian preschool-age population, offering foods in CF shapes does not increase consumption levels. However, sample sizes were small in both studies (39 and 21

subjects, respectively) and only one fruit-based snack was offered, whereas effects on vegetable-based snack intake were not examined.

Studies that have specifically examined the effect of CF shape on children's fruit and vegetable liking, preferences and/or intake are very limited; however, interpretation of results from the majority of studies supports a positive effect of CF shape on one or more of these outcome measures (70, 73, 75). Jansen et al. demonstrated an 85% greater intake of fresh fruit that was presented in a novel, visually appealing manner, (grapes, apples and strawberry kabobs skewered on flagged cocktail sticks and stuck into a watermelon) as opposed to fruit that was simultaneously offered in a more standard presentation (an identical variety of fruit kabobs skewered on plain cocktail sticks and served on a plate), among children ages 4 – 7 years (73). Of interest, children did not report a greater desire for the visually appealing as compared to the standard fruit, (measured on a 5-point scale before and after the first of two study snack exposures). This brings into question the impact of children's desire for particular foods on their level of intake and children's ability to understand and accurately report desire at this age (73). The authors note the fact that children's assessment of the visual appeal of the two fruit presentations was not measured; therefore, it was assumed that the children found the more novel presentation to be more visually appealing. Because the visually appealing and standard fruits were presented simultaneously in all exposures, an outcome regarding the total quantity that would be consumed if only visually appealing fruit was offered as opposed to if only standard fruit was offered cannot be reported. Additionally, because this study provided just two consecutive exposures to these fruit snacks, the effect of repeated exposures over time is not known (73). Although the fruit itself was not cut into CF shapes in this study, it was assumed that the arrangement of the foods was visually appealing and "fun" to children.

Olsen et al. reported similar findings in regard to fresh vegetable snacks that were cut into CF-shapes. The authors examined the impact of shape (whole/chunks, slices, sticks, or figures (stars)) and size (ordinary or small) on 9 – 12 year-old children's liking of vegetable snacks, (fresh cucumbers, carrots and red peppers). Olsen et al. determined

that star shapes were most highly preferred, slices and sticks were intermediately preferred, and chunks of ordinary-sized vegetables and whole small vegetables were preferred the least. Size was a significant predictor of preference only for vegetables that were presented either as whole pieces or chunks; chunks of ordinary-size vegetables were preferred over whole small vegetables. Children taste-tested ordinary-sized vegetable sticks to report their liking of the individual foods. All three foods were relatively well-liked; mean liking scores ranged from 70 to 81 on a 100 mm visual analog scale. The authors did not examine the influence of differences in shape on taste and textural perceptions so results were limited to assessing the impact of CF shape on children's visual preferences.

Visual preference for CF-shaped FV and CF arrangements of FV appears to be consistent across a relatively large range of ages, as suggested by the positive findings presented above. This is further reinforced by a study that was conducted to compare the preferences of children ages 5 – 12 to "parent-age" adults. Child subjects reported visual preference for plated presentations of foods that were arranged to create a figure (e.g. a smile or heart), or foods that were decorated with meaningful designs, as opposed to ordinary presentations of identical foods (75). Compared to adults, children were also observed to have a preference for plates that displayed a greater variety of foods (seven different foods) and colors (six different colors, specifically tested with FV) (75). Although adults in this study preferred less variety in terms of the number of different food items and colors present on their plate (three each for items and for color), it has been suggested that variety (e.g. of color, shape and flavor) positively influences food intake in adults (77).

CHAPTER 2. CHILDREN'S PERCEPTIONS OF CHILD-FRIENDLY SHAPED FRUIT AND VEGETABLE SNACKS: ARE THEY SEEN AS MORE FUN AND APPEALING?

(Awaiting submission)

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2.1 Abstract

The nutrients provided by fruits and vegetables (FV) are essential for optimal growth and development, yet FV are under-consumed by most children. Children's liking of foods is a primary predictor of intake. Increasing children's liking of FV may serve as an initial step toward increasing consumption. The aim of this study was to explore whether offering healthy fruit and vegetable snacks in child-friendly (CF) shapes affects how "fun" children perceive them to be, and whether it raises children's self-reported liking of the appearance, taste and texture of FV. Children were recruited for a consumer survey and optional taste-test of FV that were offered in regular shapes (small chunks and slices) or CF shapes (butterfly, chick, flower and teddy bear). Participants' (n=365) liking of fun-shaped foods was high (mean ± SD = 4.35 ± 1.03) and CF-shaped foods were perceived as having a more fun shape than regular-shaped foods ($p<0.001$), particularly among girls. Aggregate data from child and adult participants indicated that CF-shaped samples were 34% more likely to be selected, when offered for taste-test, than regular-shaped foods, (OR 1.34, 95% CI 1.02—1.76, p=0.033). Children's ratings of the appearance, taste and texture of the fruit and vegetable samples were high, (lsmeans ± SE

≥4.35 ± 0.08) and were not significantly different between CF- and regular-shaped samples. Our results suggest that the shape of FV plays a role in children's perception of these foods as being "fun" and may influence how likely children are to select them for a taste-test. However, shape did not impact liking of the foods.

2.2 Introduction

Fruit and Vegetable Intake Levels and Health Benefits in Children 2.2.1

Many fruits and vegetables (FV) are nutrient-dense foods – low in fat and calories, but rich in vitamins, minerals, fiber and phytonutrients (8, 78). These nutrients are especially important for healthy growth and development during childhood, when nutrient needs are high relative to total caloric intake (79). Indexes measuring diet quality show that children score low for intake of both of these food groups, with the exception of fruit during the preschool years (38). Among children ages 6 – 17 years old, MyPlate (the U.S. Government's dietary guidance communication tool) food intake patterns recommend 1 – 2 ½ cups of fruit and 1 ½ - 4 cups of vegetables per day depending on age, gender, and activity level (4, 80). However, Healthy Eating Index (HEI) scores for estimated fruit intake among U.S. children in this age range are just 50 - 58% of the optimal (maximum possible) score and results for vegetable intake estimates are even lower (38). Estimates based on national dietary intake data suggest that fruit and vegetable consumption decreases among children as they get older, with less than 14% of adolescents meeting the MyPlate minimum recommended daily number of servings from the fruit group and as little as 3% achieving the minimum intake recommendations for vegetables (2).

Inadequate fruit and vegetable intake in the child population is of particular concern due to the alarming increase in the prevalence of child overweight and obesity over the past three decades (26). Although the prevalence of obesity appears to be stabilizing among young Americans, recent estimates show that a staggering 14.9% of U.S. children ages 2 to 19 years old are overweight and 16.9% are obese, (defined by the

Centers for Disease Control and Prevention (CDC) age- and sex-specific body mass index-for-age growth charts as ≥85th to <95th percentile and ≥95th percentile, respectively (25)) (26). Diets low in energy density (ED) have been associated with a decreased prevalence of obesity in children, and have been found to provide twice as many servings of FV as high ED diets (29). While a definitive relationship between fruit and vegetable intake and adiposity in children remains unclear (28), developing effective ways to increase fruit and vegetable intake in children supports efforts to increase intake patterns to meet the Dietary Guidelines for Americans (DGA) 2010 goals (as expressed in the MyPlate recommendations) (1), improves diet quality (40), and may contribute to obesity and chronic disease prevention efforts (15, 17, 18). Dietary intake patterns track throughout childhood and adolescence (20); specifically, low fruit and vegetable intake has been shown to track from childhood into adolescence (32) and adolescence to young adulthood (23). Thus, efforts to increase fruit and vegetable intake would be most effective if implemented early in life.

2.2.2 Approaches to Improve Intake

Asserting pressure on children to eat healthful foods has been shown to be ineffective and may result in lower fruit and vegetable consumption and development of picky eating habits (81). Less forceful approaches, such as modeling healthy eating behavior and making FV more available and accessible (i.e. serving cut-up versus whole produce) have been shown to increase intake (81). Accessibility appears to be an especially important factor in encouraging intake in children who have an established low preference for FV (50). Additional determinants of intake that should be considered when designing efforts to increase consumption include: age, gender, socio-economic status (SES), time costs (i.e. time required for fruit and vegetable preparation) and the sensory properties of FV (aesthetics/presentation, smell, taste and texture) (41, 42). Typically, younger children, girls, and children from higher SES households consume more FV (41).

Jansen et al. studied the impact of fruit and vegetable aesthetics/presentation on intake and reported that visually appealing presentations of fresh fruit increased consumption by almost 85% as compared to a standard presentation method (73). Although visually appealing or "fun foods" targeted to young consumers are abundantly available in most grocery stores, many of these foods have poor nutritional quality due to high added sugar, fat, and/or sodium content (65). The majority of fun foods identified in a study by Elliott et al. were dry goods (cereals, crackers, cookies); only 1% of such foods were produce items – namely, small apples and baby carrots. With few exceptions, very little has been published on children's acceptance and liking of fun, healthy fruit and vegetable options (70, 73). Adequate data to support or refute the benefit of marketing fun fruits and vegetables to children as a venue to increase consumption are not available.

Successful appearance-focused efforts to increase the appeal of foods to children include offering foods in child-friendly (CF) shapes; for example, Olsen et al. reported that children preferred star-shaped versus regular-shaped vegetables (70). However, research conducted to quantify and compare the intake of a variety of snack foods presented in "cute" vs. standard shapes indicated that for the grain-, fish-, dessert- and fruit-based foods studied, the shape of the snack did not impact the quantity of food consumed (71, 72).

Children's self-reported preference for and liking of FV, measured using Likert-type facial descriptor scales, are strong predictors of observed (43) and reported (46) fruit and vegetable intake. Notably, high self-reported preference for FV has also been associated with lower risk of overweight and at-risk-for-overweight in African-American schoolchildren (30). Because food preference is correlated with intake (43, 46) and both preference for and intake of FV have been associated with reduced risk for overweight (30, 82), measuring children's self-reported liking of CF-shaped FV may serve as a strong indicator of children's potential intake of these foods and possible long-term health benefits.

2.2.3 Snacking Occasions: Opportunities for Increased Fruit and Vegetable Consumption

Frequency of snack consumption has increased over the past 40 years, and the current average is estimated at two snacks per day (83), providing roughly 27% of North American children's daily energy intake (82, 83). The main contributors to snack time calories are desserts, salty snacks, and sweetened beverages (83). The proportion of calories contributed from milk and dairy, nuts, and whole fruit has decreased among children in the U.S., while candy and fruit juice intake has increased (83). Among Canadian children ages 4 – 18 years, only 15.8% of total snack calories are contributed by FV (82). Therefore, snack occasions represent potentially powerful opportunities to improve children's fruit and vegetable intake if healthful fruit and vegetable options can be offered at snack time without displacing FV that are consumed at meals.

The objective of this study was to determine if providing healthy fruit and vegetable snacks in CF shapes results in FV being perceived as more fun and being better liked by children, as compared to offering FV in regular shapes. This study included both adult and child participants. With the exception of results regarding the number of fruit and vegetable samples that were offered and that were selected (data collected in aggregate for both adults and children), only child data are reported for the purposes of this paper. Our hypotheses were:

a) A greater percentage of fruit and vegetable samples offered for taste-testing would be selected by participants on days when CF- vs. regular-shaped samples were offered.
b) Children's rating of how "fun" the shape of CF-shaped FV were would be higher than ratings for regular-shaped FV
c) Children would report higher average liking of CF-shaped fruits and vegetables, as evidenced by higher ratings of appearance, taste and texture; this relationship would be more pronounced among girls and children who reported high levels of hunger.

This study was determined to be exempt from review by the Institutional Review Board at Purdue University. Written or verbal permission to conduct the study was

obtained from the director of marketing or the store manager at each of the locations where research was conducted, and a hazard analysis critical control point plan was submitted to and approved by the local Health Department prior to the initiation of data collection.

2.3 Materials and Methods

2.3.1 Study Sample

A convenience sample of participants was recruited at a local mall and two large supermarkets in an urban location in northwestern Indiana. At the mall location, the research station was set up next to the children's play area and parents were actively approached in order to invite their children to participate; the study was described as a questionnaire asking for children's opinions about FV, and an optional fruit and vegetable taste-test. In the grocery locations the research station was set up at the entrance to the produce department. Any child who demonstrated interest in the research station and who was accompanied by an assenting adult was invited to participate. The researchers set up a table at each data collection site including two interviewing stations, samples of the study foods, and stickers (offered as a thank-you gift/compensation to children who participated). Each interviewing station was equipped with a laptop computer (at sites that had Internet access), paper copies of the survey, and easy-to-read Likert-type facial descriptor response scales. Study participants ranged in age from approximately 2 – 18 years old, (researcher-estimated ages). Informed consent was obtained from parents of participating children and assent was obtained from children prior to participating in this study. The ages of child participants were not recorded, but the researchers assessed each child's ability to understand the survey questions and the response scale. Surveys were discarded if the child was unable to fully understand and respond to the questions (i.e. too young, language barrier, etc.). *(See Appendix A. Study Methodology Flow Chart)*

2.3.2 Survey Design

A Qualtrics® electronic consumer survey containing yes/no questions and Likert-type facial descriptor response scales was developed. The electronic version of the survey was administered at sites with Wi-Fi Internet access and an identically worded paper version was developed for use at data collection sites without Internet access.

Response scales consisted of five facial descriptor options representing a scale ranging from "not at all" (☹) to "very/very much" (☺). The facial descriptor modification of Likert-type scales has been used extensively in food liking and preference research in children (43, 46) and was referred to as the "smiley-face scale" with participants. The response scale was explained to participants before they began the survey. Survey statements were read aloud to the children and they indicated their responses both verbally and by pointing to a paper copy of the five-point scale; responses were recorded by the research staff. The survey assessed time of last meal (reported by the parent if the child was unsure); current level of hunger; gender; researcher-estimated body mass index (BMI) for height (as a range); child's general liking of foods with fun shapes (examples given were goldfish- and bear-shaped crackers, dinosaur-shaped chicken nuggets, etc.); child's perception of study samples as possessing a fun shape; and rating (visually or by taste-test) of the appearance, taste, and texture of the fruit/vegetable sample. With the exception of time of last meal (recorded in hours and minutes), gender (boy/girl) and researcher-estimated BMI for height category, all statement responses were recorded using the five-point scale. *(See Appendix B. Consumer Behavior Survey Forms)* The survey did not include a specification of whether a fruit or a vegetable was being rated by the participant, nor was it used to record which of the CF-shapes the participant taste-tested. Prior to the initiation of data collection two collaborators with expertise in public health, dietetics, and human-subject child nutrition research aided in testing the survey for comprehensibility, age appropriateness, and amount of time required for completion (less than 5 minutes, including taste-test). All researchers who administered surveys to study participants were trained prior to the start of data collection to ensure adherence to standard procedures and limit interviewer-based bias.

Data collection took place between December 2012 and February 2013. Survey collection days included weekdays (n=14) and weekend days (n=11) and included morning, midday and evening hours. *(See Appendix C. Survey Totals by Date, Survey Type, and Adult/Child Participant)*

2.3.3 Study Foods

Study foods were selected based on size, shape and textural properties that allowed the foods to be cut into CF shapes and color – white (Fuji apples, cucumbers) or orange (cantaloupe, sweet potatoes). Foods were either peeled and cut into bite-sized rectangular pieces (apple, cantaloupe), slices (cucumber), or quartered slices (sweet potato); or, they were peeled, sliced and cut into child-friendly shapes using small commercially available cookie cutters. Four shapes that were likely to appeal to children were selected: a butterfly, chick, flower and teddy bear. Sweet potatoes were steamed or baked in a small amount of water; all other foods were served fresh. Ball® Fruit Fresh® Produce Protector (ascorbic acid) was applied to the apples to prevent oxidation and to maintain color.

The shape/color combination of the sample foods was randomly selected for each study day: 1) regular-shaped white foods (apple and cucumber), 2) CF-shaped (butterfly, chick, flower and teddy bear) white foods, 3) regular-shaped orange foods (cantaloupe and sweet potato or 4) CF-shaped orange foods. The food items were presented on a platter and were offered as an optional taste-test to all participants completing the survey. *(See Appendix E. Photographs of Food Samples and Survey Stations)* If participants declined the taste-test they were asked to visually rank the foods' attributes.

2.3.4 Data Entry

Paper surveys were reviewed immediately after survey completion in order to minimize missing data. Electronic surveys were downloaded from Qualtrics®, re-

formatted, and entered into Excel. Paper survey data were double-entered in Excel and cross-checked for accuracy. Paper and electronic databases were then merged for combined analysis. The number of food items offered to participants and the number of uneaten samples that were discarded was recorded daily, by food type (apple, cucumber, cantaloupe or sweet potato) and shape (regular, butterfly, chick, flower or teddy bear). The difference between the number of items offered and the number of items discarded was used to calculate the number of items that participants selected. These data were then used to estimate the desirability of the study foods.

2.3.5 Statistical Analysis

Descriptive statistics including participant demographic information and frequency tables were generated in Excel. Statistical analysis was performed using Statistical Analysis Software (SAS), (Version 9.3, 2010, SAS Institute Inc., Cary, NC). The majority of survey responses were highly skewed to the left (-1.73 to -3.03), with the exception of hunger ratings and responses for "this food has a fun shape" regarding regular-shaped foods. The central limit theorem allows the use of parametric tests for highly skewed data, provided that the sample size is large (84). Both survey types (paper and electronic) were collected at the mall but only paper surveys were collected at the grocery store locations; therefore, a three-level variable referred to as survey type/location (mall/paper, mall/electronic, and grocery) was created and included in the statistical model to control for the possibility of confounding. Data from all sites and both survey types were then compiled and analyzed in aggregate. Differences in participants' likelihood of selecting a sample when the food was CF vs. regular were estimated using logistic regression contrasts. Analysis of variance (ANOVA) was used to assess the influence of sample shape and participant gender on perceptions regarding food shape. Sensory ratings of CF- and regular-shaped foods were analyzed using an ANOVA model containing survey type/location and gender as covariates; self-reported hunger level was found to be insignificant and was not included in the model. Statistical significance was assumed at $p<0.05$.

2.4 Results

A total of 365 children (56.7% girls) participated in the consumer survey (Table 1). Children's researcher-estimated BMI-for-age range was categorized as underweight for 0.6% of subjects, healthy for the majority of subjects (87.1%), and slightly overweight to extremely overweight for just 11.8% of subjects. Because most of the children were assessed as healthy weight, results were not analyzed by weight status. The majority of children (98.9%) tasted at least one of the sample foods prior to providing sensory rating feedback and the remaining 1.1% (four participants) who did not taste the samples visually rated the sensory properties of the foods instead. Approximately two thirds of all surveys (69.6%) were collected at the mall, the rest were collected at the two grocery store locations; 46.3% of surveys were electronic, the remainder were completed using the paper version of the survey.

Table 2 shows the percentage of food samples offered by the researchers that were selected by participants (both adult and child data, collected in aggregate), by food type and by shape. On days when CF-shaped samples were offered, the snacks were significantly more likely to be selected for a taste-test than on days when regular-shaped samples were offered, ($p=0.033$). The odds of participants selecting the CF-shaped samples that were offered were 34.2% greater than the odds of regular-shaped samples being selected, (OR 1.342, 95% CI 1.024—1.760, $p=0.033$). Participants more frequently selected fruits than vegetables; additionally, fewer total vegetable samples were offered (the sample tray was only refilled as needed in order to keep the remainder of the foods at low temperatures in a cooler). There were no significant differences in selection frequency for one shape (butterfly, chick, flower, teddy bear or regular) over the others.

Children reported a high level of liking for fun-shaped foods (FSF) in general (Figure 1). Average reported liking of FSF did not vary significantly between days when CF- and regular-shaped foods were offered, (lsmean ± SE = 4.41 ± 0.08 and 4.24 ± 0.08, respectively). Children's mean rating of how fun they perceived the sample foods' shapes to be was higher when CF-shaped foods were offered (lsmean ± SE = 4.46 ±0.10)

Table 2.1 Participant and Survey Characteristics

Participant Characteristics	**Children (n=365)**
Gender	
Male (%)	42.5
Female (%)	56.7
Missing (%)	0.8
Body Mass Index Range (Visual Estimate)[a]	
Underweight (%)	0.6
Healthy Weight (%)	87.1
Slightly Overweight (%)	7.1
Overweight (%)	4.4
Extremely Overweight (%)	0.3
Missing (%)	0.6
Tasted Sample?	
Yes (%)	98.9
No (%)	1.1
Survey Characteristics	**Child Surveys (n=365)**
Location	
Mall (%)	69.6
Grocery (%)	30.4
Survey Type	
Electronic (%)	46.3
Paper (%)	53.7

[a] Numbers may not sum to 100% due to rounding

Table 2.2 Percentage of Samples Offered that were Selected by Participants (Children and Adults), by Sample Shape

Sample Foods Offered	Number of Samples Offered, by Food Type	Percentage of Samples Offered that were Selected by Participants[a], by Sample Shape					
		Butterfly	Chick	Flower	Teddy	Regular	All Shapes
Apples[b]	374	82.05	85.45	87.80	85.37	81.82	83.42
Cucumbers[b]	193	60.00	69.23	48.00	56.00	57.61	58.03
Cantaloupe	357	86.67	87.34	74.19	82.98	83.53	83.75
Sweet Potato	227	57.69	59.38	54.84	61.29	42.99	51.10
All Foods	1151	73.33	79.69	68.75	74.31	71.08	72.89

[a]Child and adult offered/selected data were collected in aggregate and are therefore reported together.
[b]Data from two study days when white, child-friendly shaped foods were offered was excluded due to missing values for food offered or for food discarded.

compared to when regular-shaped foods were offered (3.54 ± 0.10, $p<0.001$). Gender was a significant predictor of how fun the sample foods' shapes were perceived to be as well; girls reported higher rankings than boys across both CF- and regular-shaped foods ($p<0.002$). Analyses of appearance, taste, and texture ratings revealed that shape (CF vs. regular) was not a significant predictor for any of these rankings. Female gender predicted higher appearance rankings (lsmean ± SE = 4.52 ± 0.08 vs. 4.35 ± 0.08, $p=0.013$) and higher taste ratings (4.60 ± 0.08 vs. 4.50 ± 0.08, $p=0.032$); gender approached significance for texture ratings ($p=0.066$). A Likert-type sensory scale combining appearance, taste, and texture ratings showed no significant differences between children's rating of CF-shaped foods, (lsmean ± SE = 4.50 ± 0.07), and regular-shaped foods (4.40 ± 0.07); however, female gender again predicted higher mean scale scores for both CF- and regular-shaped foods ($p=0.008$).

2.5 Discussion

Our findings show that children perceived CF-shaped fruit and vegetable snacks as being more "fun" than regular-shaped snacks, and that across child and adult participants CF-shaped samples demonstrated a higher odds of being selected compared to regular-shaped FV. Children's self-reported liking of the snack's appearance, taste and texture was not appreciably affected by the shape of the food. These results suggest that offering FV in CF shapes may be beneficial in capturing children's attention (at the grocery store, in school, or at mealtimes), and possibly in encouraging them to select and taste new foods. This in turn supports efforts aimed at increasing children's FV intake. Offering CF-shaped FV snack options to children may be an effective way to increase acceptance and consumption of these currently under-consumed foods.

High preference for FV has repeatedly been shown to correlate with higher intake of these foods in children (46, 85, 86). Zeinstra et al. measured children's preference for a variety of FV, and suggest that the most important determinants of liking in young

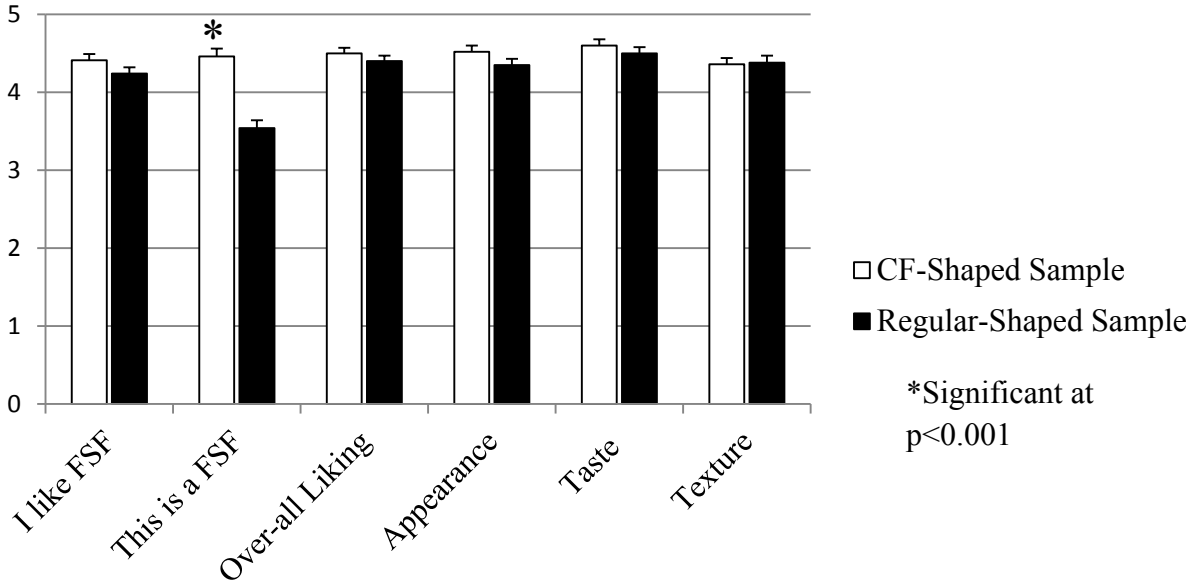

Figure 2.1 Average Participant Responses to Survey Statements, by CF-Shaped and Regular-Shaped Study Foods

[a]Responses were reported on a five-point Likert-type facial rating scale. ☹/1 indicates "no, not at all/not appealing", ☺/5 indicates "yes, very much/very appealing".
[b]Error bars represent SE.
[c]FSF = Fun-shaped food

children are appearance and texture, and that taste and understanding of health benefits become more important as children get older (87). We targeted the appearance of FV in this study, and hypothesized that children would report higher liking of CF- vs. regular-shaped FV. We measured liking due to the positive correlation of liking and preference with children's intake. Although differences were not observed in children's liking (i.e. sensory ratings) of the CF- and regular-shaped foods, participants did report that the CF-shaped foods were more fun. This aspect of fun visual attributes (i.e. CF shape) may increase fruit and vegetable intake in the absence of reported differences in liking. In a similar study by Jansen et al., presenting a fruit snack in a novel, visually appealing manner increased children's intake by almost 85% as compared to an identical snack presented in a more standard serving style, despite no differences in children's reported level of desire for the food or in pre-taste-test scores ranking how tasty the children anticipated the foods to be (73). The duration of the positive impact of such "novelty

effects" on consumption warrants further research. Also, increased familiarity with new or infrequently consumed foods may influence liking and over-all consumption even after the novelty effect has "worn off" so to speak.

We observed gender differences in participants' responses regarding their general preference for fun-shaped foods, how fun they perceived the sample foods' shapes to be, and their over-all liking of the samples. Girls consistently rated these attributes higher than boys. Jaramillo et al. reported that preschool-aged boys expressed lower over-all preference for 11 familiar fruits as compared to girls (43), a finding that has been reported in older children as well (88). This suggests that the types of foods offered in our study (fruits and vegetables) likely influenced this gender difference, as well as a possible higher affinity among females for shaped foods. Although we attempted to select shapes that would have high over-all visual appeal (89) and were targeted to both genders, there is the possibility that girls felt a higher attraction for these particular shapes.

Between 1999 and 2009, average daily fruit and vegetable intake rose in U.S. children younger than 6 years of age, increased to a lesser extent in 6 – 12 year-olds, and dropped among 13 – 17 year-olds (90). Although improvements are observed in some segments of the child population, when over-all dietary intake patterns are examined, very little of the total daily quantity of FV that Americans consume are eaten at snacking occasions (90). According to the Produce for Better Health Foundation, only 1% of vegetables are consumed as snacks (66% are eaten at dinner); and, although fruit intake is more evenly distributed across eating occasions, snacks still only account for 15% of fruit intake (90). Convenient, appealing fruit and vegetable snacks would increase total fruit and vegetable consumption if they could be added to the diet without consumers compensating by replacing the fruit and vegetable servings they regularly consume at meals.

The nature of the study was a feasibility/pilot project; therefore the consumer survey that was developed was not tested for reliability and predictive validity. A limitation of the survey tool is that it did not differentiate between whether a fruit or a

vegetable had been selected and was being rated, and did not specify the shape of the CF samples that were chosen, thus limiting the ability to analyze differences in liking ratings between fruits and vegetables, and between the four individual child-friendly shapes. Of note, some subjects taste-tested both a fruit and a vegetable sample, in which case their preferred choice was generally rated on the survey, and some subjects taste-tested multiple shapes.

2.6 Conclusions

Providing FV in CF shapes increased selection of these foods by 34% as compared to regular-shaped FV and resulted in children perceiving the foods as being more fun than regular-shaped samples. These outcomes suggest that offering FV in CF shapes may be an effective way to increase the consumption of these foods and improve children's diet quality. Assessment of the long-term impact of CF-shaped fruit and vegetable options on total fruit and vegetable consumption is a vital next step in this area of research. Future studies should also examine a) a wider variety of FV b) the effect of children's age on selection, liking, and intake, and c) preference for specific CF shapes.

CHAPTER 3. DO HEALTHY, CHILD-FRIENDLY FRUIT AND VEGETABLE SNACKS APPEAL TO CONSUMERS? A FIELD STUDY EXPLORING ADULTS' PERCEPTIONS AND PURCHASE INTENTIONS

(A version of this manuscript has been submitted to: Food Quality and Preference, February 10th, 2014)

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3.1 Abstract

The majority of children in the U.S. do not consume enough fruits and vegetables (FV). Children's liking of and preferences for FV are consistent predictors of intake, as are factors such as availability and accessibility, which are largely under the control of parents and caregivers. This study was designed to examine adults' current purchasing habits regarding child-friendly (CF)-shaped foods and pre-cut produce, determine their sensory perceptions of CF-shaped vs. regular-shaped pre-cut FV, and ascertain their willingness to pay slightly more for CF-shaped FV compared to fresh, whole produce. Healthy, CF-shaped fruit and vegetable snacks were developed by cutting FV into CF shapes (butterfly, chick, flower and teddy bear). Participants (n=298) were adults, the majority of whom (66.1%) reported having children at home. All participants who reported having children in the home recognized the CF-shaped fruit and vegetable samples as CF-shaped foods, while 64.4% reported that regular-shaped fruit and vegetable samples were CF-shaped foods as well. Participants rated CF-shaped samples as more visually appealing than regular-shaped samples, ($p<0.0001$). Female gender, the presence of children in the home, and frequent self-reported purchase of pre-cut produce

were also significant positive predictors of visual appeal. Taste and texture ratings were not consistently significantly higher for CF-shaped fruit and vegetable samples. CF shape predicted higher willingness to pay extra for the fruit and vegetable products ($p=0.0057$), as did frequent purchase of pre-cut produce and CF-shaped foods. Adults, particularly females and individuals with children in the household, find CF-shaped FV highly visually appealing and are willing to pay slightly more for these foods. Healthy, ready-to-eat, CF-shaped fruit and vegetable snacks may be a promising marketing strategy to help increase fruit and vegetable intake among children.

3.2 Introduction

The majority of children in the U.S. consume inadequate quantities of fruits and vegetables (FV) (1, 2). Patterns of low fruit and vegetable intake begin at a young age and the disparity between children's actual intake of FV and recommended intake levels increases progressively after the toddler years (1, 2). Fruit and vegetable intake patterns have been shown to track from childhood into adolescence (32) and from adolescence into adulthood (23). Therefore, establishing healthy fruit and vegetable intake patterns in early childhood is vitally important if children are to meet and maintain the recommended levels of intake set forth by the Dietary Guidelines for Americans (DGA) (1, 91).

A number of studies and methodological reviews have been conducted to examine the determinants of fruit and vegetable intake in children (52, 85, 92, 93). In a two-part review of quantitative and qualitative studies Rasmussen et al. and Krolner et al. report that the factors most widely associated with fruit and vegetable intake in children 6 – 18 years of age are: children's preferences; parents' intake levels; availability/accessibility of FV in the home; time (e.g. time required for preparation); sensory properties (appearance, smell, taste and texture); children's fruit and vegetable preparation skills; cost; and, convenience (e.g. ready-to-eat FV versus those requiring preparation) (41, 42). In the marketplace, a multitude of highly palatable, convenient foods that require little or

no preparation are targeted specifically to a child audience through the use of fun names, front-of-package characters (e.g. animals, popular cartoon personalities), artificially enhanced colors, and the food itself being offered in child-friendly (CF) shapes, (e.g. animal crackers, fruit-shaped gummies and dinosaur-shaped chicken nuggets) (65). Unfortunately, the majority of these foods are high in fat, sugar and/or sodium. With the exception of baby carrots and small apples, Elliot et al. identified no produce items that were similarly targeted to children (65). This reality begs the question of why highly successful child-targeted marketing techniques and our knowledge of the determinants of children's fruit and vegetable intake are not being integrated and used to market FV to children and parents in an effort to improve consumption levels.

A small number of research studies exploring fruit and vegetable promotion have employed techniques similar to those utilized in the marketplace, offering "fun", ready-to-eat fruit and vegetable snacks such as star-shaped fresh-cut vegetables, vegetables with names like "X-ray vision carrots", or visually appealing arrangements of fresh fruit (51, 70, 73). These authors report that children preferred fun-shaped to regular-shaped vegetables (70), selected vegetables twice as often when they had fun names (e.g. in the school lunch line) (51), and increased their intake of FV by 85% or more (51, 73).

Parents and caregivers (hereafter referred to as parents) play a key role in influencing children's fruit and vegetable intake. Parents' modeling of fruit and vegetable consumption is a key determinant of children's intake (41). Parents largely control the purchasing, preparation and provision of foods, especially for younger children, thereby determining the availability and accessibility of FV in the home. Not only do issues such as time, convenience, and cost play direct roles in influencing children's intake of FV by affecting children's self-directed intake behaviors, they also influence parents' decisions to purchase and serve FV, and thus determine the availability of FV (94). American's purchasing habits increasingly favor convenient, ready-to-eat foods. For example, sales of pre-cut produce and packaged salads increased from 1% of total produce department sales in 1987 to 15% in 1997 (95). Pre-cut produce sales were transiently negatively affected by the recent economic recession but display renewed

signs of growth; average prepared vegetable sales rose by 34.8% from 2005 to 2010 and were followed closely by prepared fruit sales (23.3% increase) (58, 96). Market research suggests that 26% of consumers purchase pre-cut FV due to the convenience of these items and 20% of consumers would like to see more ready-to-eat single-serve fruit and vegetable offerings become available in the marketplace (97). In light of these facts, conveniently packaged pre-cut fruit and vegetable options that are CF are likely be attractive options for parents who wish to provide healthy foods for their children yet have limited time for fruit and vegetable preparation.

To date, there has been a gap in the scientific literature regarding the role CF marketing strategies play in influencing children's liking of FV and parents' purchasing decisions. To begin to meet this research need, we explored consumer attitudes toward CF-shaped FV from the child and adult perspectives. This paper focuses on the results of the adult consumer behavior survey; specifically, attitudes and purchasing habits regarding CF-shaped foods and pre-cut produce and adults' sensory evaluation of CF- compared to regular-shaped fruit and vegetable samples. Child-focused data are reported elsewhere. It was hypothesized that:

a) Parents would recognize CF-shaped FV as being CF foods
b) Adults would rate the sensory properties (appearance, taste, texture) of CF-shaped FV as high or higher than regular-shaped FV
c) Parents would be willing to pay a slightly higher price for CF-shaped produce as compared to fresh, whole produce options currently available in stores

3.3 Material and Methods

This study was determined to be exempt from review by the Institutional Review Board at Purdue University.

3.3.1 Study Sample

A convenience sample of participants was recruited at a local mall and two large grocery stores in an urban location in northwestern Indiana. The researchers set up a table at each data collection site comprised of two, side-by-side interviewing stations and samples of the study foods. At the mall location, the table was set up next to the children's play area and parents were actively invited to participate; the study was described to them as a consumer behavior and preference survey and optional fruit and vegetable taste-test. At all locations any passerby who demonstrated interest was invited to participate. Each interviewing station was equipped with a laptop computer (at sites that had Internet access), as well as paper copies of surveys, consent forms, and easy-to-read 7-point numeric response scales for Likert-type questions, (a facial rating scale was provided for children). Study participants consisted primarily of parents and children, but also included adults without children. For the purposes of this paper, only adult participant data are reported, with the exception of data on the number of food samples that were offered and selected (this information was collected in aggregate for all participants). Informed consent was obtained verbally prior to participation.

3.3.2 Survey Design

A Qualtrics® consumer survey was developed by the researchers; the Qualtrics® electronic version of the survey was administered at research sites with Internet access and an identically worded paper version was used at data collection sites without Internet access.

Participants' gender was recorded and the researchers visually estimated subjects' body mass index (BMI)-based weight range, (underweight, healthy weight, overweight, or class I, II or III obese). Participants reported the time of their last meal, current level of hunger, and whether or not they had children in the home. Individuals who had children at home proceeded to report the number of children in the household and their ages. Parents were then queried as to their level of agreement with a number of

statements regarding the frequency with which they purchased CF-shaped foods, their children's level of liking of CF-shaped foods, and whether or not they perceived the sample foods to be CF shapes. All participants were asked if they wished to taste-test a sample; if they declined, they were asked to visually rate the food. Participants rated how visually appealing they perceived the sample to be, how tasty it was, if it had great texture, if they would be willing to pay "a little extra" for the product (subjectively quantified by the participant and compared to whole fresh produce), how frequently they purchased pre-cut produce, and how frequently they purchased CF-shaped foods. With the exception of a) time of last meal, b) presence of children in the household, c) number of children in the household, d) ages of children in the household and e) whether or not the sample was a CF shape (answered as "yes" or "no"), all responses were recorded on a 7-point Likert-type scale, with 1 anchored at "strongly disagree", (indicating "no, not at all" or "never") to 7, which was anchored at "strongly agree", (indicating "yes, very/very much" or "all the time"). Survey administration was tested for ease of understanding and the time required for completion (less than 5 minutes, including taste-test).

All researchers who administered surveys to study participants were trained prior to the start of data collection to ensure adherence to standard procedures to limit interviewer-based bias. Survey response scales were explained to the participants before they began the survey. All survey questions were read aloud to the participants and all responses were recorded by the researchers.

Data collection took place between December 2012 and February 2013. Survey collection days included weekdays (n=14) and weekend days (n=11) and morning, midday and evening hours.

3.3.3 Study Foods

Study foods were selected based on size, shape and textural properties that allowed the foods to be cut into child-friendly shapes and based on color – white (Fuji apples, cucumbers) or orange (cantaloupe, sweet potatoes). Foods were either peeled and

cut into bite-sized rectangular pieces (apple, cantaloupe), slices (cucumber), or quartered slices (sweet potato); or, they were peeled, sliced and cut into child-friendly shapes using small commercially available cookie cutters. Four shapes that were likely to appeal to children were chosen: a butterfly, chick, flower and teddy bear. Sweet potatoes were steamed or baked in a small amount of water; all other foods were served fresh. Ball® Fruit Fresh® Produce Protector (ascorbic acid) was applied to the apples to prevent oxidation and to maintain color.

The shape/color combination of the sample foods was randomly selected for each study day. Thus, four possible shape/color combinations emerged: 1) regular-shaped white foods (apple and cucumber), 2) CF-shaped white foods, 3) regular-shaped orange foods (cantaloupe and sweet potato) and 4) CF-shaped orange foods. The food items were presented on a platter and were replenished from additional samples kept chilled in a cooler.

3.3.4 Data Entry

Paper surveys were reviewed at the research site immediately after survey completion in order to minimize data entry errors and missing data. Electronic surveys were downloaded from Qualtrics®, re-formatted, and transferred into Excel. To optimize data reliability, all paper survey data was double-entered in Excel and cross-checked for accuracy. Paper and electronic databases were then merged for combined analysis.

The number of samples that were offered and the number that were discarded were recorded daily by food type (apple, cucumber, cantaloupe or sweet potato) and by shape (regular, butterfly, chick, flower or teddy bear). The difference between the number of items offered and the number discarded was used to determine how many samples participants had selected. These data were used to estimate the desirability of the different study foods as food type (e.g. fruit or vegetable) and food shape (on days when CF-shaped foods were offered) were not recorded in the consumer behavior survey.

Data on the number of items selected and offered was recorded in aggregate for both adult and child participants due to the fact that all participants selected samples from the same serving platters.

3.3.5 Statistical Analysis

Descriptive statistics, including participant demographic information and frequency tables, were generated in Excel. A chi-square test was performed and standardized residuals were generated to compare differences in the percent of offered samples that were selected, by food shape. General linear models were developed to assess the effects of selected explanatory variables on each outcome variable. The explanatory variables included in the models were: gender, frequency of purchasing pre-cut produce, frequency of purchasing CF-shaped foods, whether or not the subject tasted the sample, hunger level, whether or not the sample food was a CF shape, and a three-level factor corresponding to the survey type (electronic or paper) and location (mall, primary grocery location or secondary grocery location). Outcome variables included: appearance, taste and texture ratings; the subjects' willingness to pay a little extra for CF-shaped foods; and, a total sensory scale score that combined appearance, taste and texture ratings. Taste, texture, and the total sensory scale score were analyzed using two separate models; one model was used to analyze responses from subjects who had tasted the samples, the other was used to analyze responses from subjects who had visually rated the samples. For the analysis of the visual appeal of the samples and analysis of subjects' willingness to pay extra for CF-shaped foods, data from all subjects (those who taste-tested the samples and those who visually rated the samples) were combined. A variable was included in this model that corresponded to whether or not the subject had tasted the sample. Models were reduced using backward elimination. Least-squares means (lsmeans) were calculated for variables that were included in the final model. Statistical significance was defined as $p<0.05$. All analyses were performed using SAS, Version 9.3, 2010 SAS Institute Inc., Cary, NC.

3.4 Results

A total of 298 adults completed the consumer behavior survey (Table 3.1). Of these, 70.8% were female and 55.4% were visually estimated by the researchers to have a BMI in the healthy weight range. Sample foods were taste-tested by 65.8% of participants and the remaining participants visually rated the sensory attributes of the samples. Almost twice as many surveys were collected at the mall location as were collected at the grocery store locations (62.1% mall, 37.9% grocery). Half of the surveys

Table 3.1 Participant and Survey Characteristics

Participant Characteristics	**Participants (n=298)**
Gender	
Male (%)	25.2
Female (%)	70.8
Missing (%)	4
Body Mass Index (Visual Estimate)	
Underweight (%)	0.34
Healthy Weight (%)	55.37
Overweight (%)	26.85
Obese I (%)	12.08
Obese II (%)	4.03
Obese III (%)	0.34
Missing (%)	1.01
Tasted Sample?	
Yes (%)	65.8
No (%)	34.2
Survey Characteristics	**Surveys (n=298)**
Location	
Mall (%)	62.1
Grocery (%)	37.9
Survey Type	
Electronic (Mall) (%)	50
Paper (Mall and Grocery) (%)	50

were administered electronically. Of the adult participants who reported having children at home (66.1% of the total sample), the majority (77.2%) had one or two children at home and 82.2% of the children were age 11 or younger (Table 3.2). When asked how much their children liked CF-shaped foods, 70.1% of parents responded with a rating of 5 or more on a 7-point scale. On days when CF-shaped FV were offered, all parent participants (n=104) responded that "yes", the sample was a CF shape, (n=6 participant responses were missing for this question). On days when regular-shaped samples were offered, 64.4% (n=56) of parent participants stated that the sample was a CF shape and 35.6% (n=31) stated that it was not.

Table 3.2 Family Size and Ages of Children in Households with Children

Children in the Home?	**Participants (n=298)**
Yes (%)	66.1
No (%)	33.9
Number of Children at Home	**Adults with Children at Home (n=197)**
1 Child (%)	32.5
2 Children (%)	44.7
3 Children (%)	14.2
≥4 Children (%)	8.6
Ages of Children	**Total Number of Children in Households (n=403)**
0 to <2 [a] (%)	13.4
2 to 5 (%)	39.5
6 to 11 (%)	29.3
12 to 19 (%)	14.1
>19 (%)	3.5
Missing (%)	0.2

[a] Children less than 1 year of age (n=20) would be expected to consume very few whole fruits and vegetables.

Chi-square analysis revealed no significant differences in frequency of selection by food shape. The CF chick shape most closely approached a significant positive effect (residual for percent of samples selected = 1.1027, residual for percent of samples not selected = -1.8083) and the CF flower was the least frequently selected shape, (residual for percent of samples selected = -0.5490, residual for percent of samples not selected = 0.9003). A greater percentage of the fruit samples that were offered were selected for taste-test, as compared to the vegetable samples (Table 3.3).

As illustrated in Table 3.4, the majority of participants provided favorable sensory ratings (defined as 5 or above on the 7-point rating scale) for both the CF- and regular-shaped foods, but were less likely to report high levels of willingness to "pay a little extra" for the sample foods (i.e. as compared to fresh, whole produce), or to frequently purchase pre-cut produce or CF-shaped foods.

On average, participants rated the CF-shaped samples as more visually appealing than the regular-shaped samples ($p<0.0001$), (Table 3.5). When CF- and regular-shaped samples were analyzed in aggregate, individuals who taste-tested vs. visually rated the samples provided higher average visual appeal ratings, (lsmean ± SE 5.87 ± 0.11 vs. 5.47 ± 0.15, $p=0.0107$). However, there was an interaction between shape (CF/regular) and mode of rating (taste-test/visual) such that CF-shaped samples that were taste-tested were rated as slightly less visually appealing than CF-shaped samples that were visually rated (lsmean ± SE 5.99 ± 0.14 and 6.07 ± 0.18, respectively, $p=0.6841$), whereas regular-shaped samples that were taste-tested were rated as more visually appealing than regular-shaped samples that were visually rated (lsmean ± SE 5.76 ± 0.14 and 4.88 ± 0.20, respectively, $p=0.0001$), ($p=0.0011$ for interaction). Analysis by mode of rating revealed that participants who taste-tested the samples reported similar visual appeal ratings for CF- and regular-shaped foods ($p=0.1964$). Participants who visually rated the samples reported higher scores for CF- compared to regular-shaped foods ($p<0.0001$). Female gender, the presence of children in the home, and frequent self-reported purchase of pre-cut produce were also positive predictors of visual appeal ($p=0.0034$, $p=0.0324$ and $p=0.0237$).

Table 3.3 Percentage of Samples Offered that were Selected by Participants (Children and Adults), by Sample Shape

Sample Foods Offered	Number of Samples Offered	Samples Selected by Participants[a] (%), by Sample Shape					
		Butterfly	Chick	Flower	Teddy	Regular	All Shapes
Apples [b]	374	82.05	85.45	87.80	85.37	81.82	83.42
Cucumbers [b]	193	60.00	69.23	48.00	56.00	57.61	58.03
Cantaloupe	357	86.67	87.34	74.19	82.98	83.53	83.75
Sweet Potato	227	57.69	59.38	54.84	61.29	42.99	51.10
All Foods	1151	73.33	79.69	68.75	74.31	71.08	72.89

[a] Child and adult offered/selected data were collected in aggregate and are therefore reported together.

[b] Data from two study days when white, child-friendly shaped foods were offered was excluded due to missing values for number of items offered or discarded.

CF shape was not a positive predictor of taste/flavor ratings for samples when they were taste-tested, ($p=0.1716$) but was significant when foods were visually rated, ($p=0.0021$). Female gender predicted higher taste ratings for foods that were taste-tested (lsmean ± SE 6.10 ± 0.14 vs. 5.61 ± 0.17, $p=0.0111$), as did the presence of children in the home (lsmean ± SE 6.09 ± 0.14 vs. 5.62 ± 0.17, $p=0.0097$). On the other hand, when samples were visually rated for taste/flavor, more frequent self-reported purchase of CF-shaped foods raised average taste ratings by 0.15 point per one point increase in purchasing frequency, ($p=0.0139$).

Texture ratings were not significantly different by shape for samples that were taste-tested or for samples that were visually rated. However, the location-by-survey-type interaction variable impacted texture scores both for samples that were taste-tested and for those that were visually rated, with the primary grocery location shown to be consistently associated with lower scores, ($p=0.0129$ and $p=0.0123$, respectively). Among participants who tasted the samples, the number of children in the household who were ≥12 years of age was positively associated with adults' average texture ratings ($p=0.0039$), while the total number of children in the household was negatively associated with texture ratings among adults who visually rated the samples ($p=0.0109$).

When the sensory properties of the samples were analyzed together as a Likert-type scale (composed of appearance, taste, and texture), scale scores were not significantly different between CF- and regular-shaped samples when the samples were taste-tested. Females demonstrated higher scale scores than males (lsmean ± SE 18.30 ± 0.34 and 16.79 ± 0.42, respectively; $p=0.0011$). The presence of children in the home was also a positive predictor of higher sensory scale scores (lsmean ± SE 18.16 ± 0.34 vs. 16.93 ± 0.41, $p=0.0054$). However, when the samples were visually rated, CF shape did positively predict the total scale score, (lsmean ± SE 18.40 ± 0.44 for CF-shaped samples and 16.19 ± 0.48 for regular-shaped samples, $p =0.0004$). Survey type/location was also influential, (lsmean ± SE 18.03 ± 0.77 (mall), 16.01 ± 0.59 (primary grocery location) and 17.85 ± 0.37 (secondary grocery location), $p=0.0269$).

Table 3.4 Survey Statements and Distribution of Responses by Level of Agreement, Separated by Mode of Rating and Food Shape, (percentages for regular-shaped samples are in bold font and for child-friendly are in italics)

Participants who tasted the food sample[a]			
Survey Statement:	**Strongly Disagree – Disagree (%)**	**Neutral (%)**	**Agree – Strongly Agree (%)**
The sampled product looked appealing	**4.7** *3.7*	**11.8** *4.6*	**83.5** *91.7*
The sampled product was tasty	**1.2** *6.5*	**9.4** *4.6*	**89.4** *88.8*
The sampled product had great texture	**4.7** *4.7*	**7.1** *5.6*	**88.3** *89.8*
I would be willing to pay a little extra for this product	**58.8** *51*	**14.1** *15.7*	**27.1** *33.3*
I frequently purchase pre-cut produce for myself	**60** *54.6*	**11.8** *9.3*	**28.3** *36*
I frequently purchase food in child-friendly shapes	**57.6** *69.4*	**8.2** *11.1*	**34.1** *19.4*
Participants who visually rated the food sample[b]			
Survey Statement:	**Strongly Disagree – Disagree (%)**	**Neutral (%)**	**Agree – Strongly Agree (%)**
The sampled product looks appealing	**10.6** *1.8*	**21.3** *1.8*	**68** *96.3*
The sampled product looks tasty	**10.6** *0*	**10.6** *7.3*	**78.7** *92.7*
The sampled product looks like it has great texture	**0** *1.8*	**8.5** *12.7*	**91.5** *85.5*
I would be willing to pay a little extra for this product	**53.2** *34.5*	**4.3** *14.5*	**42.5** *50.9*
I frequently purchase pre-cut produce for myself	**51.1** *50.9*	**14.9** *10.9*	**34.1** *38.2*
I frequently purchase food in child-friendly shapes	**53.2** *45.5*	**14.9** *12.7*	**31.8** *41.8*

[a] n=85 subjects tasted regular-shaped samples, n=108 subjects tasted CF-shaped samples.
[b] n=47 subjects visually rated regular-shaped samples, n=55 subjects visually rated CF-shaped samples.

Table 3.5 Average Ratings of Sample Characteristics by Method of Rating (Visual Assessment or Taste-test) and by Sample Shape (CF or Regular)

Rating Method	**Visual Assessment**				**Taste-Test**			
Characteristic Rated	CF-Shaped Sample (LS Mean ± SE)	Regular-Shaped Sample (LS Mean ± SE)	F Statistic	P-Value	CF-Shaped Sample (LS Mean ± SE)	Regular-Shaped Sample (LS Mean ± SE)	F Statistic	P-Value
Visual Appeal	6.03 ± 0.13	5.32 ± 0.13	22.68	<0.0001	n/a [a]			
Taste	6.21 ± 0.18	5.41 ±0.20	10	0.0021	5.73 ± 0.15	5.97 ± 0.16	1.88	0.1716
Texture	5.84 ± 0.17	5.69 ± 0.18	0.47	0.4971	6.05 ± 0.14	5.89 ± 0.16	1.07	0.3032
Sensory Scale	18.40 ± 0.44	16.19 ± 0.48	13.33	0.0004	17.56 ± 0.36	17.53 ± 0.38	0	0.9545
Willingness to Pay a Little More	3.78 ± 0.17	3.16 ± 0.19	7.78	0.0057	n/a [a]			

[a]Analysis of the effect of shape on "visual appeal" and "willingness to pay a little more" was not performed separately for samples that were visually rated or taste-tested. Combined results are reported under the row heading "visual assessment.

Across all participants (those who tasted the samples and those who visually rated the samples), CF shape predicted higher willingness to pay extra for the product (lsmean ± SE 3.78 ± 0.17 for CF-shaped samples, 3.16 ± 0.19 for regular-shaped samples, p=0.0057). Frequent purchase of pre-cut produce and CF-shaped foods positively predicted willingness to pay extra for the sample foods ($p<0.0001$ and p=0.0001, respectively). Higher hunger ratings were a negative predictor of willingness to pay extra (p=0.0134). The primary grocery location , which was found to predict lower texture ratings, also was associated with lower willingness to pay extra for the sample foods, as compared to the mall and the secondary grocery location (lsmean ± SE 3.16 ± 0.18 compared to 3.47 ± 0.35 and 3.78 ± 0.15, respectively, p=0.0345). Weight status (healthy weight vs. overweight/obese) was not a significant predictor for any of the variables tested.

3.5 Discussion

Our results demonstrate that CF-shaped FV are perceived as highly visually appealing by adults, and as significantly more visually appealing than regular-shaped pre-cut fruit and vegetables. Parents consistently recognized CF-shaped FV as being CF-shaped foods, whereas two-thirds of parents perceived regular-shaped pre-cut produce as being a CF shape. The frequency of selection of samples by shape was not significant, but there appears to be a trend toward greater selection frequency among some CF shapes. Adults indicated they would be more willing to pay slightly higher prices for CF-shaped FV than for regular-shaped pre-cut FV, (compared to whole produce), especially if they are already purchasers of CF-shaped foods and/or pre-cut produce items. Women rated the visual appeal and flavor of pre-cut FV samples higher than men; and, interestingly, the highest visual appeal ratings were observed when the sample food was a CF shape and was visually assessed, as opposed to taste-tested.

Assessment of the marketplace shows that a greater percentage of women shop with and for their children than do men (53, 59, 60), consumer trends are shifting toward

convenient, pre-cut produce (57, 95), and most grocery items are visually assessed (as opposed to tasted) at the point of selection. Given these market characteristics, the findings of this study suggest that providing parents with healthy, CF-shaped, ready-to-eat fruit and vegetable snack options at the grocery store may be an effective marketing approach and, ultimately, a venue to encourage increased fruit and vegetable consumption in children.

Interestingly, two-thirds of parent participants perceived the regular-shaped fruit and vegetable samples as being a CF shape. This suggests that bite-sized pre-cut produce may be an attractive option to parents and children, even in the absence of a specific CF shape modification. In the interest of providing convenient, child-friendly FV for families, offering a wider variety of pre-cut produce may be a promising option that would appeal to parents and children, particularly as CF-shaped fresh fruit and vegetable products are not yet available in the marketplace.

When promoting foods that are targeted specifically to children it is important to recognize that parents are not the only decision-makers in the purchasing process. Children frequently accompany their parent(s) to the grocery store and may request foods that they find appealing. O'Dougherty et al. report that the majority of children are at least passively engaged in their parent's selection of foods in the grocery store, and many are actively involved in the decision-making process (60). When children request the purchase of specific items at the store, roughly half of their purchase requests are typically granted by parents (59, 60). A greater percentage of children's purchase requests are met early in the shopping experience (59), a fact which could be beneficial in the marketing of fresh fruit and vegetable snacks as the produce section is usually located just beyond the entryway of grocery stores. Child-focused marketing techniques and branding frequently play a role in the selection of foods, either on the part of the adult or the child, suggesting that CF-shaped fruit and vegetable snacks in attractive CF packages would likely appeal to children, positively influencing their purchase requests (60, 98, 99). Positioning CF foods at eye level has also been shown to increase children's

purchase requests (59) and is a technique frequently used by marketers in their efforts to target child consumers, as are the use of front-of-package characters and CF packaging (66).

Very few interventions that have aimed to increase fruit and vegetable sales in grocery stores have been successful (100). Mhurchu et. al recorded sustained increases in the number of healthier foods, particularly FV, that were purchased during and after an experimental price discount period (69). This finding suggests price is a motivating factor and may be used to encourage healthier eating habits. Because CF-shaped FV require greater levels of processing than whole, fresh FV their unit price would be expected to be higher. Controlling the cost of CF-shaped produce would likely be an important factor in the market success of these products.

In addition to cost, availability of FV in the marketplace appears to be an important factor in fruit and vegetable purchasing behavior (68). Increased access to healthy foods may improve customers' purchasing habits, particularly if coupled with reduced access to unhealthy food choices. In a review of product, price, placement and promotion-focused grocery store marketing strategies to reduce overweight and obesity, in-store marketing efforts that "increase promotion of nutrient-dense child-oriented foods" (Glanz et. al, 2012, pg. 508) is identified as a promising strategy to spur customers to make more healthful selections at the grocery (68). CF-shaped fruit and vegetable snacks align particularly well with this recommendation. Market research has also suggested that an increased presence of FV could be achieved in the snack category and suggests making FV more "fun" in order to help parents encourage fruit and vegetable intake among their children (97). Despite recent upward trends in snack-time fruit consumption, a very small proportion of total daily fruit and vegetable intake is consumed at snacking occasions, (1% of vegetables and 15% of fruit) (90). Convenient, ready-to-eat, child-friendly FV could be an ideal snack-time option for busy parents, and may increase children's total daily intake of FV if mealtime fruit and vegetable intake is not displaced.

Limitations of this study include the subjective nature of many of the survey questions. For example, data regarding participants' frequency of purchase of CF-shaped foods and pre-cut produce was based on individuals' self-reports of purchasing behavior as opposed to actual observed buying habits. Participants' willingness to pay "a little extra" for the sample foods was also highly subjective; however, due to between-subject differences in household income level and average grocery expenditures, it was felt that allowing participants to quantify the meaning of "a little extra" on an individual basis was the most appropriate approach. In regard to the sensory properties of the study foods and participants' willingness to pay slightly higher prices for CF-shaped produce, it is possible that respondents were inclined to answer favorably due to the fact that they verbally provided responses to the researchers as opposed to recording their own responses, which provides a greater feeling of anonymity. The survey was not intended to record whether a fruit or a vegetable had been selected and rated by the participant, nor did it specify the sample shape (on days when CF-shaped foods were offered) that had been chosen, limiting the researchers' ability to discern potential differences between participants' responses by food type and shape. Since some participants tasted multiple shapes or both a fruit and a vegetable (in which case they were asked to rate the item that they preferred), this information would have been difficult to clearly interpret within the study design of this project.

Future studies should differentiate between consumers' perceptions of and attitudes toward FV, aim to identify whether particular FV and specific CF shapes are more highly desirable, and explore the hypothetical price elasticity of CF-shaped fruit and vegetable options in order to determine the potential profitability of their production and sale.

3.6 Conclusions

This research indicates that child-friendly shaped ready-to-eat fruits and vegetables are likely to appeal to the consumer segment that most frequently shops for

children's foods; namely, females who have children in the home. Due to the strong influence of food preference, accessibility, availability and convenience on children's fruit and vegetable intake, CF-shaped FV are likely to appeal to both parent and child consumers and represent a promising product category for improving fruit and vegetable intake among children.

CHAPTER 4: CONCLUSIONS AND FUTURE DIRECTIONS

4.1 Conclusions

We have identified a novel way of presenting FV such that they are perceived as highly visually appealing by children and adults alike, and are seen as "fun" and as CF-shaped by children and adults, respectively. Regular-shaped FV cut into bite-sized pieces were typically also perceived as fun, CF-shaped foods, though to a lesser extent than their CF-shaped counterparts. Coupled with participants' high sensory ratings of the taste and texture of both CF- and regular-shaped fruit and vegetable snacks these data are encouraging as they suggest that simply offering FV in pre-cut, easy-to-eat pieces may be an important factor in influencing children's liking of FV, and potentially in increasing consumption of these foods (101). Providing FV specifically in CF shapes may mediate increased fruit and vegetable consumption by enhancing children's liking and/or preferences for FV via their increased perception of "fun" (41, 46). CF fruit and vegetable options in the marketplace could also serve as competitive, healthy alternatives to the multitude of nutrient-poor energy-dense foods that are currently marketed to children (65).

Adult participants were somewhat more willing to pay "a little extra" for CF- compared to regular-shaped pre-cut produce. Due to the influence of price on fruit and vegetable purchase and intake (41, 102) controlling the cost of CF-shaped fruit and vegetable products is likely to be an important factor in achieving the goal of increased consumption of FV. Pairing the production of CF fruit and vegetable snacks with the production of fruit and vegetable juices, sauces and other products could be one effective solution to reduce cost and waste (103). Children often prefer that a variety of FV

and a range of colors are presented at eating occasions (70, 75). Offering CF-shaped FV as mixtures of fruits and/or vegetables of different colors may optimize consumption (104). Many children prefer vegetables when they are served with a dip (70, 105), so including a healthy dip option (e.g. a low-fat ranch dip or hummus) alongside CF-shaped vegetables may improve children's liking and consumption levels. Many environmental cues influence the quantity of food consumed, from the accessibility of the food to the portion served (106). These factors are often studied in an effort to improve our understanding of over-eating and to design and implement effective weight-loss interventions. However, as suggested above, these same principles may be effective in promoting increased intake of healthful fruit and vegetable options. This research was conducted to study the impact of CF shape on fruit and vegetable selection and liking. Individuals' propensity to taste-test a food and their sensory rating of that food do not necessarily reflect their future, sustained consumption of that food. However, making FV a convenient, competitive snack choice and presenting these foods in an attractive, CF manner may serve to increase consumption among children and adolescents at mealtimes.

4.2 Future Directions

Future research should focus on both the marketing aspects of CF foods and their potential to increase total fruit and vegetable consumption among youth. Important questions include determining the types of FV best suited to this type of processing, in order to maintain high-quality appearance, sensory properties, and nutritional value. Foods should be market-tested to determine if certain FV are better accepted in this form. To guide the selection of specific CF shapes, efforts should be made to determine which shapes (or types of shapes, such as animals, stars, or miniature fruits and vegetables) children and parents find most appealing. Shapes that appeal highly to both genders, and specific shape/food pairings may be important underlying concepts. In order to maximize fruit and vegetable consumption at each eating occasion, single-portion package sizes should be tested to determine the package size for optimal consumption levels and minimum waste among children in different age groups. Another important

aspect is price elasticity of CF FV to determine how much more parents and adults are willing to pay compared to whole produce and the currently available pre-cut fruit and vegetable options on the market.

Based on the findings of our research and the available literature that has been reviewed herein, the following studies are suggested as "next steps" in beginning to address these important questions. First, a series of focus groups involving parents of children ages 2 – 18 years who represent a range of socioeconomic, racial, and geographic backgrounds is recommended to collect quantitative and qualitative data to inform consumption promotion efforts. Questions to address include: 1) what FV do you currently most frequently purchase for your children?, 2) what individual types of FV would you be most likely to purchase if they were offered in CF shapes?, 3) would you prefer to purchase pre-cut CF-shaped FV in mixed packages (e.g. mixed fruits, mixed vegetables or mixed FV) or as single item types?, 4) what CF shapes do you find most appealing?, 5) what CF shapes do/does your child(ren) (male/female) find most appealing? Finally, price ranges that consumers consider appropriate and attractive could be determined by presenting participants with sample packages of single-serving and multi-serving CF-shaped fruit and vegetable snacks and collecting quantitative feedback.

To assess whether providing CF-shaped FV increases fruit and vegetable intake in children and adolescents, intervention studies should be implemented in preschool, elementary, middle and high schools. To compare within-group effects on fruit and vegetable intake between baseline, intervention and follow-up, (using one-way ANOVA, power 0.8 and alpha 0.05), a minimum sample size of 28 children would be required at each school level, not accounting for attrition. Because the majority of children and adolescents are not routinely exposed to FV in child-friendly shapes, CF-shaped FV may be perceived as novel foods, requiring repeated (e.g. 10 – 15) taste exposures for acceptance (107-109). To control for the potential impact of repeated exposures to selected FV on fruit and vegetable intake and to elucidate differential effects of CF shape on unfamiliar vs. familiar types of FV, children would be randomized to a "regular" and a "CF" intervention group and two fruits (one familiar and one unfamiliar to the majority

of the children) and two vegetables (one familiar and one unfamiliar to the majority of the children) would be utilized throughout the intervention and follow-up phases of the study. Baseline data on school fruit and vegetable consumption would be collected for both groups of children over the course of two weeks by measuring plate waste at all in-school snack and meal occasions. Diet recalls reporting food intake at home would be conducted via telephone twice weekly; one 24-hour diet recall would be performed for a school day and one for a weekend day. Collecting weekday fruit and vegetable intake via 24-hour recalls and through in-school measurement of plate waste would allow for a weekly comparison of participant-reported and actual (measured) intake. Diet recalls would be conducted with parents in the case of participants who were too young to self-report; with parental assistance, as needed, for older children; and, with the study participants themselves in the case of adolescents.

Next, during a four-week intervention period, the selected familiar or unfamiliar fruit and the selected familiar or unfamiliar vegetable would be offered in a standard shape to the "regular" group and in CF shapes to the "CF" group at lunch or snack, replacing one of the usual fruits or vegetables served by the school. A total of ten different CF shapes would be utilized in the "CF" group, encompassing a variety of categories such as animals, stars, and miniature fruits and vegetables. The CF shapes offered would change within a two-week cycle, such that the fruit and vegetable of the day would each be presented in the same pair of CF shapes and this series of shapes would repeat during the second half of the study. Familiar and unfamiliar FV would be offered in the same pairings of shapes but on non-consecutive days. The familiar and unfamiliar FV would be staggered such that each of the four FV would be offered a total of 10 times, and would not be offered on consecutive days, to limit subject fatigue. For example, on Monday, Wednesday and Friday of Week 1 an unfamiliar fruit and unfamiliar vegetable would be offered and on Tuesday and Thursday a familiar fruit and a familiar vegetable would be offered. The following week, the unfamiliar fruit and vegetable would be offered on Tuesday and Thursday, and the familiar fruit and vegetable on Monday, Wednesday and Friday. This pattern would be repeated during Weeks 3 and 4.

The number of pieces of CF-shaped fruits or vegetables selected by each child in the "CF" group would be recorded, by shape, to determine which specific shapes may be more highly visually preferred. The plate waste method and twice weekly diet recalls (as described above) would be used to determine within-group and between-group changes in fruit and vegetable intake, compared to baseline, by individual snacking occasion (e.g. a.m. or p.m. snack), by meal (e.g. lunch) and over the course of the whole day. This would indicate whether offering FV in CF shapes impacts consumption of the regular-shaped fruit and vegetable items traditionally offered on the school menu. At the end of the intervention period, children would report their visual liking of each of the CF shapes offered during the previous two weeks using a Likert-type scale.

The intervention would be followed by a one-week wash-out period. Finally, during a two-week post-intervention phase, the same four familiar and unfamiliar FV would again be offered to the "regular" and "CF" participant groups in the pattern described above, but would be provided in a regular shape for both groups of participants. School fruit and vegetable plate waste and home diet recall data would again be collected, per protocol, to identify the presence of possible persistent short-term effects of offering FV in CF shapes on consumption of regular-shaped familiar and unfamiliar FV.

These studies would help guide marketing strategies for CF-shaped FV, provide valuable insight into immediate and short-term influences on consumption, suggest differences in responses to CF-shaped FV by participant age and gender, separate intake behaviors for fruits vs. vegetables, indicate the influence of CF shape on intake of familiar and unfamiliar FV, and help determine adults' and children's CF shape preferences.

Child-friendly fruit and vegetable snacks provide convenience and appeal, both of which are known to positively influence intake. Further research, informed by studies such as those proposed here, must focus on the potential for CF-shaped fruit and vegetable options to improve children's and adolescents' average consumption of FV in the long-term. American children consume more than a quarter of their daily kilocalories as snacks, most of which are high in fat, added sugar, and sodium (83). Fruit and

vegetable snacks serve as healthy alternatives to the mounting consumption of high-calorie foods currently eaten. However, effects on total dietary intake of FV need to be evaluated to determine if consuming CF-shaped FV would displace other fruit and vegetable consumption, and if children would compensate for increases in energy intake from FV by decreasing their consumption of less healthful foods. As has been previously suggested, the potential impact on total fruit and total vegetable intake should be examined separately, as effective methods to increase intake are not identical across food groups.

In conclusion, this research adds to a limited body of promising literature on the public health problem of inadequate fruit and vegetable intake in children and adolescents from a perspective rooted in nutrition, consumer behavior, and marketing. Results show that CF-shaped FV are perceived as more fun by children and adolescents, which may lead to increased intake.

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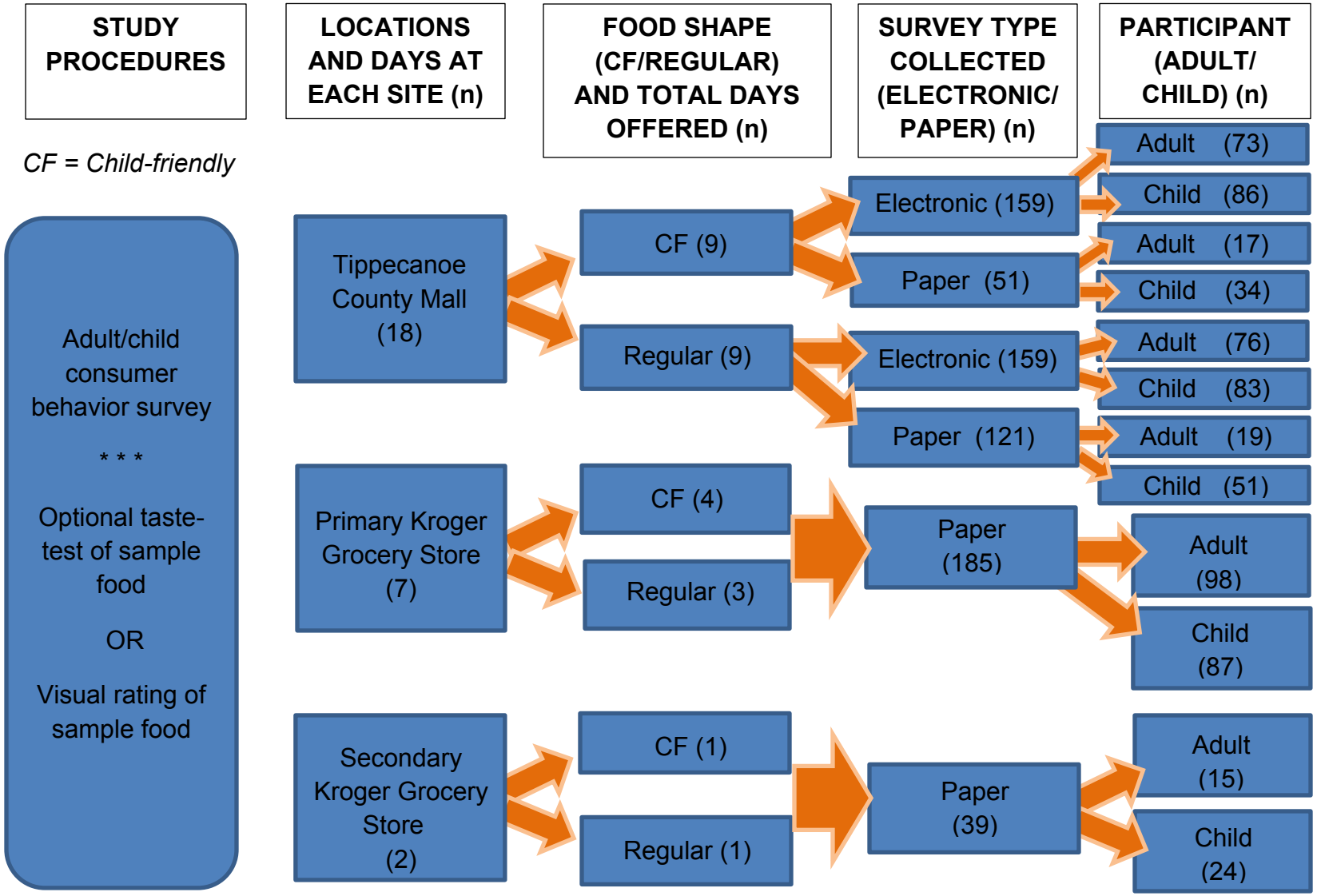
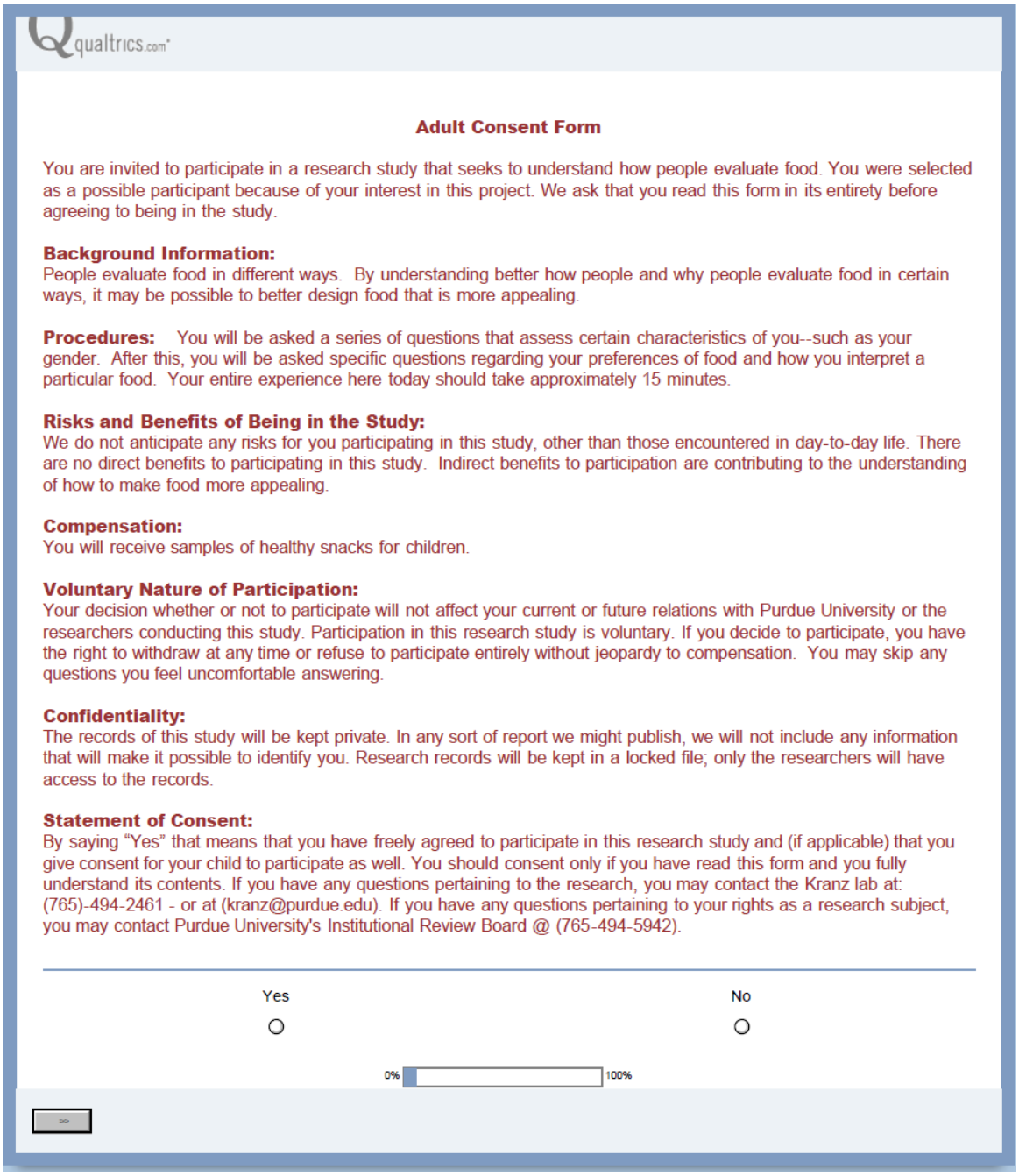
APPENDICES

Appendix A. Study Methodology Flow Chart



Appendix B. Consumer Behavior Survey Forms

Consumer Behavior Survey Adult Consent Form



qualtrics.com

Adult Consent Form

You are invited to participate in a research study that seeks to understand how people evaluate food. You were selected as a possible participant because of your interest in this project. We ask that you read this form in its entirety before agreeing to being in the study.

Background Information:
People evaluate food in different ways. By understanding better how people and why people evaluate food in certain ways, it may be possible to better design food that is more appealing.

Procedures: You will be asked a series of questions that assess certain characteristics of you--such as your gender. After this, you will be asked specific questions regarding your preferences of food and how you interpret a particular food. Your entire experience here today should take approximately 15 minutes.

Risks and Benefits of Being in the Study:
We do not anticipate any risks for you participating in this study, other than those encountered in day-to-day life. There are no direct benefits to participating in this study. Indirect benefits to participation are contributing to the understanding of how to make food more appealing.

Compensation:
You will receive samples of healthy snacks for children.

Voluntary Nature of Participation:
Your decision whether or not to participate will not affect your current or future relations with Purdue University or the researchers conducting this study. Participation in this research study is voluntary. If you decide to participate, you have the right to withdraw at any time or refuse to participate entirely without jeopardy to compensation. You may skip any questions you feel uncomfortable answering.

Confidentiality:
The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify you. Research records will be kept in a locked file; only the researchers will have access to the records.

Statement of Consent:
By saying "Yes" that means that you have freely agreed to participate in this research study and (if applicable) that you give consent for your child to participate as well. You should consent only if you have read this form and you fully understand its contents. If you have any questions pertaining to the research, you may contact the Kranz lab at: (765)-494-2461 - or at (kranz@purdue.edu). If you have any questions pertaining to your rights as a research subject, you may contact Purdue University's Institutional Review Board @ (765-494-5942).

Yes ○ No ○

0% 100%

>>

Adults' Rating Scale for Indicating Responses to Likert-Type Survey Statements

Not at all/ Never						Very/ Very often
1	2	3	4	5	6	7

Children's Facial Descriptor Rating Scale for Indicating Responses to Likert-Type Survey Statements

Not at all Maybe Very or Very Much

Adult Consumer Behavior Survey, Paper Version, (page 1 of 2)

Adult Consumer Behavior Survey **Date: _____** **Initials (Researcher): _____**

1) Who is taking this survey? **Child** **Adult**

2) ***Adult Consent Form:*** You are invited to participate in a research study that seeks to understand how people evaluate food. You were selected as a possible participant because of your interest in this project. We ask that you read this form in its entirety before agreeing to be in the study.
Background Information: People evaluate food in different ways. By understanding better how people and why people evaluate food in certain ways, it may be possible to better design food that is more appealing.
Procedures: You will be asked a series of questions that assess certain characteristics of you--such as your gender. After this, you will be asked specific questions regarding your preferences of food and how you interpret a particular food. Your entire experience here today should take approximately 15 minutes.
Risks and Benefits of Being in the Study: We do not anticipate any risks for you participating in this study, other than those encountered in day-to-day life. There are no direct benefits to participating in this study. Indirect *benefits to participation are contributing to the understanding of how to make food more appealing.*
Compensation: You will receive samples of healthy snacks for children
Voluntary Nature of Participation: Your decision whether or not to participate will not affect your current or future relations with Purdue University or the researchers conducting this study. Participation in this research study is voluntary. If you decide to participate, you have the right to withdraw at any time or refuse to participate entirely without jeopardy to compensation. You may skip any questions you feel uncomfortable answering.
Confidentiality: The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify you. Research records will be kept in a locked file; only the researchers will have access to the records.
Statement of Consent: By saying "Yes" that means that you have freely agreed to participate in this research study and (if applicable) that you give consent for your child to participate as well. You should consent only if you have read this form and you fully understand its contents. If you have any questions pertaining to the research, you may contact the Kranz lab at: (765)-494-2461 - or at (kranz@purdue.edu). If you have any questions pertaining to your rights as a research subject, you may contact Purdue University's Institutional Review Board @ (765-494-5942).

Yes **No**

3) How long ago did you eat your last meal (in hours and minutes)? *"For example, if it is 1 pm now and I ate last at 11:30 am I would write 1 hour and 30 minutes."*

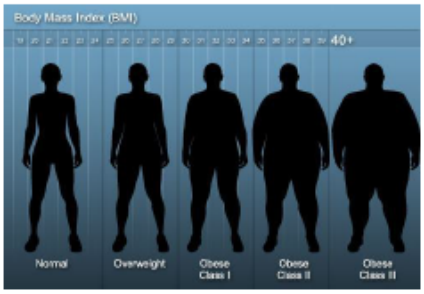
Hours: _____ **Minutes: _____**

4) Please indicate your level of disagreement or agreement with the following statement:

	Strongly Disagree						Strongly Agree
Right now I feel hungry:	**1**	**2**	**3**	**4**	**5**	**6**	**7**

5) What is your sex?: **Male** **Female**

6) (Weight: circle one)



Normal **Overweight** **Obese I** **Obese II** **Obese III**

7) "Do you have children living at home?": **Yes (8A)** **No (8B)** **Next Page**

Adult Consumer Behavior Survey, Paper Version, (page 2 of 2)

8A) If "YES", they do have children:

"How many children do you have?" **1 2 3 4 5 6 7 Other: _____**

"What are their ages?" **Child No. 1: ___ 2: ___ 3: ___ 4: _____ 5: _____ 6: ____ 7: ____ Other(s): _____**

"Please indicate your level of disagreement or agreement with the following statements on a scale of 1 to 7":

	"1 = Strongly Disagree"						"7 = Strongly Agree"
"I frequently purchase food cut into child-friendly shapes":	1	2	3	4	5	6	7
"My children like child-friendly shaped foods":	1	2	3	4	5	6	7

"The food item I am evaluating is a child-friendly shape": **Yes** **No**

"Did you eat the sample that was given you?" Yes (Go to 9A) No (Go to 9B)

8B) If "NO", they do not have children:

Did you eat the sample that was given you? Yes (Go to 9A) No (Go to 9B)

9A) If "YES" they did sample the product: "Please indicate your disagreement or agreement as before."

	Strongly Disagree						Strongly Agree
The sampled product looked appealing:	1	2	3	4	5	6	7
The sampled product was tasty:	1	2	3	4	5	6	7
The sampled product had great texture:	1	2	3	4	5	6	7
I would be willing to pay a little extra for this product:	1	2	3	4	5	6	7
I frequently purchase pre-cut produce for myself:	1	2	3	4	5	6	7
I frequently purchase food in child friendly shapes:	1	2	3	4	5	6	7

END: Thank you for your participation!

9B) I "NO" they did not sample the product: "Please indicate your disagreement or agreement as before."

	Strongly Disagree						Strongly Agree
The sampled product looks appealing:	1	2	3	4	5	6	7
The sampled product looks tasty:	1	2	3	4	5	6	7
The sampled product looks like it has great texture:	1	2	3	4	5	6	7
I would be willing to pay a little extra for this product:	1	2	3	4	5	6	7
I frequently purchase pre-cut produce for myself:	1	2	3	4	5	6	7
I frequently purchase food in child friendly shapes:	1	2	3	4	5	6	7

END: Thank you for your participation!

Child Consumer Behavior Survey, Paper Version, (page 1 of 2)

Child Consumer Behavior Survey **Date: _____** **Initials (Researcher): _____**

1) Who is taking this survey? **Child** **Adult**

2) *Child Assent*: We would like to know what you think of the foods we have here today. We will ask you a few questions about yourself, like "are you a boy or a girl?" After that, you get to taste-test some food, and let us know what you think about it. It will only take a minute or two to do the questions and the taste-test. We will give you two free stickers for participating. Say "Yes" if you want to participate, or "No" if you do not want to.

Yes **No**

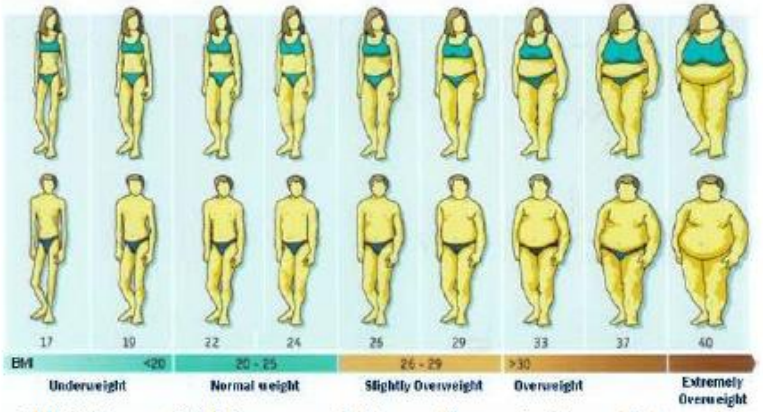
3) Ask parent how long it has been since child has had a meal (not a snack).

Hours: _____ **Minutes: _____**

4) Right now I feel hungry, (circle one: ☹ = not at all, ☺ = very/very much):

5) What is the child's sex?: **Male** **Female**

6) Weight (circle one):



Underweight **Normal Weight** **Slightly overweight** **Overweight** **Extremely overweight**

7) I like foods that have fun shapes:

Next Page

Child Consumer Behavior Survey, Paper Version, (page 2 of 2)

8) This food has a fun shape:

9) Did the child eat the food? Yes (go to 10A) No (go to 10B)

10A) The food looked good:

The food tasted good:

The food felt good in my mouth:

10B) The food looks like something I would like to eat, but not right now:

The food looks like it would taste good:

The food looks like it would feel good in my mouth:

Appendix C. Survey Totals by Date, Survey Type, and Adult/Child Participant

Survey collection totals, by date, survey type (electronic or paper) and participant type (adult or child)

Surveys Collected per Day:			**Electronic**		**Paper**	
Collection Day	**Date**	**Time**	**Adult**	**Child**	**Adult**	**Child**
1	Saturday, December 15, 2012	09:00 - 17:00	10	2	3	11
2	Sunday, December 16, 2012	11:00 - 19:00	16	5	6	29
3	Monday, December 17, 2012	13:00 - 17:00	10	5	1	2
4	Tuesday, December 18, 2012	9:00 - 13:00	6	9	1	0
5	Wednesday, December 19, 2012	15:00 - 19:00	7	11	0	1
6	Thursday, December 20, 2012	12:30 - 4:30	5	4	1	0
7	Friday, December 21, 2012	13:00 - 17:00	8	9	3	1
8	Wednesday, January 02, 2013	--	8	13	2	5
9	Thursday, January 03, 2013	12:30 - 16:30	11	19	1	6
10	Friday, January 04, 2013	14:00 - 18:00	3	5	3	2
11	Saturday, January 05, 2013	10:00 - 18:00	7	13	4	14
12	Sunday, January 06, 2013	12:00 - 18:00	3	19	3	8
13	Sunday, January 13, 2013	--	8	22	0	0
14	Tuesday, January 15, 2013	13:00 - 17:00	7	4	0	0
15	Thursday, January 17, 2013	14:00 - 18:00	7	2	3	1
16	Saturday, January 19, 2013	11:00 - 14:00	11	6	3	0
17	Sunday, January 20, 2013	12:00 - 18:00	11	18	1	5
18	Thursday, January 24, 2013	14:00 - 18:00	11	3	1	0
19	Saturday, January 26, 2013	14:30 - 18:00	0	0	23	21
20	Thursday, January 31, 2013	15:00 - 18:00	0	0	9	8
21	Sunday, February 03, 2013	12:00 - 16:00	0	0	20	24
22	Thursday, February 07, 2013	14:00 - 18:00	0	0	13	9
23	Sunday, February 10, 2013	12:00 - 16:00	0	0	21	14
24	Tuesday, February 12, 2013	3:30 - 18:00	0	0	12	12
25	Sunday, February 17, 2013	11:00 - 15:00	0	0	15	23
Survey Totals:			**149**	**169**	**149**	**196**

Notes: Time of data collection was missing for 1/2/13 and 1/13/13. Five electronic child surveys were completely blank, likely due to technical error, and therefore were discarded

Appendix D. Research Expenses

Expenses for Consumer Behavior Survey, December 2012 – February 2013

Store	**Item(s)**	**Cost**	**Submitted Payment Request**
Teachers' Delight	240 Stickers	$4.90	12/19/2012
Kitchen Art	Cookie Cutters	$8.31	12/19/2012
Payless	Fuji Apples (8 ea.), Cucumbers (8 ea.)	$21.72	12/19/2012
Aldi's	Sweet Potatoes (6 ea.), Cantaloupe (1 ea.)	$3.48	12/19/2019
Printing Services	200 Surveys, Double-Sided, Color	$159.58	1/4/2013
Dollar General	Stickers, 3 packs	$3.21	1/23/2013
Payless	2.69# Fuji Apples, Cucumbers (4 ea.)	$7.71	1/23/2013
Wal-mart	2.67 Fuji Apples	$4.46	1/23/2013
Payless	Cantaloupe (1 ea.), 3.19# Sweet Potatoes	$2.91	1/23/2013
Dollar General	Stickers, 1 pack	$1.07	1/23/2013
Target	2.27# Fuji Apples, Cucumbers (3 ea.),	$5.76	1/23/2013
Payless	2.2# Sweet Potatoes, Cantaloupe, 1 ea. 4 packs stickers	$10.27	1/23/2013
Tippecanoe Mall	1/19/2013 Health Fair Booth Rental	$125	1/23/2013
Boiler Copy Maker	Lamination of Nutrition Science Sign	$10.00	1/23/2013
Payless	1.29# Fuji Apples (2 ea.), Cucumber (1 ea.)	$3.36	1/23/2013
Payless	1.41 # Fuji Apples, Cucumber (1 ea.)	$3.60	1/26/2013
Payless	1 box toothpicks, 3 packs Stickers	$5.02	1/26/2013
Payless	1.29 # Sweet Potatoes, Cantaloupe (1 ea.)	$3.28	1/30/2013
Payless	1.45# Sweet Potatoes, Cantaloupe (1 ea.) 2 sheets stickers	$6.44	2/2/2013
Payless	1 shaker of Fruit Fresh	$4.79	2/10/2013
Payless	Cantaloupe (1 ea.), 1.91# Sweet Potatoes	$4.38	3/25/2013
	Total:	**$399.25**	

Appendix E. Photographs of Food Samples and Survey Stations

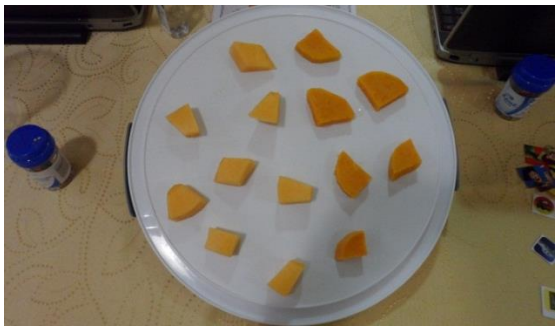
Photographs of Food Sample Preparation, Display, and Survey Table Set-Up at all Survey Locations

Preparing child-friendly (CF) shaped cucumbers and apples

CF-shaped cucumbers

Regular-shaped apples and cucumbers

CF-shaped apples and cucumbers



Regular-shaped cantaloupe and sweet potato

CF-shaped cantaloupe and sweet potato

Survey station set-up, Tippecanoe Mall location

Survey station set-up, Kroger grocery store (primary grocery location)

Survey station set-up, Kroger grocery store (secondary grocery location)

VITA

VITA

Selena L. Baker, RD
Purdue University
Department of Nutrition Science
700 W. State Street, West Lafayette, IN 47907-2059

EDUCATION:

MS	2012 – Present	Purdue University Department of Nutrition Science
BS	2001 - 2006	Purdue University Department of Foods and Nutrition Minor: Spanish

PROFESSIONAL EXPERIENCE (selected):

2012 – Present	**Graduate Research and Teaching Assistant** Purdue University, College of Health and Human Sciences Department of Nutrition Science, GPA 3.69
Jan. – Aug. 2012	**Research Dietitian** Purdue University -Developed and analyzed nutrient content of therapeutic menus -Coordinated metabolic research kitchen activities
2009—2014	**Nutrition Educator and On-Site Event Coordinator** Health Advocate (formerly WellCall) -Provided individual health consultations and group wellness seminars -Coordinated health fairs and health screening events
2007 – 2011	**Clinical Dietitian** St. Rose Hospital -Implemented the nutrition care process in a broad clinical setting -Collaborated in development of a bariatric surgery program -Developed and presented community education classes -Organized and led community education outreach and activities
2006-2007	**Dietetic Internship** Johns Hopkins Bayview Medical Center

2005 –2006 **Nutrition Paraprofessional**
Tippecanoe County WIC Clinic
-Performed client certifications, education, and outreach activities
-Assisted in operating the Farmers' Market Nutrition Program

PEER REVIEWED PUBLICATIONS:

Brauchla MC, Reidenbach KL, **Baker SL**, McCabe SD, Kranz S.
The effects of increased dietary fiber intake on the self-reported quality of life of school-age children. *Health*. 2014. 6(1):115-122. doi:10.4236/health.2014.61013

PUBLICATIONS IN REVIEW:

Baker SL, McCabe SD, Swithers SE, Payne CR, Kranz S. Do healthy, child-friendly fruit and vegetable snacks appeal to consumers? A field study exploring adults' perceptions and purchase intentions.

Brauchla MC, Miller K, **Baker SL**, Kranz S. The Effect of Offering a High-Fiber Snack in the Morning and the Afternoon on Overall Diet Quality and Dietary Fiber Intake in a Sample of School-Age Children.

PUBLICATIONS IN PREPARATION:

Baker SL, McCabe SD, Swithers SE, Payne CR, Kranz S. Children's perceptions of child-friendly shaped fruit and vegetable snacks: are they seen as more fun and appealing?

MEETING ABSTRACTS:

Society for Behavioral Medicine Conference, Philadelphia, PA, April 2014 **Baker SL**, McCabe SD, Swithers SE, Payne CR, Kranz S.
Children's liking of child-friendly shaped fruits and vegetables: does shape influence liking?

Experimental Biology Conference, San Diego, CA, April 2014
Baker SL, McCabe SD, Swithers SE, Payne CR, Kranz S. (Presented by Brauchla MC)
Children's liking of child-friendly shaped fruits and vegetables: does shape influence liking?

Experimental Biology Conference, San Diego, CA, April 2014
Baker SL, McCabe SD, Swithers SE, Payne CR, Kranz S. (Presented by Huss LR)
Adults' attitudes toward and purchasing intentions for child-friendly shaped healthy fruit and vegetable snacks.

National Nutrient Databank Conference, Boston, MA, April 2013.

Baker SL, Kranz S, Payne C.
Does the shape of fruit and vegetable snacks have an effect on consumer response: exploratory, community-based field study in children and caretakers of children.

Experimental Biology Conference, Boston, MA, April 2013.
Baker SL, Reidenbach KL, McCabe SD, Brauchla MC, Kranz S.
Correlations between child and parent-reported pediatric health-related quality of life in a sample of 7 to 11-year-old healthy children.

Experimental Biology, Boston, MA, April 2013.
Baker SL, Reidenbach KL, McCabe SD, Brauchla MC, Kranz S.
Effects of high-fiber snacks on quality of life in school-aged children.

AWARDS/FELLOWSHIPS:

2012 – 2013 Charles C. Chappelle Fellowship
Student representative for the International Life Sciences Institute North America Nutrition Graduate Student Summit, May 2013

TEACHING ACTIVITIES *(Purdue University)*

Teaching Assistant:
Nutrition Science 465, Engagement Experience, spring 2014
Nutrition Science 461, Clinical Nutrition Experience, spring 2014
Nutrition Science 443, Food Service Management Experience, fall 2013
Nutrition Science 426, Community Experience, fall 2013

INVITED SPEAKER:

Interdepartmental Nutrition Program Seminar, August 2013, (co-presenter).
Baker SL, Huss LR, Larrick B, Reyes-Fernandez P, Wright C, Zheng W. ILSI North America Nutrition Graduate Student Summit 2013: Translating Science into Policy

Nutrition 411: Supervised Practice Preparation, November 2013 (co-presenter).
Baker S, Lee J. Next Steps: Dietetic Internship and Graduate School

College Mentors for Kids, October 2013 (co-presenter).
Baker SL, Brauchla MC. Putting the "U" in Nutrition

PURDUE POSTER PRESENTATIONS:

Ingestive Behavior Research Conference, October 2013.

Brauchla MC, Miller KB, **Baker SL**, Kranz S. The effect of offering two high-fiber snacks per day to a sample of school-age children on their overall diet quality: results of a community-based prospective, random-controlled, nutrition intervention study.

Next Generation Scholars Research Fair, November 2013.
Baker SL, McCabe SD, Payne CR, Swithers SE, Kranz S. Do children like fruits and vegetables more when they are in fun shapes?

May Conference, May 2013
Brauchla M, **Baker S**, Reidenbach K, McCabe S, McCabe G, Miller K, Kranz S. Effects of High-Fiber Snacks on Diet Quality, Gastrointestinal Health, and Health-Related Quality of Life in a Sample of School-Aged Children.

PROFESSIONAL AFFILIATIONS:

Academy of Nutrition and Dietetics
American Society of Nutrition
Society for Behavioral Medicine
The Obesity Society

UNIVERSITY ENGAGEMENT:

Treasurer, Nutrition Science Graduate Student Organization, February - July 2013
Member, Nutrition Science Graduate Student Organization, fall 2012 – Present
Health and Human Sciences Dean Search Committee, Fall 2012