

Summer 2021

Strengthening the Evidence-Base of Youth Nutrition Programs: A Three Part Approach

Rebecca Kyryliuk

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STRENGTHENING THE EVIDENCE-BASE OF YOUTH NUTRITION
PROGRAMS: A THREE PART APPROACH

by

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For the Degree of Doctor of Philosophy in

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The Norman J. Arnold School of Public Health

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2021

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DEDICATION

To my family:

My person, Nicholas; my first girl, Murphy; and my heart, Lily

ACKNOWLEDGEMENTS

I am fortunate to have many wonderful people in my life who have helped me to where I am today and who continue to inspire and remind me of what is important and beautiful in this life.

My advisor, Dr. Michael Beets, I greatly appreciate your mentorship and patience throughout this long process. My committee members in addition to Dr. Beets: Drs. Russ Pate, Brie Turner-McGrievy, and Sara Wilcox. This dissertation would not have been possible without all your contributions. Each of you are exemplary in the field and bring a wealth of expertise that is so valuable to public health and from which I am so grateful to have benefited. I aspire to be as generous and encouraging with my students in the future. It cannot be expressed enough that this dissertation would not have been possible without your patience, support, and that each of you maintained your confidence in me. I would also like to thank Dr. J. Larry Durstine who first inspired me to examine the links between health behaviors and prevention of disease in populations and who was the first person to state he believed I could be a valuable teacher and scientist and would do well to continue my studies. I am grateful for his confidence, guidance, and enduring kindness over the years.

My fellow P2YP and BBIP cohorts, especially Drs. Jessica Winterer, Keith Brazendale, Falon Tilley Smith, and Kara Whitaker. It was a pleasure to collaborate with you all and I appreciate all your help.

I would like to thank the Provost for funding my work with a SPARC grant. I would also like to thank the BBIP program for funding my start into this doctoral program. I began this journey a decade ago, knowing that I loved teaching, wanting security in that role, and open to the possibilities this degree could unveil. I finish now with an incredible respect for research, a new home, a job doing what I love, and a new little toddler adding perspective to everything.

My parents, Bill and Mary Kaye – you never got to see this journey but I never for one moment doubted your love for or confidence in me. I cannot imagine how proud, in awe, and, yet, not surprised you would be. I appreciate more every day how hard you worked to make sure we knew your unconditional love, felt joy in each day, and found home in each other. In losing you, I know what will be left behind and I hope my mark on this world is as filled with humor, comfort, and love.

My daughter, Lily, for providing meaning and perspective to everything in this life. You are my heart beating outside my body, my every moment of joy, and the reason for everything good that I do. You inspired me to finish this and are a reminder that I want to raise a strong, brave girl who knows we can do hard things – and there will always be Mama's hugs when the hard feels too much.

Finally, my Nicholas, my person, who believed in me and a life beyond any of my wildest dreams and has made that our reality. You truly are my everything and you know this would not have been possible without you by my side every step of the long journey. Thank you for being you and for loving me.

ABSTRACT

National dietary guidelines recommend that children's diets consist of fruits, vegetables and whole grains, while limiting high-fat foods. Studies indicate, however, that children consume an abundance of sugar-sweetened, calorically dense foods and are lacking in fruit and vegetables, behaviors which significantly contribute to high rates of childhood obesity and subsequent, lifelong, detrimental health impacts. This dissertation provides new knowledge to strengthen the evidence-base and inform future best practices in youth nutrition programming so that more children will have the opportunity to meet national dietary recommendations. Three distinct investigations sought to *1) examine current and past youth dietary intake by comparing the most common foods consumed by children and adolescents (ages 2-18 years) at each daily eating occasion (breakfast, lunch, dinner, snacks), evaluated as a whole and by age groups, in 1971-1974 and 2009-2010 2) evaluate the effectiveness of the Food & Fun After School (FFAS) curriculum on changes in dietary knowledge, dietary self-efficacy and snack preferences of children in afterschool programs (ASPs) 3) utilize an iterative literature review examining best-practices of train-the-trainer (TtT) program delivery to develop a conceptual model for TtT use in research and practice.*

Study 1 showed youth dietary intake, in terms of food groups and items consumed, was largely similar in 2009 and 1977. Youth in 2009, however, have swapped fat, in the form of beef, for carbohydrates, in the form of refined carbohydrates and added sugars, in their overall daily diet. These critical differences coincide with changes to the

national food industry over the same period, largely driven by convenience, advertising, and policy.

In the second study, significant improvements in food knowledge were found for intervention students compared to controls. No significant effects were seen for self-efficacy to consume FV. During snack 1, when only served a choice of FV, over 93% of all children selected a FV at pre and post-test. This is compared to less than 10% of children selecting a FV at pre and post-test during snack 2, when less-healthy alternatives were also served. The intervention had a significant effect on fully consumed FV and FV waste for snack 2 among the small percentage of children who selected FV. These small significant improvements in food knowledge, FV consumption, and waste reduction for youth in intervention afterschool programs (ASPs) suggest curricula combined with structural controls on the foods offered for snack could enhance youth dietary knowledge and habits in the ASP setting.

The third study describes a conceptual model that identifies the critical factors necessary for interventions to effectively use and evaluate TtT. These critical considerations include the number of tiers, or training cohorts, with multiple tiers required for a full TtT approach, purposive selection of trainers, training on pedagogical techniques and program content, expansion of the reach of experts, the dampening of the effect with the addition of tiers, and the evaluation of implementation and costs throughout all tiers from stakeholders to expert instructors, facilitators, and eventually to the target population. With the consensus on TtT use provided by this model, program delivery has the potential to be not only more efficient but ultimately more impactful, creating true population level change on a broad public health scale.

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LIST OF SYMBOLS

N	Sample size.
SD	Standard deviation.
OR	Odds ratio.
CI	Confidence interval.

LIST OF ABBREVIATIONS

ASP	Afterschool Program
CHW	Community Health Worker
D&I	Dissemination & Implementation
FV	Fruits & Vegetables
K.....	Kindergarten
LHA	Lay Health Advisor
NFCS.....	National Food Consumption Survey
NHANES	National Health & Nutrition Examination Survey
NIH	National Institutes of Health
OST	Out of School Time
RCT.....	Randomized Controlled Trial
SCT	Social Cognitive Theory
TtT.....	Train-the-trainer
UNC-CH	University of North Carolina – Chapel Hill
Y.....	Years

CHAPTER 1

INTRODUCTION

Over the past four decades, the prevalence of obesity has more than tripled among children in the United States, from 5% in 1971-1974 to 17% in 2009-2010 [1-3].

Approximately 1 in 3 U.S. children are currently classified as either overweight or obese [2]. The consequences of overweight and obesity in youth may include, but are not limited to, diabetes, hypertension, metabolic syndrome, depression and low self-esteem, and can persist over the course of the child's lifetime [4-9]. Although a host of individual and environmental factors influence childhood obesity, diet and factors influencing diet play a fundamental role.

The Dietary Guidelines for Americans [10] recommend that children consume a diet consisting of whole grains, low-fat milk, reduced total fat intake and a variety of fruits and vegetables. However, current research indicates that the diets of children and adolescents contain an abundance of sugar-sweetened foods and beverages and are low on fruits and vegetables [11-13].

A variety of nutrition curricula and programs aimed to improve children's diets are available both for a charge and free-of-cost and can be administered in schools, afterschool settings, summer camps, community-based settings and in the home. Whereas some of these curricula are evidence-based [14-19], the overall evidence-base

for nutrition curricula, in regards to their efficacy, effectiveness and dissemination is limited.

The overall goal of this dissertation is to strengthen the evidence-base and inform future best practices in youth nutrition programming so that more children will have the opportunity to meet national dietary recommendations. This research consists of three distinct studies.

The first study examines current and past youth dietary intake by analyzing what specific foods children and adolescents (ages 2-18 yrs) eat at their various eating occasions (breakfast, lunch, dinner, snacks) throughout the day. Previous research has examined the macronutrient breakdown of dietary intake in youth [20-23], as well as the major calorie contributors [23-25], and whether youth are meeting national guidelines [12, 13]. The primary goal of this study is to be the first to show what foods are on children's plates at each meal throughout the day; thereby, providing a stronger evidence-base for the need and specific targets for future intervention to improve dietary intake in youth.

The second study evaluates whether a current, widely disseminated youth dietary curriculum in ASPs, *Food & Fun After School*, is effective at improving its proposed outcomes of youth dietary knowledge and behaviors. This evaluation seeks to provide the much-needed evidence-base for curriculum effectiveness. Additionally, analysis of the outcomes provides insight into areas for curriculum improvement and enhancement for future broad-scale implementation.

The third study looks at consensus on best practices through an iterative review of studies that use a train-the-trainer method (TtT) of program delivery across a multitude of

disciplines. The review includes studies primarily from the fields of healthcare and public health. A preliminary analysis of the literature indicates that no clear understanding of the concept of TtT currently exists in the field of public health; thus, this review will propose a comprehensive theoretical framework that can be used in future research on widespread dissemination of effective interventions.

Considering the three research concerns presented above, the following specific aims were proposed:

Specific Aim 1. Use cross-sectional nationally representative data from both the first and most recently available National Health and Nutrition Examination Surveys (NHANES) to determine and compare the most common foods consumed by children and adolescents (ages 2-18 years) at each daily eating occasion (breakfast, lunch, dinner, snacks), evaluated as a whole and by age groups, in 1977-1978 and 2009-2010.

Specific Aim 2. Evaluate the effectiveness of the *Food & Fun After School* curriculum on changes in dietary knowledge, dietary self-efficacy and snack preferences of children attending ASPs.

Specific Aim 3. Develop a conceptual model and theoretical framework for TtT methodologies, informed by a multi-disciplinary iterative review of TtT use in the literature.

The expected outcomes included a more complete understanding of the evidence-base and needs related to current youth dietary consumption by eating occasion, differences in youth dietary consumption over the past four decades, establishment of an evidence base for the current *Food & Fun After School* nutrition curriculum, and creation

of a theoretical framework for the TtT method of program delivery for future public health and multidisciplinary research.

Literature Review

Overall Background, Significance, and Rationale

Although recent national rates of childhood obesity have plateaued, childhood obesity remains unacceptably high in the United States, with nearly 1/3 of children between the ages of 2-18 years classified as overweight or obese [1-3]. The consequences of childhood obesity include, but are not limited to, lower self-esteem and early onset diabetes, hypertension, high cholesterol and metabolic syndrome in childhood [4-7]. These diseases often persist into adulthood and present lifelong health complications that become more difficult for children to overcome with every passing year [8, 9]. A host of individual factors, particularly diet and physical activity, play a role in childhood obesity, as well as the overarching social, physical and societal environments that foster such factors in American youth.

National dietary guidelines recommend that children's diets consist of fruits, vegetables and whole grains, while limiting high-fat foods [10]. Studies indicate, however, that children consume an abundance of sugar-sweetened, calorically dense foods and are lacking in fruit and vegetables [24, 25]. In fact, major contributors to daily caloric intake for youth include pizza, full-fat milk, grain-based desserts (doughnuts/pastries), and sugar-sweetened beverages [25, 26]. Concurrently, consumption of fruits and vegetables by youth consistently does not meet recommendations [12]. This clear imbalance in nutrient quality and caloric intake is likely a key contributor to youth

overweight and obesity and has been shown to be associated with both diabetes and cardiovascular disease in youth [5-7].

Mere food preferences at the individual level are insufficient to explain these discrepancies [27]. Rather the larger socioeconomic environment, which is conducive to less healthy choices and opportunities, must be factored into youth health. In accordance with the Socioecological Model [28], factors at the organizational, community and policy level must be addressed in order to prevent and treat child nutrition inadequacies and subsequent weight concerns. As such, recent government calls to action have targeted interventions and policies to reduce nutrient imbalances in youth environments, such as schools, homes, out-of-school-time (OST) and community programs [29-31].

Before such interventions and policies are implemented, a proper evidence-base for nutrition education and promotion is warranted. Many nutrition curricula already exist and are being disseminated that could be utilized, compiled, and examined for valuable information and approaches [14-19]. Each curriculum contains activities and lessons to help enhance children's dietary knowledge and improve their dietary habits. Few, if any, of these curricula, however, are evidence-based and proven to be effective; thus, the time and effort spent by schools, OST programs, community organizations and/or parents to deliver such curricula cannot yet be proven to be the best use of resources and dissemination may be premature. According to a workshop summary from the Institute of Medicine on the creation of national nutrition education standards, we still do not know the best way to promote nutrition knowledge and educate students on healthy eating choices [32]. Further, we do not know how best to train teachers and educators on healthy nutrition promotion. The creation of a reliable evidence-base

regarding the need for, effectiveness of, and generalizability of such curricula is needed to move the field forward.

Evidence is often thought of in terms of the efficacy of an intervention to improve health behaviors and outcomes in target populations. Efficacy research is necessary to create an evidence-base; however, it is not always sufficient to determine broad scale intervention effectiveness, generalizability or diffusion into communities [33]. From the community perspective, two other types of evidence must be considered: the evidence of need and the evidence of demand [34]. Evidence of need establishes a health behavior problem as a public health priority and comprises the size, severity and cost of a problem. Evidence of demand refers to acceptability of intervention efforts by the community, often based on methods of dissemination. In creating a strong evidence-base for any field, these types of evidence must be considered.

This study proposes to strengthen the overall evidence-base for practice in youth dietary research through a series of three distinct studies. The first study will strengthen the evidence of need by establishing the current dietary habits of children and the specific food items contributing to healthy and unhealthy dietary habits. This study will provide an illustration of the magnitude of unhealthy eating in today's youth as a public health concern. Further, this study will relate today's youth's dietary habits to those of youth 40 years ago, prior to the current childhood obesity concerns, to see if there is a difference in the foods consumed and patterns of consumption. The second study will strengthen the evidence of the effectiveness of one current, widely-disseminated nutrition curriculum in afterschool programs (ASPs) to determine if such efforts to change the dietary behaviors of children are effective. The third study will strengthen the evidence-base for

dissemination by proposing a model of one way to get effective programs successfully implemented in communities.

Study 1. Establishing evidence of need. Nationally, children's diets are calorically dense, yet lacking in nutrients, which has been clearly defined as a public health concern of great importance [11-13, 20-24]. Such dietary patterns have been linked to adverse health outcomes and overweight and obesity in youth, persisting into adulthood [4-9]. What this literature has not demonstrated, and what the first study will examine, is specifically what food items are being consumed by children that contribute to these dietary imbalances; essentially what foods contribute to both healthy and unhealthy eating habits across all age groups from toddlers to adolescents at each eating occasion. A comparison of the current foods consumed by youth to those consumed 40 years ago will further emphasize the difference in healthy and/or unhealthy dietary habits over this time; thereby, enhancing the evidence of the need for effective nutrition curricula, programs and partnerships for youth.

Study 2. Establishing evidence of effectiveness. OST programs include both ASPs and summer day camps. ASPs in the United States serve 10.2 million children daily and summer day camps serve approximately 14 million children each year [35]. The National Afterschool Alliance, in an attempt to create healthier environments for children after school, recently developed the *Healthy Eating Standards*, which call for ASPs to serve a fruit or vegetable and water every day, while avoiding sugar-based and artificially flavored foods and beverages [30]. Many ASPs are not held accountable to these recommendations or given the proper resources to achieve such standards [36]. As such, the creation and dissemination of evidence-based practices to improve the healthy

habits of children enrolled in ASPs, as well as create health supportive environments in ASPs are essential to bridging the gaps between policy and practice in ASPs. If provided with easily-accessible and low-or-no-cost, evidence-based curricula, healthy nutrition promotion and education efforts will be more likely to be broadly disseminated not only in ASPs but to other settings, creating population-level impacts. This study will seek to establish the much-needed evidence-base for one such nutrition curriculum, currently being disseminated nationally in ASPs.

Study 3. Evidence for dissemination. One factor requiring attention in regards to the delivery of effective health and dietary programming in all settings is a universal understanding of the various methods of program delivery. In some cases, interventions and/or curricula are directly delivered to programs by research staff. Other methods involve training of community members and/or program staff to deliver interventions themselves. One such method in need of a consensus to inform interventions is the train-the-trainer (TtT) model, wherein a researcher or lead trainer trains one or more levels of individuals to train other individuals to deliver interventions and/or curricula to program participants. Thus, the TtT model has the potential to broaden overall intervention/curricula reach. Much research in a variety of disciplines, including public health, psychology, social work and healthcare, references using TtT methods; however, the use of the TtT model is often inconsistent, particularly in regards to the levels or degrees from which the head trainer is removed from program participants.

Before the effectiveness of TtT methods can be addressed, a consensus on usage must be formed. A theoretical framework is necessary to build a universal understanding of TtT methods across disciplines and to help individuals who want to use the approach.

With the creation of such a framework, research referencing TtT methods and their effectiveness in program dissemination can be compared and an evidence-base can be formed. Even the most innovative scientific programs and strategies do not become a standard of practice unless targeted and sustained efforts are used to enhance dissemination. As such, the proposed third study will seek to provide one effective avenue (TtT methods) to broaden program reach and enhance dissemination.

This overall study proposes to strengthen the evidence-base for research into youth dietary programming by addressing inconsistencies in current research regarding what we currently know about child nutrition and how it's changed over the last 40 years, the evidence-base for one potentially helpful dietary curriculum in ASPs, and the theoretical framework to be used in creating an evidence-base for the TtT model. These inquiries are innovative for the following reasons:

- This will be the first study to examine the individual food items and foods groups most commonly consumed by food occasion for youth aged 2-18 years. Previous studies have examined macronutrient consumption and caloric contributors. But research has yet to show what items are on a child's plate at breakfast, lunch, dinner and for snacks. Further, this study will break down the food item consumption by age groups to show differences between various cohorts of children. This will allow for comparisons of those age groups where nutrition is at its worst. This clear, understandable analysis of what foods children eat will provide unequivocal evidence of the healthy and/or unhealthy nature of our children's diets. Specifically, this study will illustrate what food items are contributing to the imbalance in macronutrient consumption and overconsumption

of calories previously reported, which will allow for precise targeting of interventions.

- Through a comparable analysis and comparison of dietary recall data from 1977-1978 to current data, this study will be the first to show how the components of children's meals have changed over the last 40 years, which happens to coincide with the rise in national obesity rates. As such, this study has the potential to illuminate correlations between dietary differences and differences in obesity rates from the 1970's to today.
- This study provides the opportunity to provide the first evidence of the effectiveness of a widely disseminated nutrition curriculum under current usage. Should the results be positive, we will include recommendations to broaden curriculum reach. Fidelity to program implementation and evaluation of the process will allow for recommendations for curriculum improvement if necessary.
- No conceptual papers currently exist regarding how to use the TtT methods of program delivery. This will be the first study to create a multidisciplinary consensus on TtT methodologies through the creation of a theoretical framework, including a concept model and definition of TtT, to inform future interventions. This theoretical framework will be guided by an iterative multidisciplinary review of TtT methods referenced in current research.
- This study will bring together various facets of the baseline knowledge necessary to determine targets for dietary program improvement, the evidence-base for a currently used dietary curriculum, and the theory behind the TtT method of

program delivery to better understand the current evidence-base for dietary research in youth.

CHAPTER 2

METHODS

Manuscript/ Aim 1. Is this What We Eat in America? Analysis of child and adolescent food consumption by age and eating occasion, 1977-1978 vs. 2009-2010

A. Background and Significance – NHANES Dietary Analysis

A.1. Importance of the Problem Addressed by this Project. Coinciding with increase in overweight and obesity over the past 30-40 years, children in the U.S. have increased their total daily energy intake and number of daily eating occasions considerably [37].

Major contributors to overall energy intake in youth include sugar-sweetened beverages, pizza, full-fat milk, grain-based desserts, breads, pasta and savory snacks [21, 25, 38].

While children are consuming an abundance of solid fats and added sugars daily, their consumption of recommended fruits and vegetables remains inadequate [12, 13, 25].

This clear imbalance in the overall nutrient quality of children's diets is likely a key contributor to overweight and obesity in youth and the resulting health consequences. As such, recent government calls to action have targeted interventions to reduce these imbalances, specifically in youth environments, such as schools and ASPs [31, 32, 39].

A.2. Advances in Scientific Knowledge. Although research has studied recent trends in eating behaviors of both adults and children (increases in portion sizes, snacking, proportion of energy consumed away from home) [22, 40-42], and breakdowns of daily macronutrient and caloric intakes [37], we still do not have a clear picture of what

specific food items are being consumed by children and adolescents for their breakfast, lunch, dinner and snacks. As such, we do not have a reliable baseline for making specific food item recommendations for meals and snacks that are relevant to children's eating habits. Knowing the specific occasions when children are consuming recommended foods, such as fruits, vegetables and whole grains, if at all, as well as when they are eating the least healthy foods, will allow targeting of interventions towards relevant eating occasions. Further breakdown of the analysis by age groups will also indicate differences in the foods consumed at the various eating occasions for young children, elementary school-aged children, middle schoolers and adolescents. This breakdown will allow targeting of interventions towards age groups that appear to be more susceptible to less healthful eating. This study will, thus, fulfill a critical need in the nutrition evidence-base for a more comprehensive understanding of eating habits of youth. Without adequate data indicating current nutrient behaviors of youth, researchers and practitioners are less able to assess the needs for and create relevant health-promoting programs to improve child and adolescent dietary behaviors.

In addition to clarifying and elaborating on the evidence-base for current dietary behaviors of youth, this study will compare the foods that youth currently report consuming at each eating occasion with those foods most commonly reported being consumed by youth 40 years ago. As the time frame between the dietary recall in the first Nationwide Food Consumption Survey (NFCS) (1977-1978) and the most recently available NHANES 2009-2010 coincides with the rising obesity rates in the nation, the differences seen in food consumption between youth then and now could inform the current understanding of childhood obesity in America. At the very least, comparison of

the foods reported and the foods included in the codebooks, from 1977-1978 versus 2009-2010, will illustrate differences in the number of food options available to children in the 1970's versus now. This comparison could also provide an enhanced understanding of the reasons behind dietary differences between 40 years ago and today.

B. Approach

B.1. Objectives. Our overall goal is to improve the evidence-base regarding what children eat by identifying the most commonly reported specific foods that are consumed by children and adolescents at the various eating occasions (breakfast, lunch, dinner, snacks) on any given day. Additionally, we seek to look at comparable analyses from 1977-1978 to determine differences in dietary habits which may further inform research into childhood obesity and dietary-related health consequences for youth.

The objective for this study is to conduct a secondary analysis of the most recently available NHANES 2009-2010 data to determine what food groups and specific food items are most commonly reported as being on children's and adolescent's plates during each of their daily meals and snacks. An additional secondary analysis will be performed on the NFCS dataset from 1977-1978 and used for comparison to current results. The rationale for the proposed research is that a clearer understanding of the specific foods that children are eating daily will provide insight into the current status of youth diets and provide targets for future dietary intervention and program success. The potential outcome of such success would be the creation of more effective, targeted messages and interventions to alter dietary habits of youth. For example, if we find that children consume an abundance of calorie-dense, nutrient-poor foods for breakfast, future interventions could target changes in youth breakfast offerings and habits. Further

insight into age differences in food consumption might also allow for future research to find target ages where nutrient quality appears to shift or where specific eating occasions are at risk and use these results to target vulnerable age groups.

Through the secondary analyses performed on dietary recall data from NFCS from 1977-1978, comparisons will be made between current and past dietary behaviors of youth, which can be used to inform research into childhood obesity and dietary-related adverse health outcomes that have arisen over the past 40 years.

Through secondary analysis of NHANES data, looking at frequency of reported consumption, we will seek to accomplish the following specific aim:

Specific Aim 1. Use cross-sectional nationally representative data from both the first and most recently available National Health and Nutrition Examination Surveys (NHANES) to determine and compare the most common foods consumed by children and adolescents (ages 2-18 years) at each daily eating occasion (breakfast, lunch, dinner, snacks) in 1977-1978 and 2009-2010.

The expected outcome of this study is that the specific food groups and items seen on children's plates will reinforce our current understanding of the portion sizes and nutrient breakdown of children's overall diets; thus, indicating the specific foods contributing to the abundance of calories and added sugars, and at which eating occasions fruits and vegetables are missing. We further expect the results to show differences in nutrient quality, as well as in portion sizes and calories consumed, beyond the recommendations, between the various age groups, with older age groups displaying less healthful dietary habits. Finally, we expect to be able to draw conclusions based on the comparison of foods consumed by youth in 1977-1978 versus 2009-2010 as to

differences in the specific food items being consumed at each meal, as well as the overall nutrient quality of those foods.

B.2. Participants. This study will use 24-hour dietary recall data on children and adolescents (ages 2-18 years) from NFCS and What We Eat in America, NHANES 2009-2010. NHANES surveys provide nationally representative estimates of dietary intake for the civilian, non-institutionalized U.S. population through the use of a complex, multistage, stratified sampling design. For example, in 2009-2010, Non-Hispanic blacks and Mexican-Americans were oversampled to improve the precision of estimates for these race/ ethnicity groups.

For participants aged <6 years, interviews were conducted with a proxy (generally a parent or the person most knowledgeable about the child's food intake). With children aged 6-11 years, proxy-assisted interviews were conducted with the child and their caregiver. All interviews for participants aged 12 years and older were conducted with the individual. To maintain consistency with similar nutrient analyses, the first day of available 24-hour recalls, conducted by trained researchers in person, will be used in this study.

The following table (*Table 2.1*) provides a breakdown of the demographics for our population of interest from 2009-2010.

Table 2.1. NHANES 2009-2010 Youth Demographics

Age groups, years	
2 – 5	23.4%
6 – 11	34.9%
12 – 18	41.7%
Female	49.8%
Race/Ethnicity	
Non-Hispanic white	57.5%
Non-Hispanic black	13.5%
Mexican American	14.4%
Other	14.6%

B.3. Methodology for Current Project

Study Design. The proposed research will be two secondary data analyses of dietary recall data from NFCS and NHANES 2009-2010 for children and adolescents (ages 2-18 years). As our goal is to determine what foods were/are most commonly consumed at each eating occasion, we will generate frequency tables and rank the most commonly reported items. A threshold of 5% will be used as the minimum frequency reported, meaning that all food groups consumed by at least 5% of the population of interest will be ranked. Further, the five most common specific food items consumed within each food group will be determined to provide a precise illustration of what was/is on a child's plate. We will perform this analysis on all children and adolescents (ages 2-18 years) combined, as well as on subgroups by age. Comparisons will be made between the results from NFCS and NHANES 2009-2010.

In order to complete the proposed analysis, we will first have to classify our age groups, eating occasions and food grouping schema.

Age Groups. Each of the analyses will be performed for all children and adolescents, as well as for the subgroups of children aged 2-5 years and 6-11 years and adolescents aged 12-14 years and 15-18 years. These groupings coincide with common

milestones in children's development, such as starting elementary school at the age of 6 years and middle school at the age of 12 years. These age divisions also coincide with differences in use of a proxy for their 24-hour dietary recall. These age subgroups will allow for comparison of results between children and adolescents at different life stages.

Eating Occasions. The following are the listed eating occasions reported by participants in NHANES: breakfast, lunch, dinner, supper, brunch, snack, beverage/drink, feeding-infant only, extended consumption, desayuno, almuerzo, comida, merienda, cena, entre comida, botana, bocadillo, tentempie, bebida, and other. These eating occasions will be condensed into the four occasions of breakfast (breakfast, desayuno, brunch), lunch (lunch, almuerzo, comida), dinner (dinner, supper, cena) and snack (snack, extended consumption, merienda, entre comida, botana, bocadillo, tentempie) for our research purposes.

Food Grouping. Each food and beverage from NHANES 2009-2010 was recorded by using a discrete 8-digit food code and matched to the nutrient information from the USDA's Food and Nutrient Database for Dietary Studies version 5.0 [43], which is derived from the National Nutrient Database for Standard Reference version 26. The applicable version of the National Nutrient Database from 1971-1974 will be used to group foods reported in NFCS. Originating with the nine USDA food groupings, groups will be systematically aggregated based on nutrient composition, critical dietary behaviors and similarities in consumption and processing patterns. A total of 61 mutually exclusive food, beverage, baby food and condiment groups will be created. For our analyses, condiments, beverages and baby food will be excluded, leaving 43 distinct food categories, shown in Table 2 below.

Table 2.2. NHANES Food Categories

Food Category	Food Category	Food Category
Yogurt	Sandwiches with meat, poultry, fish	Oatmeal/ cooked cereal
Milk desserts	Eggs, egg mixtures, dishes, sandwiches	Rice and couscous
Cheese	Legumes, dried beans, meat substitutes	Cereal
Cottage cheese	Nuts and seeds	Grain mixtures
Processed cheeses, mixtures, soups	Nut butters and nut butter sandwiches	Fruits, raw
Beef	Breads and rolls	Dried fruit
Pork and ham	Biscuits	Vegetables
Bacon	Corn bread, corn muffins, tortillas	French fries/ hashbrowns
Other meats (game, lamb, veal)	Muffins and popovers	White potato chips
Poultry	Cakes, cookies, pies, cobblers, pastries	Fried vegetables
Chicken nuggets/ tenders	Danish, breakfast pastries, doughnuts	Vegetable soups/ mixtures
Frankfurters, sausages, lunchmeat	Crackers	Fruits, canned/ frozen
Fish and shellfish	Salty snacks from grains	Gelatin desserts/ salads
Meat, poultry, fish mixtures and soup	Pancakes, waffles, French toast	Ices, popsicles, sherbet
Frozen meat meals	Pasta	Candies

B.4. Outcomes of Interest

Our primary outcomes of interest are the ranked frequencies of food groups being consumed for all children and adolescents at the four eating occasions of breakfast, lunch, dinner and snacks. In addition to the frequency of consumption, we will also determine the average quantity (grams) and energy (kcal) of each food group consumed. This analysis will be performed for all food groups consumed by more than 5% of respondents at the indicated eating occasion. For each of the food groups, further frequency analysis

will be conducted to determine the top five specific foods consumed in each group. Average quantity, energy, and serving sizes for each specific food will be analyzed. Serving sizes will be specific to each individual item to allow for precise interpretation. The above analyses will additionally be performed on each age subgroup (ages 2-5, 6-11, 12-14, 15-18 y).

B.5. Statistical Analysis. Survey commands within STATA13 will be used to account for complex survey design and to incorporate sample weights, which reflect probability of selection, nonresponse and post-stratification. For estimates to be representative of the children and adolescents living in the U.S., analytic weights were assigned to survey respondents who participated in the dietary recall and account for differential probabilities of selection and participation. Data analysis is anticipated to take place in 2014.

C. Limitations. The overall survey sampling design and 24-hour recall protocols have advanced over the past 40 years. Any comparisons between NHANES I and NHANES 2009-2010 must take such methodological differences into account. Despite improvements in dietary assessment methods, such as the use of the multiple pass method in collecting NHANES data, research suggests that collecting reliable and accurate data from children and adolescents remains difficult [44-46]. As all 24-hour dietary recall is self-report, the results are subject to social desirability bias and accurate memories. Underreporting and misreporting of dietary intake has been associated with age, race/ethnicity and body weight status, and is most common among unhealthy foods or foods perceived to be related to obesity [47-50]. However, previous similar research with the NHANES databases indicate that parents and children continue to report consumption

of foods that include added fats and sugars [20-25]; thus, we expect this analysis to create an accurate representation overall.

Manuscript/ Aim 2. Evaluation of the *Food & Fun After School* nutrition curriculum: Establishing an evidence base for practice

D. Background and Significance – *Food & Fun After School*

D.1. Importance of the Problem Addressed by this Project. ASPs in the United States serve 10.2 million children daily, with over half of those children (67%) qualifying for food assistance programs; thus, representing a largely low-income population of children from food insecure homes [35, 51]. ASPs serve snacks daily, largely consisting of inexpensive, artificially-flavored, refined, and individually packaged foods supplying children with no more than empty calories. The National Afterschool Alliance, in an attempt to create healthier environments for children after school, recently developed the *Healthy Eating Standards*, which call for ASPs to serve a fruit or vegetable and water every day, while avoiding sugar-based and artificially flavored foods and beverages [30]. Many ASPs are not held accountable to these recommendations or given the proper resources to achieve such standards [36]. As such, the creation and dissemination of evidence-based practices to improve the healthy habits of children enrolled in ASPs, as well as create health supportive environments in ASPs are essential to bridging the gaps between policy and practice in ASPs.

D.2. Advances in Scientific Knowledge. *Food & Fun After School* (© President and Fellows of Harvard College and YMCA of the USA) is a freely available curriculum designed to develop healthy habits for children and families in ASPs. The curriculum consists of 7 units on healthy eating, with 3-4 crafts/ games/ activities per unit. *Food &*

Fun After School has been widely adopted by hundreds of YMCA's, the nation's largest non-profit provider of childcare [52]. The curriculum reports having positive impacts on children's and parent's dietary knowledge, eating habits and self-efficacy to make healthy choices. The curriculum further reports that it improves dietary environments in ASPs [53]. Despite these statements and already widespread dissemination, no empirical evidence exists to support that with the investment of the nearly 150 hours of time and effort necessary to fully implement the curriculum, the desired improvements will be achieved. Prior to further widespread implementation, a proper trial of the curriculum would be appropriate and necessary to ensure that the curriculum is effective; thus strengthening the evidence-base for practice.

E. Approach

E.1. Objectives. Our long-term goal is to identify effective low-or no-cost curricula that ASPs can use to meet the *Healthy Eating Standards*.

The objective for this study is to conduct the first evaluation of the *Food & Fun After School* nutrition curriculum in terms of improving dietary knowledge, dietary self-efficacy to consume fruits and vegetables (F&V) and snack preferences of children attending ASPs. The rationale for the proposed research is that wide dissemination of the *Food & Fun After School* curriculum might be premature given that no research has yet shown whether the curriculum results in its proposed outcomes.

Through a trial of the fully implemented nutrition curriculum, we will determine whether this widely disseminated program effectively directs ASPs to meet *Healthy Eating Standards* and improves dietary knowledge, dietary self-efficacy for F&V, and snack preferences for children in ASPs. We will further be able to identify ways to

enhance the current curriculum to achieve its specified goals. We hypothesize that by the end of the project, we will have collected sufficient evidence to determine the effectiveness of the *Food & Fun After School* curriculum at achieving its goals of improved food knowledge, dietary self-efficacy for F&V, and snack preferences of children in ASPs. Positive results will warrant broadened reach and implementation of the curriculum beyond the YMCA's. Fidelity to the curriculum and process evaluation throughout the study will allow for any recommendations for improvement, if necessary.

Using a randomized controlled design in 8 ASPs, serving over 750 children daily, we will accomplish the following specific aim:

Specific Aim 2. Evaluate the effectiveness of the *Food & Fun After School* curriculum on changes in dietary knowledge, dietary self-efficacy for F&V, and eating snack preferences of children attending ASPs.

The expected outcome from this study will be the provision of a strengthened evidence-base for whether the *Food & Fun After School* nutrition curriculum results in improvements in dietary knowledge of children, dietary self-efficacy for F&V, and dietary habits, as indicated by snack preferences. If the curriculum is found to be highly effective, this study will provide impetus for more widespread national dissemination beyond the YMCA's. We further expect to be able to identify specific reasons why the curriculum may or may not be effective and offer recommendations to maximize curriculum impact.

E. 2. Participants. Participants include children in 8 ASPs within the Boys and Girls Club of the Midlands, operating in nine counties and expected to serve over 750 elementary-aged children in 2014-2015. These ASPs take place in elementary schools,

immediately after the end of the regular school day, and offer children opportunities for homework, snack, enrichment, socialization and recreation until ~6pm each day of the school year.

E.3. Methodology for Current Project

Recruitment. Participating ASPs (n=8) will be recruited through the Boys and Girls Club of the Midlands' President, who has an existing professional relationship with the principle investigator's research group. The curriculum will be administered to a subset of students in the four participating intervention ASPs, with the other four ASPs serving as controls. We anticipate that 75% of children will participate and complete measures based on our recruitment from the major advisor's current studies.

Study Design. The proposed research will use a randomized experimental design, with measures at pre-test and post-test on children from 4 intervention and 4 control ASPs in the fall of 2014. Pre-test measures will be collected from children prior to curriculum implementation in August. To ensure fidelity, the nutrition curriculum (*see Table 2.3*) will be administered, as designed and with no deviations, over the course of fourteen weeks (two waves of 7 weeks per site) by trained research staff. Post-test measures will be collected after full nutrition curriculum delivery in October (group 1) and December (group 2).

Table 2.3. *Food & Fun After School Nutrition Curriculum and Goals*

Unit Title	Theme	Behavioral Goal
Take a Bite!	Fruits and vegetables	Eat more fruits and vegetables (5-a-day!).
Be Sugar Smart	Sugar-sweetened drinks	Drink fewer sweetened beverages and eat fewer sweets.
Go for Good Fat	Healthy and unhealthy fats	Choose foods with healthy fats when possible.
Go for Whole Grains	Whole grains	Eat more whole grain foods.
Super Snacks	Healthy snacking	Choose healthy snack foods.
Mix it Up	Fruits and vegetables	Eat a variety of fruits and vegetables.
Be Active, Stay Cool	Keeping hydrated	Drink water at every snack and when they are thirsty.

E.3.1. Outcomes of Interest. Primary outcomes of interest are effects of the *Food & Fun After School* curriculum on dietary knowledge, self-efficacy for F&V, and eating habits/preferences for ASP children. An age-appropriate, previously-validated survey will be used to determine children’s dietary knowledge. As no widely accepted dietary knowledge survey currently exists for children [54], we will adapt reliable and valid measures used in similar research [55-57]. The Child Dietary Self-efficacy Scale will be used to measure self-efficacy [58].

In addition to the dietary knowledge and self-efficacy surveys, trained researchers will conduct a food preferences study for each site at two time points, baseline and post-test, to measure child dietary habits and preferences. All ASP children will be provided with their choice of 14 snacks, including a variety of fruits, vegetables, flavored salty snacks, unflavored grains and sugar-sweetened snacks, commonly seen in ASPs. Description of the snacks and serving sizes are presented in *Table 2.4*.

Table 2.4. Description of snacks served to elementary-aged students in ASPs at baseline and post-test to determine dietary habits and preferences

Snack Group	Serving Size (oz)
Fruit	
Apples	6.3
Oranges	6.7
Bananas	7.5
Vegetables	
Carrots with low-fat ranch	3.0
Celery with peanut butter	4.0
Sugar-Sweetened Foods	
Cream Filled Sandwich Cookie	2.0
Fruit Gummie Candy	2.0
Animal Crackers	0.9
Flavored Salty Snacks	
Nacho Cheese Flavored Tortilla Chips	1.0
Cheese Puffs	1.0
Cheese Flavored Crackers	1.0
Less Processed and Unflavored Grains	
Air Popped Pop Corn	1.5
Pretzels	1.0
Plain Corn Tortilla Chips	0.5

Prior to snack time at baseline and post-test, all snacks will be pre-weighed, using a digital food scale. At each snack time, enough snacks will be available of each food item to feed all children if a single item was selected by all the children (e.g., 76 children present - 76 apples present, 76 cookies present). Each child will be recorded for the snack they select and the quantity of each snack taken will be recorded and confirmed based on the quantity remaining. The number of children consuming food items from home and the outside items consumed during the snack time will also be recorded. Children will be instructed to leave all trash and any leftover snacks at their tables.

Immediately following snack time, research staff will collect the snack bags and all waste and separate them by each snack offering. The quantity of partially and fully-consumed snacks will be recorded for each item. Fully consumed snacks are defined as no edible food items remaining. For whole fruit, fully-consumed is defined as the consumption of everything except for the apple core, or banana and orange peel. All other leftover snacks will be defined as partially consumed. The remaining snack waste will be weighed and recorded for each snack to determine the total waste for each item. For the estimated weight of the fruit waste, the weight of the apple cores, and banana and orange peels will be excluded from the final waste weight. These procedures will be repeated at each site at baseline and post-test and are consistent with previous snack preference studies [59].

E.4. Statistical Analysis

Primary Analysis. Statistical analysis will be performed on primary outcomes from baseline to post-test. Specifically, the children's food knowledge, self-efficacy for F&V and dietary habits/preferences will be compared using mixed-model ANOVAs accounting for multiple measures on children nested within ASPs. As approximately 40-50 students are expected to sign up for the study at each site, we anticipate survey and self-efficacy outcomes from 240 children (30 per site). According to a power analysis with *G*Power 3.1.7*, a randomly-selected sample size of at least 56 children (~7 from each of the 8 sites) will be required to detect a moderate effect size, with $\alpha=0.05$ and a power of 0.80 for each measure of children's dietary habits.

F. Limitations and Benchmarks for Success. The primary limitation for this study is the use of self-report measures to determine two of our primary outcomes. However, the

Child Dietary Self-Efficacy Scale has been shown to have strong psychometric properties [58]. The children's food knowledge survey is adapted from three previously validated measures in similar studies [55-57]. Thus, reliability of self-reports will have been maximized. And the snack preference component will provide objective results related to changes in dietary habits during snack in ASPs.

A second expected limitation will be natural attrition of children from the ASPs over the course of the semester. The abbreviated time frame of this study at each site (7 weeks) should minimize attrition effects. However, attrition will be a factor for children who are not present for both pre- and post-assessment. The benchmark for success will be completed measures from the anticipated 75% of our sample in order to fully determine program efficacy.

Table 2.5. FFAS Outcomes of Interest

Dependent Variable	Outcome	Measure	Time Collected
Child Food Knowledge	Primary	Food knowledge surveys	Pre/Post intervention
Child Dietary Habits	Primary	Snack preference study	Pre/Post intervention
Child Self-efficacy	Primary	Child Dietary Self-efficacy Scale	Pre/Post intervention

Table 2.6. FFAS Study Timeline

Activity	Fall 2014				
	Aug	Sep	Oct	Nov	Dec
Baseline Measures Group 1					
<i>Food & Fun</i> Implementation 1					
Post-test Measures Group 1					
Baseline Measures Group 2					
<i>Food & Fun</i> Implementation 2					
Post-test Measures Group 2					
Data Analysis					

Manuscript/ Aim 3. A Review of Train-the-Trainer Approaches: Creating a Theoretical Framework for Future Research

G. Background and Significance – Train-the-Trainer Review

G.1. Importance of the Problem Addressed by this Project. One of the most fundamental issues impeding improvements in health programming today is the gap between what research has shown can optimize health and what is actually implemented in everyday practice; essentially an issue of translating the evidence-base into practice, particularly on a large scale. For evidence-based approaches to have a broad and lasting impact on population health behaviors, effective interventions must be widely used.

Dissemination has been defined as a set of planned, systematic efforts designed to make a program or innovation more widely available [34]. These planned efforts must take into consideration the target audiences and the settings in which the research findings are to be received [60]. Diffusion is the direct or indirect outcomes of those efforts. Successful diffusion, thus, requires effective dissemination strategies and efforts to affect the specific mechanisms acting on such strategies. Despite the recognition that diffusion of evidence-based health interventions is a public health priority, the field of dissemination and implementation (D&I) research is still fairly new, with little consensus on the best practices to accomplish successful, systematic diffusion [61].

One critical factor to the issue of D&I is for all parties to be on the same page in regards to priorities and evidence-based best practices. This study proposes to address one gap between evidence-based research and practice by creating a comprehensive, multidisciplinary theoretical framework for the use of TtT to inform future interventions as a potential dissemination best practice.

G.2. Advances in Scientific Knowledge. Multiple and often inconsistent definitions of TtT methodologies currently exist. Lack of consensus surrounding terminology is not uncommon when concepts, such as TtT, are new or are used in a variety of disciplines, including psychology, social work, public health and education [62]. Also, no conceptual papers currently exist to clarify the proper use of TtT in practice. Acknowledging such inconsistencies, this study seeks to create a comprehensive, theoretical framework to provide common ground for future research. Further, this study will review the multidisciplinary body of research referencing use of TtT to better understand the current state of practice.

The proposed theoretical framework and iterative review, pulling from the literature, will help individuals and programs who want to use the approach by orienting such individuals to the conceptual model and definition of TtT, how TtT is to be used most effectively, and the associated limitations and benefits. The framework will address the dual components of TtT methods; factors related both to training the trainers and the overall intervention impact on target participants.

At each stage of the research, decisions must be made balancing methodological rigor (internal validity) with practical constraints, including cost and real-world factors [34, 63]. Expected benefits include the fact that TtT methods have the potential to be more cost-effective, more manageable and more responsive to local needs; thus, increasing reach and community buy-in. Expected limitations include diminished returns with each level of training, as the message becomes diluted. However, low-intensity interventions that are less efficacious but that can be delivered to large numbers of people may have a more pervasive overall impact [64-66]. Essentially, a successful TtT model

will appropriately balance both internal and external validity to maximize efficacy and reach of evidence-based interventions.

G.3. Models to Inform Diffusion of Evidence-Based Programs. The most widely recognized and utilized theoretical basis for D&I research is Roger's diffusion of innovations model [67] which attempts to explain how, why and at what rate an innovation or program spreads through a defined population. The model purports that uptake of an innovation occurs via a five phase process involving knowledge, persuasion, decision, implementation and confirmation. Along this continuum, diffusion of innovations theory recognizes the following five categories of participants, categorized by their rates of adopting innovations: innovators, early adopters, early majority, late majority and laggards [67]. TtT methods are primed to use the innovators to target the early adopters and early majority to eventually train the late majority and potentially impact even the laggards in a target population.

Included in the five phases of the diffusion of innovations model is the concept of persuasion, necessary to achieve buy-in from the target trainers and population. An applicable model specifically targeting persuasion is the persuasive communication matrix [60, 68, 69], which includes the following five persuasion variables that influence the impact of program dissemination: the source of communication, the message to be communicated, the channels of communication, the audience characteristics and the setting. A comprehensive TtT framework will need to account for and evaluate processes at each of these persuasion variables, with the source being the researchers, the message being the evidence-based program, the channels being the levels of trainers, and the characteristics of those trainers in their settings.

Another framework, which is complementary to both diffusion of innovations theory and the persuasive communication matrix, and is useful for evaluating D&I research, is Glasgow's RE-AIM framework [64]. Utilizing the RE-AIM framework for program implementation and evaluation, the following factors must be considered: reach to the intended population; efficacy of the intervention; adoption by target staff; implementation consistency, cost, and adaptations; and maintenance of effects over time. A critical concept with RE-AIM is that the impact of an intervention is determined by a combination of not only "reach" multiplied by "efficacy," but also the degree to which it is adopted, implemented with fidelity, and maintained. An effectively disseminated, evidence-based intervention, with far-reaching public health impacts, according to RE-AIM standards, needs to have a broad reach and be feasible to implement and maintain in the real-world settings, thus maximizing both internal and external validity.

Use of TtT methods would have the potential to address and maximize each component of the RE-AIM framework for program dissemination. The reach of an intervention using TtT is far greater than that of a one-on-one approach, as elaborated on in section I.3.1 below. The evidence-base for efficacy of interventions disseminated with TtT methods should have been previously proven in controlled, efficacy trials. The efficacy of the TtT method itself, as a dissemination tool, has not been widely tested, as the concept remains inconsistent in the literature. This proposed research will allow for future investigation into TtT efficacy as a dissemination tool in future practice. The adoption of the intervention and maintenance aspects of TtT have the potential to be maximized due to buy-in from the individuals as they themselves become trainers and, thus, have a greater sense of ownership of intervention success. Finally, TtT methods

have the potential to offer a more cost-effective implementation over time by producing a larger pool of qualified trainers.

Among school-based diffusion studies, a few general points were determined: the most important predictor of diffusion success is training, preferably in-person hands-on training, and trainer familiarity and self-efficacy with the target behavior is another key predictor of success [34, 70-72]. Additionally, in the physical activity literature, a consistent pattern has developed, indicating that the physical activity levels of the trainers and respondents are related to effective physical activity program dissemination [73-75]. Thus, the TtT framework, in addition to being informed by theories for overall program dissemination and impact, must be informed by theories relating to the process of training the trainers.

To address the training of trainers, the TtT framework will be informed primarily by Social Cognitive Theory (SCT), particularly the components of self-efficacy, social support, and reciprocal determinism [76, 77]. In order to enhance self-efficacy, trainings will involve setting small achievable goals with specified rewards, and monitoring and reinforcement, including self-monitoring and evaluation. Social support will be enhanced through building the TtT network of trainers. And reciprocal determinism is inherent in the various levels of trainers, whereby each trainer will act as both an agent of change (trainer for the trainers and target population) and a responder to change (trainee of researchers and trainers) throughout the intervention process. Interventions desiring a more customized approach can also factor in the Transtheoretical Model [78] and stage of change (precontemplation, contemplation, preparation, action, maintenance) of each

trainer, in regards to the target behavior and self-efficacy to change, and implement appropriate strategies in training to accommodate each stage.

G.3.1. Proposed Reach Analysis. The basic premise for the TtT method hinges on the concept that the overall intervention reach, however diluted due to the degrees of separation of the target population from the master trainer/researcher, will be greater than direct one-on-one training methods, yet still retain the benefit of hands-on trainings. For example, when the master trainer trains the lead trainers, the impact has a direct effect, which we will label as “A.” The knowledge and tools are delivered directly from the master trainer to the lead trainers. However, as the master trainer is only one person with time constraints, he/she is limited in the number of individuals he/she is able to impact. Therefore, one master trainer can have “A” impact on a small number of lead trainers. The lead trainers each then deliver the same knowledge and tools imparted on them to their own set of trainers. This dilutes the impact of the program by a factor of “B.” Thus, each of the lead trainers impacts a set number of trainers by a factor of “A – B.” Although the direct impact is diluted, the total impact of “A – B” on a larger number of individuals would be greater than the direct impact of “A” on only a few lead trainers. Finally, the trainers would deliver the master trainer/ researcher’s program to the program participants, or trainees. The impact of the program will have been diluted by another factor of “C,” as the knowledge and tools will be indirectly delivered via the trainers, through the lead trainers who received the knowledge from the master trainer/ researcher. Thus, the final impact of the program on the target participants will be “A – B – C.” Although the impact is diluted, the TtT method purports that the impact of “A – B – C”

on a larger population is still greater than that of “A” on only a few individuals, which is the limited capacity of direct methods.

Therefore, with the use of the TtT method, a program can reach exponentially larger groups of individuals, creating a broader scale public health impact by leveraging a network of trainers and capacity rather than relying on, often limited, direct intervention and education.

H. Approach

H.1. Objectives. Our long-term goal is to help create a comprehensive, theoretical framework for the TtT to be used across disciplines through a proposed conceptual model and its resultant universally-applicable definition and an iterative review of the literature regarding TtT methods.

The objective for this study is to create a conceptual model for the TtT method and to use that model with an iterative review of the literature on multidisciplinary references to TtT. The rationale for the proposed research is that no current consensus exists regarding the TtT model, resulting in inconsistent study findings and discrepancy regarding use of TtT as a best practice in intervention dissemination. Currently, many studies reference use of the TtT model; however, we hypothesize these studies are inconsistent in their application of TtT methods. The potential outcome of this research is the contribution of a theoretical framework on TtT methods and definitions for current and future multidisciplinary research.

Through development of a conceptual model and creation of a theoretical framework for TtT methods, we will seek to accomplish the following specific aim:

Specific Aim 3. Develop a conceptual model and theoretical framework for TtT methodologies, informed by a multi-disciplinary iterative review of TtT use in the literature.

H.2. Methodology for Current Project. The conceptual model will be used with an iterative review of multidisciplinary research in public health and healthcare. Searches of electronic databases will be limited to 1980 – 2014 and will include Ebsco, PubMed, Scholar Google, Web of Knowledge and PsycInfo. Search terms used will include: train-the-trainer, train, trainer, TTT, TtT, program delivery, and interventions. These terms will be looked at both individually and in applicable combinations.

Relevant reference lists of selected studies and published reviews will be searched. Titles and abstracts across sources and databases will be search for relevancy and duplications. Studies with multiple publications will be combined and counted as one.

Studies will be selected for review if they meet all of the following inclusion criteria: (1) published in a peer-reviewed journal; (2) written in English; (3) mention use of the TTT method. The review will seek to find best practices from each field to inform the conceptual model and allow for multidisciplinary comparisons of definitions and efficacy.

H.3. Outcomes of Interest. Descriptive information from each selected study will be extracted and tabulated. Variables of interest will include: manuscript title, author and date; study topic; study design; description of TtT methods used; training duration; measured outcomes; and study results. The variables of interest, particularly the TtT methods used, will be compared across studies and to the proposed conceptual model.

Such comparisons will allow for a more universal understanding of the TtT method as well as the current state of its usage. This review will also allow for recommendations regarding the use of TtT methods in future interventions.

I. Limitations and Benchmarks for Success. The primary limitation for this review might be the small amount of research currently published regarding the use of TtT in each specific discipline and a lack of agreement between disciplines regarding TtT usage. The TtT method is still fairly new to some fields, including public health, as evidenced by the lack of consensus on its definition and use. However, this allows for the creation of a comprehensive theoretical framework, which is critical to future use of the methodology in all fields. Likewise, a theoretical framework will allow for better determination of the efficacy and usefulness of TtT in D&I research. The potential impact of a properly administered and evaluated evidence-based program indicates TtT to be a formidable public health and RE-AIM tool to be used to translate policy and research to practice on a broad scale.

CHAPTER 3

IS THIS WHAT WE EAT IN AMERICA? ANALYSIS OF CHILD AND ADOLESCENT FOOD CONSUMPTION BY AGE AND EATING OCCASION, 1977-1978 VS. 2009-2010

Abstract

Background: Changes in daily energy and macronutrient intake and dietary trends for youth have previously been reported; however, the specific food items contributing to these intakes at each eating occasion remain unknown.

Purpose: The purpose of this study was to compare dietary intake patterns from 1977-1978 vs 2009-2010 of youth (ages 2-18 years) at different eating occasions (breakfast, lunch, dinner, snacks) throughout the day.

Methods: Using cross-sectional, nationally representative data from the Nationwide Food Consumption Survey 1977-1978 (NFCS77) and the National Health and Nutrition Examination Survey 2009-2010 (NHANES09), differences in energy and macronutrient intake were analyzed by age group and eating occasion. Frequency tables were generated to determine the food groups and items consumed by over 5% of youth at each eating occasion.

Results: Frequency rankings indicated overall similar food group consumption between surveys, except for higher intakes of macaroni and cheese and pizza at lunch, and

candies, crackers and salty grains as snacks in 2009, and higher intakes of beef in 1977. Significant differences ($p < 0.01$) were found between the intakes of calories and macronutrients at each eating occasion between NFCS77 and NHANES09, with results including fewer calories and carbohydrates consumed at dinner, less protein and fat consumed at most eating occasions, and more carbohydrates consumed in snacks and some lunches in 2009 compared to 1977.

Conclusion: Youth dietary intake, in terms of food groups and items consumed, was largely similar in 2009 and 1977. Youth in 2009, however, have swapped fat, in the form of beef, for carbohydrates, in the form of refined carbohydrates and added sugars, in their overall daily diet. These critical differences coincide with changes to the national food industry over the same period, largely driven by convenience, advertising, and policy. These results might help to explain concurrent differences in health outcomes for youth in the U.S.

Keywords: nutrition, youth, NHANES, eating occasion, food groups

Introduction

Current trends in childhood obesity indicate a persistent positive energy imbalance in American youth at the population level. Coinciding with increases in overweight and obesity over the past 30-40 years and the potential negative health consequences [1-9] is a pervasive belief that youth dietary intake has dramatically worsened over time. Contrary to this understanding, a subset of the literature reveals that mean daily energy intake changed little from the late 1970's into the mid-1990's [10], and has increased only slightly in the 21st century [11, 12]. Concurrently, literature indicates that children in the U.S. have increased their portion sizes of less healthful foods and number of daily eating occasions [11, 13-20]. Major contributors to overall energy intake in youth today include sugar-sweetened beverages, pizza, full-fat milk, grain-based desserts, breads, pasta, and savory snacks [17, 21, 22]. Children are also consuming an abundance of solid fats and added sugars daily with their consumption of recommended fruits and vegetables remaining inadequate [14, 15, 21].

Trends in eating behaviors for both adults and children since the 1970's have been reported (increases in portion sizes, snacking, proportion of energy consumed away from home) [12, 18, 23, 24], including breakdowns of daily macronutrient and caloric intakes [11], and whether youth are meeting dietary guidelines [14, 15]. Even so, we still cannot answer the fundamental question of what specific foods many children eat at each occasion of breakfast, lunch, dinner and snacks. Such information is important to create a clear, relatable picture of youth daily dietary intake and will allow for realistic recommendations and a clear understanding of necessary targets, be they specific food items or eating occasions, for intervention.

The purpose of this study was to analyze the specific food items children and adolescents (ages 2-18 years) eat at their various eating occasions (breakfast, lunch, dinner, snacks) throughout the day. This study compares the foods that youth currently report consuming at each eating occasion with those foods most commonly reported being consumed by youth 40 years ago. From this analysis, we can identify if and how the food items consumed by youth for each eating occasion today differ from decades ago. Future studies can then determine if these differences are associated with current health concerns. As the time frame between the dietary recall in the NFCS77 and the most recently available NHANES09 coincides with the rising obesity rates in the nation [1-3], the differences seen in food consumption between youth then and now could add clarity to previously reported dietary trends [16-18, 25, 26] by demonstrating specific food items contributing to macronutrient inconsistencies and potentially contributing to the current understanding of childhood obesity in America.

Methods

Survey Design and Sample. This study used 24-hour dietary recall data on 12,052 children and adolescents (ages 2-18 y) from the NFCS77 [27] and 3,128 youth from What We Eat in America, NHANES09 [28]. Both surveys provide nationally representative estimates of dietary intake for the civilian, non-institutionalized U.S. population using a complex, multistage, stratified sampling design. NHANES09 uses sampling procedures, survey instruments, dietary collection methods, and food composition tables that were designed to match earlier procedures of NFCS77. Detailed information pertaining to each survey has been published previously [28, 29].

In both time periods, for participants aged <6 y, interviews were conducted with a proxy (generally a parent or the person most knowledgeable about the child's food intake). With children aged 6-11 y, proxy-assisted interviews were conducted with the child and their caregiver. All interviews for participants aged 12 y and older were conducted with the individual. To coincide with these methodological differences and common milestones in children's development, each of our analyses was performed for all children and adolescents, as well as for subgroups of children by age (2-5, 6-11, 12-14, 15-18-y-olds). The first day of available 24-hour recalls was used in this study to maintain consistency with similar nutrient analyses [23], which also consistently use the first day of recall data, and between the two survey protocols, as the 1977-1978 surveys only consisted of one recall day.

Eating Occasions. All reported eating occasions have been condensed into the four meals of breakfast, lunch, dinner, and snack, as designated by each respondent. During each interview, a list of eating occasion names was provided for reference. However, the eating occasions were not defined for the respondents; thus, the interpretation may differ from one child to another [28]. For example, one child might refer to their afternoon meal as a snack, while another might consider the same meal supper.

Food Grouping. Each food and beverage from NHANES09 was recorded by using a discrete 8-digit food code and matched to the nutrient information from the USDA's Food and Nutrient Database for Dietary Studies version 5.0 [30], which is derived from the National Nutrient Database for Standard Reference version 26 [31]. The applicable nutrient codebook, based on the USDA National Nutrient Database from

1977-1978, was used to group foods reported in the NFCS77 [29]. In a similar manner to the University of North Carolina-Chapel Hill (UNC-CH) food grouping system [25, 32], groups were systematically aggregated based on nutrient composition, youth dietary behaviors, similarities in consumption and our research questions. Some differences in our grouping, as compared to that of UNC-CH, included segregation of raw fruits and vegetables from those which were frozen, canned or fried, as well as the segregation of chicken nuggets and chicken tenders from other poultry, as we believed these to be critical distinctions for our study based on the processing of the foods. A total of 61 mutually exclusive food, beverage, baby food and condiment groups were created. For our analyses, condiments, beverages and baby food were excluded, leaving 45 distinct food categories, shown in Supplemental Table 1.

Statistical Analysis. Survey commands within STATA13 (College Station, TX) were used to account for complex survey design and to incorporate sample weights, which reflect probability of selection, nonresponse and post-stratification for estimates to be representative of the children and adolescents living in the U.S. at the time of each survey.

Paired t-tests and chi-squared tests, with Bonferroni corrections, were used to make overall comparisons between the surveys regarding sample demographics and overall consumption of calories and macronutrients (carbohydrates, proteins, fats) daily and at each eating occasion. Frequency tables were generated to rank the most commonly reported food groups consumed by all children and adolescents at the four eating occasions of breakfast, lunch, dinner and snacks. In addition to the ranked frequencies, we determined the average quantity (grams (g)) and energy (kcal) of each food group

consumed. This analysis was performed for all food groups consumed by more than 5% of respondents at the indicated eating occasion. Identical analyses were conducted on the top five specific food items consumed in each food group. Serving sizes were specific to each individual item to allow for precise illustration and practical interpretation of portions consumed. This analysis was performed with all children and adolescents (ages 2-18 y) combined, as well as with age subgroups (ages 2-5, 6-11, 12-14, 15-18 y) for both samples from the NFCS77 and NHANES09.

Results

Demographics and daily energy and macronutrient consumption

Table 1 provides sociodemographic and daily energy and macronutrient intake information for both samples from NFCS77 and NHANES09. The two sample populations had significant differences ($p < 0.01$) in race/ethnicity and head-of-household education levels, with a larger representation of Hispanics (21.4% vs. 5.3%) and a higher level of college graduates (28.7% vs. 19.7%) in NHANES09 vs. NFCS77; differences which are largely due to intentional differences in sampling design. Youth from the NHANES09 sample consumed less total fat (-4.7 ± 1.3 g, $p \leq 0.01$) and more carbohydrates ($+20.7 \pm 3.4$ g; $p \leq 0.01$) daily than youth from NFCS77, with no significant differences in daily protein or calorie consumption.

Food Group and Item Consumption

Table 2 illustrates the ranked frequencies of food groups consumed by over 5% of all children and the specific age groups at each eating occasion from NHANES09 and NFCS77. Tables 3 and 4 show these ranked frequencies and the specific food items in each group consumed by over 5% of children, as well as the quantity consumed (g),

energy consumed (kcal), and serving sizes for specific food items. This study found no meaningful differences of food groups and items consumed based on race/ethnicity, gender or parental education. As such, breakdowns by race/ethnicity, gender, and parental education are not presented. The following are the substantive differences in food items consumed at each eating occasion between 1977 and 2009 for all youth and relevant age groups.

Food Consumption Differences for NHANES09 vs. NFCS77: All Youth

Breakfast. Cereal was the food group most frequently consumed for breakfast by all children in both NHANES09 (24.5%) and NFCS77 (30.9%). Breads and rolls were consumed by 12.6% of youth in 2009 and 19.9% of youth in 1977. Eggs and egg dishes, mixtures and sandwiches were consumed by 8.1% of youth in 2009 and 11.5% of youth in 1977. The only difference in breakfast consumption is the inclusion of pancakes, waffles, and French toast, consumed by 8.7% of youth, as well as raw fruits, consumed by 7.1% of youth in 2009 compared to less than the 5% threshold in 1977. Overall, breakfast consumption was largely similar in both surveys.

Lunch. Over 5% of youth from both NHANES09 and NFCS77 consumed breads and rolls, vegetables, frankfurters, sausages and lunchmeat, and raw fruits for lunch. The differences in lunch group consumption include the greater presence of mixtures, primarily consisting of a variety of macaroni and cheese and pizza entrees, consumed by 11.3% of youth, and cheese, consumed by 5.1% of youth, in NHANES09 as compared to NFCS77. In contrast, cakes, cookies, pies, cobblers and pastries were consumed by 6.3% of youth in NFCS77 and not in over 5% of youth in NHANES09.

Dinner. Vegetables, breads and rolls, and the combination of meat, poultry, fish mixtures and soups (barbeque chicken, meatloaf, barbeque beef, spaghetti sauce with beef, beef stew, meatballs) were reportedly consumed by over 5% of youth for dinner in both NHANES09 and NFCS77. In addition, mixtures, mostly including macaroni and cheese, spaghetti, and pizza, were consumed by 12.6% of youth in NHANES09 at lunch but less in NFCS77. Rather, cakes, cookies, pies, cobblers and pastries were consumed by 6.6% of youth and beef was consumed by 6.0% of youth in NFCS77 but not in over 5% of youth in NHANES09.

Snacks. Perhaps the greatest food group discrepancies between 2009 and 1977 was found in snack consumption. Over 5% of youth in both samples from NHANES09 and NFCS77 consumed raw fruits, cakes, cookies, pies, cobblers and pastries, and milk desserts for snacks. The most frequently reported snack consumed by youth in 2009, but not in consumed by more than 5% of youth in 1977, was candies (candy, fruit snacks, taffy, gumdrops and milk chocolate), consumed by 13.5% of youth. Salty snacks from grains (corn tortilla chips, corn puffs, hard pretzels, buttered popcorn and cheese corn chips) were also consumed by 11.4% of youth, and crackers were consumed by 6.9% of youth in 2009 but not by over 5% of youth in 1977.

Food Consumption Differences for NHANES09 vs. NFCS77: Age Group Specifics

The breakdown of food group and item consumption by age group for each eating occasion for the NHANES09 sample is presented in Supplemental Tables 2-5, and the equivalent data for the NFCS77 sample is presented in Supplemental Tables 6-9.

Overall, the substantive differences in food group consumption by each age group for each eating occasion mirror those seen for all youth. All age groups had similar breakfast

consumption, with cereal consumed either most frequently, or second most frequently (ages 15-18y NFCS77), in both NHANES09 and NFCS77. Upon closer examination of the specific cereal items consumed, all of the most frequently consumed cereals by youth over the age of 6y in 2009 were sugar-sweetened, which is in contrast to fewer sugar-sweetened cereals reported by the equivalent groups in 1977. A greater percentage of elementary and middle school-aged children consumed danish, breakfast pastries and doughnuts, as well as pancakes, waffles, and French toast for breakfast in NHANES09 as compared to youth in NFCS77. Mixtures, consisting mostly of pizza and macaroni and cheese, were consumed more frequently by each age group at lunch in 2009 compared to 1977. Mixtures, again mostly pizza and macaroni and cheese, were consumed more frequently by each age group in 2009 than 1977 and seemingly replaced the beef and cakes and cookies consumed in 1977 for dinner. In addition, candies and salty snacks from grains were consumed at a greater frequency as snacks by all age groups in 2009 compared to 1977, when vegetables were more frequently consumed as snacks by youth over the age of 6y.

Overall energy and macronutrient consumption by age and eating occasion

Table 2 presents the mean energy and macronutrient consumption reported by all youth and each age group for each eating occasion from both NFCS77 and NHANES09. The youngest children consumed significantly more calories at lunch in 2009 vs. 1977. All age groups from the NFCS77 sample reported significantly larger caloric intakes at dinner ($p < 0.01$).

The consumption of protein at lunch was significantly greater, as measured in grams, in 2-5y olds in the NHANES09 sample vs. NFCS77 ($p < 0.01$), with no significant

differences seen in other age groups at lunch. With the exception of 12-14y olds at dinner, protein consumption was significantly lower in the NHANES09 sample, as compared to the NFCS77, for all age groups at dinner and for snacks ($p < 0.01$).

Significantly higher intakes of carbohydrates, as measured in grams, were consumed in the NHANES09 sample of 2-5y olds ($p < 0.01$) at lunch, and by all age groups, except 15-18y olds, as snacks ($p < 0.01$). In contrast, all age groups of the NHANES09 sample consumed fewer carbohydrates than their counterparts from NFCS77 for dinner ($p < 0.01$).

The consumption of total fat was significantly lower for the following age groups and eating occasions from NHANES09 compared to NFCS77: 6-11y olds at lunch; 2-5, 6-11 and 15-18y olds at dinner; and 2-5y and 15-18y olds at snack ($p < 0.01$). In comparison, 6-11y olds at breakfast and 2-5y olds at lunch consumed greater quantities of fat in 2009 compared to 1977 ($p < 0.01$).

Discussion

To our knowledge, this is the first study not only to break down youth dietary consumption by eating occasion, but also to do so by specifying the food groups and items contributing to intakes at each occasion for youth today and 40 years ago. Findings from the smaller Bogalusa Heart Study showed similar trends in food group consumption from 1973 - 1994; however, their sample was limited to 10y olds from one school in Louisiana and results were not broken down to detailed food items [33]. Contrary to expectations, youth dietary intake, in terms of food groups and items consumed, was largely similar in 2009 and 1977. Across all eating occasions and in each age group, our study did not find intakes of calories and macronutrients to consistently be higher for the

NHANES09 sample compared to NFCS77. Whereas overall daily caloric and protein consumption from our samples were not significantly different, carbohydrate consumption was significantly greater and fat intake was significantly less in the NHANES09 sample. Thus, the conclusion can be made that, to some extent, youth in 2009 have swapped fat for carbohydrates, mostly in the form of refined carbohydrates and added sugars, in their overall daily diets [34, 35].

Despite previous findings that daily caloric intakes for youth have modestly (+103 – 176 kcal/day) increased since NFCS77 [11, 12], our study found that energy intake, when considering food items alone, have remained fairly stable. Calories consumed at dinner were significantly lower in the current NHANES09 sample compared to NFCS77 for all age groups, with few other significant differences in calories consumed by eating occasion. Consistent with previous studies examining overall energy intake and fast-food consumption, but not specific food group or item consumption from 40 years ago [11, 12, 20, 21], our findings indicate a higher intake of pizza and macaroni and cheese for most age groups at lunch and dinner in 2009 compared to 1977. Other food groups more frequently reported by the NHANES09 sample include pancakes, waffles and French toast at breakfast, and candies, crackers, and salty snacks as snacks. These differences might be the reasons why carbohydrate intakes were consistently higher for the daily NHANES09 sample and at each eating occasion. This was true for overall daily intakes, most age groups at snacks, and a few age groups at lunch and breakfast; however, the carbohydrate intakes at dinner were lower, coinciding with lower caloric intakes at dinner.

The uptake in consumption of pizza, macaroni and cheese, pancakes, waffles and French toast, and candies, crackers and salty snacks coincide with changes to the national food supply and industry patterns over the same period. For example, the post-World War II era saw a rise of frozen foods and TV dinners, prioritizing convenience in meal and snack preparation. The emphasis on convenience led to a proliferation of frozen and boxed meals and snacks, including pizzas, macaroni and cheese and waffles [36]. The demand for such food items increased throughout the end of the 20th century and into the 21st, as more women entered the workforce and were less likely to make elaborate meals at home [36]. Concurrent with and likely driving these cultural changes in food demand was advertising for such convenience items, which markedly increased as large companies invested in product development and expanded their supplies of items such as sugar-sweetened cereals, frozen waffles, frozen chicken nuggets and French fries. The emphasis on convenience that led to an increase in commercially prepared foods was also a primary driving force behind the 146% increase in cheese consumption from 1970-97 [36]. Overall, changes in the amounts and types of foods in the supply chain over the last four decades reflected the balance of consumer demand versus supply over time, which are determined by price, convenience and preference driven by production, policy, marketing, and economics [37].

Differences in findings for other macronutrient intakes for youth between 1977 and 2009 include significantly lower protein and fat intakes for the NHANES09 sample, particularly at dinner and snacks, compared to 1977, resulting primarily from a decreased consumption of beef (steak and hamburgers) in 2009 compared to 1977. This finding likely resulted from the Dietary Guidelines in America that recommended decreases in

red meat and saturated fat consumption in response to rising national rates of heart disease [38-41]. In fact, the per capita meat supply became leaner due to shifting demands of the public and food industry in response to nutritional concerns regarding fat and cholesterol [36, 37]. It would seem that, particularly at dinner, youth in 2009 have traded their consumption of protein and fat from beef with carbohydrates from pizza and macaroni and cheese; although these foods are still high in saturated fat.

Another key, and perhaps surprising, finding of this study is the fact that fruits and vegetables are often consumed by more than this study's minimum threshold of 5% of youth at each eating occasion during both survey periods. Current national policies and research indicate that youth consistently do not meet dietary guidelines regarding fruit and vegetable consumption [14, 15, 41]. Upon further inspection of the serving sizes being consumed, the conclusion can be made that while youth overall are consuming fruits and vegetables at each eating occasion, each individual youth is not accumulating adequate quantities throughout the day to meet guidelines. In fact, most of the serving sizes of the vegetables, in particular, are consistent with garnishes rather than full meal components. These results indicate that future efforts to meet dietary guidelines [41] and increase fruit and vegetable consumption in youth should emphasize increasing the quantity of these foods when consumed, in addition to the frequency at which they are consumed.

Limitations

Limitations to this study include differences in overall survey sampling design and 24-hour recall protocols over the past 40 years, the use of self-report, and the cross-sectional comparisons. Any comparisons between NFCS77 and NHANES09 must take

sampling and recall methodological differences into account. However, no current bridging studies exist to determine the specific impact of these changes on our results [42, 43]. Therefore, we have followed protocols consistent with similar studies in our approach to this analysis [25, 32]. Despite improvements in dietary assessment methods, such as the use of the multiple pass method in collecting NHANES09 data, research suggests that collecting reliable and accurate data from children and adolescents remains difficult [44-46]. As all 24-hour dietary recall is self-report, the results are subject to social desirability bias and accurate memories. Underreporting and misreporting of dietary intake has been associated with older age in children, as parents are involved in reporting for young children, race/ethnicity, and higher BMI status, and is most common among unhealthy foods or foods perceived to be related to obesity [47-50].

Conclusions

The differences in energy and macronutrient intake by eating occasion revealed in this study are best understood through our analysis of the specific food items being consumed at each eating occasion by American youth. By determining the specific food items consumed by children for breakfast, lunch, dinner and snacks today, and comparing these results to those from 40 years ago, this study reveals which primary eating occasions and food items continually contribute to dietary imbalances in youth and the fact that the differences in consumption are lesser than expected. Whereas energy intake from foods has remained fairly stable, it seems youth in 2009 have swapped fat, in the form of beef, for refined carbohydrates and added sugars, in the form of pizza, macaroni and cheese, pancakes, waffles and French toast, and candies, crackers, and salty snacks. This swap has been based on decades of shifts in the food industry, largely driven by

convenience, and nutrition policy. Additionally, our results indicate that future efforts to meet dietary guidelines and increase fruit and vegetable consumption in youth should emphasize increasing the quantity of these foods when consumed rather than simply the frequency at which they are consumed. Such insight can be used to focus future public health efforts to reduce the intake of empty calories and improve dietary quality to better meet guidelines and improve the energy imbalance in American children.

Table 3.1. Sample demographics for youth (ages 2-18y) from NFCS 1977-78 and NHANES 2009-2010

	NFCS 1977-78	NHANES 2009- 2010
Sample size (n)	12052	3128
Age (years)	10.4 ± 0.1	10.0 ± 0.1
Female (%)	50.2	49.9
Race/ ethnicity (%)*		
• Non-Hispanic white	79.8	57.6
• Non-Hispanic black	15.9	13.3
• Hispanic	5.3	21.4
Parents' education (%)*		
• <High school	22.6	20.6
• High school	37.9	20.5
• Some college	19.9	29.9
• College graduate	19.7	28.7
Daily caloric intake (kcal)	1447.0 ± 12.8	1472.9 ± 21.3
Daily carbohydrate intake (g)*	159.1 ± 1.7	179.8 ± 3.0
Daily total fat intake (g)*	64.4 ± 0.7	59.7 ± 1.1
Daily protein intake (g)	60.2 ± 0.6	57.3 ± 1.2

*denotes significant difference between NFCS 1977-1978 and NHANES 2009-2010 at $p \leq 0.01$

Table 3.2. Macronutrient and food item consumption at each eating occasion for youth (ages 2-18y) from NFCS 1977-78 and NHANES 209-2010, overall and by age group

NFCS 1977-1978 - ALL KIDS			NHANES 2009-2010 - ALL KIDS		
Breakfast		Average Consumed	Breakfast		Average Consumed
Energy (kcal)		277.5	Energy (kcal)		283.6
Fat (g)		9.3	Fat (g)		9.9
Protein (g)		9.3	Protein (g)		9.0
Carbohydrates (g)		39.7	Carbohydrates (g)		40.6
Children Reporting Consumption			Children Reporting Consumption		
1	Cereal	30.9%	1	Cereal	24.5%
2	Breads and rolls	19.9%	2	Breads and rolls	12.6%
3	Eggs and egg mixtures, dishes, sandwiches	11.5%	3	Pancakes, waffles, french toast	8.7%
			4	Eggs and egg mixtures, dishes, sandwiches	8.1%
			5	Fruits, raw	7.1%
Lunch		Average Consumed	Lunch		Average Consumed
Energy (kcal)		454.4	Energy (kcal)		461.3
Fat (g)		21.0	Fat (g)		19.4
Protein (g)		19.4	Protein (g)		20.2
Carbohydrates (g)		47.8*	Carbohydrates (g)		52.2*
Children Reporting Consumption			Children Reporting Consumption		
1	Breads and rolls	17.1%	1	Breads and rolls	13.0%
2	Vegetables	15.4%	2	Vegetables	12.3%
3	Cakes, cookies, pies, cobblers, pastries	6.3%	3	Mixtures, mainly grains, pasta, bread	11.3%

	Frankfurters, sausages, 4 lunchmeat	6.3%	4	Fruits, raw	7.2%
	5 Fruits, raw	5.6%	5	Frankfurters, sausages, lunchmeat	5.9%
			6	Cheese	5.1%
	Dinner	Average Consumed		Dinner	Average Consumed
	Energy (kcal)	687.6*		Energy (kcal)	541.2*
	Fat (g)	32.9*		Fat (g)	22.9*
	Protein (g)	31.0*		Protein (g)	27.1*
	Carbohydrates (g)	68.0*		Carbohydrates (g)	56.7*
		Children Reporting Consumption			Children Reporting Consumption
	1 Vegetables	22.9%	1	Vegetables	18.8%
	2 Breads and rolls	10.6%	2	Mixtures, mainly grains, pasta, bread	12.6%
	3 Cakes, cookies, pies, cobblers, pastries	6.6%	3	Breads and rolls	7.6%
	4 Beef	6.0%	4	Meat, poultry, fish mixtures and soups	5.8%
	5 Meat, poultry, fish mixtures and soups	5.1%			
	Snacks	Average Consumed		Snacks	Average Consumed
	Energy (kcal)	440.8*		Energy (kcal)	408.9*
	Fat (g)	20.3*		Fat (g)	16.4*
	Protein (g)	16.0*		Protein (g)	9.1*
	Carbohydrates (g)	50.0*		Carbohydrates (g)	58.5*
		Children Reporting Consumption			Children Reporting Consumption
	1 Vegetables	16.5%	1	Candies	13.5%

	Cakes, cookies, pies, cobblers, 2 pastries	11.0%	2	Fruits, raw	13.0%
3	Milk desserts	8.5%	3	Salty snacks from grains	11.4%
4	Breads and rolls	8.0%	4	Cakes, cookies, pies, cobblers, pastries	10.7%
5	Fruits, raw	6.2%	5	Crackers	6.9%
			6	Milk desserts	6.0%

NFCS 1977-1978 - AGES 2-5 YEARS			NHANES 2009-2010 - AGES 2-5 YEARS		
Breakfast		Average Consumed	Breakfast		Average Consumed
Energy (kcal)		207.4	Energy (kcal)		198.7
Fat (g)		6.4	Fat (g)		6.5
Protein (g)		6.7	Protein (g)		6.3
Carbohydrates (g)		32.1	Carbohydrates (g)		29.7
Children Reporting Consumption			Children Reporting Consumption		
1	Cereal	34.6%	1	Cereal	28.6%
2	Breads and rolls	17.8%	2	Fruits, raw	11.1%
3	Eggs and egg mixtures, dishes, sandwiches	13.4%	3	Breads and rolls	8.9%
4	Oatmeal and cooked cereals	7.4%	4	Eggs and egg mixtures, dishes, sandwiches	8.3%
5	Bacon	5.0%	5	Pancakes, waffles, French toast	8.0%
Lunch		Average Consumed	Lunch		Average Consumed
Energy (kcal)		284.1*	Energy (kcal)		339.3*
Fat (g)		12.8*	Fat (g)		14.5*

Protein (g)	11.8*	Protein (g)	14.2*
Carbohydrates (g)	30.9*	Carbohydrates (g)	38.8*
Children Reporting Consumption		Children Reporting Consumption	
1 Breads and rolls	18.8%	1 Breads and rolls	12.4%
2 Vegetables	9.6%	2 Vegetables	10.9%
3 Frankfurters, sausages, lunchmeat	7.5%	3 Mixtures, mainly grains, pasta, bread	10.0%
4 Cakes, cookies, pies, cobblers, pastries	6.3%	4 Fruits, raw	8.0%
5 Fruits, raw	5.2%	5 Frankfurters, sausages, lunchmeat	6.1%
6 Mixtures, mainly grains, pasta, bread	5.1%		
Dinner	Average Consumed	Dinner	Average Consumed
Energy (kcal)	459.1*	Energy (kcal)	351.4*
Fat (g)	21.0*	Fat (g)	14.5*
Protein (g)	20.3*	Protein (g)	17.2*
Carbohydrates (g)	48.0*	Carbohydrates (g)	38.3*
Children Reporting Consumption		Children Reporting Consumption	
1 Vegetables	20.3%	1 Vegetables	19.0%
2 Breads and rolls	11.0%	2 Mixtures, mainly grains, pasta, bread	12.2%
3 Cakes, cookies, pies, cobblers, pastries	6.6%	3 Breads and rolls	7.1%
4 Beef	5.5%	4 Meat, poultry, fish mixtures and soups	5.5%
Snacks	Average Consumed	Snacks	Average Consumed
Energy (kcal)	350.5	Energy (kcal)	324.1

Fat (g)		15.8*	Fat (g)		11.8*
Protein (g)		13.9*	Protein (g)		7.4*
Carbohydrates (g)		39.0*	Carbohydrates (g)		49.1*
Children Reporting Consumption			Children Reporting Consumption		
1	Vegetables	18.5%	1	Fruits, raw	16.3%
2	Cakes, cookies, pies, cobblers, pastries	10.0%	2	Candies	12.2%
3	Breads and rolls	7.6%	3	Crackers	10.6%
4	Milk desserts	6.8%	4	Cakes, cookies, pies, cobblers, pastries	9.8%
5	Fruits, raw	5.2%	5	Salty snacks from grains	8.8%
			6	Milk desserts	5.4%
NFCS 1977-1978 - AGES 6-11 YEARS			NHANES 2009-2010 - AGES 6-11 YEARS		
Breakfast		Average Consumed	Breakfast		Average Consumed
Energy (kcal)		258.1*	Energy (kcal)		273.9*
Fat (g)		7.6*	Fat (g)		9.4*
Protein (g)		8.0	Protein (g)		8.5
Carbohydrates (g)		40.1	Carbohydrates (g)		39.7
Children Reporting Consumption			Children Reporting Consumption		
1	Cereal	38.3%	1	Cereal	26.1%
2	Breads and rolls	18.2%	2	Breads and rolls	13.2%
3	Eggs and egg mixtures, dishes, sandwiches	10.0%	3	Pancakes, waffles, French toast	11.6%
4	Oatmeal and cooked cereals	5.0%	4	Eggs and egg mixtures, dishes, sandwiches	7.6%

		5	Danish, breakfast pastries, doughnuts	5.1%	
Lunch		Average Consumed		Lunch	Average Consumed
Energy (kcal)		448.3		Energy (kcal)	436.2
Fat (g)		20.0*		Fat (g)	17.6*
Protein (g)		18.5		Protein (g)	18.6
Carbohydrates (g)		49.6		Carbohydrates (g)	51.6
Children Reporting Consumption			Children Reporting Consumption		
1	Breads and rolls	17.8%	1	Breads and rolls	14.3%
2	Vegetables	15.6%	2	Vegetables	11.7%
3	Cakes, cookies, pies, cobblers, pastries	7.0%	3	Mixtures, mainly grains, pasta, bread	10.5%
4	Fruits, raw	6.4%	4	Fruits, raw	8.9%
5	Frankfurters, sausages, lunchmeat	6.2%	5	Frankfurters, sausages, lunchmeat	5.8%
			6	Cheese	5.1%
Dinner		Average Consumed		Dinner	Average Consumed
Energy (kcal)		665.8*		Energy (kcal)	533.3*
Fat (g)		31.4*		Fat (g)	22.5*
Protein (g)		29.4*		Protein (g)	25.8*
Carbohydrates (g)		67.5*		Carbohydrates (g)	57.2*
Children Reporting Consumption			Children Reporting Consumption		
1	Vegetables	22.8%	1	Vegetables	17.4%
2	Breads and rolls	10.1%	2	Mixtures, mainly grains, pasta, bread	12.2%
3	Cakes, cookies, pies, cobblers, pastries	7.2%	3	Breads and rolls	7.6%

4	Beef	6.0%	4	Fruits, raw	5.4%
Snacks			Snacks		
Average Consumed			Average Consumed		
	Energy (kcal)	389.4		Energy (kcal)	397.3
	Fat (g)	17.4		Fat (g)	15.5
	Protein (g)	13.6*		Protein (g)	8.1*
	Carbohydrates (g)	46.2*		Carbohydrates (g)	58.6*
Children Reporting Consumption			Children Reporting Consumption		
1	Vegetables	16.7%	1	Candies	15.9%
2	Cakes, cookies, pies, cobblers, pastries	11.5%	2	Fruits, raw	12.3%
3	Milk desserts	9.1%	3	Cakes, cookies, pies, cobblers, pastries	11.2%
4	Fruits, raw	7.1%	4	Salty snacks from grains	11.2%
5	Breads and rolls	6.9%	5	Crackers	6.9%
			6	Milk desserts	5.1%
NFCS 1977-1978 - AGES 12-14 YEARS			NHANES 2009-2010 - AGES 12-14 YEARS		
Breakfast			Breakfast		
Average Consumed			Average Consumed		
	Energy (kcal)	302.3		Energy (kcal)	334.6
	Fat (g)	10.3		Fat (g)	11.4
	Protein (g)	10.0		Protein (g)	10.0
	Carbohydrates (g)	42.9*		Carbohydrates (g)	49.0*
Children Reporting Consumption			Children Reporting Consumption		
1	Cereal	28.2%	1	Cereal	22.8%
2	Breads and rolls	21.1%	2	Breads and rolls	15.4%

3	Eggs and egg mixtures, dishes, sandwiches	10.5%	3	Pancakes, waffles, French toast	9.1%
			4	Eggs and egg mixtures, dishes, sandwiches	6.6%
			5	Danish, breakfast pastries, doughnuts	5.5%
			6	Fruits, raw	5.2%
Lunch		Average Consumed	Lunch		Average Consumed
	Energy (kcal)	509.5		Energy (kcal)	551.3
	Fat (g)	23.5		Fat (g)	23.4
	Protein (g)	21.4		Protein (g)	24.0
	Carbohydrates (g)	54.4		Carbohydrates (g)	61.8
Children Reporting Consumption			Children Reporting Consumption		
				Mixtures, mainly grains, pasta,	
1	Breads and rolls	17.2%	1	breads	13.4%
2	Vegetables	16.1%	2	Breads and rolls	13.1%
3	Cakes, cookies, pies, cobblers, pastries	6.7%	3	Vegetables	11.5%
4	Frankfurters, sausages, lunchmeat	6.1%	4	Fruits, raw	7.1%
5	Fruits, raw	5.5%	5	Frankfurters, sausages, lunchmeat	6.8%
6	Mixtures, mainly grains, pasta, bread	5.4%	6	Cheese	6.3%
Dinner		Average Consumed	Dinner		Average Consumed
	Energy (kcal)	784.7*		Energy (kcal)	646.0*
	Fat (g)	37.9*		Fat (g)	27.8*
	Protein (g)	35.3		Protein (g)	33.8
	Carbohydrates (g)	76.7*		Carbohydrates (g)	65.3*

		Children Reporting Consumption			Children Reporting Consumption
1	Vegetables	23.3%	1	Vegetables	20.0%
2	Breads and rolls	10.7%	2	Mixtures, mainly grains, pasta, breads	12.8%
3	Cakes, cookies, pies, cobblers, pastries	6.7%	3	Breads and rolls	6.9%
4	Beef	6.1%	4	Meat, poultry, fish mixtures and soups	6.5%
5	Meat, poultry, fish mixtures and soups	5.1%			
Snacks		Average Consumed	Snacks		Average Consumed
Energy (kcal)		499.6	Energy (kcal)		451.7
Fat (g)		23.4	Fat (g)		19.1
Protein (g)		17.3*	Protein (g)		10.3*
Carbohydrates (g)		56.6*	Carbohydrates (g)		62.0*
		Children Reporting Consumption			Children Reporting Consumption
1	Vegetables	14.4%	1	Salty snacks from grains	13.6%
2	Cakes, cookies, pies, cobblers, pastries	12.7%	2	Candies	12.2%
3	Milk desserts	9.5%	3	Fruits, raw	10.6%
4	Breads and rolls	8.0%	4	Cakes, cookies, pies, cobblers, pastries	10.1%
5	Fruits, raw	6.9%	5	Milk desserts	8.4%
			6	White potato chips	5.4%
NFCS 1977-1978 - AGES 15-18 YEARS			NHANES 2009-2010 - AGES 15-18 YEARS		
Breakfast		Average Consumed	Breakfast		Average Consumed

Energy (kcal)	344.6	Energy (kcal)	374.2
Fat (g)	13.3	Fat (g)	14.2
Protein (g)	12.8	Protein (g)	12.9
Carbohydrates (g)	43.8	Carbohydrates (g)	49.6
Children Reporting Consumption		Children Reporting Consumption	
1 Breads and rolls	22.8%	1 Cereal	17.7%
2 Cereal	20.1%	2 Breads and rolls	14.3%
3 Eggs and egg mixtures, dishes, sandwiches	12.7%	3 Eggs and egg mixtures, dishes, sandwiches	9.9%
4 Bacon	5.4%	4 Fruits, raw	7.0%
Lunch	Average Consumed	Lunch	Average Consumed
Energy (kcal)	556.8	Energy (kcal)	576.2
Fat (g)	26.9	Fat (g)	24.9
Protein (g)	25.4	Protein (g)	27.0
Carbohydrates (g)	53.8*	Carbohydrates (g)	61.4*
Children Reporting Consumption		Children Reporting Consumption	
1 Vegetables	18.3%	1 Vegetables	16.0%
2 Breads and rolls	17.2%	2 Mixtures, mainly grains, pasta, bread	12.7%
3 Frankfurters, sausages, lunchmeat	5.6%	3 Breads and rolls	11.4%
4 Beef	5.3%	4 Frankfurters, sausages, lunchmeat	5.3%
Dinner	Average Consumed	Dinner	Average Consumed
Energy (kcal)	839.1*	Energy (kcal)	669.3*
Fat (g)	41.2*	Fat (g)	28.6*
Protein (g)	39.0*	Protein (g)	34.4*

Carbohydrates (g)		79.1*	Carbohydrates (g)		68.2*
Children Reporting Consumption			Children Reporting Consumption		
1	Vegetables	25.1%	1	Vegetables	20.1%
2	Breads and rolls	11.0%	2	Mixtures, mainly grains, pasta, bread	13.6%
3	Beef	6.3%	3	Breads and rolls	8.9%
4	Cakes, cookies, pies, cobblers, pastries	5.7%	4	Meat, poultry, fish mixtures and soup	7.3%
5	Meat, poultry, fish mixtures and soup	5.5%			
Snacks		Average Consumed	Snacks		Average Consumed
Energy (kcal)		589.8*	Energy (kcal)		494.5*
Fat (g)		28.1*	Fat (g)		21.3*
Protein (g)		21.4*	Protein (g)		11.7*
Carbohydrates (g)		64.4	Carbohydrates (g)		66.5
Children Reporting Consumption			Children Reporting Consumption		
1	Vegetables	15.1%	1	Salty snacks from grains	13.7%
2	Breads and rolls	10.5%	2	Candies	11.9%
3	Cakes, cookies, pies, cobblers, pastries	10.3%	3	Cakes, cookies, pies, cobblers, pastries	11.7%
4	Milk desserts	9.1%	4	Fruits, raw	10.9%
5	Fruits, raw	6.0%	5	Milk desserts	6.4%

* indicates significance at $p < 0.01$

Table 3.3. Food groups and items consumed by $\geq 5\%$ of youth (ages 2-18y) at each eating occasion from NHANES 2009-2010

BREAKFAST - ALL KIDS		Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
1	Cereal	24.5%	35.7	(1.1)	135.8	(4.3)	
	Honey Nut Cheerios	8.0%	36.2	(3.8)	142.1	(14.9)	1.2 cups
	Fruit Loops	7.3%	29.9	(1.4)	111.4	(5.4)	1.0 cup
	Cheerios	5.6%	22.8	(1.3)	83.5	(5.0)	0.8 cup
	Cinnamon Toast Crunch	5.4%	41.9	(3.5)	173.6	(14.4)	1.4 cups
	Kellogg's Frosted Flakes	5.0%	37.4	(2.6)	137.1	(9.3)	1.2 cups
2	Breads and rolls	12.6%	59.2	(1.9)	172.7	(6.9)	
	White toast	14.5%	43.9	(3.0)	128.7	(8.7)	1.6 slices
	Bagels	12.7%	87.6	(3.5)	225.2	(8.9)	0.8 medium bagel
	White bread	9.8%	48.1	(1.3)	127.3	(3.4)	1.7 slices
	Wheat toast	7.3%	41.5	(3.2)	130.0	(10.2)	1.5 slices
	Wheat bread	5.9%	47.9	(2.5)	129.4	(6.7)	1.7 slices
3	Pancakes, waffles, French toast	8.7%	89.0	(5.1)	228.6	(11.2)	
	Pancakes	32.7%	96.1	(9.5)	216.4	(21.3)	2.5 pancakes
	Waffles	26.2%	87.8	(6.6)	272.7	(20.6)	1.2 waffles
	French toast	8.8%	123.4	(25.6)	301.1	(62.5)	1.9 slices
	Pancakes w/ chocolate chips	7.7%	84.6	(23.5)	186.1	(51.7)	2.2 pancakes
	French toast sticks	6.1%	81.6	(0.5)	277.5	(1.8)	3.9 sticks
4	Eggs and egg mixtures, dishes, sandwiches	8.1%	106.2	(4.1)	198.6	(10.5)	
	Scrambled eggs	38.8%	114.5	(9.3)	197.5	(16.5)	1.9 eggs

	Fried eggs	20.8%	68.7	(5.4)	140.5	(11.0)	1.5 eggs
	Scrambled eggs w/ cheese	11.8%	122.9	(10.0)	248.4	(21.9)	2.0 eggs
	Boiled eggs	5.2%	67.3	(5.0)	103.8	(7.7)	1.3 eggs
	Scrambled eggs w/ ham or bacon	3.7%	181.5	(18.8)	358.0	(38.2)	3.0 eggs
5	Fruits, raw	7.1%	96.4	(6.3)	58.6	(4.0)	
	Bananas	33.8%	94.7	(4.7)	84.4	(4.2)	0.8 banana
	Apples	14.9%	145.7	(10.6)	75.8	(5.6)	0.8 apple
	Strawberries	11.1%	67.8	(8.8)	21.7	(2.8)	5.7 strawberries
	Grapes	7.7%	68.3	(14.0)	47.2	(9.6)	0.5 cup
	Cantaloupe	7.1%	91.1	(10.2)	31.0	(3.4)	0.5 cup
LUNCH - ALL KIDS							
1	Breads and rolls	13.0%	48.6	(1.2)	133.9	(3.4)	
	Soft white roll	27.6%	49.5	(1.6)	137.9	(4.5)	1.4 rolls
	White bread	21.9%	49.5	(1.7)	130.8	(4.6)	1.8 slices
	Whole wheat bread	12.0%	40.8	(2.5)	107.3	(6.7)	1.5 slices
	Wheat bread	10.3%	49.8	(2.2)	134.4	(5.8)	1.8 slices
	Wheat toast	2.2%	33.6	(4.4)	105.1	(13.9)	1.2 slices
2	Vegetables	12.3%	49.3	(4.1)	28.9	(3.5)	
	Lettuce	19.4%	28.5	(2.4)	4.0	(0.4)	0.5 cup
	Tomatoes	11.4%	47.6	(7.6)	8.6	(1.4)	2.4 slices
	Carrots	8.2%	37.1	(4.0)	15.2	(1.7)	3.7 baby carrots
	Cucumber	4.7%	62.6	(21.9)	7.4	(2.6)	0.6 cup
	Dill pickles	3.7%	33.5	(8.7)	3.9	(1.0)	0.2 cup
3	Mixtures, mainly grains, pasta, bread	11.3%	190.7	(5.6)	358.2	(17.4)	

	Macaroni w/ cheese, made from dry mix	7.4%	198.0	(16.5)	306.5	(39.6)	1.0 cup
	Cheese pizza, regular crust	7.4%	137.6	(15.9)	366.1	(42.4)	1.3 slices
	Macaroni/ noodles with cheese	6.0%	215.4	(31.1)	414.5	(58.1)	1.1 cups
	Pepperoni pizza, regular crust	5.5%	152.5	(12.8)	430.3	(36.1)	1.4 slices
	Pepperoni pizza, thick crust	4.8%	143.6	(18.1)	412.0	(51.9)	1.2 slices
4	Fruits, raw	7.2%	109.5	(5.0)	58.1	(2.0)	
	Apples	30.8%	125.1	(4.8)	65.1	(2.5)	0.7 apple
	Grapes	11.1%	71.4	(8.1)	49.3	(5.6)	0.5 cup
	Bananas	10.4%	99.5	(7.8)	88.6	(6.9)	0.8 banana
	Oranges	8.8%	100.8	(8.8)	47.5	(4.1)	0.6 orange
	Strawberries	6.3%	81.8	(11.6)	26.0	(3.7)	6.8 strawberries
5	Frankfurters, sausages, lunchmeat	5.9%	58.5	(2.8)	119.7	(10.5)	
	Chicken/ turkey loaf deli meat	22.9%	59.8	(3.7)	62.7	(3.8)	2.1 slices
	Sliced ham deli meat	22.1%	60.4	(5.0)	63.4	(5.2)	2.6 slices
	Beef hot dogs	8.0%	79.6	(5.5)	257.4	(17.8)	1.4 hot dogs
	Hot dogs	6.2%	64.2	(7.6)	207.3	(24.7)	1.1 hot dogs
	Salami	5.7%	81.9	(7.2)	275.0	(24.2)	9.1 slices
6	Cheese	5.1%	30.2	(1.4)	106.0	(5.2)	
	Cheddar/ American style cheese	19.2%	28.3	(1.3)	103.8	(4.7)	1.3 slices
	Natural cheddar/ American cheese	18.9%	33.8	(3.1)	136.2	(12.5)	1.2 slices
	Part-skim mozzarella	11.8%	30.9	(3.2)	93.6	(10.0)	1.1 slices

	Mozzarella (incl. pizza topping)	7.2%	31.5	(5.2)	95.2	(15.6)	1.1 slices
	Swiss cheese	6.9%	33.5	(4.0)	127.5	(15.1)	1.2 slices
DINNER - ALL KIDS							
1	Vegetables	18.8%	63.8	(2.3)	39.9	(1.6)	
	Lettuce	11.5%	45.9	(6.2)	6.4	(0.9)	0.8 cup
	Tomatoes	9.0%	54.6	(7.8)	9.8	(1.4)	2.7 slices
	Carrots	4.5%	47.0	(8.3)	19.3	(3.5)	4.7 baby carrots
	Cucumber	4.4%	41.3	(4.4)	5.0	(0.5)	0.4 cup
	Onions, raw	3.1%	22.2	(4.1)	8.8	(1.6)	1.6 slices
2	Mixtures, mainly grains, pasta, bread	12.6%	203.0	(8.8)	365.7	(13.2)	
	Macaroni or noodles w/ cheese, from dry mix	5.9%	157.6	(10.0)	238.7	(13.4)	0.8 cup
	Spaghetti w/ tomato and meat sauce	5.8%	298.5	(19.0)	398.6	(25.4)	1.2 cups
	Macaroni or noodles w/ cheese	5.3%	199.8	(14.5)	388.3	(28.5)	1.1 cups
	Soup, mostly noodles	4.2%	305.8	(18.1)	202.8	(12.0)	1.2 cups
	Pepperoni pizza, regular crust	3.7%	170.5	(13.2)	480.8	(37.2)	1.5 slices
3	Breads and rolls	7.6%	52.7	(2.4)	152.6	(7.1)	
	Soft white roll	35.6%	52.7	(1.2)	146.6	(3.5)	1.5 rolls
	White bread	13.5%	51.2	(2.3)	135.4	(6.1)	1.8 slices
	Wheat bread	6.6%	55.5	(5.9)	149.9	(15.9)	2.0 slices
	White toast	4.9%	49.4	(4.8)	144.9	(13.9)	1.8 slices
	Garlic bread	4.7%	92.5	(15.2)	323.9	(53.0)	1.6 slices
4	Meat, poultry, fish mixtures and soups	5.8%	269.0	(9.9)	194.1	(15.6)	

	BBQ Chicken, no skin	7.3%	109.4	(5.1)	186.5	(8.6)	0.3 breast
	Meatloaf w/ beef and tomato sauce	5.8%	117.0	(9.9)	194.9	(16.5)	2.1 slices
	Meatloaf w/ beef	3.3%	136.1	(34.2)	266.3	(67.0)	2.4 slices
	BBQ Beef	3.1%	181.0	(2.2)	324.4	(4.0)	2.1 3-oz. servings
	Homemade-style spaghetti sauce with beef	3.0%	208.0	(5.7)	184.1	(5.0)	0.8 cup
SNACKS - ALL KIDS							
1	Candies	13.5%	27.4	(0.9)	120.2	(4.4)	
	Hard candy	24.6%	17.8	(1.3)	70.1	(5.2)	3.0 pieces
	Fruit leather/ fruit snacks	12.0%	26.4	(1.5)	96.3	(5.5)	1.3 packets
	candy						
	Taffy	8.1%	21.5	(3.1)	86.2	(12.5)	1.4 pieces
	Gumdrops	6.2%	34.4	(4.2)	136.3	(16.6)	8.2 gumdrops
	Milk chocolate	6.0%	33.0	(5.2)	176.7	(27.9)	4.7 miniatures
2	Fruits, raw	13.0%	124.6	(6.6)	71.1	(3.9)	
	Apples	24.3%	164.5	(16.0)	85.6	(8.3)	0.9 apple
	Bananas	20.1%	112.4	(4.1)	100.2	(3.6)	0.9 banana
	Grapes	13.4%	88.8	(6.5)	61.3	(4.5)	0.6 cup
	Oranges	9.6%	129.8	(13.2)	61.2	(6.2)	0.8 orange
	Strawberries	7.7%	64.4	(4.7)	20.7	(1.5)	5.4 strawberries
3	Salty snacks from grains	11.4%	32.8	(1.8)	159.0	(8.8)	
	Corn tortilla chips	24.2%	40.0	(3.7)	197.4	(18.1)	1.4 1-oz. bags
	Corn puffs	14.2%	31.7	(3.1)	179.2	(17.5)	0.9 packages
	Hard pretzels	13.4%	34.9	(6.9)	132.7	(26.3)	1.2 1-oz bags
	Buttered popcorn, popped in oil	13.1%	32.2	(2.6)	170.0	(13.7)	2.9 cups

	Cheese corn chips	6.8%	40.8	(4.2)	211.2	(21.5)	1.5 1-oz. bags
4	Cakes, cookies, pies, cobbler, pastries	10.7%	48.6	(2.4)	202.6	(9.3)	
	Chocolate chip cookies	21.1%	57.0	(3.3)	270.4	(15.5)	3.8 cookies
	Chocolate coated/ striped cookies	12.3%	39.4	(2.4)	185.1	(11.5)	2.3 cookies
	Brownies without icing	5.6%	60.8	(11.0)	230.6	(41.6)	1.1 large brownies
	Chocolate chip cookies, homemade or bakery	5.6%	19.4	(1.3)	95.0	(6.1)	1.3 cookies
	Butter or sugar cookies	3.7%	24.6	(2.8)	116.9	(13.1)	1.6 cookies
5	Crackers	6.9%	29.0	(1.4)	136.0	(6.5)	
	Snack cracker	27.1%	25.3	(1.2)	127.4	(6.0)	0.9 1-oz bag
	Cheese crackers	13.6%	36.0	(4.1)	176.0	(19.9)	1.3 1-oz bags
	Graham crackers	12.8%	25.5	(4.7)	107.7	(19.9)	3.6 graham squares
	Animal crackers	10.8%	29.9	(4.2)	133.6	(18.9)	0.5 box
	Peanut butter sandwich crackers	7.4%	32.1	(1.8)	158.9	(8.8)	4.9 crackers
6	Milk desserts	6.0%	112.3	(3.7)	219.9	(6.5)	
	Vanilla ice cream	37.1%	125.9	(7.1)	260.6	(14.6)	1.0 cup
	Vanilla ice cream cone	6.6%	86.3	(2.6)	189.1	(5.6)	0.7 cone
	Ice cream sandwich	5.8%	57.4	(3.1)	136.2	(7.3)	0.8 sandwich
	Chocolate ice cream	5.1%	137.4	(14.2)	297.1	(30.7)	1.0 cup
	Chocolate covered ice cream bar	2.9%	80.7	(8.6)	267.3	(28.4)	1.6 bars

Table 3.4. Food groups and items consumed by $\geq 5\%$ of youth (ages 2-18y) at each eating occasion from NFCS 1977-78

BREAKFAST - ALL KIDS	Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
Cereal	30.9%	26.0	(0.8)	139.7	(2.5)	
Cereal, non-specified	13.9%	3.8	(0.1)	109.6	(1.7)	0.1 cup
Corn Flakes	9.5%	29.5	(0.6)	112.2	(2.3)	1.0 cup
Fruit Loops/ Apple Jacks	9.0%	15.4	(0.5)	120.7	(3.9)	0.5 cup
Cheerios	7.7%	28.5	(1.1)	113.3	(4.2)	1.0 cup
Boo Berry/ Frankenberry	6.7%	8.4	(0.2)	130.0	(2.9)	0.3 cup
Breads and rolls	19.9%	40.2	(0.6)	121.2	(1.8)	
White toast	51.2%	34.7	(0.6)	109.0	(1.8)	1.2 slices
White bread	15.4%	43.6	(1.0)	118.0	(2.8)	1.5 slices
Toast	6.2%	32.4	(0.9)	101.6	(2.7)	1.1 slices
Whole wheat toast	5.0%	35.9	(1.1)	103.9	(3.1)	1.3 slices
Soft white rolls	2.8%	45.2	(1.4)	134.5	(4.3)	1.3 rolls
Eggs and egg mixtures, dishes, sandwiches	11.5%	75.9	(1.1)	123.4	(1.8)	
Fried eggs	43.4%	64.6	(0.8)	116.4	(1.4)	1.4 eggs
Scrambled eggs	39.1%	92.4	(1.4)	136.8	(2.0)	1.5 eggs
Boiled eggs	6.7%	61.2	(1.8)	96.8	(2.8)	1.2 eggs
Eggs, non-specified	5.0%	68.7	(2.4)	108.6	(3.8)	1.1 eggs
Whole cooked eggs	2.1%	61.0	(3.0)	96.5	(4.7)	1.0 egg
LUNCH - ALL KIDS						
Breads and rolls	17.7%	47.2	(0.5)	132.3	(1.5)	
White bread	49.6%	46.9	(0.5)	126.8	(1.3)	1.7 slices
Soft white rolls	17.7%	44.8	(0.6)	133.4	(1.7)	1.3 rolls
Whole wheat bread	5.1%	55.2	(1.5)	134.1	(3.5)	2.0 slices
Bread, unspecified	5.0%	47.5	(1.1)	128.5	(2.8)	1.7 slices

White toast	4.8%	40.3	(1.4)	126.4	(4.4)	1.4 slices
Vegetables	15.4%	72.9	(2.1)	55.0	(1.7)	
Lettuce	12.5%	24.0	(1.2)	3.1	(0.2)	0.4 cup
Mashed white potatoes	7.8%	138.5	(4.2)	130.2	(3.9)	0.6 cup
Tomatoes	7.8%	65.0	(2.5)	14.4	(0.6)	3.3 slices
Tossed salad (lettuce, tomatoes, carrots)	6.6%	40.0	(2.2)	59.2	(1.8)	0.3 cup
Green string beans	4.0%	70.6	(2.4)	36.5	(1.2)	0.5 cup
Cakes, cookies, pies, cobblers, pastries	6.3%	53.0	(1.6)	188.3	(4.7)	
Chocolate chip cookies	13.5%	22.4	(1.1)	105.8	(5.0)	1.5 cookies
Cookies, non-specified	5.6%	24.5	(1.7)	117.6	(8.2)	1.6 cookies
Chocolate covered, fudge sandwich cookies	5.4%	33.5	(3.1)	165.7	(15.5)	2.0 cookies
Peanut butter cookies	5.2%	26.5	(1.9)	125.4	(8.7)	1.8 cookies
Sugar cookies	4.7%	36.4	(2.8)	161.7	(12.4)	2.4 cookies
Frankfurters, sausages, lunchmeat	6.3%	51.2	(1.0)	153.5	(3.1)	
Bologna	33.8%	42.7	(0.9)	129.8	(2.9)	1.4 slices
Hot dogs	21.2%	61.2	(1.6)	186.1	(4.9)	1.1 hot dogs
Boiled ham	9.8%	51.9	(2.2)	121.5	(5.2)	2.5 slices
Beef frankfurters	6.0%	62.8	(2.9)	213.6	(9.8)	1.1 frankfurters
Ham	5.3%	57.4	(4.0)	168.9	(11.8)	2.7 slices
Fruits, raw	5.6%	121.6	(3.8)	76.0	(1.4)	
Apples	33.4%	135.8	(2.1)	78.6	(1.2)	0.7 apple
Oranges	13.5%	136.8	(3.7)	67.1	(1.8)	0.9 orange
Mixed fresh fruit	12.2%	19.5	(1.1)	54.7	(1.7)	0.1 cup
Bananas	12.2%	112.9	(2.4)	96.0	(2.0)	1.0 banana
Peaches	4.2%	157.1	(8.4)	59.9	(3.2)	1.0 peach
DINNER - ALL KIDS						
Vegetables	22.9%	84.2	(1.4)	62.6	(1.4)	

Mashed white potatoes	7.5%	155.2	(5.0)	145.9	(4.7)	0.7 cup
Lettuce	7.4%	32.9	(1.5)	4.4	(0.2)	0.6 cup
Tomatoes	6.4%	67.2	(1.8)	14.9	(0.4)	3.4 slices
Tossed salad (lettuce, tomatoes, carrots)	5.5%	47.4	(2.0)	70.2	(1.6)	0.3 cup
Baked white potatoes	4.1%	93.7	(2.1)	86.9	(2.0)	0.6 cup
Breads and rolls	10.6%	45.8	(0.6)	129.9	(1.7)	
White bread	49.2%	43.0	(0.9)	116.3	(2.5)	1.5 slices
Soft white rolls	15.4%	51.0	(0.9)	151.7	(2.8)	1.5 rolls
Whole wheat bread	4.4%	47.3	(2.1)	114.9	(5.0)	1.7 slices
Bread, unspecified	4.3%	44.8	(1.5)	121.0	(4.1)	1.6 slices
White toast	2.3%	40.7	(1.8)	127.8	(5.8)	1.4 slices
Cakes, cookies, pies, cobblers, pastries	6.6%	58.5	(1.5)	207.8	(4.6)	
Chocolate chip cookies	14.6%	24.5	(1.1)	115.5	(5.1)	1.6 cookies
Chocolate covered, fudge sandwich cookies	6.5%	35.0	(1.9)	173.5	(9.3)	2.1 cookies
Cookies, non-specified	4.0%	27.8	(1.4)	133.2	(6.8)	1.9 cookies
Oatmeal raisin cookies	3.8%	39.7	(2.2)	179.3	(10.1)	2.6 cookies
Chocolate cake with icing	3.7%	93.3	(5.2)	316.5	(17.7)	0.7 piece
Beef	6.0%	119.8	(2.0)	416.8	(7.3)	
Hamburgers	25.7%	114.8	(2.6)	363.8	(8.3)	1.4 patties
Roast beef	17.4%	116.8	(3.8)	513.9	(16.8)	1.4 3-oz. servings
Steak, boneless	7.3%	124.9	(4.7)	441.0	(16.5)	1.5 3-oz. servings
Ground beef	5.1%	111.1	(4.6)	317.5	(13.2)	1.3 3-oz. servings
Steak, with bone	4.6%	130.4	(7.8)	460.5	(27.4)	1.5 3-oz. servings

Meat, poultry, fish mixtures and soups	5.1%	159.7	(4.2)	230.3	(8.8)	
Beef loaf	6.7%	125.0	(7.3)	350.0	(20.4)	2.2 slices
Beef stew with vegetables	6.4%	304.4	(17.4)	276.9	(15.9)	1.6 cups
Meatloaf	4.8%	110.9	(7.3)	310.7	(20.5)	2.0 slices
Meatballs	3.2%	76.5	(6.0)	214.2	(16.9)	4.1 meatballs
Ground beef with tomato sauce	3.1%	198.2	(16.0)	219.9	(17.8)	2.3 3-oz. servings
SNACKS - ALL KIDS						
Vegetables	16.5%	70.8	(3.1)	52.3	(2.6)	
Lettuce	8.6%	28.6	(2.3)	3.8	(0.3)	0.5 cup
Tomatoes	6.3%	56.0	(4.9)	12.4	(1.1)	2.8 slices
Tossed salad (lettuce, tomatoes, carrots)	6.2%	42.0	(4.5)	62.2	(3.3)	0.3 cup
Mashed white potatoes	6.0%	151.0	(12.5)	142.0	(11.7)	0.7 cup
Green string beans	4.4%	54.5	(5.1)	28.2	(2.6)	0.4 cup
Cakes, cookies, pies, cobblers, pastries	11.0%	53.2	(1.9)	200.5	(7.1)	
Chocolate chip cookies	15.6%	21.5	(1.4)	101.6	(6.8)	1.4 cookies
Chocolate covered, fudge sandwich cookies	8.5%	34.6	(2.3)	171.6	(11.3)	2.0 cookies
Cookies, non-specified	4.4%	27.1	(2.8)	129.7	(13.5)	1.8 cookies
Chocolate cupcakes	3.8%	59.1	(4.7)	200.5	(15.9)	1.6 cupcakes
Cookie ice cream cones	3.7%	5.2	(0.2)	19.9	(0.8)	1.0 cone
Milk desserts	8.5%	115.7	(3.1)	228.0	(5.9)	
Non-chocolate ice cream	53.3%	119.1	(4.2)	240.5	(8.4)	0.9 cup
Chocolate ice cream	15.1%	114.5	(7.9)	240.5	(16.6)	0.8 cup
Ice cream, non-specified	7.9%	107.7	(9.1)	217.4	(18.3)	0.8 cup
Ice cream sandwich	3.5%	80.9	(8.1)	223.6	(22.3)	1.2 sandwiches
Chocolate covered ice cream bar	2.5%	56.6	(5.1)	175.5	(15.8)	1.1 bars
Breads and rolls	8.0%	45.5	(1.1)	130.3	(3.6)	

White bread	41.4%	44.9	(2.0)	121.5	(5.5)	1.6 slices
Soft white rolls	16.0%	46.3	(2.1)	137.8	(6.3)	1.3 rolls
Whole wheat bread	4.2%	38.2	(4.8)	92.8	(11.8)	1.3 slices
White toast	4.1%	40.0	(5.4)	125.6	(16.9)	1.4 slices
Onion or potato rolls	3.4%	33.3	(4.4)	99.1	(13.1)	0.9 roll
Fruits, raw	6.2%	142.2	(5.3)	77.0	(2.0)	
Apples	30.7%	140.5	(5.4)	81.4	(3.1)	0.8 apple
Bananas	17.3%	102.0	(4.4)	87.7	(3.8)	0.9 banana
Oranges	15.5%	143.8	(5.5)	70.5	(2.7)	0.9 orange
Peaches	6.0%	157.5	(12.3)	60.1	(4.7)	1.1 peaches
Watermelon	4.9%	451.8	(69.3)	117.6	(18.0)	1.6 wedges

Table 3.5. Distinct food categories for food group analysis

Food Category	Food Category
Yogurt	Sandwiches with meat, poultry, fish
Milk desserts	Eggs, egg mixtures, dishes, sandwiches
Cheese	Legumes, dried beans, meat substitutes
Cottage cheese	Nuts and seeds
Processed cheeses, mixtures, soups	Nut butters and nut butter sandwiches
Beef	Breads and rolls
Pork and ham	Biscuits
Bacon	Corn bread, corn muffins, tortillas
Other meats (game, lamb, veal)	Muffins and popovers
Poultry	Cakes, cookies, pies, cobblers, pastries
Chicken nuggets/ tenders	Danish, breakfast pastries, doughnuts
Frankfurters, sausages, lunchmeat	Crackers
Fish and shellfish	Salty snacks from grains
Meat, poultry, fish mixtures and soup	Pancakes, waffles, French toast
Frozen meat meals	Pasta
Oatmeal/ cooked cereal	French fries/ hashbrowns
Rice and couscous	White potato chips
Cereal	Fried vegetables
Grain mixtures	Vegetable soups/ mixtures
Fruits, raw	Fruits, canned/ frozen
Dried fruit	Gelatin desserts/ salads
Vegetables	Ices, popsicles, sherbet
	Candies

Table 3.6. Food groups and items consumed by $\geq 5\%$ of youth (ages 2-5 y) at each eating occasion from NHANES 2009-2010

BREAKFAST – AGES 2-5 YEARS		Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
78	1 Cereal	28.6%	25.7	(1.0)	97.1	(3.3)	
	Cheerios	11.2%	20.2	(1.2)	74.2	(4.2)	0.7 cup
	Fruit Loops	9.0%	25.3	(1.8)	94.0	(6.8)	0.8 cup
	Honey Nut Cheerios	6.7%	27.2	(3.1)	107.1	(12.3)	0.9 cup
	Kellogg's Rice Krispies	5.1%	21.2	(0.8)	80.5	(2.9)	0.7 cup
	Frosted Mini Wheats	4.5%	42.6	(3.9)	146.0	(13.6)	1.4 cups
	2 Fruits, raw	11.1%	74.4	(5.1)	49.4	(5.3)	
	Banana	45.1%	82.1	(6.2)	73.2	(5.5)	0.7 banana
	Strawberries	14.4%	72.6	(1.5)	23.2	(0.4)	0.5 cup
	Apple	7.3%	70.1	(2.3)	36.4	(1.2)	0.4 apple
	Grapes	6.7%	57.5	(3.5)	39.7	(2.4)	0.4 cup
	Cantaloupe	4.7%	76.8	(35.8)	26.0	(12.0)	0.4 cup
	3 Breads and rolls	8.9%	43.5	(4.6)	123.3	(14.7)	
							0.6 medium
	Bagel	15.7%	65.4	(17.4)	168.1	(44.8)	bagel
	White toast	11.2%	32.6	(1.0)	95.6	(2.8)	1.2 slices
	White bread	10.3%	42.0	(4.8)	111.0	(12.5)	1.5 slices
	Whole wheat toast	10.5%	36.4	(7.1)	113.3	(22.0)	1.3 slices
	Whole grain white bread	6.4%	44.2	(0.0)	105.3	(0.0)	1.6 slices
4	Eggs and egg mixtures, dishes and sandwiches	8.3%	87.7	(3.7)	156.8	(7.6)	
	Scrambled egg	47.7%	93.8	(5.0)	159.9	(8.2)	1.5 eggs
	Scrambled egg w/ cheese	15.1%	113.9	(6.0)	232.5	(14.7)	1.9 eggs
	Fried egg	12.3%	38.0	(6.9)	61.6	(11.1)	0.8 egg

5	Boiled egg	4.3%	62.7	(8.0)	96.7	(12.2)	1.3 eggs
	Scrambled egg w/ ham or bacon	3.6%	125.9	(17.5)	247.2	(32.1)	2.1 eggs
	Pancakes, waffles, French toast	8.0%	56.1	(2.9)	152.5	(7.9)	
	Waffle	34.3%	68.5	(1.7)	212.8	(5.4)	0.9 waffle 1.2
	Pancakes	32.5%	46.0	(4.2)	103.5	(9.5)	pancakes
	French toast sticks	7.2%	71.1	(1.0)	241.9	(3.4)	3.3 sticks
	Fruit pancakes (incl. blueberry)	6.3%	52.9	(4.7)	100.2	(8.9)	1.4 pancakes
	French toast	5.1%	82.1	(21.5)	200.4	(52.5)	1.3 slices
	LUNCH - AGES 2-5 YEARS						
	1 Breads and rolls	12.4%	38.1	(1.6)	105.5	(4.4)	
2	White bread	20.3%	40.9	(4.1)	108.1	(10.9)	1.5 slices
	Soft white roll	15.4%	42.0	(2.2)	116.9	(6.1)	1.2 rolls
	Whole wheat bread	14.8%	33.4	(2.0)	88.0	(5.4)	1.2 slices
	Wheat bread	14.3%	45.1	(4.1)	121.8	(11.2)	1.6 slices
	Whole wheat toast	4.9%	35.1	(6.2)	109.2	(19.2)	1.3 slices
	Vegetables	10.9%	45.0	(3.7)	28.3	(4.1)	
	Lettuce	12.5%	17.3	(2.0)	2.5	(0.3)	0.3 cup
	Tomatoes	12.4%	39.5	(4.8)	7.0	(0.8)	2.0 slices 2.8 baby
	Carrots	7.2%	27.6	(2.3)	11.4	(0.9)	carrots
	Cucumber	4.5%	32.5	(13.9)	3.8	(1.7)	0.3 cup
	Canned green string beans, cooked	4.2%	18.4	(5.2)	4.5	(1.2)	0.1 cup

08	3	Mixtures, mainly grains, pasta, bread	10.0%	162.3	(5.5)	248.3	(14.5)	
		Macaroni w/ cheese, made from dry mix	11.6%	148.4	(18.9)	235.4	(41.4)	0.7 cup
		Soup, mostly noodles	8.1%	258.7	(13.2)	171.7	(8.8)	1.0 cup
		Macaroni w/ cheese	6.5%	196.7	(24.5)	383.2	(48.2)	1.0 cup
		Cheese pizza, regular crust	5.7%	66.7	(2.8)	177.5	(7.4)	0.6 slice
		Spaghetti with tomato sauce, meatless	3.8%	96.0	(7.7)	114.0	(9.2)	0.4 cup
	4	Fruits, raw	8.0%	92.7	(5.6)	51.5	(3.6)	
		Apple	24.6%	112.5	(7.7)	58.5	(4.0)	0.6 apple
		Banana	13.2%	87.9	(11.1)	78.3	(9.9)	0.7 banana
		Grapes	10.8%	69.2	(4.1)	47.8	(2.8)	0.5 cup
		Pineapple	7.0%	116.9	(40.0)	58.5	(19.9)	0.7 cup
		Watermelon	6.6%	149.4	(77.5)	44.9	(23.3)	1.0 cup
	5	Frankfurters, sausages, lunchmeat	6.1%	46.1	(4.0)	103.0	(12.9)	
		Chicken/ turkey loaf deli meat	20.0%	46.9	(1.9)	49.2	(1.9)	1.7 slices
		Sliced ham deli meat	16.4%	36.5	(3.3)	38.4	(3.5)	1.6 slices
		Beef hot dog	9.5%	65.1	(4.2)	210.1	(13.6)	1.1 hot dogs
		Pork and beef bologna	7.6%	42.4	(2.2)	130.4	(6.8)	1.6 slices
		Turkey/ chicken breast, deli meat	5.8%	26.6	(2.0)	27.8	(2.0)	1.0 slice
	DINNER - AGES 2-5 YEARS							
	1	Vegetables	19.0%	50.8	(2.3)	31.9	(2.6)	
		Tomatoes	8.6%	35.6	(3.1)	6.4	(0.5)	1.8 slices
		Lettuce	8.1%	24.7	(5.9)	3.5	(0.8)	0.4 cup

	Canned green string beans, cooked	4.1%	50.9	(9.6)	12.6	(2.3)	0.4 cup
	Cucumber	3.9%	47.4	(3.5)	5.6	(0.4)	0.5 cup
	Carrots	3.2%	19.7	(0.7)	8.0	(0.3)	2.0 baby carrots
2	Mixtures, mainly grains, pasta, bread	12.2%	139.2	(4.2)	226.7	(8.0)	
	Macaroni w/ cheese, made from dry mix	10.6%	114.3	(9.1)	174.3	(11.1)	0.6 cup
	Macaroni w/ cheese	7.3%	157.3	(8.2)	311.3	(16.1)	0.8 cup
	Spaghetti w/ tomato and meat sauce	6.8%	210.0	(10.1)	280.4	(13.5)	0.9 cup
	Spanish rice	4.5%	109.6	(27.4)	117.4	(29.6)	0.7 cup
	Macaroni w/ cheese, from mix w/ prepared cheese	4.4%	114.9	(8.8)	204.8	(15.7)	0.6 cup
3	Breads and rolls	7.1%	34.4	(1.2)	99.4	(3.5)	
	Soft white roll	28.2%	38.3	(2.5)	106.7	(6.8)	1.1 rolls
	Whole wheat bread	10.3%	29.8	(0.7)	78.0	(2.0)	1.1 slices
	White bread	10.0%	36.3	(2.0)	96.1	(5.2)	1.3 slices
	White toast	5.8%	22.2	(2.2)	65.1	(6.4)	0.8 slice
	Wheat bread	5.4%	35.2	(4.4)	95.1	(11.9)	1.3 slices
4	Meat, poultry, fish mixtures and soups	5.5%	142.6	(9.0)	188.0	(11.8)	
	BBQ Chicken, no skin	8.0%	103.9	(10.1)	177.0	(17.2)	0.3 breast
	Beef stroganoff with noodles	7.9%	227.3	(19.1)	292.3	(24.6)	0.9 cup
	Beef stroganoff	3.3%	96.0	(0.0)	144.0	(0.0)	0.4 cup
	Mexican chicken vegetable soup with rice	3.1%	177.7	(24.8)	133.1	(18.4)	0.7 cup
	Meatloaf with beef	3.0%	135.7	(31.1)	265.6	(61.0)	2.4 slices

SNACKS - AGES 2-5 YEARS							
28	1	Fruits, raw	16.3%	107.5	(4.6)	65.4	(2.9)
		Banana	25.9%	105.0	(4.7)	93.5	(4.2) 0.9 banana
		Apple	21.3%	138.0	(5.3)	71.8	(2.8) 0.8 apple
		Grapes	14.4%	83.4	(4.5)	57.6	(3.1) 0.6 cup
		Orange	9.4%	99.7	(9.8)	46.9	(4.6) 0.6 orange
							5.1
		Strawberries	5.4%	60.6	(3.8)	19.4	(1.3) strawberries
	2	Candies	12.2%	20.1	(1.5)	82.8	(6.0)
		Hard candy	25.4%	17.5	(2.7)	69.1	(10.5) 2.9 pieces
		Fruit leather/ fruit snacks	18.0%	22.2	(1.6)	81.3	(5.7) 1.1 packets
							37.9
		M&M's milk chocolate	9.7%	26.5	(3.2)	130.6	(15.5) M&M's
		Taffy	8.7%	12.3	(0.0)	49.5	(0.1) 0.8 pieces
							4.6
		Gumdrops	8.4%	19.4	(1.8)	76.8	(7.2) gumdrops
	3	Crackers	10.6%	24.5	(2.4)	114.4	(11.1)
							0.8 1-oz.
		Snack crackers	31.2%	21.4	(1.0)	108.2	(5.1) bag
							4.1 graham
		Graham crackers	19.7%	29.0	(6.0)	122.4	(25.5) squares
		Animal crackers	9.5%	21.9	(2.8)	98.0	(12.7) 0.4 box
							1.2 1-oz.
		Cheese crackers	8.3%	33.5	(1.2)	163.8	(5.9) bags
		Peanut butter sandwich crackers	6.3%	24.6	(6.1)	121.5	(30.2) 3.8 crackers
	4	Cakes, cookies, pies, cobbles and pastries	9.8%	33.3	(2.0)	138.5	(8.2)
		Chocolate chip cookies	20.5%	41.5	(5.4)	196.7	(25.5) 2.8 cookies

5	Chocolate coated/ striped cookies	10.5%	25.4	(1.1)	119.1	(4.9)	1.5 cookies
	Chocolate chip cookies, homemade or bakery	6.6%	17.7	(0.8)	87.0	(3.8)	1.2 cookies
	Butter or sugar cookie	5.6%	22.3	(2.8)	105.8	(13.5)	1.5 cookies
	Chocolate cupcake with icing	5.0%	38.0	(3.7)	151.8	(14.7)	1.0 cupcake
	Salty snacks from grains	8.8%	19.0	(1.3)	91.2	(6.3)	
	Corn tortilla chips	20.2%	22.9	(1.5)	113.1	(7.4)	0.8 1-oz. bag
	Hard pretzels	14.8%	16.4	(1.2)	62.3	(4.5)	0.6 1-oz. bag
	Buttered popcorn, popped in oil	12.2%	20.1	(1.8)	106.3	(9.3)	1.8 cups
	Corn puffs	10.0%	23.4	(2.2)	132.0	(12.2)	0.7 package
	Lowfat popcorn, popped in oil	7.6%	12.6	(4.5)	53.2	(19.2)	1.1 cups
	Milk desserts	5.4%	72.7	(8.0)	139.2	(13.7)	
	Vanilla ice cream	31.8%	78.9	(9.5)	163.2	(19.7)	0.6 cup
	Ice cream sandwich	7.1%	52.6	(2.7)	124.8	(6.5)	0.8 sandwich
	Mousse, not chocolate	7.1%	7.7	(0.0)	15.9	(0.0)	< 0.1 cup
	Chocolate ice cream	7.0%	106.3	(18.5)	229.8	(40.0)	0.8 cup
	Chocolate pudding	5.1%	114.5	(0.0)	162.2	(0.0)	1.1 4-oz container

Table 3.7. Food groups and items consumed by ≥5% of youth (ages 6-11y) at each eating occasion from NHANES 2009-2010

BREAKFAST - AGES 6-11 YEARS	Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
1 Cereal	26.1%	134.3	(1.9)	35.3	(6.4)	
Honey Nut Cheerios	7.8%	36.2	(3.0)	142.1	(11.9)	1.2 cups
Froot Loops	6.7%	28.9	(1.6)	107.6	(6.0)	1.0 cups
Cinnamon Toast Crunch	6.5%	37.4	(3.0)	154.6	(12.4)	1.2 cups
Cocoa Puffs	5.6%	35.9	(3.5)	133.0	(12.9)	1.2 cups
Fruity Pebbles	5.4%	31.5	(5.0)	125.8	(20.1)	1.1 cups
2 Breads and rolls	13.2%	57.3	(2.6)	167.3	(10.9)	
White toast	21.1%	42.6	(4.0)	124.8	(11.9)	1.5 slices
Bagel	11.3%	98.7	(3.5)	253.8	(9.0)	0.9 medium bagel
White bread	11.2%	47.7	(2.0)	126.0	(5.3)	1.7 slices
Wheat bread	7.7%	54.2	(2.6)	146.3	(7.0)	1.9 slices
Wheat toast	7.0%	31.0	(1.4)	97.1	(4.4)	1.1 slices
3 Pancakes, waffles, french toast	11.6%	90.4	(7.9)	230.9	(18.2)	
Pancakes	27.9%	101.1	(13.8)	227.5	(31.1)	2.7 pancakes
Waffle	21.4%	87.4	(3.8)	271.5	(11.9)	1.2 waffles
French toast	11.5%	133.0	(41.4)	324.7	(101.0)	2.1 slices
Pancakes w/ chocolate chips	8.2%	75.9	(21.0)	167.0	(46.2)	2.0 pancakes
Chocolate chip waffles	6.9%	66.8	(10.7)	186.3	(29.8)	0.9 waffle
4 Eggs and egg mixtures, dishes, sandwiches	7.6%	106.7	(5.0)	196.1	(14.4)	
Scrambled egg	36.6%	106.6	(6.2)	184.5	(10.4)	1.7 eggs

	Fried egg	25.2%	68.0	(4.8)	138.7	(8.7)	1.5 eggs
	Boiled egg	6.5%	84.5	(7.3)	130.3	(11.2)	1.7 eggs
	Scrambled egg w/ cheese	4.6%	124.8	(28.6)	248.8	(56.4)	2.0 eggs
	Scrambled egg w/ ham or bacon	4.1%	176.7	(18.4)	335.9	(25.2)	2.9 eggs
5	Danish, breakfast pastries, doughnuts	5.1%	75.9	(3.4)	300.5	(13.7)	
	Breakfast tart	42.4%	83.7	(4.0)	327.2	(15.7)	1.6 tarts
	Cake doughnut	8.7%	47.0	(4.9)	196.6	(20.5)	1.0 doughnut
	Raised yeast doughnut	8.2%	87.6	(4.4)	349.4	(17.5)	1.4 doughnuts
	Chocolate cake doughnut w/ chocolate icing	6.9%	148.4	(6.2)	610.1	(25.6)	2.5 doughnuts
	Danish pastry with fruit	4.5%	86.3	(4.8)	320.3	(17.6)	1.2 pastries
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	LUNCH - AGES 6-11 YEARS						
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1	Breads and rolls	14.3%	46.8	(2.1)	129.2	(6.9)	
	Soft white roll	25.4%	47.5	(2.4)	132.1	(6.6)	1.4 rolls
	White bread	21.1%	49.0	(2.1)	129.5	(5.6)	1.8 slices
	Whole wheat bread	13.7%	36.8	(1.1)	96.9	(2.8)	1.3 slices
	Wheat bread	9.9%	49.4	(1.9)	133.2	(5.0)	1.8 slices
	Wheat roll	3.1%	40.2	(5.7)	109.7	(15.4)	1.1 rolls
2	Vegetables	11.7%	50.2	(5.5)	29.7	(3.5)	
	Lettuce	20.4%	20.6	(1.6)	2.9	(0.2)	0.4 cup 4.2 baby
	Carrots	13.6%	42.4	(5.3)	17.4	(2.2)	carrots
	Tomatoes	10.9%	31.5	(3.6)	5.7	(0.6)	1.6 slices
	Dill pickles	7.4%	32.8	(10.2)	3.8	(1.1)	0.2 cup
	Mashed white potatoes	3.4%	109.1	(0.4)	96.8	(0.3)	0.5 cup

8	3	Mixtures, mainly grains, pasta, bread	10.5%	171.6	(8.9)	326.0	(12.7)	
		Cheese pizza, regular crust	8.0%	120.4	(6.2)	320.6	(16.4)	1.1 slices
		Macaroni w/ cheese, from dry mix	7.0%	154.8	(25.7)	241.6	(53.6)	0.8 cup
		Pepperoni pizza, regular crust	6.5%	163.5	(20.6)	461.1	(58.0)	1.5 slices
		Macaroni w/ cheese	6.3%	187.2	(8.4)	350.8	(13.5)	1.0 cup
		Cheese pizza, thin crust	4.6%	95.2	(1.5)	287.8	(4.6)	1.3 slices
	4	Fruits, raw	8.9%	104.0	(5.4)	55.2	(2.9)	
		Apple	34.7%	119.5	(5.1)	62.1	(2.7)	0.7 apple
		Orange	11.8%	90.2	(7.7)	42.5	(3.6)	0.6 orange
		Grapes	9.7%	77.6	(10.3)	53.6	(7.0)	0.5 cup
		Banana	6.9%	93.6	(2.5)	83.3	(2.2)	0.8 banana
		Pineapple	4.9%	79.8	(16.3)	39.7	(8.2)	0.5 cup
	5	Frankfurters, sausages, lunchmeat	5.8%	52.3	(3.7)	103.1	(11.4)	
		Sliced ham deli meat	23.9%	56.3	(5.3)	58.9	(5.6)	2.4 slices
		Chicken/ turkey loaf deli meat	21.4%	56.4	(3.0)	59.1	(3.1)	2.0 slices
		Hot dog	10.2%	68.6	(9.9)	221.7	(32.2)	1.2 hot dogs
		Turkey/ chicken breast deli meat	6.8%	28.8	(2.1)	29.7	(2.2)	1.0 slice
		Beef hot dog	4.8%	67.3	(3.6)	217.5	(11.8)	1.2 hot dogs
	6	Cheese	5.1%	28.0	(2.4)	96.8	(8.7)	
		Part-skim mozzarella	19.7%	34.4	(2.7)	104.1	(8.1)	1.2 slices
		Natural cheddar/ American cheese	15.4%	28.0	(3.2)	112.6	(12.8)	1.0 slice
		Cheddar/ American cheese	15.3%	28.1	(1.6)	103.2	(6.0)	1.3 slices

	Cheese	12.4%	18.4	(5.3)	62.5	(17.9)	0.9 slice
	Swiss cheese	11.0%	31.6	(5.1)	120.1	(19.2)	1.1 slices
DINNER - AGES 6-11 YEARS							
1	Vegetables	17.4%	63.0	(4.6)	41.5	(4.2)	
	Tomatoes	8.4%	48.7	(5.5)	8.7	(0.9)	2.4 slices
	Lettuce	8.3%	35.8	(4.4)	5.0	(0.6)	0.6 cup
	Carrots	6.3%	59.1	(4.6)	24.3	(1.9)	5.9 baby carrots
	Cucumber	4.4%	43.7	(3.5)	5.1	(0.5)	0.4 cup
	Dill pickles	2.9%	60.3	(24.5)	7.3	(2.9)	0.4 cup
2	Mixtures, mainly grains, pasta, bread	12.2%	208.2	(8.0)	367.3	(17.3)	
	Spaghetti w/ tomato and meat sauce	7.0%	317.2	(21.1)	423.6	(28.2)	1.3 cups
	Macaroni w/ cheese, from dry mix	6.5%	192.8	(11.0)	303.0	(18.2)	1.0 cup
	Macaroni w/ cheese	5.9%	206.4	(6.1)	407.4	(11.9)	1.1 cups
	Soup, mostly noodles	5.1%	340.1	(9.9)	225.6	(6.6)	1.3 cups
	Pepperoni pizza, regular crust	4.1%	164.7	(6.0)	464.4	(16.9)	1.5 slices
3	Breads and rolls	7.6%	52.7	(2.9)	153.7	(9.2)	
	Soft white roll	34.0%	48.5	(3.0)	134.9	(8.4)	1.4 rolls
	White bread	10.8%	44.6	(1.6)	118.1	(4.4)	1.6 slices
	Wheat bread	9.8%	56.9	(1.8)	153.7	(4.8)	2.0 slices
	Garlic bread	6.8%	107.2	(4.2)	375.4	(14.9)	1.8 slices
	White toast	5.9%	45.9	(4.2)	134.5	(12.2)	1.6 slices
4	Fruits, raw	5.4%	107.4	(9.3)	52.1	(5.2)	
	Watermelon	19.7%	147.1	(14.9)	44.2	(4.4)	1.0 cup

	Apple	16.3%	115.0	(8.2)	59.8	(4.2)	0.6 apple
	Strawberries	16.1%	112.3	(16.6)	35.9	(5.4)	0.7 cup
	Blueberries	9.0%	40.0	(12.5)	22.8	(7.0)	0.3 cup
	Banana	8.8%	116.5	(0.3)	103.7	(0.2)	1.0 banana
SNACKS - AGES 6-11 YEARS							
1	Candies	15.9%	24.4	(1.4)	106.7	(6.6)	
	Hard candy	29.6%	16.9	(1.8)	66.6	(7.2)	2.8 pieces
	Fruit leather/ fruit snacks	10.9%	28.6	(2.9)	104.3	(10.5)	1.4 packets
	Taffy	8.4%	18.9	(3.1)	75.9	(12.5)	1.3 pieces
	Milk chocolate candy	6.3%	38.0	(1.2)	203.6	(6.4)	5.4 miniatures
	Gumdrops	5.0%	35.6	(5.5)	141.1	(21.7)	8.5 gumdrops
2	Fruits, raw	12.3%	117.8	(6.7)	67.3	(4.6)	
	Apple	23.6%	150.4	(7.4)	78.2	(3.9)	0.8 apple
	Banana	17.7%	120.3	(7.7)	107.2	(6.8)	1.0 banana
	Grapes	14.5%	85.7	(11.3)	59.2	(7.7)	0.6 cup
	Orange	8.9%	126.2	(7.4)	59.5	(3.4)	0.8 orange
	Strawberries	7.5%	67.8	(3.9)	21.7	(1.2)	0.4 cup
3	Cakes, coookies, pies, cobbler, pastries	11.2%	52.2	(4.8)	217.4	(18.2)	
	Chocolate chip cookies	19.3%	59.9	(7.5)	284	(35.7)	4.0 cookies
	Chocolate coated/ striped cookies	13.1%	34.7	(4.9)	162.9	(22.9)	2.0 cookies 1.2 large brownies
	Brownie without icing	9.6%	66.1	(14.5)	250.3	(54.8)	
	Chocolate chip cookies, homemade or bakery	5.1%	23.4	(4.1)	114.8	(20.0)	1.6 cookies
	Homemade white cake with icing	5.1%	82.1	(8.2)	314.5	(31.4)	0.7 piece

4	Salty snacks from grains	11.2%	31.1	(1.8)	153.0	(9.1)	
	Buttered popcorn, popped in oil	18.2%	17.9	(4.7)	75.6	(24.7)	1.6 cups
	Corn tortilla chips	17.9%	30.7	(1.7)	151.4	(8.5)	1.1 1-oz. bag
	Corn puffs	17.7%	31.1	(4.1)	175.8	(23.3)	0.9 package
	Hard pretzels	14.5%	29.9	(5.6)	113.9	(21.3)	1.1 1-oz. bags
	Lowfat popcorn, popped in oil	5.9%	17.9	(1.0)	75.6	(4.3)	1.6 cups
5	Crackers	6.9%	31.7	(2.0)	148.1	(8.8)	
	Snack crackers	24.2%	28.2	(2.9)	142.1	(14.5)	1.0 1-oz. bag
	Cheese crackers	14.3%	33.6	(2.0)	164.2	(9.8)	1.2 1-oz. bags
	Peanut butter sandwich crackers	9.5%	36.3	(2.2)	179.6	(10.8)	5.6 crackers
	Reduced-fat cheese crackers	7.9%	24.7	(1.7)	103.2	(7.2)	0.9 1-oz. bag
	Graham crackers	7.8%	17.5	(4.0)	74.2	(16.8)	2.5 graham squares
6	Milk desserts	5.1%	124.9	(8.3)	245.0	(14.8)	
	Vanilla ice cream	42.2%	149.1	(11.4)	308.6	(23.6)	1.1 cups
	Vanilla ice cream cone	7.5%	98.0	(6.0)	214.6	(13.2)	0.8 cone
	Light vanilla ice cream	3.8%	146.7	(29.8)	264.1	(53.5)	1.1 cups
	Chocolate ice cream	3.7%	148.5	(5.3)	320.9	(11.4)	1.1 cups
	Pudding, from dry mix, not chocolate	3.5%	99.0	(0.0)	90.0	(0.0)	0.9 4-oz. container

Table 3.8. Food groups and items consumed by ≥5% of youth (ages 12-14y) at each eating occasion from NHANES 2009-2010

BREAKFAST - AGES 12-14 YEARS	Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
1 Cereal	22.8%	48.7	(3.8)	188.7	(15.1)	
Cinnamon Toast Crunch	10.5%	53.8	(6.2)	222.8	(25.5)	1.8 cups
Cap'N Crunch	8.9%	66.1	(21.3)	263.1	(85.0)	2.2 cups
Kellogg's Frosted Flakes	8.5%	45.3	(0.5)	166.2	(2.0)	1.5 cups
Lucky Charms	7.9%	35.1	(0.7)	143.1	(3.0)	1.2 cups
Fruit Loops	6.7%	36.2	(1.3)	134.8	(4.7)	1.2 cups
2 Breads and rolls	15.4%	69.7	(6.0)	214.0	(26.5)	
Wheat toast	15.9%	51.7	(2.6)	162.2	(8.0)	1.8 slices
White toast	10.9%	51.1	(2.3)	150.1	(6.7)	1.8 slices
White bread	10.4%	47.9	(4.0)	126.7	(10.7)	1.7 slices
						1.0 medium
Bagel	10.0%	105.6	(2.1)	271.5	(5.6)	bagel
Whole wheat toast	6.3%	27.8	(1.8)	86.5	(5.5)	1.0 slices
3 Pancakes, waffles, french toast	9.1%	115.3	(11.4)	285.2	(14.9)	
Pancakes	50.3%	123.7	(12.0)	278.5	(26.9)	3.3 pancakes
Waffle	23.6%	90.1	(1.9)	279.7	(5.9)	1.2 waffle
Chocolate chip pancakes	10.0%	160.6	(52.9)	353.4	(116.7)	4.2 pancakes
French toast sticks	6.0%	101.8	(4.2)	346.1	(14.2)	4.8 sticks
Chocolate chip waffle	5.2%	70.0	(0.0)	195.0	(0.0)	0.9 waffle
4 Eggs and egg mixtures, dishes, sandwiches	6.6%	120.7	(8.3)	227	(18.7)	
Scrambled egg	30.7%	152.0	(30.0)	255.8	(50.4)	2.5 eggs

	Fried egg	25.0%	71.5	(10.2)	115.5	(16.6)	1.6 eggs
	Scrambled egg w/ cheese	23.9%	150.8	(5.0)	302.1	(8.5)	2.5 eggs
	Egg white omelet	4.5%	49.0	(0.0)	79.0	(0.0)	0.8 egg
	Egg, cheese, and sausage biscuit	4.0%	156.0	(0.0)	487.0	(0.0)	1.0 biscuit
5	Danish, breakfast pastries, doughnuts	5.5%	83.1	(6.7)	325.4	(25.9)	
	Breakfast tart	55.7%	103.5	(0.6)	404.6	(2.3)	2.0 tarts
							1.4
	Cake doughnut	6.8%	62.1	(14.3)	259.7	(60.0)	doughnuts
	Raised yeast doughnut	6.7%	60.5	(4.1)	241.2	(16.2)	0.9 doughnut
	Danish pastry with fruit	6.0%	46.7	(7.4)	173.4	(27.4)	0.7 pastry
	Chocolate raised yeast doughnut	5.5%	50.0	(0.0)	195.0	(0.0)	0.8 doughnut
6	Fruits, raw	5.2%	117.1	(25.9)	65.7	(17.8)	
	Apple	30.5%	156.9	(9.0)	81.7	(4.7)	0.9 apple
	Red raspberries	17.2%	15.4	(0.0)	8.0	(0.0)	0.1 cup
	Grapes	12.9%	142.1	(4.3)	98.0	(3.0)	0.9 cup
	Orange	12.8%	124.4	(34.8)	58.7	(16.3)	0.8 orange
	Cantaloupe	12.2%	132.9	(12.9)	45.1	(4.5)	0.8 cup
LUNCH - AGES 12-14 YEARS							
1	Mixtures, mainly grains, pasta, bread	13.4%	191.9	(17.2)	390.4	(20.2)	
	Cheese pizza, regular crust	10.3%	156.7	(11.6)	417.2	(30.7)	1.5 slices
	Macaroni w/ cheese, from dry mix	9.7%	317.8	(18.1)	495.1	(49.8)	1.6 cups
	Pepperoni pizza, thick crust	9.2%	140.8	(13.1)	403.8	(37.5)	1.2 slices
	Pepperoni pizza, regular crust	7.4%	126.1	(3.7)	355.8	(10.4)	1.1 slices

	Frozen cheese pizza, thin crust	5.7%	164.8	(0.0)	441.5	(0.0)	2.4 slices
2	Breads and rolls	13.1%	56.2	(3.0)	154.1	(8.2)	
	Soft white roll	42.0%	49.8	(2.7)	138.8	(7.6)	1.4 rolls
	White bread	26.2%	59.8	(3.4)	158.0	(9.0)	2.1 slices
	Whole wheat bread	8.4%	49.1	(0.4)	129.3	(0.9)	1.8 slices
	Hoagie roll	3.7%	130.7	(43.6)	363.5	(121.1)	1.2 rolls
	Wheat toast	3.0%	49.4	(0.8)	155.0	(2.7)	1.8 slices
3	Vegetables	11.5%	59.3	(8.4)	29.1	(7.5)	
	Lettuce	30.3%	37.1	(7.1)	5.2	(1.1)	0.7 cup
	Tomatoes	13.2%	98.2	(29.9)	17.7	(5.5)	4.9 slices
	Cucumber	11.8%	29.6	(2.5)	3.5	(0.3)	0.3 cup 4.3 baby
	Carrots	11.5%	42.9	(0.9)	17.7	(0.3)	carrots
	Mashed white potatoes	4.5%	172.3	(12.4)	153.7	(11.2)	0.7 cup
4	Fruits, raw	7.1%	131.1	(14.7)	65.0	(6.4)	
	Apple	23.0%	127.9	(27.3)	66.8	(14.1)	0.7 apple
	Strawberries	21.7%	96.5	(22.2)	30.6	(7.0)	0.6 cup
	Grapes	17.2%	57.2	(4.6)	39.3	(3.2)	0.4 cup
	Banana	16.4%	112.8	(0.6)	100.4	(0.6)	0.9 banana
	Pineapple	5.7%	61.9	(0.0)	31.0	(0.0)	0.4 cup
5	Frankfurters, sausages, lunchmeat	6.8%	78.0	(5.5)	151.8	(17.6)	
	Sliced ham deli meat	29.4%	89.6	(7.1)	94.1	(7.4)	3.9 slices
	Chicken/ turkey loaf deli meat	24.0%	56.6	(3.3)	59.2	(3.5)	2.0 slices
	Salami	12.7%	100.9	(1.9)	338.9	(6.5)	11.2 slices
	Beef hot dog	11.2%	91.3	(5.0)	295.3	(16.4)	1.6 hot dogs
	Turkey hot dog	8.3%	85.5	(0.0)	195.0	(0.0)	1.5 hot dogs
6	Cheese	6.3%	36.2	(3.5)	128.2	(12.9)	
	Natural cheddar cheese	25.2%	47.7	(6.9)	192.2	(27.6)	1.7 slices

Cheddar cheese	20.5%	29.7	(0.2)	108.8	(0.9)	1.1 slices
Cheese	13.3%	29.4	(8.5)	99.7	(28.6)	1.4 slices
Monterey cheese	8.7%	30.6	(0.0)	114.0	(0.0)	1.1 slices
Mozarella	7.7%	25.8	(1.7)	77.7	(5.3)	0.9 slice
DINNER - AGES 12-14 YEARS						
1 Vegetables	20.0%	82.4	(9.7)	49.7	(9.1)	
Lettuce	11.8%	61.5	(6.2)	8.6	(0.9)	1.1 cups
Tomatoes	10.9%	81.4	(29.0)	14.6	(5.2)	4.1 slices
Cucumber	7.4%	39.1	(0.1)	4.8	(0.1)	0.4 cup 4.9 baby
Carrots	7.2%	48.7	(10.4)	20.0	(4.3)	carrots
Mashed white potatoes	5.4%	134.3	(50.4)	119.8	(44.9)	0.6 cup
2 Mixtures, mainly grains, pasta, bread	12.8%	251.5	(51.5)	465	(79.5)	
Spaghetti w/ tomato and meat sauce	6.4%	394.7	(11.0)	526.9	(14.6)	1.6 cups
Macaroni w/ cheese	4.9%	246.7	(30.6)	474.2	(71.9)	1.3 cups
Nachos w/ cheese	4.0%	62.1	(1.0)	172.3	(2.8)	4.4 nachos
Pepperoni pizza, thick crust	3.9%	198.3	(27.0)	569.1	(77.3)	1.7 slices
Pepperoni pizza, regular crust	3.7%	121.5	(15.3)	342.5	(43.1)	1.1 slices
3 Breads and rolls	6.9%	57.4	(4.2)	165.2	(14.0)	
Soft white roll	44.6%	52.7	(1.0)	146.6	(2.8)	1.5 rolls
White bread	22.9%	56.8	(3.9)	150.4	(10.2)	2.0 slices
Italian bread	7.0%	29.1	(12.5)	78.9	(33.9)	1.5 slices
Garlic bread	3.7%	142.2	(32.0)	498.0	(112.0)	2.4 slices
White toast	2.5%	57.2	(7.6)	168.1	(22.1)	2.0 slices
4 Meat, poultry, fish mixtures and soups	6.5%	277.4	(30.6)	390.4	(37.9)	

Chicken parmigiana	9.6%	241.7	(0.0)	422.5	(0.0)	1.7 cups
Chinese lemon chicken	8.4%	170.3	(24.0)	384.7	(54.2)	7.1 pieces
Beef stroganoff	7.2%	256.0	(0.0)	383.0	(0.0)	1.1 cups
Beef meatloaf w/ tomato sauce	6.9%	44.4	(10.0)	74.0	(16.6)	0.8 slice
Pork shish kabob w/ vegetables	5.5%	606.0	(0.0)	736.0	(0.0)	4.8 kabobs
SNACKS - AGES 12-14 YEARS						
1 Salty snacks from grains	13.6%	39.5	(4.0)	187.3	(16.2)	
Corn puffs	17.4%	35.1	(6.7)	198.4	(37.6)	1.0 package 2.3 1-oz. bags
Hard pretzels	12.9%	64.5	(3.7)	245.5	(14.0)	
Flavored popcorn (cheese, BBQ, sour cream)	6.9%	25.4	(1.1)	126.9	(5.5)	2.3 cups
Popcorn, popped in oil	5.7%	12.0	(7.4)	70.0	(43.0)	1.1 cups
Buttered popcorn, popped in oil	4.9%	44.9	(1.4)	236.8	(7.4)	4.1 cups
2 Candies	12.2%	38.6	(5.0)	173.8	(23.7)	
Hard candy	21.6%	14.6	(2.4)	57.4	(9.4)	2.4 pieces 5.0
Milk chocolate	11.5%	35.1	(6.5)	187.8	(35.0)	miniatures
Taffy	7.9%	41.5	(0.8)	166.0	(3.3)	2.8 pieces
Snickers	7.3%	33.2	(3.1)	162.7	(15.4)	2.2 fun size
Fruit leather/ fruit snacks	6.9%	20.9	(2.9)	76.3	(10.7)	1.0 packet
3 Fruits, raw	10.6%	135.2	(4.8)	74.9	(2.1)	
Apple	24.4%	156.3	(13.5)	81.4	(7.1)	0.9 apple
Banana	17.9%	110.9	(1.7)	98.8	(1.5)	0.9 banana
Orange	15.9%	189.9	(6.3)	89.6	(3.0)	1.2 oranges
Grapes	13.5%	102.9	(14.9)	70.9	(10.3)	0.7 cup

	Strawberries	7.9%	76.1	(20.7)	24.3	(6.6)	6.3 strawberries
4	Cakes, coookies, pies, cobbler, pastries	10.1%	62.1	(5.6)	263.1	(22.8)	
	Chocolate chip cookies	25.2%	74.4	(2.3)	352.4	(10.7)	5.0 cookies
	Chocolate coated/ striped cookies	16.9%	55.4	(1.0)	259.9	(4.6)	3.3 cookies
	Brownie with icing	6.0%	84.0	(15.3)	340.2	(61.9)	1.5 large brownies
	Brownie without icing	5.5%	44.2	(9.2)	167.7	(34.9)	0.8 large brownie
	Peanut butter cookies	4.6%	75.0	(0.0)	358.0	(0.0)	5.0 cookies
5	Milk desserts	8.4%	109.5	(8.4)	236.6	(12.6)	
	Vanilla ice cream	37.6%	108.9	(0.4)	225.2	(0.8)	0.8 cup
	Vanilla ice cream cone	12.2%	78.0	(0.0)	171.0	(0.0)	0.7 cone
	Ice cream sandwich	7.6%	57.2	(6.1)	135.8	(14.5)	0.8 sandwich
	Fudgesicle	6.5%	73.0	(0.0)	133.0	(0.0)	1.4 bars
	Chocolate covered ice cream bar	4.9%	112.0	(0.0)	371.0	(0.0)	2.2 bars
6	White potato chips	5.4%	44.9	(5.1)	230.6	(26.5)	
	White potato chips	56.8%	45.2	(6.0)	234.3	(31.0)	1.6 1-oz. bags
	Ruffled white potato chips	30.1%	53.4	(4.1)	275.7	(20.8)	1.9 1-oz. bags
	Baked potato chips	12.4%	20.7	(1.7)	96.7	(8.0)	0.7 1-oz. bag
	Reduced fat potato chips	0.7%	78.8	(0.0)	371.0	(0.0)	2.8 1-oz bags

Table 3.9. Food groups and items consumed by $\geq 5\%$ of youth (ages 15-18y) at each eating occasion from NHANES 2009-2010

BREAKFAST - AGES 15-18 YEARS	Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
1 Cereal	17.7%	45.3	(2.3)	169.5	(8.5)	
Honey Nut Cheerios	14.0%	42.0	(6.0)	165.1	(23.5)	1.4 cups
Frosted Mini-Wheats	11.4%	56.5	(3.9)	193.6	(13.3)	1.9 cups
Kellogg's Frosted Flakes	6.7%	41.8	(0.9)	153.4	(3.1)	1.4 cups
Fruit Loops	5.7%	41.2	(4.8)	153.3	(17.9)	1.4 cups
Cocoa Puffs	5.3%	44.3	(6.5)	164.1	(24.0)	1.5 cups
2 Breads and rolls	14.3%	66.4	(4.8)	186.7	(16.5)	
						0.8 medium
Bagel	14.5%	83.7	(10.2)	215.3	(26.1)	bagel
White toast	10.2%	51.9	(1.9)	152.2	(5.3)	1.8 slices
Whole wheat bread	7.7%	33.0	(3.3)	86.6	(8.8)	1.2 slices
White bread	6.7%	57.6	(3.4)	152.5	(9.2)	2.0 slices
Wheat English muffin	6.6%	58.0	(0.0)	129.0	(0.0)	1.0 muffin
3 Eggs and egg mixtures, dishes, sandwiches	9.9%	118.7	(5.8)	234.4	(18.1)	
Scrambled egg	35.6%	163.5	(17.9)	283.7	(32.8)	2.7 eggs
Fried eggs	22.5%	62.0	(10.1)	126.2	(20.9)	1.3 eggs
Scrambled egg w/ cheese	10.5%	102.2	(32.2)	208.4	(69.5)	1.7 eggs
Boiled egg	6.5%	45.1	(1.2)	69.6	(1.8)	0.9 egg
Egg salad	4.4%	166.5	(0.0)	530.0	(0.0)	0.7 cup
4 Fruits, raw	7.0%	65.3	(9.7)	112.5	(7.0)	

Banana	23.8%	121.1	(0.1)	107.8	(0.1)	1.0 banana
Apple	18.8%	193.5	(18.7)	100.6	(9.7)	1.1 apples
Strawberries	15.8%	63.7	(15.4)	20.5	(4.9)	5.3 strawberries
Grapes	12.0%	34.6	(4.5)	24.2	(3.1)	0.2 cup
Cantaloupe	8.1%	93.1	(11.5)	31.8	(3.9)	0.5 cup
LUNCH - AGES 15-18 YEARS						
1 Vegetables	16.0%	64.8	(7.4)	38.5	(10.0)	
Lettuce	27.0%	17.5	(4.0)	7.1	(0.6)	0.3 cup
Tomatoes	15.2%	44.5	(5.0)	8.0	(0.9)	2.2 slices
Onions	6.6%	31.3	(0.5)	12.6	(0.2)	2.2 slices
Cucumber	5.7%	64.7	(6.5)	7.7	(0.7)	0.6 cup
Pepper	3.8%	170.0	(0.0)	34.0	(0.0)	1.1 cups
2 Mixtures, mainly grains, pasta, bread	12.7%	246.5	(16.1)	488.2	(59.2)	
Canned pasta w/ tomato sauce and meatballs	6.9%	266.3	(63.0)	285.0	(67.4)	1.1 cups
Pepperoni pizza, thick crust	6.0%	210.7	(15.6)	604.6	(44.9)	1.8 slices
Cheese pizza, regular crust	5.6%	215.3	(30.8)	572.6	(81.9)	2.0 slices
Macaroni w/ cheese	5.4%	212.6	(12.4)	406.7	(22.5)	1.1 cups
Macaroni w/ cheese, from mix w/ prepared cheese	5.0%	360.8	(5.3)	643.0	(9.4)	1.9 cups
3 Breads and rolls	11.4%	60.1	(2.7)	164.8	(7.6)	
Soft white roll	35.7%	56.9	(4.4)	158.6	(12.3)	1.6 rolls
White bread	21.9%	50.1	(3.2)	132.4	(8.4)	1.8 slices

	Wheat bread	13.2%	58.0	(2.5)	156.6	(6.7)	2.0 slices
	Whole wheat bread	7.5%	68.2	(7.6)	179.6	(20.0)	2.4 slices
	Hoagie roll	2.6%	101.5	(21.2)	281.9	(58.8)	0.9 roll
4	Frankfurters, sausages, lunchmeat	5.3%	68.1	(3.4)	143.0	(21.4)	
	Chicken/ turkey loaf deli meat	28.6%	80.9	(0.1)	84.7	(0.1)	2.9 slices
	Sliced ham deli meat	19.3%	53.4	(3.5)	56.0	(3.7)	2.3 slices
	Salami	11.6%	61.9	(12.0)	208.2	(40.3)	6.9 slices
	Pepperoni	11.1%	38.0	(0.6)	187.5	(3.1)	19.0 slices
	Beef hot dog	8.9%	99.9	(14.8)	323.1	(48.1)	1.8 hot dogs
DINNER - AGES 15-18 YEARS							
1	Vegetables	20.1%	74.3	(7.1)	44.9	(5.6)	
	Lettuce	20.8%	52.8	(4.0)	7.4	(0.6)	0.9 cup
	Tomatoes	10.7%	56.0	(5.0)	10.0	(0.9)	2.8 slices
	Onions	7.0%	24.9	(0.5)	9.9	(0.2)	1.8 slices
	Cucumber	3.7%	34.7	(6.5)	4.5	(0.7)	0.3 cup
	Canned green string beans	3.1%	52.8	(4.6)	13.4	(1.3)	0.4 cup
2	Mixtures, mainly grains, pasta, bread	13.6%	220.7	(11.2)	422.1	(21.4)	
	Frozen meat pizza, thin	5.9%	219.6	(23.3)	623.7	(66.2)	1.4 slices
	Macaroni w/ cheese, from dry mix	4.1%	185.6	(18.0)	259.9	(11.9)	0.9 cup
	Soup, mostly noodles	3.9%	295.6	(41.0)	196.1	(27.2)	1.2 cups
	Pepperoni pizza, regular crust	3.4%	245.4	(16.6)	692.2	(46.7)	2.2 slices
	Soft taco w/ beef, cheese, lettuce	3.1%	171.4	(13.0)	353.2	(26.9)	1.7 tacos

3	Breads and rolls	8.9%	64.9	(4.1)	186.9	(11.8)	
	Soft white roll	38.7%	65.8	(4.5)	177.6	(12.6)	1.9 rolls
	White bread	14.5%	60.8	(5.2)	160.8	(13.8)	2.1 slices
	Hoagie roll	6.8%	91.4	(0.2)	254.4	(0.6)	0.8 roll
	Croutons	6.1%	8.2	(3.5)	38.3	(16.6)	0.3 cup
	Wheat bread	5.9%	65.8	(3.5)	177.6	(9.5)	2.3 slices
4	Meat, poultry, fish mixtures and soups	7.3%	211.1	(20.8)	307.3	(36.2)	
	BBQ chicken, no skin	10.4%	107.1	(7.3)	182.6	(12.3)	0.3 breast
	BBQ beef	6.5%	222.2	(43.8)	398.1	(78.4)	2.6 3-oz. servings
	Beef meatloaf w/ tomato sauce	6.1%	165.4	(22.8)	275.5	(37.9)	3.0 slices
	Chili con carne w/out beans	5.0%	5.3	(0.0)	5.0	(0.0)	< 0.1 cup
	Chicken, rice and vegetables	4.6%	255.0	(0.0)	289.0	(0.0)	1.8 cups
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SNACKS - AGES 15-18 YEARS							
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1	Salty snacks from grains	13.7%	43.3	(4.4)	210.7	(21.2)	
	Corn tortilla chips	36.7%	52.6	(5.1)	259.8	(25.1)	1.9 1-oz. bags
	Cheese corn chips	12.9%	45.1	(1.3)	233.8	(6.7)	1.6 1 oz. bags
	Buttered popcorn, popped in oil	12.7%	32.9	(6.1)	173.2	(32.2)	3.0 cups
	Hard pretzels	10.9%	41.2	(6.0)	156.5	(22.8)	1.5 1 oz. bags
	Corn puffs	10.5%	36.5	(2.8)	206.0	(15.9)	1.0 package
2	Candies	11.9%	37.1	(3.2)	167.4	(16.4)	
	Hard candy	13.5%	27.5	(4.8)	108.5	(18.9)	4.6 pieces

	Fruit leather/ fruit snacks	9.8%	35.2	(11.2)	128.7	(40.8)	1.7 packets
	Taffy	6.8%	28.7	(3.7)	114.9	(14.8)	1.9 pieces
	Snickers	6.5%	44.8	(2.0)	219.8	(9.8)	3.0 fun size
	Gumdrops	5.3%	28.8	(4.2)	113.9	(16.5)	6.9 gumdrops
3	Cakes, cookies, pies, cobblers, pastries	11.7%	52.4	(5.0)	215.9	(19.3)	
	Chocolate chip cookies	22.3%	57.2	(9.7)	271.4	(46.1)	3.8 cookies
	Chocolate coated/ striped cookies	10.3%	49.9	(5.6)	234.4	(26.4)	2.9 cookies
	Homemade chocolate chip cookies	6.2%	19.9	(3.2)	97.6	(15.7)	1.3 cookies 1.0 large brownie
	Brownie with icing	4.6%	55.5	(7.4)	224.7	(30.0)	
	Oatmeal sandwich cookie w/ crème filling	4.4%	40.5	(19.4)	195.0	(93.2)	1.1 cookies
4	Fruits, raw	10.9%	169.2	(27.1)	89	(14.2)	
	Apple	32.6%	229.4	(13.1)	119.4	(6.8)	1.3 apples
	Banana	13.7%	125.0	(5.1)	111.2	(4.5)	1.1 bananas 4.9
	Strawberries	13.3%	58.7	(3.7)	19.0	(1.1)	strawberries
	Grapes	8.8%	102.4	(17.4)	70.7	(12.1)	0.7 cup
	Pineapple	7.1%	261.0	(55.6)	130.2	(27.7)	1.6 cups
5	Milk desserts	6.4%	146.8	(7.8)	268.4	(15.5)	
	Vanilla ice cream	35.7%	157.7	(9.4)	326.5	(19.4)	1.2 cups
	Cake-covered ice cream bar	8.6%	87.0	(0.0)	243.0	(0.0)	1.7 bars
	Ice cream soda	6.6%	271.8	(5.5)	230.4	(4.7)	2.1 cups
	Chocolate ice cream	6.2%	164.2	(6.9)	355.0	(15.0)	1.2 cups
	Ice cream sandwich	5.9%	59.0	(0.0)	140.0	(0.0)	0.8 sandwich

Table 3.10. Food groups and items consumed by $\geq 5\%$ of youth (ages 2-5y) at each eating occasion from NCFS 1977-78

BREAKFAST - AGES 2-5 YEARS	Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
1 Cereal	34.6%	20.9	(0.8)	116.6	(4.4)	
Fruit Loops/ Apple Jacks	10.4%	12.6	(0.5)	98.6	(4.0)	0.4 cup
Cheerios	10.1%	24.0	(1.0)	95.2	(3.9)	0.8 cup
Cereal, non-specified	9.3%	3.8	(0.3)	108.6	(5.3)	0.1 cup
Boo Berry/ Frankenberry	8.8%	6.4	(0.3)	99.6	(4.4)	0.2 cup
Corn Flakes	8.5%	22.0	(1.0)	83.7	(3.8)	0.7 cup
2 Breads and rolls	17.8%	26.7	(0.5)	80.8	(1.3)	
White toast	56.9%	26.4	(0.7)	82.8	(2.3)	0.9 slice
White bread	12.8%	28.4	(1.8)	77.0	(4.8)	1.0 slice
Toast, non-specified	7.1%	22.6	(1.1)	70.9	(3.5)	0.8 slice
Whole wheat toast	5.0%	23.9	(0.9)	69.0	(2.7)	0.8 slice
Cracked wheat toast	1.8%	21.9	(2.7)	68.7	(8.3)	0.8 slice
3 Eggs and egg mixtures, dishes, sandwiches	13.4%	62.4	(1.3)	99.6	(2.0)	
Scrambled eggs	46.3%	74.3	(1.7)	110.0	(2.5)	1.2 eggs
Fried eggs	35.9%	49.0	(1.2)	88.3	(2.1)	1.1 eggs
Boiled eggs	7.3%	53.2	(2.3)	84.1	(3.6)	1.1 eggs
Eggs, non-specified	4.8%	56.5	(3.1)	89.3	(4.9)	0.9 egg
Poached eggs	1.5%	81.4	(8.1)	127.8	(12.7)	1.6 eggs
4 Oatmeal and cooked cereals	7.4%	171.7	(5.1)	91.1	(2.9)	
Oatmeal	20.5%	193.0	(11.6)	106.1	(6.4)	0.8 cup
Instant oatmeal	14.6%	180.5	(11.6)	99.3	(6.4)	0.8 cup
Quick-cooking grits	12.4%	156.9	(14.1)	79.9	(7.2)	0.6 cup
Cream of Wheat	10.2%	172.0	(13.0)	72.3	(5.4)	0.7 cup

	Quick-cooking oatmeal	9.3%	159.7	(15.3)	81.2	(7.8)	0.7 cup
5	Bacon	5.0%	14.0	(0.6)	84.2	(3.5)	
	Bacon, smoked or cured	94.9%	13.9	(0.6)	85.2	(3.6)	0.9 slice
	Lean bacon, smoked or cured	2.4%	15.0	(2.5)	56.6	(9.5)	0.9 slice
	Bacon, formed, lean meat added	2.1%	14.8	(2.8)	65.5	(12.0)	0.9 slice
LUNCH - AGES 2-5 YEARS							
1	Breads and rolls	18.8%	38.8	(0.6)	107.6	(1.6)	
	White bread	49.6%	39.0	(0.9)	105.4	(2.5)	1.4 slices
	Soft white rolls	17.7%	39.5	(1.2)	117.4	(3.6)	1.1 rolls
	Whole wheat bread	5.1%	42.9	(2.2)	104.3	(5.3)	1.5 slices
	Bread, non-specified	5.0%	40.5	(1.9)	109.4	(5.1)	1.4 slices
	White toast	2.7%	32.2	(2.0)	101.0	(6.2)	1.1 slices
2	Vegetables	9.6%	55.7	(2.1)	40.3	(2.1)	
	Tomatoes	10.6%	55.0	(6.4)	12.2	(1.4)	2.8 slices
	Lettuce	10.5%	17.1	(2.8)	2.3	(0.4)	0.3 cup
	Mashed white potatoes	7.5%	100.4	(8.7)	94.3	(8.2)	0.5 cup
	Green peas	4.1%	58.8	(9.0)	51.6	(8.0)	0.4 cup
	Carrots	3.5%	34.1	(6.6)	14.4	(2.8)	3.4 baby carrots
3	Frankfurters, sausages, lunchmeat	7.5%	43.3	(1.3)	129.9	(3.9)	
	Bologna	33.2%	36.9	(1.9)	112.0	(5.7)	1.2 slices
	Hot dog	21.7%	56.1	(3.0)	170.7	(9.2)	1.0 hot dog
	Boiled ham	9.1%	38.5	(3.8)	90.1	(8.9)	1.8 slices
	Beef frankfurter	8.3%	51.1	(2.8)	174.1	(9.3)	0.9 frankfurter
	Ham	5.1%	40.8	(8.0)	120.0	(23.5)	1.9 slices

4	Cakes, cookies, pies, cobbler, pastries	6.3%	39.2	(2.0)	146.6	(5.6)	
	Chocolate chip cookies	18.6%	17.5	(1.2)	82.5	(5.7)	1.2 cookies
	Cookies, non-specified	9.4%	30.0	(4.5)	143.7	(21.5)	2.0 cookies
	Chocolate covered, fudge sandwich cookies	8.6%	26.8	(2.6)	133.0	(13.0)	1.6 cookies
	Sugar cookies	5.2%	30.2	(4.3)	134.3	(19.1)	2.0 cookies
	Oatmeal raisin cookies	4.7%	26.2	(2.5)	118.0	(11.2)	1.7 cookies
5	Fruits, raw	5.2%	116.9	(3.2)	70.4	(1.9)	
	Apples	32.9%	122.1	(4.3)	70.7	(2.5)	0.7 apple
	Bananas	22.0%	101.5	(4.2)	86.4	(3.6)	0.9 banana
	Oranges	13.2%	131.3	(5.4)	64.4	(2.6)	0.8 orange
	Peaches	6.8%	147.7	(4.2)	56.4	(1.6)	1.0 peach
	Pears	3.6%	133.7	(16.2)	81.5	(9.9)	0.8 pear
6	Mixtures, mainly grains, pasta, bread	5.1%	165.0	(6.5)	136.1	(7.2)	
	Chicken noodle soup	26.8%	219.4	(12.9)	56.9	(3.4)	0.9 cup
	Macaroni w/ cheese	16.3%	146.1	(15.4)	213.2	(22.4)	0.8 cup
	Spaghetti w/ tomato sauce and meatballs	11.2%	185.5	(18.9)	191.2	(19.4)	0.8 cup
	Cheese pizza	5.9%	76.7	(11.6)	187.9	(28.5)	0.7 slice
	Spaghetti w/ tomato sauce	5.0%	196.5	(20.4)	192.8	(20.0)	1.4 cups
DINNER - AGES 2-5 YEARS							
1	Vegetables	20.3%	63.4	(1.9)	47.9	(1.7)	
	Mashed white potatoes	7.5%	111.0	(5.2)	104.3	(4.9)	0.5 cup

	Lettuce	7.4%	22.5	(2.0)	3.0	(0.3)	0.4 cup
	Tomatoes	6.4%	47.7	(2.7)	10.6	(0.6)	2.4 slices
	Tossed salad (lettuce, tomatoes, carrots)	5.5%	29.7	(3.1)	44.0	(2.5)	0.2 cup
	Baked white potatoes	4.1%	72.1	(3.9)	66.8	(3.6)	0.5 cup
2	Breads and rolls	11.0%	34.3	(0.6)	96.2	(1.7)	
	White bread	54.9%	33.8	(0.9)	91.6	(2.4)	1.2 slices
	Soft white rolls	13.1%	38.2	(1.3)	113.6	(4.0)	1.1 rolls
	Whole wheat bread	5.2%	36.6	(2.2)	88.9	(5.4)	1.3 slices
	Bread, non-specified	4.1%	33.9	(2.2)	91.9	(5.8)	1.2 slices
	White toast	2.3%	33.5	(5.1)	105.2	(15.8)	1.2 slices
3	Cakes, cookies, pies, cobblers, pastries	6.6%	37.0	(1.5)	138.5	(4.6)	
							1.3
	Chocolate chip cookies	21.5%	18.8	(1.2)	88.6	(5.8)	cookies
	Chocolate covered, fudge sandwich cookies	8.8%	26.1	(2.0)	129.3	(9.7)	1.5 cookies
							1.2
	Cookies, non-specified	4.2%	18.5	(1.8)	88.5	(8.6)	cookies
	Vanilla wafers	3.8%	23.9	(7.5)	110.4	(34.6)	6.4 wafers
							1.9
	Oatmeal raisin cookies	3.5%	28.2	(3.3)	127.2	(14.9)	cookies
4	Beef	5.5%	73.9	(1.8)	251.6	(6.5)	
	Hamburger	30.0%	82.1	(3.2)	260.2	(10.1)	1.0 patty 0.8 3-oz.
	Steak, boneless	13.7%	67.9	(6.2)	239.7	(22.0)	serving
	Roast beef	12.9%	64.1	(7.0)	282.1	(30.7)	0.8 3-oz. serving
	Ground beef	5.6%	82.7	(6.4)	236.4	(18.2)	1.0 3-oz. serving

	Steak, w/ bone	5.1%	59.7	(7.7)	210.7	(27.4)	0.7 3-oz. serving
	SNACKS - AGES 2-5 YEARS						
	1 Vegetables	18.5%	52.0	(2.2)	37.3	(2.1)	
	Lettuce	8.6%	23.8	(4.9)	3.2	(0.6)	0.4 cup
	Tomatoes	6.3%	45.2	(6.7)	10.1	(1.5)	2.3 slices
	Tossed salad (lettuce, tomatoes, carrots)	6.2%	33.8	(8.1)	50.1	(5.7)	0.2 cup
	Mashed white potatoes	6.0%	102.5	(10.7)	96.4	(10.0)	0.5 cup
	Green string beans	4.4%	33.0	(4.5)	17.1	(2.3)	0.3 cup
	2 Cakes, cookies, pies, cobblers, pastries	10.0%	38.7	(2.9)	143.6	(11.2)	
	Chocolate chip cookies	18.4%	20	(2.2)	92.3	(10.2)	1.3 cookies
	Chocolate covered, fudge sandwich cookies	7.0%	27.3	(2.9)	135.4	(14.5)	1.6 cookies
	Cookie ice cream cone	6.3%	5.6	(0.4)	21.2	(1.6)	1.0 cone
	Vanilla wafers	6.1%	12.5	(2.6)	57.4	(11.9)	3.3 wafers
	Chocolate cupcakes	5.4%	52.5	(9.2)	178.1	(31.1)	1.4 cupcakes
	3 Breads and rolls	7.6%	30.1	(1.1)	84.8	(3.2)	
	White bread	41.4%	28.5	(1.9)	77.1	(5.2)	1.0 slice
	Soft white rolls	16.0%	34.0	(2.4)	101.1	(7.0)	1.0 roll
	Whole wheat bread	4.2%	24.9	(3.4)	60.4	(8.2)	0.9 slice
	White toast	4.1%	22.0	(0.0)	69.0	(0.0)	0.8 slice
	Onion or potato rolls	3.4%	28.9	(6.3)	86.1	(18.7)	0.8 roll
	4 Milk desserts	6.8%	78.7	(3.2)	157.2	(6.2)	
	Non-chocolate ice cream	58.7%	81.0	(4.3)	163.5	(8.6)	0.6 cup

Chocolate ice cream	13.4%	75.5	(5.9)	158.7	(12.3)	0.5 cup
Ice cream, non-specified flavor	7.7%	86.3	(11.8)	174.3	(23.9)	0.7 cup
Fudgesicle	3.1%	49.3	(6.2)	61.2	(7.6)	0.6 fudgesicle
Chocolate-covered ice cream bar	2.5%	50.3	(2.6)	156.0	(8.0)	1.0 bar
5 Fruits, raw	5.2%	106.7	(5.0)	61.4	(2.7)	
Apples	30.7%	105.2	(5.8)	60.8	(3.4)	0.6 apple
Bananas	17.3%	91.0	(7.3)	77.5	(6.2)	0.8 banana
Oranges	15.5%	139.0	(10.3)	68.2	(5.0)	0.9 orange
Peaches	6.0%	121.6	(22.6)	46.3	(8.7)	0.8 peach
Watermelon	4.9%	252.5	(63.3)	65.8	(16.5)	0.9 wedge

Table 3.11. Food groups and items consumed by ≥5% of youth (ages 6-11y) at each eating occasion from NCFS 1977-78

BREAKFAST - AGES 6-11 YEARS	Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
1 Cereal	38.3%	24.4	(0.9)	138.2	(3.5)	
Cereal, non-specified	15.4%	3.7	(0.1)	106.0	(2.4)	0.1 cup
Fruit Loops/ Apple Jacks	9.9%	16.0	(0.4)	125.8	(3.5)	0.5 cup
Corn Flakes	9.1%	28.5	(0.8)	108.5	(3.1)	1.0 cup
Cheerios	7.9%	28.7	(1.4)	114.1	(5.6)	1.0 cup
Frankenberry/Boo Berry	7.5%	9.5	(0.3)	147.6	(4.3)	0.3 cup
2 Breads and rolls	18.2%	37.8	(1.0)	114.9	(3.0)	
White toast	55.1%	33.5	(0.8)	105.0	(2.5)	1.2 slices
White bread	12.8%	41.0	(2.1)	110.8	(5.6)	1.4 slices
Toast, non-specified	5.5%	31.7	(1.5)	99.5	(4.7)	1.1 slices
Whole wheat toast	5.4%	34.8	(1.7)	100.5	(4.9)	1.2 slices
English muffins	2.9%	63.8	(6.4)	190.3	(19.0)	1.1 muffins
3 Eggs and egg mixtures, dishes, sandwiches	10.0%	71.9	(1.3)	115.9	(2.1)	
Fried eggs	41.4%	59.5	(1.3)	107.4	(2.4)	1.3 eggs
Scrambled eggs	40.3%	89.2	(2.5)	132.1	(3.6)	1.5 eggs
Boiled eggs	7.5%	58.9	(2.8)	93.2	(4.4)	1.2 eggs
Eggs, non-specified	7.2%	60.3	(4.0)	95.4	(6.3)	1.0 egg
Poached eggs	2.3%	56.2	(5.5)	88.6	(8.6)	1.1 eggs
4 Oatmeal and cooked cereals	5.0%	201.6	(5.4)	108.6	(3.5)	
Oatmeal	17.2%	230.3	(13.5)	126.7	(7.4)	1.0 cup

	Cream of Wheat	12.0%	178.0	(12.6)	74.7	(5.3)	0.7 cup
	Instant oatmeal	11.8%	220.4	(20.0)	121.3	(11.0)	0.9 cup
	Quick-cooking oatmeal	10.2%	238.2	(20.0)	131.0	(11.0)	1.0 cup
	Quick-cooking grits	9.7%	165.3	(15.0)	84.1	(7.6)	0.6 cup
LUNCH - AGES 6-11 YEARS							
1	Breads and rolls	17.8%	45.1	(0.7)	126.1	(1.9)	
	White bread	50.5%	45.0	(0.6)	121.6	(1.7)	1.6 slices
	Soft white rolls	19.2%	42.0	(0.6)	124.9	(1.9)	1.2 rolls
	Bread, non-specified	5.2%	46.0	(1.3)	124.4	(3.5)	1.6 slices
	Whole wheat bread	5.2%	51.8	(1.5)	125.8	(3.6)	1.8 slices
	White toast	1.9%	44.6	(3.0)	139.9	(9.3)	1.6 slices
2	Vegetables	15.6%	67.3	(3.0)	51.9	(2.1)	
	Lettuce	11.1%	21.6	(2.1)	2.8	(0.3)	0.4 cup
	Mashed white potatoes	7.8%	125.8	(5.3)	118.3	(5.0)	0.6 cup
	Tossed salad (lettuce, tomatoes, carrots)	7.2%	30.0	(2.4)	44.4	(1.9)	0.2 cup
	Tomatoes	5.9%	61.1	(3.9)	13.5	(0.9)	3.1 slices 3.4 baby carrots
	Carrots	4.6%	34.1	(3.2)	14.4	(1.4)	
3	Cakes, cookies, pies, cobblers, pastries	7.0%	49.0	(2.1)	173.6	(6.4)	
	Chocolate chip cookies	13.6%	23.2	(2.1)	109.2	(9.7)	1.5 cookies
	Peanut butter cookies	5.9%	22.0	(2.3)	104.4	(10.9)	1.5 cookies 1.6
	Non-chocolate cupcakes	5.5%	60.0	(5.9)	214.7	(21.1)	cupcakes
	Cookies, non-specified	5.4%	20.8	(2.3)	99.8	(11.0)	1.4 cookies 1.3
	Chocolate cupcakes	5.3%	49.2	(4.3)	166.7	(14.7)	cupcakes

4	Fruits, raw	6.4%	116.5	(4.9)	73.9	(1.8)	
	Apples	31.8%	135.6	(2.4)	78.5	(1.4)	0.7 apple
	Mixed fresh fruit	14.0%	19.0	(1.7)	53.2	(3.0)	0.1 cup
	Oranges	13.6%	125.0	(4.5)	61.3	(2.2)	0.8 orange
	Bananas	10.0%	113.2	(3.3)	96.2	(2.8)	1.0 banana
	Peaches	4.6%	167.7	(15.9)	64.0	(6.0)	1.1 peaches
5	Frankfurters, sausages, lunchmeat	6.2%	47.6	(1.3)	144.1	(4.5)	
	Bologna	35.0%	40.1	(1.3)	121.8	(4.1)	1.3 slices
	Hot dogs	23.6%	54.5	(1.5)	165.9	(4.5)	1.0 hot dog
	Boiled ham	8.6%	49.4	(2.9)	115.6	(6.8)	2.4 slices
							1.1
	Beef frankfurters	5.3%	61.7	(5.4)	210.1	(18.2)	frankfurters
	Ham	4.5%	56.8	(6.4)	167.0	(18.7)	2.7 slices
DINNER - AGES 6-11 YEARS							
1	Vegetables	22.8%	79.6	(1.8)	59.8	(1.6)	
	Lettuce	7.3%	29.3	(1.3)	3.9	(0.2)	0.5 cup
	Mashed white potatoes	7.1%	144.6	(5.1)	136.0	(4.8)	0.7 cup
	Tossed salad (lettuce, tomatoes, carrots)	6.1%	42.9	(2.8)	63.5	(2.3)	0.3 cup
	Tomatoes	5.9%	64.0	(3.2)	14.2	(0.7)	3.2 slices
	Baked white potatoes	4.3%	92.5	(3.0)	85.8	(2.8)	0.6 potato
2	Breads and rolls	10.1%	47.7	(0.7)	121.9	(2.3)	
	White bread	47.4%	40.7	(1.0)	110.0	(2.6)	1.4 slices
	Soft white rolls	19.0%	45.9	(1.2)	136.6	(3.7)	1.3 rolls
	Bread, non-specified	4.5%	43.8	(2.5)	118.5	(6.8)	1.5 slices
	Whole wheat bread	3.7%	38.6	(2.5)	93.8	(6.1)	1.4 slices
	White toast	2.5%	35.5	(1.7)	111.5	(5.5)	1.3 slices

110	3 Cakes, cookies, pies, cobblers, pastries	7.2%	53.3	(1.9)	193.0	(6.0)	
	Chocolate chip cookies	13.9%	24.9	(1.7)	117.5	(7.8)	1.7 cookies
	Chocolate covered, fudge sandwich cookies	6.7%	36.9	(3.4)	182.7	(16.7)	2.2 cookies
	Chocolate cake w/ icing	4.4%	89.9	(7.3)	305.0	(24.7)	0.7 piece
	Sugar cookies	4.2%	35.5	(2.5)	157.8	(11.3)	2.4 cookies
	Cookies, non-specified	4.2%	30.0	(2.4)	143.8	(11.3)	2.0 cookies
	4 Beef	6.0%	110.0	(2.2)	380.2	(8.5)	
	Hamburger	25.2%	114.8	(3.8)	363.9	(12.0)	1.4 patties
							1.2 3-oz.
	Roast beef	15.6%	105.9	(5.3)	466.0	(23.5)	servings
							1.4 3-oz.
	Steak, boneless	7.9%	123.2	(6.6)	434.8	(23.3)	servings
							1.3 3-oz.
	Ground beef	5.2%	107.0	(6.7)	305.9	(19.3)	servings
							1.3 3-oz.
	Steak, w/ bone	4.9%	109.4	(7.9)	386.3	(27.7)	servings
SNACKS - AGES 6-11 YEARS							
110	1 Vegetables	16.7%	69.3	(2.9)	48.4	(2.7)	
	Tossed salad (lettuce, tomatoes, carrots)	14.0%	41.8	(6.4)	61.9	(4.2)	0.3 cup
	Lettuce	8.7%	28.9	(3.4)	3.8	(0.4)	0.5 cup
	Tomatoes	5.4%	67.6	(13.8)	15.0	(3.0)	3.4 slices
	Green string beans	4.7%	55.5	(4.1)	28.6	(2.1)	0.4 cup
	Baked white potatoes	4.6%	87.7	(5.8)	81.3	(5.3)	0.6 potato
	2 Cake, cookies, pies, cobblers, pastries	11.5%	49.7	(3.1)	195.6	(12.2)	
	Chocolate chip cookies	15.8%	19.9	(1.4)	93.7	(6.5)	1.3 cookies

	Chocolate covered, fudge sandwich cookies	10.6%	32.1	(3.4)	159.2	(16.8)	1.9 cookies
	Oatmeal raisin cookies	4.8%	22.6	(2.7)	102.0	(12.2)	1.5 cookies
	Cookies, non-specified	4.6%	24.8	(3.6)	119.0	(17.3)	1.7 cookies
	Peanut butter cookies	3.5%	43.0	(5.0)	203.2	(23.8)	2.9 cookies
3	Milk desserts	9.1%	106.6	(4.1)	208.0	(7.6)	
	Non-chocolate ice cream	52.6%	112.9	(5.5)	228.0	(11.1)	0.9 cup
	Chocolate ice cream	12.1%	90.1	(6.8)	189.1	(14.2)	0.6 cup
	Ice cream, non-specified	6.7%	89.0	(11.5)	179.7	(23.3)	0.7 cup
	Ice cream sandwich	4.1%	62.5	(10.2)	172.8	(28.2)	0.9 sandwich
	Chocolate pudding	3.6%	164.7	(31.9)	204.0	(39.4)	1.5 4-oz containers
4	Fruits, raw	7.1%	158.6	(9.6)	82.6	(3.0)	
	Apples	27.0%	145.5	(6.3)	84.3	(3.6)	0.8 apple
	Bananas	18.3%	107.9	(5.9)	91.8	(5.0)	0.9 banana
	Oranges	15.2%	139.6	(8.7)	68.5	(4.2)	0.9 orange
	Peaches	7.7%	169.6	(20.9)	64.7	(8.0)	1.1 peaches
	Watermelon	7.0%	472.6	(91.1)	123.2	(23.7)	1.7 wedges
5	Breads and rolls	6.9%	45.2	(2.0)	129.7	(6.1)	
	White bread	33.6%	42.9	(4.2)	116.0	(11.4)	1.5 slices
	Soft white rolls	21.3%	44.8	(3.2)	133.2	(9.5)	1.3 rolls
	White toast	6.9%	38.2	(9.6)	119.7	(30.2)	1.3 slices
	Whole wheat bread	4.1%	38.2	(7.9)	92.8	(19.1)	1.3 slices
	Italian bread	3.9%	29.0	(6.4)	79.7	(17.5)	1.0 slices

Table 3.12. Food groups and items consumed by $\geq 5\%$ of youth (ages 12-14y) at each eating occasion from NCFS 1977-78

BREAKFAST - AGES 12-14 YEARS		Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
1	Cereal	28.2%	29.9	(1.5)	148.0	(4.2)	
	Cereal, non-specified	15.5%	3.7	(0.2)	105.0	(3.7)	0.1 cup
	Corn Flakes	10.2%	33.1	(1.3)	125.7	(5.1)	1.1 cups
	Fruit Loops/ Apple Jacks	9.6%	16.8	(0.7)	131.9	(5.3)	0.6 cup
	Cheerios	6.2%	30.8	(1.6)	122.1	(6.2)	1.0 cup
	Rice Krispies	5.4%	38.4	(3.8)	145.9	(14.3)	1.3 cups
2	Breads and rolls	21.1%	46.5	(1.2)	140.1	(3.7)	
	White toast	48.3%	39.1	(1.3)	122.7	(4.0)	1.4 slices
	White bread	16.9%	45.9	(1.9)	124.1	(5.1)	1.6 slices
	Toast, non-specified	5.8%	37.8	(2.4)	118.6	(7.6)	1.3 slices
	Whole wheat toast	4.9%	38.3	(2.5)	110.8	(7.2)	1.4 slices
	Soft white rolls	3.5%	50.1	(3.2)	149.1	(9.5)	1.4 rolls
3	Eggs and egg mixtures, dishes, sandwiches	10.5%	79.5	(1.7)	131.1	(2.7)	
	Fried eggs	52.2%	69.4	(1.7)	125.2	(3.1)	1.5 eggs
	Scrambled eggs	32.3%	98.2	(3.3)	145.2	(4.9)	1.6 eggs
	Boiled eggs	7.1%	64.9	(4.5)	102.7	(7.1)	1.3 eggs
	Eggs, non-specified	6.5%	79.2	(6.6)	125.2	(10.4)	1.3 eggs
	Scrambled eggs w/ cheese	0.9%	199.1	(29.0)	365.0	(54.7)	3.3 eggs
LUNCH - AGES 12-14 YEARS							

1	Breads and rolls	17.2%	50.7	(0.8)	142.7	(2.5)	
	White bread	47.9%	51.3	(1.2)	138.6	(3.2)	1.8 slices
	Soft white rolls	20.1%	46.1	(1.2)	137.1	(3.5)	1.3 rolls
	Whole wheat bread	4.8%	61.7	(3.7)	149.9	(9.0)	2.2 slices
	Bread, non-specified	3.8%	53.4	(3.2)	144.3	(8.5)	1.9 slices
	Rolls, non-specified	2.9%	49.1	(8.8)	146.0	(26.1)	1.4 rolls
2	Vegetables	16.1%	75.5	(2.6)	57.6	(2.2)	
	Lettuce	12.8%	24.8	(3.3)	3.2	(0.4)	0.4 cup
	Mashed white potatoes	8.6%	135.3	(7.8)	127.2	(7.3)	0.6 cup
	Tomatoes	8.2%	72.1	(5.9)	16.0	(1.3)	3.6 slices
	Tossed salad (lettuce, tomatoes, carrots)	7.3%	42.0	(4.5)	62.2	(3.7)	0.3 cup
	Green string beans	4.8%	73.7	(5.0)	38.1	(2.6)	0.6 cup
3	Cakes, cookies, pies, cobblers, pastries	6.7%	59.2	(2.7)	208.0	(8.6)	
	Chocolate chip cookies	10.5%	21.6	(1.9)	102.0	(9.1)	1.4 cookies
	Chocolate cake w/ icing	5.8%	73.5	(6.6)	249.4	(22.5)	0.5 piece
	Cake, non-specified	5.4%	69.1	(6.7)	251.7	(24.3)	0.5 piece
	Peanut butter cookie	5.2%	27.0	(5.5)	127.9	(25.9)	1.8 cookies
	Chocolate covered, fudge sandwich cookies	5.0%	31.9	(3.8)	158.2	(18.6)	1.9 cookies
4	Frankfurters, sausages, lunchmeat	6.1%	53.4	(2.1)	158.1	(6.5)	
	Bologna	36.1%	44.5	(1.9)	135.1	(5.8)	1.5 slices
	Hot dogs	21.7%	66.7	(5.3)	203.1	(16.0)	1.2 hot dogs
	Boiled ham	9.5%	60.3	(5.3)	141.2	(12.3)	2.9 slices
	Ham	6.3%	54.2	(6.2)	159.4	(18.2)	2.6 slices
	Salami	4.9%	61.1	(7.6)	177.0	(22.2)	1.1 frankfurters
5	Fruits, raw	5.5%	122.3	(4.3)	79.0	(2.3)	

	Apples	35.9%	140.0	(3.9)	81.1	(2.3)	0.8 apple
	Mixed fresh fruit	14.6%	21.8	(2.2)	61.2	(2.5)	0.1 cup
	Oranges	14.2%	138.2	(4.8)	67.7	(2.3)	0.9 orange
	Bananas	9.6%	129.3	(7.7)	109.8	(6.6)	1.1 bananas
	Fresh fruit cocktail	3.6%	162.0	(17.8)	123.1	(13.6)	0.9 cup
6	Mixtures, mainly grains, pasta, bread	5.4%	167.7	(8.2)	257.2	(10.1)	
	Cheese tacos	25.2%	17.7	(1.5)	232.3	(11.9)	0.3 taco
	Cheese pizza	11.7%	135.0	(15.1)	330.7	(37.0)	1.3 slices
	Chicken noodle soup	10.2%	273.3	(18.5)	70.8	(4.8)	1.1 cups
	Spaghetti w/ tomato sauce and meatballs	9.7%	301.3	(18.3)	310.4	(18.8)	1.2 cups
	Sausage pizza	6.6%	148.0	(15.3)	417.4	(43.2)	1.3 slices
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	DINNER - AGES 12-14 YEARS						
1	Vegetables	23.3%	92.6	(2.4)	67.2	(2.4)	
	Mashed white potatoes	7.8%	174.0	(8.3)	163.5	(7.8)	0.8 cup
	Tomatoes	7.4%	74.2	(3.8)	16.4	(0.8)	3.7 slices
	Lettuce	7.4%	36.5	(2.6)	4.8	(0.3)	0.6 cup
	Tossed salad (lettuce, tomatoes, carrots)	4.9%	58.9	(5.3)	87.2	(4.0)	0.4 cup
	Green string beans	3.9%	91.4	(6.4)	47.5	(3.3)	0.7 cup
2	Breads and rolls	10.7%	51.4	(1.0)	145.8	(3.2)	
	White bread	49.5%	47.9	(1.1)	129.5	(3.2)	1.7 slices
	Soft white rolls	16.2%	56.7	(2.2)	168.9	(6.6)	1.6 rolls
	Whole wheat bread	3.6%	51.9	(6.4)	126.1	(15.6)	1.8 slices
	Bread, non-specified	3.5%	44.7	(2.6)	120.8	(6.9)	1.6 slices
	Rolls, non-specified	2.7%	51.3	(4.7)	152.8	(14.0)	1.5 rolls

115	3 Cakes, cookies, pies, cobblers, pastries	6.7%	67.3	(2.3)	235.5	(7.1)	
	Chocolate chip cookies	12.2%	29.6	(2.9)	139.5	(13.8)	2.0 cookies
	Chocolate covered, fudge sandwich cookies	6.0%	39.0	(4.6)	193.2	(22.9)	2.3 cookies
	Yellow cake w/ icing	4.3%	107.5	(14.6)	362.3	(49.4)	0.7 piece
	Chocolate cake w/ icing	4.0%	110.1	(12.3)	373.5	(41.7)	0.8 piece
	Cookies, non-specified	3.8%	29.2	(3.2)	140.0	(15.6)	1.9 cookies
	4 Beef	6.1%	137.1	(3.5)	479.4	(12.7)	
	Hamburger	23.4%	120.2	(5.7)	381.1	(18.0)	1.4 patties
	Roast beef	20.3%	129.8	(8.3)	571.0	(36.5)	1.5 3-oz. servings
	Steak, boneless	6.4%	149.0	(9.7)	526.0	(34.4)	1.8 3-oz. servings
	Steak, w/ bone	5.0%	186.3	(20.0)	657.6	(70.7)	2.2 3-oz. servings
	Ground beef	4.9%	131.2	(10.2)	374.9	(29.1)	1.5 3-oz. servings
	5 Meat, poultry, fish mixtures and soups	5.1%	191.1	(8.8)	282.6	(17.9)	
	Beef stew w/ vegetables	7.0%	318.4	(31.4)	289.7	(28.6)	1.6 cups
	Beef loaf	6.1%	181.3	(21.5)	507.5	(60.3)	3.2 slices
	Meatballs	4.4%	81.5	(12.3)	228.4	(34.3)	4.4 meatballs
	Meatloaf	3.5%	111.0	(14.9)	311.0	(41.9)	2.0 slices
	Chili con carne w/ beans	3.3%	344.9	(43.4)	458.6	(57.6)	1.4 cups
<hr/> SNACKS - AGES 12-14 YEARS <hr/>							
	1 Vegetables	14.4%	83.6	(5.5)	61.1	(5.4)	
	Lettuce	9.9%	31.1	(5.7)	4.1	(0.7)	0.5 cup
	Tomatoes	8.2%	58.9	(7.0)	13.1	(1.5)	2.9 slices
	Tossed salad (lettuce, tomatoes, carrots)	6.0%	43.0	(13.5)	63.7	(11.5)	0.3 cup
	Mashed white potatoes	5.9%	174.3	(24.1)	163.7	(22.6)	0.8 cup

	Carrots	4.4%	79.7	(6.7)	24.6	(2.1)	8.0 baby carrots
2	Cakes, cookies, pies, cobbler, pastries	12.7%	67.3	(4.9)	243.6	(17.1)	
	Chocolate covered, fudge sandwich cookies	9.5%	37.4	(4.4)	185.3	(21.6)	2.2 cookies
	Chocolate chip cookies	9.1%	27.6	(6.2)	130.2	(29.0)	1.8 cookies
	Cookies, non-specified	5.6%	34.5	(7.3)	165.3	(35.2)	2.3 cookies
	Chocolate cake	4.4%	114.8	(26.1)	389.3	(88.5)	0.8 piece 1.7 large brownies
	Brownies	3.7%	94.2	(49.0)	456.8	(237.4)	
3	Milk desserts	9.5%	140.9	(8.1)	280.1	(14.6)	
	Non-chocolate ice cream	50.1%	135.7	(9.0)	274.2	(18.1)	1.0 cup
	Chocolate ice cream	17.0%	163.5	(23.0)	343.5	(48.3)	1.1 cups
	Ice cream, non-specified	10.0%	130.8	(18.6)	264.2	(37.6)	1.0 cup
	Ice cream sandwich	5.3%	95.2	(14.2)	263.2	(39.0)	1.4 sandwiches
	Ice cream cone, non-specified	3.4%	72.0	(0.0)	155.0	(0.0)	0.6 cone
4	Breads and rolls	8.0%	52.0	(2.4)	146.4	(6.8)	
	White bread	50.5%	57.6	(4.6)	155.5	(12.4)	2.0 slices
	Soft white rolls	10.8%	64.5	(7.9)	192.0	(23.5)	1.8 rolls
	French bread	4.4%	29.9	(7.5)	87.0	(21.5)	1.1 slices
	Bread, non-specified	3.5%	65.5	(12.0)	176.7	(32.5)	2.3 slices
	Whole wheat bread	2.7%	49.5	(21.3)	120.5	(52.0)	1.7 slices
5	Fruits, raw	6.9%	160.9	(16.8)	85.9	(5.8)	
	Apples	29.3%	165.9	(20.1)	96.2	(11.7)	0.9 apple
	Oranges	18.9%	141.9	(10.7)	69.5	(5.2)	0.9 orange
	Bananas	15.0%	110.6	(16.0)	94.1	(13.6)	0.9 banana
	Mixed fresh fruit	5.7%	34.0	(11.5)	95.0	(0.0)	0.2 cup

Table 3.13. Food groups and items consumed by $\geq 5\%$ of youth (ages 15-18y) at each eating occasion from NCFS 1977-78

BREAKFAST - AGES 15-18 YEARS	Children Reporting Consumption	Mean Quantity Consumed (g)	(SE)	Mean Energy Consumed (kcal)	(SE)	Average Serving Size
1 Breads and rolls	22.8%	46.8	(0.8)	140.1	(2.4)	
White toast	45.3%	40.5	(1.0)	127.2	(3.2)	1.4 slices
White bread	18.9%	50.6	(1.9)	136.7	(5.0)	1.8 slices
Toast, non-specified	6.8%	36.1	(1.3)	113.3	(4.0)	1.3 slices
Whole wheat toast	4.8%	43.7	(2.1)	126.4	(6.1)	1.5 slices
Soft white rolls	3.4%	47.4	(2.4)	141.1	(7.2)	1.3 rolls
2 Cereal	20.1%	33.1	(1.7)	166.8	(5.7)	
Cereal, non-specified	14.8%	4.4	(0.2)	125.1	(3.5)	0.1 cup
Corn Flakes	11.4%	35.9	(1.7)	136.3	(6.4)	1.2 cups
Rice Krispies	7.0%	39.4	(2.3)	149.7	(8.8)	1.3 cups
Frosted Flakes	5.6%	51.9	(3.8)	197.2	(14.5)	1.7 cups
Cheerios	5.4%	36.8	(2.6)	146.1	(10.4)	1.2 cups
3 Eggs and egg mixtures, dishes, sandwiches	12.7%	89.4	(1.6)	147.1	(2.5)	
Fried eggs	46.3%	76.3	(1.6)	137.5	(2.8)	1.7 eggs
Scrambled eggs	36.1%	113.1	(3.0)	167.3	(4.4)	1.9 eggs
Eggs, non-specified	8.6%	78.9	(4.5)	124.7	(7.1)	1.3 eggs
Boiled eggs	5.2%	71.3	(4.6)	112.8	(7.2)	1.4 eggs
Poached eggs	1.4%	67.7	(7.9)	106.3	(12.3)	1.4 eggs
4 Bacon	5.4%	24.4	(0.8)	148.0	(5.2)	
Bacon, smoked or cured	96.2%	24.6	(0.9)	150.7	(5.3)	1.5 slices
Lean bacon, smoked or cured	2.3%	15.5	(2.5)	58.2	(9.4)	1.0 slice

	Bacon, non-specified	0.8%	21.6	(2.7)	132.6	(16.3)	1.4 slices
	Bacon, formed, lean meat added	0.7%	20.1	(11.0)	89.3	(48.5)	1.3 slices
LUNCH - AGES 15-18 YEARS							
1	Vegetables	18.3%	83.9	(2.8)	62.1	(2.8)	
	Lettuce	14.8%	27.6	(1.9)	3.6	(0.2)	0.5 cup
	Tomatoes	8.7%	67.5	(4.5)	14.9	(1.0)	3.4 slices
	Mashed white potatoes	7.3%	171.7	(10.2)	161.4	(9.6)	0.8 cup
	Tossed salad (lettuce, tomatoes, carrots)	6.7%	54.0	(5.0)	80.0	(3.5)	0.4 cup
	Onions	4.3%	27.5	(4.0)	10.6	(1.5)	1.9 slices
2	Breads and rolls	17.2%	53.6	(0.9)	150.7	(2.8)	
	White bread	44.7%	53.4	(1.3)	144.2	(3.5)	1.9 slices
	Soft white rolls	18.2%	50.5	(1.5)	150.4	(4.5)	1.4 rolls
	Whole wheat bread	4.4%	67.9	(4.3)	164.9	(10.4)	2.4 slices
	Bread, non-specified	4.4%	53.5	(2.6)	144.5	(7.1)	1.9 slices
	Rolls, non-specified	2.7%	43.0	(4.1)	127.7	(12.3)	1.2 rolls
3	Frankfurters, sausages, lunchmeat	5.6%	62.0	(1.8)	185.8	(5.8)	
	Bologna	30.3%	51.5	(2.6)	156.3	(8.0)	1.7 slices
	Hot dogs	16.6%	75.8	(4.2)	230.8	(12.8)	1.4 hot dogs
	Boiled ham	12.9%	57.3	(5.1)	134.2	(12.0)	2.7 slices
	Beef frankfurters	6.5%	82.6	(7.8)	280.8	(26.5)	1.5 frankfurters
	Salami	6.2%	70.0	(8.1)	202.9	(23.6)	5.7 slices
4	Beef	5.3%	124.9	(3.2)	430.0	(12.4)	
	Hamburger	44.8%	116.6	(4.3)	369.5	(13.5)	1.4 patties
	Roast beef	17.6%	131.2	(10.1)	577.3	(44.4)	1.5 3-oz. servings
	Ground beef	8.2%	101.0	(6.7)	288.6	(19.2)	1.2 3-oz. servings

	Steak, boneless	3.4%	205.4	(24.8)	725.0	(87.5)	2.4 3-oz. servings
	Lean ground beef	2.4%	84.9	(18.2)	269.1	(57.8)	1.0 3-oz. serving
DINNER - AGES 15-18 YEARS							
1	Vegetables	25.1%	98.3	(2.5)	72.9	(2.4)	
	Lettuce	8.5%	39.5	(2.5)	5.2	(0.3)	0.7 cup
	Mashed white potatoes	7.1%	190.2	(8.5)	178.7	(8.0)	0.9 cup
	Tomatoes	6.7%	76.1	(3.8)	16.8	(0.8)	3.8 slices
	Tossed salad (lettuce, tomatoes, carrots)	5.8%	56.2	(4.1)	83.3	(3.0)	0.4 cup
	Baked white potatoes	4.0%	106.8	(5.4)	99.0	(5.0)	0.7 potato
2	Breads and rolls	11.0%	55.3	(1.1)	157.0	(3.4)	
	White bread	46.6%	51.0	(1.6)	137.7	(4.2)	1.8 slices
	Soft white rolls	16.0%	62.2	(2.3)	185.2	(6.9)	1.8 rolls
	Whole wheat bread	5.5%	61.7	(4.3)	149.9	(10.5)	2.2 slices
	Bread, non-specified	4.8%	53.9	(3.5)	145.7	(9.6)	1.9 slices
	White toast	2.5%	51.3	(3.8)	160.9	(11.8)	1.8 slices
3	Beef	6.3%	154.0	(4.3)	541.6	(16.0)	
	Hamburger	25.1%	138.9	(7.0)	440.2	(22.3)	1.6 patties
	Roast beef	20.8%	142.6	(7.9)	627.5	(34.8)	1.7 3-oz. servings
	Steak, boneless	6.9%	157.9	(10.6)	557.5	(37.5)	1.9 3-oz. servings
	Ground beef	4.7%	125.4	(12.4)	358.5	(35.3)	1.5 3-oz. servings
	Steak, w/ bone	4.0%	189.0	(25.6)	667.2	(90.5)	2.2 3-oz. servings
4	Cakes, cookies, pies, cobblers, pastries	5.7%	80.6	(4.3)	276.5	(14.2)	
	Chocolate chip cookies	11.6%	28.7	(4.0)	135.1	(18.7)	1.9 cookies
	Apple pie	4.5%	142.9	(11.7)	365.8	(29.8)	1.1 pieces
	Chocolate covered, fudge sandwich cookies	4.4%	41.8	(4.8)	206.9	(23.6)	2.5 cookies

	Chocolate cake w/ icing	4.3%	100.5	(11.3)	340.8	(38.5)	0.7 piece
	Oatmeal raisin cookies	3.7%	51.1	(7.9)	230.3	(35.5)	3.4 cookies
5	Meat, poultry, fish mixtures and soups	5.5%	201.7	(7.6)	285.7	(15.7)	
	Beef stew w/ vegetables	7.3%	413.7	(43.3)	376.4	(39.4)	2.1 cups
	Beef loaf	5.3%	170.3	(15.5)	477.0	(43.5)	3.0 slices
	Meatloaf	5.0%	110.1	(9.4)	308.3	(26.4)	2.0 slices
	Chili	3.2%	274.2	(46.5)	364.7	(61.8)	1.1 cups
	Meatballs	3.1%	98.8	(13.3)	276.6	(37.4)	1.2 meatballs
SNACKS - AGES 15-18 YEARS							
1	Vegetables	15.1%	96.8	(7.1)	79.0	(7.3)	
	Lettuce	13.0%	30.2	(5.4)	4.0	(0.7)	0.5 cup
	Tomatoes	10.0%	51.5	(4.6)	11.4	(1.0)	2.6 slices
	Tossed salad (lettuce, tomatoes, carrots)	6.6%	50.2	(11.5)	74.4	(7.7)	0.4 cup
	Salad (lettuce, onions, cucumbers, celery)	5.5%	27.4	(8.2)	52.6	(6.8)	0.2 cup
	Mashed white potatoes	5.2%	236.8	(52.1)	222.5	(48.9)	1.1 cups
2	Breads and rolls	10.5%	58.0	(3.0)	168.6	(9.7)	
	White bread	41.4%	51.9	(4.2)	140.2	(11.4)	1.8 slices
	Soft white rolls	19.1%	51.9	(4.0)	154.6	(11.9)	1.5 rolls
	White toast	9.4%	49.3	(6.8)	154.6	(21.5)	1.7 slices
	Whole wheat bread	2.8%	63.9	(11.8)	155.6	(28.8)	2.3 slices
	Bread stuffing	2.4%	168.1	(46.7)	601.4	(167.0)	0.8 cup
3	Cakes, cookies, pies, cobblers, pastries	10.3%	65.5	(4.8)	245.3	(16.7)	
	Chocolate chip cookies	17.8%	23.9	(4.3)	112.6	(20.3)	1.6 cookies
	Chocolate cake w/ icing	6.5%	111.3	(10.0)	377.5	(32.4)	0.8 piece

	Chocolate covered, fudge sandwich cookies	5.6%	51.1	(9.1)	253.0	(45.2)	3.0 cookies
	Cookies, non-specified	5.5%	29.7	(4.8)	142.6	(23.2)	2.0 cookies
	Brownies	5.0%	79.3	(19.0)	384.6	(92.1)	1.4 large brownies
4	Milk desserts	9.1%	148.4	(8.9)	291.1	(17.6)	
	Non-chocolate ice cream	51.6%	162.0	(13.4)	327.4	(27.1)	1.2 cups
	Chocolate ice cream	20.0%	130.0	(19.2)	272.9	(40.3)	0.9 cup
	Ice cream, non-specified	8.1%	129.1	(28.4)	260.5	(57.3)	1.0 cup
	Sherbert	4.7%	211.7	(47.3)	296.2	(66.1)	1.4 cups
	Ice cream sandwich	2.9%	111.5	(18.2)	308.1	(50.2)	1.6 sandwiches
5	Fruits, raw	6.0%	138.2	(7.7)	77.4	(5.0)	
	Apples	31.1%	162.1	(8.8)	94.0	(5.1)	0.9 apple
	Oranges	16.7%	157.8	(16.0)	77.2	(7.8)	1.0 orange
	Bananas	11.4%	107.9	(9.3)	92.0	(7.9)	0.9 banana
	Peaches	10.4%	157.6	(19.8)	60.1	(7.6)	1.1 peach
	Mixed fresh fruit	4.0%	1.4	(0.5)	4.0	(0.0)	< 0.1 cup

CHAPTER 4

EVALUATION OF A NUTRITION CURRICULUM ON CHILDREN'S FOOD PREFERENCES, KNOWLEDGE AND SELF-EFFICACY: A RANDOMIZED CONTROLLED TRIAL

Abstract

Introduction: The purpose of this study was to evaluate the effectiveness of a widely disseminated nutrition curriculum on changes in dietary knowledge, self-efficacy to consume fruits and vegetables (FV), and food preferences of children attending afterschool programs (ASPs).

Methods: Using a randomized-controlled design, pre- and post-measures were collected on 665 children (56.0% male, mean age=7.6yrs) from eight ASPs (four intervention/four control) surrounding a 7-week intervention in 2014. Intervention ASPs received the nutrition curriculum. Control ASPs received no intervention and operated as usual. Food knowledge and self-efficacy were measured using validated surveys. Food preferences were measured during two procedures: A) offering one choice from 5 FV (snack 1) and B) offering one of 14 different snacks, including FV and less healthful alternatives (snack 2). Selection, 100% FV consumption, and waste of FV were measured. Mixed model regressions were used to determine the curriculum impact.

Results: Treatment-by-time interactions showed significant improvements in food knowledge for intervention students compared to controls (+4.46%, CI=1.2%, 7.8%). No significant effects were seen for self-efficacy to consume FV. During snack 1, over 93% of all children selected a FV at pre and post-test, with no significant intervention effects (OR=0.22, CI=0.02, 2.91). During snack 2, less than 10% of children selected a FV at pre and post-test with no significant intervention effects (OR=0.78, CI=0.30, 2.03). The intervention had a significant effect on 100% FV consumption (+12.2%, CI=2.0%, 52.0%, $p=0.03$) and FV waste (-20.1%, CI=-50.1%, -1.4%, $p=0.04$) for snack 2 among the small percentage of children who selected FV. Delivery costs of \$1,000 and 75 hours, including ASP delivery time, were required to implement the curriculum to an average-sized (100 students) program over 7 weeks.

Discussion: The small significant improvements in food knowledge, FV consumption, and waste reduction for youth in intervention ASPs suggest curricula combined with structural controls on the foods offered for snack could enhance youth dietary knowledge and habits in the ASP setting.

Keywords: nutrition, curriculum, afterschool, youth, randomized controlled trial

Introduction

A healthy diet during childhood promotes optimal health and development, reduces the likelihood of obesity, and contributes to the prevention of chronic disease across the lifespan [1-6]. As eating habits formed in youth often track into adulthood, the childhood years before adolescence represent an optimal time to educate children on healthful dietary behaviors [6-9]. Unfortunately, youth consume an abundance of sugar-sweetened, calorically-dense foods, while under-consuming fruits and vegetables (FV); thus, most children's diets do not meet national standards [10-12].

Across the nation, afterschool programs (ASPs) serve nearly 10.2 million, or 41% of elementary-aged children annually for an average of 8 hours per week [13], every week of the school year. Because of this extensive reach, ASPs are recognized as settings that can influence the dietary habits of children. Snack time, in particular, represents an opportunity for ASPs to promote healthy habits while providing nutrients and sustenance between meals. Within the last decade, programs have been called upon to play an active role in promoting healthful dietary intake of those children attending [14]. One approach ASPs have adopted is the incorporation of nutrition education into their daily routines through the use of nutrition curricula.

Many nutrition curricula are available with varying effectiveness, associated costs, and time requirements necessary for preparation and implementation. Some curricula are sold commercially in packets to educators, while others are freely available online. Some offer an outline of lessons and activities, while others provide detailed lesson plans, complete with all resources necessary for implementation. *Food & Fun*

After School (FFAS) (© President and Fellows of Harvard College and YMCA of the USA) is one of the most promising, nationally-recommended, freely-available curricula designed to develop healthy habits for children and families in ASPs. The curriculum consists of 7 units on healthy eating, with 3-4 crafts/games/activities per unit. *FFAS* has been widely adopted by hundreds of YMCA's, the nation's largest non-profit provider of childcare [15]. The behavioral goals associated with the nutrition component of the curriculum include having positive impacts on children's dietary knowledge, eating habits, and self-efficacy to make healthy choices [15]. While widely adopted, no studies have been conducted to establish that the curriculum results in changes in children's dietary behaviors. As such, the purpose of this study was to evaluate the effectiveness of the *FFAS* curriculum on changes in dietary knowledge, self-efficacy to consume FV, and snack preferences of children attending ASPs.

Methods

Participants and setting. This study was conducted from August through December 2014. The participants were 665 children from 8 ASPs operated by a single organization. The ASPs operated in elementary schools, immediately after the end of the regular school day, and offered children opportunities for homework, snacks, enrichment, and recreation until ~6pm every weekday of the school year. The median annual household income for the two counties where the programs operated were \$39,587 and \$45,140 [16]. The median percentage of students receiving free-and-reduced lunch for this sample was 58.2% [16]. All study protocols were approved by the University of South Carolina Institutional Review Board and there was no racial or gender bias in the selection of participants. Written parental consent was collected from every parent/legal

guardian of each participant. Children offered verbal confirmation confirming their assent to participate.

This study utilized a randomized experimental design with measures collected at baseline and post-test in four intervention and four control ASPs. Each ASP was matched, based on enrollment size and school district, to a comparable ASP prior to randomization, with one of the pair randomized to intervention or control condition. Baseline measures were collected at the beginning of the school year prior to curriculum delivery. Post-test measures were collected one week after the last lesson was delivered. The CONSORT diagram presented in Figure 1 illustrates the sample participation throughout the trial.

Curriculum Implementation. The nutrition component of the *FFAS* curriculum (Appendix Table 1) was administered as designed over a total of seven weeks by trained research staff. The following implementation schedule was developed after consultation with the *FFAS* staff and is consistent with reports of current *FFAS* implementation practices by the YMCA of USA [17]. The curriculum was delivered two days each week for the total seven weeks by the lead author and research assistant. Each curriculum lesson was delivered to all ASP students in their respective grade groups (Kindergarten (K), 1st-2nd, 3rd, 4th-5th). In accordance with the curriculum guidelines, each group's lesson for each day lasted between 20 – 40 minutes, depending on the number of activities involved. Each school had a total of 14 visits with all lessons and activities pertaining to each unit completed in two visits per week for each of the 7 units. Additionally, weekly newsletters and emails for parents, available in accordance with the curriculum, were sent home with the children at intervention sites via the program leader

of each intervention ASP (n=4). Post-test measures were collected one week after the final 7th unit was delivered.

Time and cost. The time and resources to fully implement the *FFAS* curriculum were documented in real-time prospectively throughout the intervention and are presented in Appendix Table 1. The totals were standardized to cost per 100 children. Costs included supplies for supplies for games, arts and crafts, printing and taste-tests.

Measurements. Demographics: All demographic measures were provided by the ASP for each child at baseline. The demographic variables consisted of age, gender, race/ethnicity (black, white, Hispanic, Asian, other), and grade (K – 5th).

Questionnaires: Food knowledge and self-efficacy measures were collected from 3rd-5th grade students only. As no widely accepted dietary knowledge survey currently exists for children [18], and upon consultation with experts in the field of dietary assessment in youth, we developed a questionnaire that mapped onto the learning outcomes stated in each of the 7 nutrition units, resulting in a 25-item dietary knowledge survey [19-21]. The 34-item Child Dietary Self-efficacy Scale, with dichotomous responses of “sure/not sure” was used to measure self-efficacy to consume fruits and vegetables for the 3rd-5th graders at baseline and post-assessment [22]. This scale has previously been shown to have strong psychometric properties in similar populations [22, 23].

Snack preferences: Two snack preference observations were conducted on separate days at baseline and again at post-test to objectively measure the impact of the *FFAS* curriculum on children’s snacking behaviors. The first day of snack observation

measured child snack preferences and consumption when given the option of a fruit or vegetable only. The fruit options were whole apples, sliced apples, or bananas. The vegetable options were sliced celery or baby carrots. The children were offered the choice of peanut butter or ranch as a dip. These snack options were based on the literature describing food items widely observed and accepted by children in the ASP setting [24].

The second day of snack observation measured child snack selection and consumption when given the option of the same fruits and vegetables from the first day, along with other less-healthy alternatives. These less-healthy foods included: fruit gummie snacks, cream-filled sandwich cookies, animal crackers, pretzels, plain corn tortilla chips, air-popped popcorn, nacho cheese flavored tortilla chips, cheese puffs and cheese flavored crackers. These snacks were selected based on items regularly served in ASPs [25, 26].

A sample of 10 of each snack choice were weighed prior to snack time, using a digital food scale (Taylor 3801, Taylor, USA), to establish an average weight of each serving before consumption. Enough snacks were made available of each food item to feed all children at each program if a single item was selected by all the children (e.g., 60 children present – 60 apples present, 60 bananas present, 60 cookies present). Twenty portions of each snack option were presented on a table at the front of the cafeteria. Extra servings of each snack were added as items were selected to retain 20 on the table at all times. Each child was offered the choice of one snack on each snack observation day and his/her selection was recorded. Children were instructed to leave all trash and any leftover snacks at their tables and all trash receptacles were removed.

Immediately following each observed snack time, research staff collected all snack bags and waste and separated them by each snack offering. The quantity of partially and fully consumed snacks was recorded for each item. Fully consumed snacks were defined as no edible food items remaining. All other leftover snacks were defined as partially consumed. The snack waste was weighed and recorded for each snack to determine the total waste for each item. For the estimated weight of the fruit waste, the weight of the apple cores and banana peels was excluded from the final waste weight. These procedures were repeated at each site at baseline and post-test and are consistent with previous snack preference studies [27].

Youth Focus Groups: Focus groups were conducted with each age group during the last lesson at each intervention site. The focus groups were guided by open-ended questions, presented in Appendix Table 2, to determine the curriculum components that children enjoyed, specific examples of how their eating behaviors may have changed both in and outside of the ASPs, and how the children communicated with their parents regarding the lessons. All focus group interviews were digitally recorded, and notes were taken by research staff.

Statistical Analysis

Descriptive characteristics for the sample were summarized and t-tests and chi-square analyses conducted to examine baseline differences between intervention and control groups. The primary analyses used were mixed model regressions, adjusting for the repeated measures and clustering of students within ASPs, and included race, age and gender as covariates. Food knowledge and self-efficacy scores were translated into

percentages for analyses. Food knowledge scores represented the percentage of correct responses on the 25-item questionnaire. Self-efficacy to consume FV scores represented the percentage of time the child responded in the affirmative of being “sure” he/she could engage in the designated FV behavior. Fewer than 3% of the questionnaires were incomplete and, therefore, not used in the analysis.

Comparisons for healthy snack selection, 100% FV consumption (i.e., zero waste), and the percentage of FV wasted were made between treatment and control groups on both snack occasions when only FV were available and when FV were served alongside less healthful options. The snacks were dichotomized as “healthy” for the 5 FV options (apples, sliced apples, bananas, celery, carrots) and “less healthful” for the 9 other snack options. Mixed model logistic regressions were used to compare the proportion of children selecting FV at baseline and post-test by treatment group and snack occasion. Mixed model regression analyses were also performed to determine the impact of the curriculum and snack occasion on the percentage of students consuming 100% of the FV and FV wasted. Finally, because attendance across the 7 weeks varied by child, a dichotomous exposure (i.e., attendance) variable was created and added to the model to determine if attendance at 75% or more of the lessons had a differential impact on the outcomes for those in the treatment condition. As attendance did not impact the outcomes, this variable was not included in the final model. Data were collected in the fall of 2014 and all analyses were conducted in 2015 using Stata (v. 14.0 College Station, TX).

Results

Baseline student characteristics. Baseline participant characteristics are presented in Table 1. Overall, the populations were largely similar, with small but significant baseline differences between treatment conditions for race, with the control group having slightly more Black students than in the intervention group.

Primary Outcome Results. Table 2 compares the primary outcomes related to food knowledge, self-efficacy to consume FV, and healthy snack choices, as well as 100% FV consumption and FV waste over time and between intervention and control groups. The treatment by time interaction indicated that the curriculum significantly improved children's food knowledge compared to controls (CI = 1.2%, 7.8%, $p = 0.01$). Children from the intervention sites answered 65.6% (16 out of 25) of the questions correctly at post-test, which was an improvement of 1.6% from baseline. Children in the control group answered 55.2% (14 out of 25) of the questions correctly at post-test, representing a decline of -2.0% from baseline. The treatment by time interaction indicated the intervention was not significantly associated with change in self-efficacy to consume FV (CI = -6.4%, 7.4%, $p=0.89$).

Snack selection, consumption & waste. During snack one, the curriculum did not have a significant effect on the selection of FV when served alone (OR=0.22, CI=0.02, 2.91, $p=0.25$). Additionally, no significant curriculum effects were seen for the percentage of the intervention group consuming 100% of their FV relative to the control group (CI=-12.3%, 18.6%, $p =0.69$) or reduced FV waste (CI=-10.2%, 15.0%, $p=0.71$).

For snack 2, exposure to the curriculum did not significantly influence children's healthy snack selection when offered the choice (OR=0.78, CI=0.30, 2.03, $p=0.69$). For the small group of children selecting FV as their snack when offered this choice (7.4% intervention, 5.4% control), the curriculum had a significant effect on consuming 100% of FV and reduction in waste of FV. The percentage of intervention children consuming 100% of their FV increased from 57.9% at baseline to 70.1% at post-test. Concurrently, the percentage of children consuming 100% of their FV in the control group decreased from 88.8% at baseline to 73.9% at post-test. The treatment by time interaction showed the curriculum had a significant effect on the percentage of children consuming 100% of their FV by post-test (+12.2%, CI=2.0%, 52.0%, $p=0.03$). The curriculum was also significantly associated with a reduction in FV waste. The intervention group wasted 27.6% of the FV at baseline compared to 7.5% at post-test. The control group wasted 9.2% of the FV at baseline compared to 14.9% at post-test. The treatment by time interaction showed the curriculum had a significant effect on FV waste by post-test (-20.1%, CI=-50.1%, -1.4%, $p=0.04$). The overall intervention effect on FV consumption and waste reduction represented improvements by the treatment group with coinciding declines for the controls which made the two groups equivalent at post-test.

Focus groups. Appendix Table 2 provides the focus group questions and examples of the most common student responses. The most common responses included the following: the older children (5th grade) did not like the activities they felt were too “young” for them. The same older children did not like the activities that resembled schoolwork. The primary communication children reported having with their parents

about the curriculum content involved the children requesting FV. The children responded that they enjoyed the lessons involving physically active games and taste tests.

Program cost. As shown in Appendix Table 1, over 75 hours were required by more than one staff member (35 hours for one to prep, 40 hours for 2 to deliver) to fully implement the nutrition portion of the curriculum for each average-sized (100 children) program over 7 weeks. At the average wage of \$8.50 per hour, this equates to an investment of at least \$977.50 for staff. Additionally, nearly \$1000 was invested to pay for supplies for games, arts and crafts, printing, and purchasing foods for the taste-test curriculum components. Of importance to note is that these funds did not include the cost for the ASP snacks themselves but merely materials for the curriculum.

Discussion

Curricula that foster healthful dietary choices are an important part of the overall approach to establishing healthy child development and well-being, particularly in light of national childhood obesity rates and consistent reports indicating that youth diets are lacking in healthy nutrients [10-12]. In particular, schools, ASPs, and other settings regularly catering to large groups of children are in need of evidence-based resources that programs can use to improve youth dietary behaviors through healthy, engaging education methods. The *FFAS* curriculum is one of the most widely adopted curricula recommended for use by the National Afterschool Association to help ASPs provide such education and is currently being implemented by some of the nation's largest ASP providers [15]. The results of this RCT indicate the *FFAS* nutrition curriculum, when administered over the course of 7 weeks with twice weekly lessons, produces small but

significant improvements in children's food knowledge, as well as improved FV consumption and waste reduction for the children selecting FV when offered the option between FV and less healthful alternatives. However, the children exposed to the curriculum did not change their preferences by selecting a FV at post-test when offered the choice between a FV or a less healthful snack. These findings have important implications regarding the limited potential of nutrition education curricula alone and the need for concurrent policy-level changes to the snacks being served to eliminate the role of preference for less-healthful alternatives leading to broader dietary behavior change.

The fact that FV preferences did not change despite the slight improvements in food knowledge indicate that food knowledge, alone, is important yet insufficient to create healthy snacking changes, particularly when faced with less healthful temptations. These results are not surprising in light of youth consumption patterns and lack of self-regulation, particularly regarding snacking and the desire for unhealthy foods [28]. Additionally, food knowledge changes of greater magnitude might be more impactful but would likely require more than the limited exposure over 7 weeks in the ASP setting. For the small subset of students who made the healthy FV choices when faced with less healthful alternatives, the curriculum enhanced their already-healthy snacking behaviors wherein they consumed more and wasted less of the FV they selected, making them more likely to meet dietary guidelines for FV consumption. One potential goal of future studies could be to isolate factors relating to this subset of students to better understand why they selected the FV and the specific curriculum components that enhanced their consumption patterns.

Overall, fewer than 10% of children selected healthy FV when offered the choice of those or less healthy options at both baseline and post-test. For both the treatment and control groups, healthy snack selection did not significantly change, indicating that the curriculum did not impact children's snack preferences. When the less healthful choices were removed, over 93% selected a FV, with less than 30% of those FV thrown out as waste, with or without curriculum exposure. Additionally, the majority (over 64%) of the children selecting those FV consumed 100% of those snacks. This suggests that if children are offered FV in the absence of less healthful alternatives, the majority will select and fully consume those snacks and will not go hungry; however, if the less healthful alternatives are served, fewer children will select the FV [27]. These results align with public health interventions and policies emphasizing unconscious engagement with health behaviors based on environments that make the healthy choice the easy choice or, in this case, the only choice [29-31]. Even without such constraints, however, the *FFAS* curriculum can still serve to enhance food knowledge for all children and improve consumption and decrease waste for the few selecting FV.

A primary benefit of the *FFAS* curriculum is the fact that it is a freely-available, online program and easily accessible for all ASPs. However, the time and resources required to fully implement a curriculum (Appendix Table 1) must factor into any programming decisions. Based on this study, at least 75 hours total, with 35 hours outside of routine ASP operation, were required from more than one staff member to fully implement the nutrition portion of the curriculum to an average-sized program of 100 children. These hours were spent acquiring and preparing materials for crafts, creating required accessories for games, studying the curriculum, and acquiring and

prepping all snacks for curriculum taste tests. Additionally, nearly \$1000 was required to pay for supplies for games, arts and crafts, printing and taste-tests, as specifically prescribed by the curriculum (Appendix Table 1). Such costs need to be considered, with the potential gains in knowledge and FV consumption, when selecting an intervention to deliver.

This study's exposure over the course of 7 weeks was sufficient to produce small changes to food knowledge and FV consumption but not self-efficacy to consume FV or snack choices. Based on these findings, we recommend the following improvements that may enhance the beneficial effects of the *FFAS* curriculum. These include offering the curriculum messages at a greater frequency in ASPs and in a variety of additional settings and improved specificity regarding target age groups and behavioral goals. Recent meta-analyses indicate that youth-focused interventions lasting more than one year or those with at least 50 hours of exposure are more likely to improve knowledge and self-reported intake of FV [6, 32-38]; however, objective evidence of the impact on changes in eating behavior is limited [6, 33, 35, 39]. The likelihood of lasting changes in behavior would be enhanced with reinforcement of nutrition education in other settings, such as in the home or school [6, 32, 33, 38, 40, 41]. Although many curricula include parental components to engage the home setting, our focus group responses from the children indicate that emails and newsletters alone seem largely ineffective at engaging the parents.

When focusing solely on what can be accomplished in the ASP setting, the most popular component of the *FFAS* curriculum, according to our focus group responses, was the taste testing associated with each unit. These taste tests created positive associations

with, and exposure to, fruits, vegetables and whole grains for the children, to the extent that the children reported requesting these items from their parents. However, these taste tests were costly, at nearly \$4 for each child over the 7 units, and time-consuming to prepare. And despite our positive focus group responses, taste testing lacks strong support from the literature or objective results [42, 43]; thus, programs must carefully weigh the investment necessary to implement this curriculum component with potential positive program impact.

The primary limitation for this study was the use of self-report measures to determine two of the outcomes. However, the Child Dietary Self-Efficacy Scale has been shown to have strong psychometric properties [22, 23]. And the children's food knowledge survey was adapted from three previously validated measures in similar studies [19-21]. Strengths of this study include the randomized study design with a large, diverse sample, the high response rates for self-report (>97% completed questionnaire response), and the inclusion of objective observations of healthy snack preferences (for over 80% of overall sample) to offset self-report limitations.

Conclusion

Based on the results of this trial, the *FFAS* nutrition curriculum can lead to small improvements in children's food knowledge and FV consumption, but not self-efficacy to consume FV or healthy snacking preferences in the ASP setting. More research is needed to determine the specific curriculum components that were responsible for significant effects and that should be emphasized in future implementation.

Funding: This study was supported by a SPARC grant from the Office of the Provost at the University of South Carolina.

Acknowledgement: We have no conflicts to report.

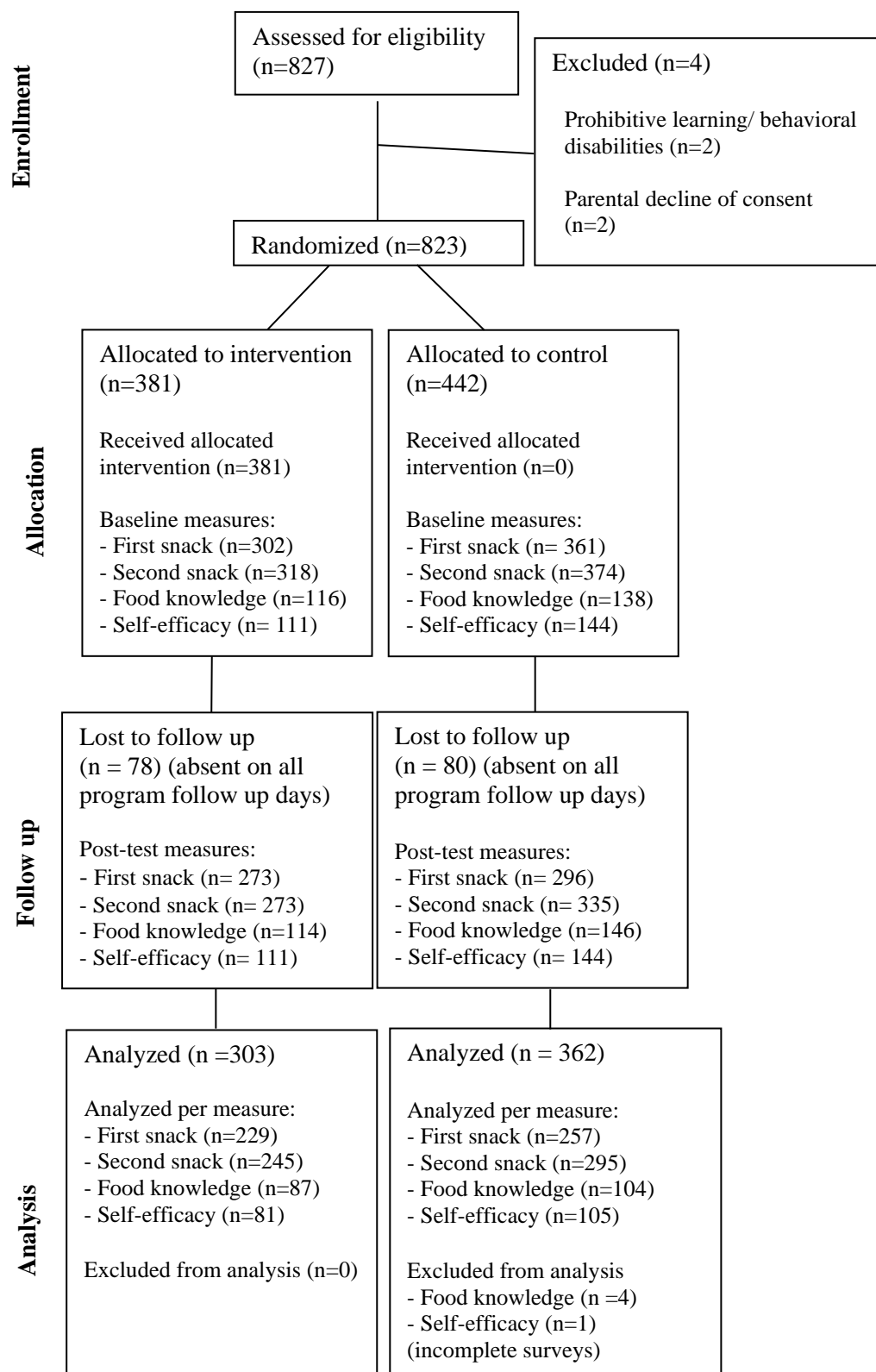


Figure 4.1. CONSORT diagram showing the flow of children attending ASPs through each stage of the RCT

Table 4.1. Baseline demographic and outcome characteristics for the total sample of elementary-aged students in ASPs

		Total Sample			Treatment			Control			<i>p</i>-value
		N	Mean or %	(SD)	N	Mean or %	(SD)	N	Mean or %	(SD)	
Age (years)		665	7.6	(1.7)	30			36			0.52
					3	7.5	(1.7)	2	7.7	(1.7)	
					30			36			0.87
					3	54.9		2	57.0		
	Male (%)	665	56.0								0.83
	Grade										
	K	113	17.0		55	18.2		58	16.0		< 0.01
	1 st	109	16.3		53	17.5		56	15.5		
	2 nd	120	18.1		56	18.5		64	17.7		
	3 rd	99	14.9		45	14.9		54	14.9		
	4 th	124	18.7		51	16.8		73	20.2		
	5 th	100	15.0		43	14.1		57	15.7		
	Race (%)*										
					15			13			
	White	291	43.8		2	50.2		9	38.4		
					14			19			
	Black	338	50.8		2	46.8		6	54.1		
	Hispanic	25	3.8		2	0.7		23	6.4		
	Asian	6	0.9		4	1.3		2	0.6		
	Other	5	0.7		3	1.0		2	0.5		

* indicates significant baseline differences between treatment and control groups at $p \leq 0.05$

Table 4.2. Changes in Food Knowledge, Self-Efficacy to Consume F&V, Snack Behaviors and Healthy Snack Choices for Elementary-Aged Students in ASPs

Outcome Variable	N	Attendance (%)	(SD)	Baseline		Post-test		Change			
				Mean (%)	SD	Mean (%)	SD	Within	(95%CI)	Between	(95%CI)
Food knowledge*										10.4	(1.2, 7.8)
Intervention	87	71.5	(26.7)	64.0	(12.7)	65.6	(12.0)	1.6	(-0.7, 4.0)		
Control	104			57.2	(13.1)	55.2	(12.4)	-2.0	(-6.3, 0.6)		
Self-efficacy for FV										0.1	(-6.4, 7.4)
Intervention	81	70.6	(26.8)	70.3	(23.0)	73.1	(22.2)	2.8	(-0.7, 8.3)		
Control	105			69.0	(23.7)	73.0	(23.0)	4.0	(-1.5, 8.5)		
Healthy snack choice:											
Snack 1-FV only										2.2	(-1.2, 0.7)
Intervention	229	61.3	(34.2)	99.6	(6.6)	99.1	(9.3)	-0.5	(0.0, 5.5)		
Control	257			93.4	(24.9)	96.9	(17.3)	3.5	(0.9, 5.2)		
Snack 2-All snacks										2.0	(-0.7, 2.2)
Intervention	245	62.1	(33.5)	9.9	(29.9)	7.4	(26.3)	-2.5	(0.4, 1.4)		
Control	295			5.8	(23.3)	5.4	(22.7)	-0.4	(0.5, 1.9)		
100% FV consumption:											
Snack 1-FV only										-3.8	(-12.3, 18.6)
Intervention	4			64.1	(12.7)	65.0	(8.0)	0.9	(-11.8, 13.7)		

Control	4	71.0 (8.9)	68.8 (5.2)	-2.2 (-11.0, 6.5)	
Snack 2-All snacks*					-3.8 (2.0, 52.0)
Intervention	4	57.9 (24.0)	70.1 (23.8)	12.2 (-16.6, 40.8)	
Control	4	88.8 (13.1)	73.9 (25.0)	-14.9 (-38.8, 9.1)	
FV Waste:					
Snack 1-FV only					1.0 (-10.2, 15.0)
Intervention	4	23.9 (13.0)	26.4 (8.6)	2.5 (-10.7, 15.7)	
Control	4	25.3 (6.5)	25.4 (3.8)	0.1 (-6.3, 6.5)	
Snack 2-All snacks*					-7.4 (-50.1, -1.4)
Intervention	4	27.6 (25.7)	7.5 (9.5)	-20.1 (-43.2, 3.2)	
Control	4	9.2 (7.0)	14.9 (15.7)	5.7 (-8.9, 20.3)	

Table 4.3. *Food & Fun After School* curriculum implementation schedule and required resources

Unit Title	Theme	Behavioral Goals	Day	Activities	Prep Time (min)	Cost (\$/per 100 children)
Take a Bite!	F&V	Eat more F&V (5-a-day!).	1	F&V Placemats	150	29.28
				Find the Favorite	30	8.38
			2	I'm Going on a Picnic	10	0.00
				Bingo	30	8.38
				F&V Relay Games	75	3.06
				Bugs on a Log		
				Fruit Kebobs		
				Spiced Yogurt Topping	150	98.33
Be Sugar Smart!	Sugar-sweetened drinks	Drink fewer sweetened beverages and eat fewer sweets.	3	Bowling for Sugar Smarts	120	6.15
				Pour It Out	120	11.17
			4	Sugar Surprises	40	1.12
				Count It Up (4th-5th grade)	25	4.47
				Trail Mix	30	43.29
Go for the Good!	Healthy and unhealthy fats	Choose foods with healthy fats when possible.	5	Track the Trans Fat	25	1.68
				Snatch the Healthy Fat	45	2.23
			6	Food Label Collage	150	28.32
				Salsa Fresca	90	73.00

Go for Whole Grains!	Whole grains	Eat more whole grain foods.	7	Mosaic Creations	90	41.04
			8	Red Hen Relays	30	9.73
Super Snacks!	Healthy snacking	Choose healthy snack foods.	9	Super Snack Book	90	108.70
				Silly Snacks	15	8.38
			10	Too Much "Slow" Food Tag Healthy House	90	58.85
			11	Commercial Mania (4th- 5th grade) Butterfly Bites Fruity Peanut Butter Pitas	60 180	8.68 93.70
Mix It Up!	F&V	Eat a variety of F&V.		Build a Rainbow Parts of the Plant	25 30	8.38 8.38
			12	Color Relay Games Fruity Freeze Tag Cucumber Yogurt Dip Tasty Bug	60 10 75	3.06 0.00 81.15
Be Active, Stay Cool	Keeping hydrated	Drink water at every snack and when they are thirsty.	13	Cup Coolers Gulp!	120 150	157.00 15.41
					2115	921.32

Table 4.4. Focus group questions and sample responses from elementary-aged children in intervention ASPs

	Focus Group Questions	Sample Student Responses
1	What was your favorite activity that we did in our nutrition lessons? Why was it your favorite?	<p>“Taste testing because we got to eat real food and it’s actually really good.”</p> <p>“Bowling for Sugar because we got to throw balls and see what drinks were good and not good.”</p> <p>“Relay races and Slow Food, Go Food Tag because it’s fun to run around and it’s healthy.”</p>
2	What was your least favorite activity that we did? Why was it your least favorite?	<p>“Coloring the Rainbow because it was boring and we prefer to be moving around and doing something challenging.”</p> <p>“The sugar fractions and worksheets because it was like schoolwork and not that fun.”</p> <p>“Bowling for Sugar because we didn’t get to take enough turns and it wasn’t like real bowling: the ball bounced too much.”</p>
3	Can you tell me about a time you ate healthy after our visits this school year?	<p>“When [restaurant] came to our school for lunch, I asked for extra salad.”</p> <p>“Today, for lunch, I had a salad because I wanted to be healthy.”</p> <p>“At home, I asked my grandma if we could have some yummy fruit, like a peach, for me.”</p>
4	What do you think is the hardest part about eating healthy? Why?	<p>“Everyone who’s old enough to tell me what to do makes me eat all the things that I really don’t like, like peas.”</p> <p>“When you look at food that you want that’s not healthy and you want to eat and eat it. I just can’t resist the ice cream and cupcakes and stuff like that.”</p>

		“It gets stuck in your teeth and you have to pick out the seeds.”
6	What healthy eating facts and lessons have you talked about with your parents?	<p>“I told my grandma that I need to eat 5 fruits and vegetables a day, so at the store she bought a package of grapes, and every day I eat grapes at lunchtime.”</p> <p>“Well I told my parents all about the lessons and I asked my mom for healthy apples even though it’s hard for me because I want to eat sweets all the time.”</p> <p>“I told my parents we got free food and played fun games and that we should not drink so many sugary sodas and juices and stuff.”</p>

CHAPTER 5

TRAIN THE TRAINER: A CONCEPTUAL MODEL FOR RESEARCH AND PRACTICE

Abstract

Despite widespread use in public health, no framework currently details the theoretical underpinnings and considerations when applying the train-the-trainer (TtT) approach for program implementation, dissemination, and evaluation. Drawing from a review of the literature, this article describes a conceptual model that identifies the critical factors necessary for interventions to effectively use and evaluate TtT. Considerations include the number of tiers, or training cohorts, with multiple tiers required for a full TtT approach, purposive selection of trainers, training on pedagogical techniques and program content, expansion of the reach of experts, the dampening of the effect with the addition of tiers, and the evaluation of implementation and costs throughout all tiers from stakeholders to expert instructors, facilitators, and eventually to the target population. Attending to these issues when applying TtT will assist in understanding the benefits and challenges associated with the creation of a cadre of trainers who are poised to expand the reach of evidence-based interventions. Thus, through TtT, program delivery has the potential to be not only more efficient but ultimately more impactful, leading to population-level change on a broad public health scale.

Introduction

One of the fundamental issues impeding improvements in health programming today is the gap between what research has shown can optimize health in controlled settings and what is implemented in everyday practice; essentially an issue of translating the evidence-base into practice, particularly on a large scale [1-4]. For evidence-based approaches to have far-reaching and enduring impacts on population health, effective interventions must be widely and efficiently disseminated. According to Glasgow's RE-AIM framework, such efficiently disseminated, evidence-based interventions could maximize their impact by having extensive reach and being reasonable to implement and maintain in real-world settings [5]. As such, recent contributions to public health and medical research and the Roadmap by the National Institutes of Health (NIH) [3, 4] indicate the need for a shift of emphasis from research involving basic discovery and evaluation of efficacy to that which focuses on real-world implementation and assessment of the resultant impacts on population health [5,6].

At all points of intervention, decisions must be made balancing methodological precision with practical limitations, including cost and real-world factors, with the goal of maintaining internal validity while maximizing external validity [6, 7]. Current public health research often evaluates interventions within more controlled settings that emphasize internal validity. As such, resultant outcomes might not be realistic or relevant for implementation in practice. There is a need to fill the gap between research and practice with proven best-practices in real-world settings, through the scaling of potentially efficacious interventions [2, 3]. One such potential best-practice to bridge this gap is the train-the-trainer (TtT) method; the nuances of which, to be most effective,

sshould be considered at all stages of intervention, from conceptualization through implementation and evaluation; ideally balancing methodological rigor with practical application [1, 3, 6].

TtT methods of program translation, implementation, and dissemination, also referred to as cascade training, involve the transfer of knowledge and practical skills from one (or more) expert individual(s) to other individuals or groups, who, in turn, are responsible for training others; thus, cascading the knowledge and skills from a master trainer, to lead trainers (first tier), local facilitators (second tier), and eventually to learners in the target population (third tier) [8, 9]. The TtT model, which, according to Gould [8], dates back over 75 years and has been widely used not only in the fields of public health and medicine, but also in business [10] and education [11], is based on the theoretical expectation of extending the reach of expert trainers, who are usually researchers, primary investigators or program developers. These experts teach lead trainers not only in the designated program or treatment through one tier of training, but also in how to teach it to other practitioners in the cascading tiers.

TtT has the greatest potential to help in communities where lack of access and resources, including qualified professionals, are of concern [9, 12, 13]. In such often-developing countries and rural towns, where access, trust, and communication are critical, community health workers (CHWs), lay health advisors (LHAs), and promotoras can be ideal facilitators to utilize for TtT success [11-17]. Inherent in the use of CHWs, LHAs and promotoras is the concept of training a lay person to implement a program. However, not all programs utilizing CHWs, LHAs, and promotoras have the cascading tiers and trickle-down orientation to qualify as TtT. Likewise, not all facilitators in TtT

cascades qualify as CHWs. However, when incorporated into a TtT framework, these individuals often have a more complete knowledge of the dynamics, language, and customs of the target community which can add salience, relevance, trust, and, thus, sustainability to program messages [14, 18, 19].

Despite continued use since the 1940's, particularly in healthcare and public health sectors, many articles and curricula cite use of a "classic TtT" method with no framework outlining optimal or standard usage [20-25]. The scientific, commercial, and healthcare communities assume TtT to be common sense; however, a closer look at the research shows no universal framework for implementing or evaluating TtT specifically [9, 25]. Models and competencies exist detailing best practices for similar dissemination tools, including those for previously-mentioned CHWs [26-34]; however, a framework specific to TtT remains undefined. Thus, the purpose of this article is to provide a conceptual framework for TtT, informed by an iterative literature review, and based on Kirkpatrick's model of educational outcomes [35, 36].

Kirkpatrick's model of educational outcomes provides a systematic outline for program assessment based on four distinct levels of impact. The first level of Kirkpatrick's model focuses on learner satisfaction, often through attendance records and immediate self-assessment, focused on the degree to which participants found the training useful, engaging, and relevant. The second level evaluates changes in the learners' knowledge, skills, and attitudes through self-assessment of these perceived changes. Level 3 of Kirkpatrick's model assesses the behavioral application of teaching skills related to the training and often includes objective measures of the degree to which learners apply the skills learned during the training in real-world settings. Level 4

assesses the overall impact of the trainings on the target community, beyond the first tier of training, which includes measuring targeted program outcomes [35].

Our proposed conceptual framework identifies the critical, modifiable factors to be used with TtT methods in research and program dissemination. Use of this framework and recognition of its identified factors can lead to the successful dissemination of evidence-based interventions and programs on a large scale and improved evaluation of their real-world effectiveness through all levels of Kirkpatrick's model. Without a well-defined framework for optimal use of TtT, the body of knowledge regarding TtT will remain inconsistent, making accurate evaluation of TtT and comparison of TtT methods with each other and alternative forms of program translation, implementation, and dissemination difficult to explore. Therefore, this article will prove useful for researchers and community partners in designing, evaluating, and comparing dissemination of evidence-based interventions and public health programs on a large scale.

Methods

A comprehensive literature review was used in an iterative process to determine best practices for TtT and to guide the creation of this conceptual model. Searches of electronic databases were limited to 1980 – 2020 and included PubMed, Web of Science, Cinahl, Scholar Google, and PsycInfo. The search terms included combinations of the following: program evaluation, program delivery, program dissemination, interventions, lay health advisors, community health advisors, promotoras, health educators, public health, health promotion, train-the-trainer, and TtT. Studies selected for inclusion must have been published in a peer-reviewed journal and written in English. As shown in Figure 1, the review resulted in 1617 relevant abstracts, with 191 qualifying for a full

review of the associated article. In total, 94 articles were used to inform best practices and create this conceptual model, with 51 representing public health interventions and 43 from healthcare fields, focusing primarily on continuing medical education.

Literature Review Results: How TtT is Used and Why a Framework is Needed

TtT use remains inconsistent, with substantial variability in terms of the degree of expert, trainer and trainee participation, as well as confusion and discord on what qualifies as TtT [21-24]. For example, several studies perpetuate the assumption that attending a workshop and providing the materials to staff at home is sufficient to qualify as standard TtT practice [21, 37]. Other studies assume that one tier of cascading, meaning the experts directly train staff to deliver a program, with no other layers of training, evaluation, or exponential reach, qualifies as standard TtT practice [23, 38-43]. This equates to an understanding that the mere provision and distribution of resources, such as a curriculum toolkit or flash drive, with no requirements for dissemination or training, and no cascading tiers, is sufficient to qualify as TtT.

It is our belief that optimal TtT methods are more nuanced and focus not only on the provision of program resources, but diffusion of all program elements through training of individuals to become lead trainers (first tier) who transfer program knowledge and skills to other practitioners or groups (second tier) who then train others (third tier) [9], as laid out by our proposed conceptual model. Below is a breakdown of critical findings from the literature review related to each tier of the TtT cascade.

First Tier Training: Critical Considerations and Lessons Learned

The first level, or tier of training, involves the transfer of knowledge and skills from the expert trainer to the lead trainers. Most often conducted in workshops, for anywhere from 5 to 50 lead trainers, some trainings last only a few hours, with others taking place over the course of months. The majority of lead trainer workshops, based on the articles reviewed, last 2 days, with emphasis placed on the transfer of content, knowledge and skills, as well as program standards, instructional tools, and evaluation guidelines [44]. The most successful first tier trainings, based on participant feedback, spend at least half of the time focusing on instructional techniques through a multi-component mix of role play, lecture, interactive teaching strategies, delivery specifics, and practical and presentation training [45-47] and are not merely didactic lectures with support materials.

Shared buy-in from and support for the lead trainers both during and after initial training is necessary. Letters of agreement, or signed action plans, wherein the lead trainers commit to cascading the trainings beyond the first tier and transferring all program content are often used, yet rarely effective, at ensuring buy-in and follow through [48-52]. For example, in a study by Kovacich, of the 165 trainers who attended 6 training sessions and signed action plans to train other professionals, only 6, or 4%, conducted additional trainings [48]. In another study by Beltran-Algrudo, only 10 of 50 trainers, or 20%, continued the cascade, despite signed letters of agreement [49]. This often-seen drop-off illustrates the need for a shared commitment and vision at all levels of the cascade. The top-down approach to enforce training can result in a lack of commitment if lead trainers feel they are being forced to take on additional

responsibilities without consideration or compensation [49]. Competing demands on time, as well as lack of institutional buy-in and stakeholder support, high turnover, and lack of teaching experience all contribute to reduced follow-through in second and third tier trainings [53]. Ongoing support, monitoring, and process evaluation by the expert trainers in this first tier and beyond are critical to ensure cascading and overall TtT success [8].

Second Tier Training: Program Fidelity and Sustaining the Cascade

The second tier of the training occurs when the lead trainers each train a group of facilitators, the number of which is determined by the intended reach of the program and the capabilities and motivation of each lead trainer. On average, lead trainers train anywhere from 1 to 25 facilitators; thus, exponentially expanding the reach of the experts beyond what the expert could accomplish alone. These trainings can be done individually or in group workshops, on one or more occasions. The focus of the second tier trainings is on transfer of knowledge, skills, program standards and evaluation guidelines [8-10, 13]. Less emphasis is placed on instructional and pedagogical techniques, as the role of the facilitators is to implement and track the program itself, rather than teaching others to be instructors [9, 13]. Maintenance of program integrity through the second cascade requires continued monitoring, and audits should focus on adherence to the program through continued communication from lead trainers and comprehensive checklists [18, 54].

The second tier of the TtT cascade provides an opportune moment to include aforementioned CHWs, LHAs, and promotoras, as the target population can more readily associate with them and form useful alliances to enhance overall program impacts [14,

18, 19, 55]. In a study by Tobias et al., experts and lead trainers built the training capacity of the community by utilizing HIV-positive peers as facilitators for a National HIV/ AIDS Strategy (NHAS) [15]. These peers had a unique and personal understanding of the target population and similar characteristics to their clients. This made them more effective at reaching the target population, potentially resulting in greater long-term program sustainability. The community connection also resulted in a stronger commitment from the facilitators. Ninety-six percent of the trained, local HIV-positive peers cascaded their knowledge through the third tier, conducting local trainings for 272 of their peers. Experienced lead trainers (first tier), comprehensive trainings for the HIV-positive peer-educators (second tier), organizational support, and ongoing monitoring and support from the experts were crucial to the continued motivation of the peer facilitators and successful cascading of the program to the target population.

A study by Carlo et al. illustrates the effective mix of expert and local expertise in a multi-layer training cascade for newborn care and resuscitation skills in rural communities in six countries (Argentina, Democratic Republic of Congo, Guatemala, India, Pakistan and Zambia) [56, 57]. Most of these communities had impoverished health systems with high rates of home births supported by local birth attendants. Three experienced intervention experts trained two local lead trainers for each site in a three-day workshop. These two lead trainers then trained one or more community coordinators (often a physician or nurse trained in research) for each site. These community coordinators were recognized health experts in each community and acted as the facilitators to train local birth attendants in the necessary techniques for newborn care and resuscitation. These local birth attendants represented the CHWs that would then utilize

the intervention skills to effectively implement the newborn care techniques, hopefully resulting in improved birth outcomes and norms for each community in the long term. This intervention utilized the existing community practice of home births, with community coordinators as facilitators and local birth attendants and pregnant women as the target populations, as an avenue to effectively cascade and implement their program through the second and third tiers.

Third Tier Training: Evaluation of TtT and Overall Impact

TtT models have not been exposed to the same evaluation rigor as many other methods adopted in continuing medical education and public health. Of the 94 articles referenced, only 8 included a full evaluation of the overall program impacts in the community [36, 57-63]. Twenty-seven additional studies indicated whether cascading resulted in transfer of knowledge and skills to trainees beyond the first tier of initial training. Of those 27 studies, only 10 provided objective measures to quantify multilevel training effects [8, 12, 64-72]. The remaining article evaluations consisted of basic process evaluation alone, tracking numbers of individuals trained and self-reported knowledge and confidence gains in the first-tier trainings.

There is a need for more substantive investigation into levels 3 and 4 of Kirkpatrick's model; the behavioral application of teaching skills and the overall impact of the trainings beyond the first tier [35]. Rigorous monitoring and process evaluation through regular audits to determine fidelity to the curriculum, consistency of the message, and effectiveness of the training are necessary to evaluate programs at level 3. The most successful programs, in these regards, are those wherein core experts maintain contact with trainers either through onsite visits or teleconferencing [65, 73]; thus, for program

success, training is an ongoing proposition and not a singular task that ends after the initial workshop. This is particularly relevant in situations with high turnover of trainers.

A study by Stratos et al., evaluating a TtT program for faculty development in End-of-Life care, provides a rare example of successful evaluation through level 3 in Kirkpatrick's model [66]. Seventeen medical faculty participated in an intensive, month-long training, focusing on teaching skills, content review, guest talks, and practice seminars and implementation, with expert feedback throughout. These 17 lead faculty trainers then conducted a series of interactive seminars for 6-8 people at a time, training a total of 62 facilitators, who then trained over 3,400 teacher trainees, showing the potential broad reach of effective TtT programs. Self-reported improvements were assessed via surveys administered before and after trainings, representing levels 1 and 2 of Kirkpatrick's model. The second tier trainings, administered by lead trainers, and the third tier trainings, administered by facilitators to the target population, were videotaped and reviewed by experts, analyzing both teaching skills and content fidelity, in order to evaluate level 3 factors. No evaluation of the overall impact of the training on the 3,400 teacher trainees was conducted; therefore, level 4 factors remained unaddressed.

The previously-mentioned study by Carlo et al., utilizing local facilitators to train local birth attendants, provides one rare example of outcome evaluation through level 4 of Kirkpatrick's model [56, 57]. In addition to rigorous evaluation and monitoring of trainings throughout each tier, overall study results included neonatal mortality, stillbirth, and perinatal mortality rates for affected births, indicating the overall program impact on the population. Whereas the mortality rates did not significantly change, stillbirth rates

decreased, indicating at least one broad-reaching program impact and some population-level success of the TtT method.

Potential Benefits of TtT

TtT programs have the potential to exponentially expand the magnitude of their reach beyond that which an expert can accomplish alone; bridging the gaps between the experts and the target population in a manner that is concurrently cost-effective and builds community capacity. For example, in a study by Besculides et al., trainers at community-based organizations, who were familiar with the target population and able to culturally-tailor materials, were able to expand the expert reach to over 2,000 hard-to-reach women throughout Massachusetts [74]. Another intervention by Dunn et al., was able to train over 1,300 participants in 53 facilitator trainings over 6 months, due to a rich infrastructure and supportive partnership between the state and counties, as well as motivated and prepared county teams [75]. As the goal of TtT is to create a diverse cadre of qualified trainers, the TtT benefits are particularly impactful in settings with a lack of professionals and disproportionate health disparities [17]. Perhaps the best example of this is an intervention which leveraged the limited resources of Vietnamese nurses to develop and maintain a national network to provide ongoing HIV education [64]. Over the course of 6 years, 87 nurse lead trainers were able to train nearly 67,000 healthcare workers as facilitators to implement HIV education to the target population in Vietnam. As impressive as these numbers appear, more complete evaluation of program impact, beyond mere counts of numbers reached, is still needed to determine the overall effectiveness of TtT in target communities.

The adoption of TtT programs is made easier through the use of CHWs, LHAs, and promotoras to make the programs culturally relevant and build on the social capital of the community [18]. The trainings become mutually beneficial, with greater ownership of the program success taken by the newly-educated facilitators and the target population leading to greater likelihood of long-term program sustainability [19]. TtT trials can thus increase community capacity by developing competent lead trainers who can train, supervise, and monitor both implementation by facilitators within each community and overall population impact [76].

The cost-effectiveness of TtT has been assumed: the initial training costs for the first tier experts, though substantial, are presumably offset by reduced costs to cascade the trainings to the lower levels. A study by Olmstead et al. confirmed that the initial investment of the first tier training is greater than if the experts directly implemented the program themselves [77]. This is due to the need for experts to comprehensively teach content, program standards, and teaching and supervising techniques to the lead trainers rather than simply implementing the program. However, the recurring costs are less, contingent upon the following assumptions: the trainers remain at all levels, the training quality does not diminish over time or with each tier, and the training cascade continues thru at least three tiers [77].

Potential Barriers to TtT

If the designated assumptions of optimal TtT dissemination are not met, the benefits and overall success of TtT become less likely, as the following barriers to TtT success persist: diminishing effects and lessened overall program impact with each training tier, high turnover rates, and lack of commitment from all sectors. Training

plans must account for the expected, but not inevitable, retention gap at each training tier. The gradual degradation of program impact that is possible with a TtT approach can be mitigated through detailed training materials, audit checklists, and continued support and monitoring [9, 78, 79]. Levy et al. and Jolicoeur et al. showed that trainers were able to replicate their own learning in their trainees, creating a consistent learning gain at all levels [79, 80]. Hinds et al. further found that non-expert lead trainers and facilitators, such as the CHWs, LHAs, and promotoras, might be preferable to experts for transferring knowledge to the target community, as the non-experts are more likely to use concrete, relatable terms, rather than jargon and abstract examples, without degradation of the overall content or diminishing effects [55].

A second barrier to successful TtT dissemination is the loss of trainers through turnover, requiring repeated trainings and continued monitoring and engagement from the experts [53, 60, 73]. The first tier training is, thus, not a “one and done” proposition. Gozalo et al. were able to avoid this barrier by training multiple lead trainers for each intervention site; thereby, reducing the need for repeated trainings if one of the lead trainers left [60]. Administrative encouragement and prioritization to provide the additional initial investment necessary for these trainings were critical to this success. Jones et al. ensured sustained program maintenance through continued training of new facilitators at each community health center site and refresher trainings for current facilitators [73]. Additionally, the inclusion of monthly booster trainings and phone consultations for facilitators enhanced long-term program sustainability for a promotoras-led nutrition intervention [65].

Perhaps the most critical barrier to TtT success is a lack of commitment from all tiers, particularly stakeholders, such as corporate administrators and owners. Without a shared vision for change and the prioritization to invest in that change, the lead trainers and facilitators have to fight a lack of corporate support which leads to a lack of time and funds for trainings, resulting in a lack of teaching experience: all of these factors reduce the likelihood of cascading beyond the first tier [44, 53, 81]. Letters of agreement combined with continued expert support and encouragement, through visits, phone calls or online communication, can limit barriers and maximize continued commitment from all parties involved [53].

TtT Conceptual Model: Putting It All Together

Several critical factors for proper understanding and optimal usage of TtT to maximize the benefits and minimize barriers are illustrated in the proposed conceptual model, shown in Figure 2. Programs that do not fit this model are not necessarily excluded from TtT, rather they are simply not optimized for maximum impact. First, contrary to many previous illustrations of TtT methods, this conceptual model has a horizontal, rather than a top-down progression. This orientation purposefully demonstrates that each tier of training is equal and, ideally, that the content and expertise shared in the second and third tiers is equal to that passed on from the “expert,” who is usually a researcher, primary investigator or program developer. Second, TtT models must have multiple tiers, or cascades, of training to qualify as TtT: merely training individuals to implement a program is not sufficient. Such programs might still be highly effective; however, they do not meet the criteria for specific, optimal TtT implementation proposed by this model. At the heart of this concept of TtT is the notion of exponentially

expanding the reach of an expert. If the content and expertise delivered are dramatically diminished with each level removed from the expert trainer, program diffusion and the potential for broad reach remain ineffective. Along with the equality of content and expertise is the need for equal buy-in and motivation at all levels of the cascade for successful program diffusion. A shared vision for change must be consistent at all levels, with priority given to training from stakeholders, experts, managers, trainers, staff and the target population [44]. The most effective way to ensure such equality and consistency of content and teaching is through rigorous process evaluation, monitoring, collaboration and follow-up at all levels of training [54].

First Tier: Purposive Selection of Trainers and Pedagogy

Effective trainers are vital for successful program implementation: as such, selection criteria and purposive targeting of appropriate lead trainers, who are already subject experts, experienced communicators, and trained on the materials is warranted [45, 82]. These lead trainers must be confident and able to teach both content and effective teaching, motivation, and presentation skills to others [47]. Such confidence and baseline expertise will allow the focus of this first tier training to remain on instructional techniques, program specifics and evaluation guidelines, rather than mere content mastery.

Second Tier: Expanding Expert Reach by Harnessing Community

Just as purposive targeting of appropriate lead trainers is necessary, particularly regarding buy-in and motivation, selection criteria for facilitators are also necessary. Of particular concern is the relatability of the facilitators, as they will be directly interacting with the target population. As such, the second tier training provides an opportune

avenue to involve CHWs, LHAs, and promotoras, as previously mentioned. When incorporated into a TtT cascade, and trained by lead trainers as facilitators to implement a program or intervention in their target community, CHWs, LHAs and promotoras can effectively improve the social capital in the community and, thus, the likelihood of mutually-beneficial program sustainability in the long-term [14, 18, 19].

Third Tier: Reaching the Target Population

The third tier of the cascade involves the transfer of basic program components, including content, knowledge and skills, through the provision of resources and practical experience, from the facilitators to the trainees, or target population. In other words, the third tier of TtT is the implementation of the program or intervention in the community. The trainees will not be responsible for evaluating or teaching the program to others but rather implementing the program themselves. Fidelity to the program and auditing to ensure fidelity is critical at this level. Outcome evaluation at this trainee level allows for determination of the overall impact and reach of the intervention. The potential reach at this tier becomes more and more exponential, depending on the motivation, support and commitment from the facilitators. Some programs and interventions have reported populations upwards of 50,000 individuals, or trainees, reached by facilitators [64]. If the quality of the TtT cascade has been ensured throughout, with rigorous process evaluation and continued support from experts, the quality of information received by the target population will be equivalent to that provided by the experts, resulting in successful, exponential program diffusion. When optimally implemented, following the provided conceptual framework and its constituent components, especially a shared vision and

consistency at all tiers, TtT programs have the potential to maximize all elements of Glasgow's RE-AIM standards, particularly reach, adoption and maintenance [5].

Future Directions

Regarding maintaining program integrity throughout the cascading training tiers, a conflict exists between maintaining fidelity to the program and consistency of the trainings and the appeal of a more flexible, customizable approach for each community. Customized messages for trainers and participants may make the lessons and program components more memorable and, thus, more salient and sustainable in the long term. Likewise, messages that are tailored to the target population's customs will be more relevant and relatable, particularly when administered via CHWs, LHAs or promotoras in the third tier. If the training components are customized to each group of trainers or trainees, standardized evaluation becomes difficult; however, a modular approach which allows for customization while ensuring fidelity to core program factors might be an appropriate option. Process evaluation, monitoring, and checklists will ensure adherence to critical components and can measure the population response to the customization.

The introduction of technology into the TtT cascade, particularly the use of teleconferencing and live online communication, has the potential to further expand the reach of TtT programs while reducing training costs. For example, experts could conduct workshops and follow-up communications with aforementioned programs in remote villages without the need for travel. This could also make program monitoring and continued expert follow-up easier; thus, increasing the likelihood of continued cascading and program maintenance. Hamdallah et al. utilized proactive hour-long teleconferences to reinforce the curriculum, transfer knowledge and lessons learned from trainers, and

strategize for difficult group dynamics [83]. While this interactive use of technology has great potential to enhance TtT effects, simply using technology as an alternative to in-person interactions is not likely to be effective. Dubois et al. illustrated a drop-off associated with distance learning wherein three times the number of trainers discontinued the program compared to their onsite counterparts [84]. The use of online streaming and provision of online resources may enhance in-person trainings, follow-ups, and workshops; however, without personal connection and accountability, simple streaming is not likely to result in full program cascading, buy-in from all tiers, or long-term program sustainability.

Conclusions

In addition to expanding the potential of TtT methods with the use of technology, future efforts are needed to study and evaluate the overall effectiveness and full potential of TtT program translation, implementation, and dissemination utilizing the provided conceptual framework. With this consensus on TtT usage, future studies should examine the following factors: comprehensive evaluation of overall program impact at level four of Kirkpatrick's model; tier-based analysis of diminishing returns; cost-effectiveness analysis; the potential for, and effects of, varying tiers of cascades; and comparison of TtT methods with traditional program dissemination. Regardless of future study results, the necessary first step is the provision of this conceptual model, allowing for consensus on TtT use and illustrating the critical factors for compliance. By maximizing the benefits and minimizing challenges associated with the creation of a cadre of trainers who are poised to exponentially expand the reach of interventions through TtT, program

delivery has the potential to be not only more efficient but ultimately more impactful, creating true population level change on a broad public health scale.

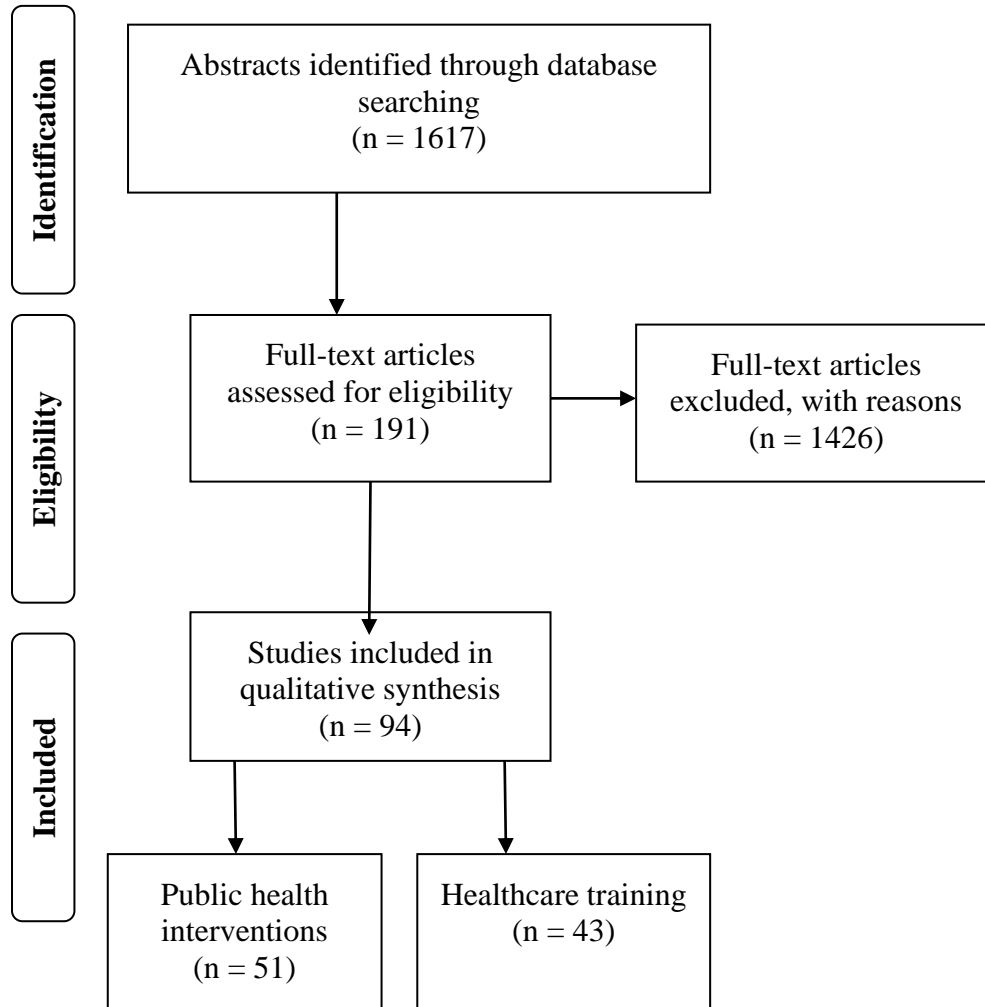


Figure 5.1. Diagram detailing the review process which informed the TtT conceptual model

TRAIN THE TRAINER

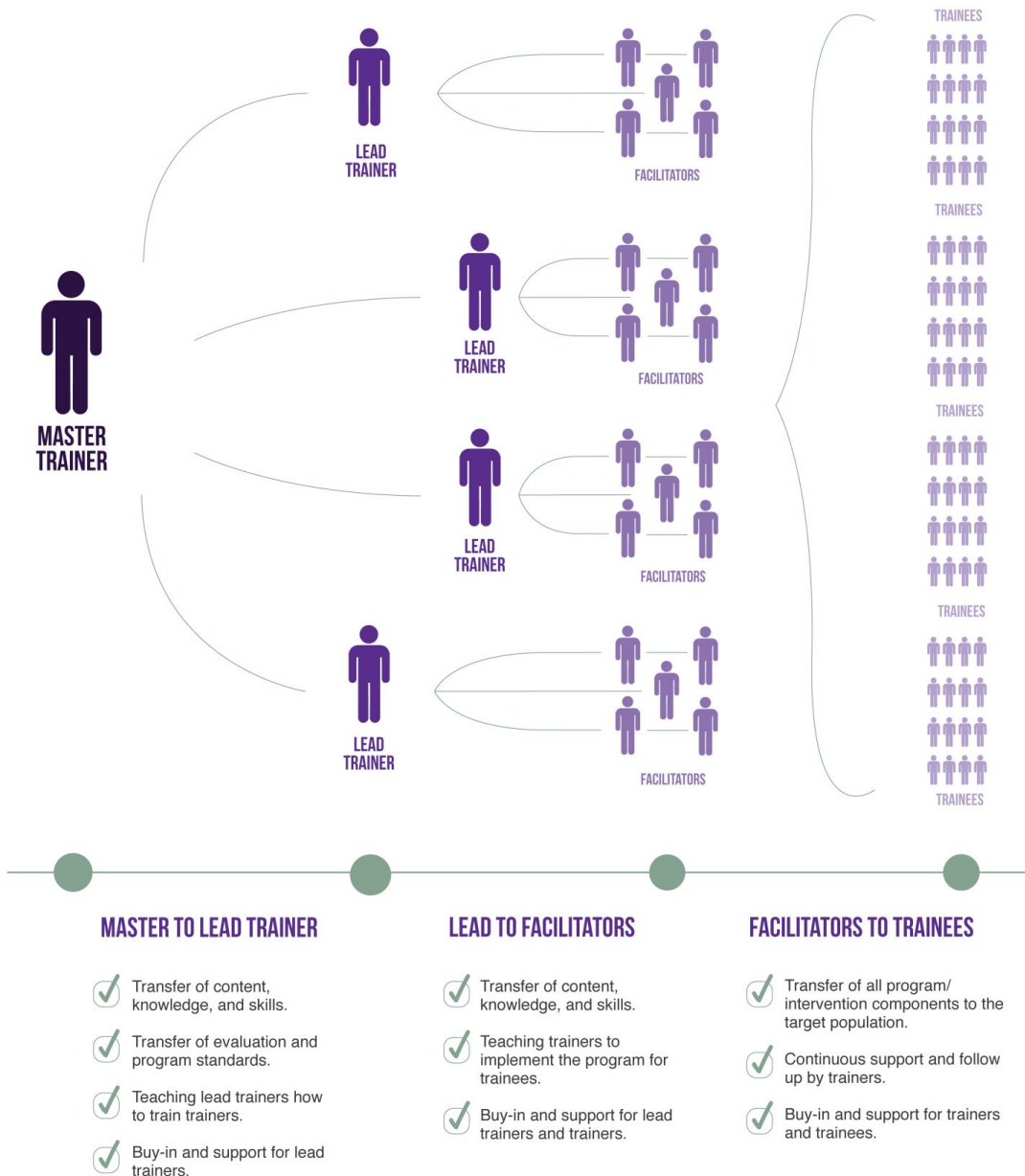


Figure 5.2. Conceptual model for train-the-trainer methods of program translation, dissemination, and implementation

CHAPTER 6

OVERALL SUMMARY AND CONCLUSIONS

Nationally, children's diets are calorically dense, yet lacking in nutrients, which has been clearly defined as a public health concern of great importance. Such dietary patterns have been linked to adverse health outcomes and overweight and obesity in youth, persisting into adulthood. The larger socioeconomic environment, which is conducive to less healthy choices and opportunities, must be factored into youth health. Although this host of individual and environmental factors influence childhood obesity, diet and factors influencing diet play a fundamental role and can, in turn, have a lasting influence on overall health, longevity, and quality of life. This dissertation contributed new information to the body of knowledge regarding youth dietary behaviors to inform future best practices in youth nutrition programming, with an overarching goal that more children will have the opportunity to meet national dietary recommendations and, thus, a greater likelihood of positive health outcomes.

Overall, this dissertation took a three-part approach to understanding the current evidence of need, effectiveness, and demand related to youth dietary behaviors and programs. By investigating the food items regularly consumed by American youth in the first study, the effectiveness of one widely-disseminated nutrition curriculum on improving intrapersonal dietary outcomes in youth in the second study, and best-practices in employing TtT methods of program translation, dissemination, and implementation,

which could be applied to nutrition programs in youth, in the third study, this dissertation has strengthened the evidence-base related to critical dietary factors impacting children in the United States today.

Specifically, the purpose of this dissertation was to:

- 1) examine current and past youth dietary intake by comparing the most common foods consumed by children and adolescents (ages 2-18 years) at each daily eating occasion (breakfast, lunch, dinner, snacks), evaluated as a whole and by age groups, in 1971-1974 and 2009-2010.
- 2) evaluate the effectiveness of the *FFAS* curriculum on changes in dietary knowledge, dietary self-efficacy and snack preferences of children attending ASPs.
- 3) utilize an iterative literature review to examine best-practices of TtT program delivery in public health and healthcare to develop a conceptual model and theoretical framework for TtT methodologies to be used in research and practice.

Each of these studies was a unique investigation contributing to our current understanding of the foods consumed by children, the effectiveness of one nutrition curriculum to influence the foods consumed by children, and the potential for broad public health impacts when utilizing TtT methods of program delivery, including those aimed to improve the foods consumed by children. The studies discussed here provide insight into the current state of youth dietary behaviors and how to bridge the gaps between research and practice to improve those dietary behaviors on a population level;

thereby, potentially creating lasting, far-reaching public health impacts and enabling more American youth to meet the dietary guidelines.

The primary results of each of these studies include:

1. Frequency rankings indicated overall similar food group and item consumption between surveys, except for higher intakes of macaroni and cheese and pizza at lunch, and candies, crackers and salty grains as snacks in 2009, and higher intakes of beef in 1977. Significant differences ($p < 0.01$) were found between the intakes of calories and macronutrients at each eating occasion between NFCS77 and NHANES09, with results including fewer calories and carbohydrates consumed at dinner, less protein and fat consumed at most eating occasions, and more carbohydrates consumed in snacks and some lunches in 2009 compared to 1977.
2. Significant improvements in food knowledge were found for intervention students compared to controls. No significant effects were seen for self-efficacy to consume FV. During snack 1, when only served a choice of FV, over 93% of all children selected a FV at pre and post-test, compared to less than 10% of children selecting a FV at pre and post-test during snack 2 when less-healthy alternatives were also served. The intervention had a significant effect on 100% FV consumption and FV waste for snack 2 among the small percentage of children who selected FV. Delivery costs of \$1,000 and 75 hours, including ASP delivery time, were required to implement the curriculum to an average-sized (100 students) program over 7 weeks.
3. Critical considerations presented in our proposed conceptual model of TtT included the number of tiers, or training cohorts, with multiple tiers required for a

full TtT approach, purposive selection of trainers, training on pedagogical techniques and program content, expansion of the reach of experts, the dampening of the effect with the addition of tiers, and the evaluation of implementation and costs throughout all tiers from stakeholders to expert instructors, facilitators, and eventually to the target population.

These results strengthen the evidence-base for research into youth dietary programming by addressing inconsistencies in current research regarding the following: what we currently know about child nutrition and how it's changed over the last 40 years, the effectiveness of one potentially helpful dietary curriculum in ASPs, and the use of TtT methods of program translation, dissemination, and implementation. The novelty of these studies include the fact that each study was the first to investigate its desired outcomes: the first to present specific food items on a child's plate at various eating occasions, the first to evaluate the effectiveness of the widely-disseminated *FFAS* curriculum at improving youth dietary outcomes, and the first to create a conceptual model for TtT methods of program delivery to be used in multidisciplinary research and practice.

This dissertation brought together various facets of the baseline knowledge necessary to determine targets for youth dietary program improvement. Paper 1 reinforced the, perhaps unexpected, fact that food item consumption today is not vastly different from items consumed 40 years ago. Youth in 2009, however, have swapped fat, in the form of beef, for refined carbohydrates and added sugars, in the form of pizza, macaroni and cheese, pancakes, waffles and French toast, and candies, crackers and salty snacks in their overall daily diet. Paper 2 provided evidence that the *FFAS* nutrition

curriculum can lead to small improvements in children's food knowledge and FV consumption, but not self-efficacy to consume FV or healthy snacking preferences in the ASP setting. The small significant improvements in food knowledge, FV consumption, and waste reduction for youth in intervention ASPs suggest curricula combined with structural controls on the foods offered for snack could enhance youth dietary knowledge and habits in the ASP setting. Paper 3 utilized an iterative literature review to create the first conceptual model for TtT methods of program translation, dissemination, and implementation with a goal to create consistency in research and practice and create a cadre of trainers, poised to expand the reach of evidence-based interventions.

In terms of future directions, from paper 1, efforts to meet dietary guidelines and increase fruit and vegetable consumption in youth should emphasize increasing the quantity of these foods when consumed rather than simply the frequency at which they are consumed. From paper 2, more research is needed to determine the specific *FFAS* curriculum components that were responsible for significant effects and that should be emphasized in future implementation. With the consensus on usage of the TtT conceptual model, provided in paper 3, future studies should examine a comprehensive evaluation of overall program impacts at all levels of intervention, a tier-based analysis of diminishing returns with training, a cost-effectiveness analysis, the potential for, and effects of, varying tiers of cascades, incorporation of technology into TtT, and comparison of TtT methods with traditional program dissemination.

In conclusion, these three papers show that youth dietary behaviors on a population level still need improvement but can be positively impacted through precise administration of evidenced-based nutrition curricula, policies emphasizing supportive

environments for healthy dietary choices (i.e., do not serve less-healthy alternatives), and harnessing community capacity and training to exponentially expand the reach of experts through consistent TtT methods of program delivery. Research and public health efforts can benefit by targeting the less-healthy food items commonly consumed by youth at each eating occasion, implementing effective nutrition curricula in a variety of settings to enhance socioeconomic impacts, and utilizing our proposed TtT conceptual model to create consistency in the use and evaluation of TtT methods of program delivery. Dietary behaviors in youth are multifaceted, with long-lasting and far-reaching health effects in childhood and beyond. This dissertation is one step in acknowledging the nuances of these behaviors and how research and practice might bridge the gaps to increase the likelihood of children meeting dietary guidelines and potentially improve lifelong health outcomes.

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