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The Graduate School
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HEALTHY WHOLE WHEAT ELEMENTARY EDUCATION PROJECT

A Thesis in

Nutrition

by

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ABSTRACT

Increasing whole grain intake is associated with various health benefits. Numerous governmental and non-governmental organizations have collectively recommended an increased daily intake of whole-grains. In spite of these recommendations, however, recent dietary intake data show that children and adolescents consume only 0.8 to 1.0 mean servings of whole grains on a daily basis, which represent less than the recommended intakes. With over 30 million children participating in the National School Lunch Program (NSLP), schools provide an excellent venue for carrying out nutrition education interventions. Previous whole grain school interventions based on the Social Cognitive Theory comprised of intensive curriculum designs that required an increased implementation time and assistance from external professionals. These studies were successful in increasing the whole grain intake among school children. Hence, there was a need to develop a streamlined educational and promotional whole wheat campaign which would be more likely to be adapted in schools. The objective of the Healthy Whole Wheat project was to determine the relative effectiveness of two interventions of varying intensity, involving classroom education and cafeteria promotion of whole wheat products, in increasing 4th and 5th grade student's selections of whole wheat products in the school cafeteria. A total of two hundred and three (n=203) students from two elementary schools of the same school district participated in the study. One of the elementary schools served as the intervention site, while the other elementary school served as the control group. At the intervention site, classroom teachers volunteered

their classrooms to be in either the whole wheat classroom education group (n=67) or the cafeteria promotion group (n=67). The classroom education component included in-class education on whole wheat and in-class taste tests of lunch items. The cafeteria promotions consisted of whole wheat poster displays in the cafeteria. During the course of the study, the school food service personnel substituted whole wheat products in the school lunch menu. The students in the control school (n=69) were not given whole wheat classroom education nor were they exposed to cafeteria promotions but were offered the same whole wheat choice in the cafeteria. The cafeteria data, consisting of the number of whole wheat items selected by students, was collected by trained school food service personnel. In the present study, we observed that students, who received classroom education, increased their whole wheat item selections in the cafeteria from as low as 5% at baseline to a statistically significant 82% during intervention, as compared to students in the cafeteria promotions group and the control group. The students in the cafeteria promotions groups increased their whole wheat item selections in the cafeteria but did not reach statistical significance as compared to the control group. Our study showed that a school-based intervention of minimum intensity successfully increased the intake of whole-grain foods by children. However, further studies aimed at the implementation of a randomized intervention on a broader scale are recommended. In addition, the development of innovative whole wheat promotional strategies needs further investigation.

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Chapter 1

INTRODUCTION

1.1 Background

Obesity is a widespread public health concern that affects adults and children alike. However, increasing rates of childhood obesity and associated health risks are particularly alarming. Considerable scientific evidence suggests that obesity-related health problems, such as early signs of heart disease, high blood pressure and Type 2 diabetes, once thought to apply only to adults, are now being diagnosed in children.

¹Over the past three decades, the percentage of overweight children has nearly tripled, reaching 18.8% and 17.4% for children 6-11 years and 12-19 year olds respectively.

²Two of the major contributing factors to this problem are the children's poor diet and exercise habits.³

The Dietary Guidelines for Americans have not only provided recommendations for the general public but also serve as the basis for federal food and nutrition education programs, including the National School Lunch Program (NSLP). Since the passage of the School Meals Initiative (SMI) in 1995, schools have been required to meet nutrient standards based on the 2005 Dietary Guidelines. However, evidence has suggested that children do not meet these dietary guidelines and schools continue to face difficulties in meeting the SMI standards. As per the School Nutrition Dietary Assessment III study,

less than one-third of schools offered and served lunches that met the standards for total fat or saturated fat, few schools (6-7%) offered and served lunches that met all of the SMI standards, and only 5% of the schools included whole grains or dried beans on their lunch menus.⁴

Ample scientific evidence suggests that whole grains reduce the risk for obesity, type 2 diabetes, heart disease, all-cause mortality and certain cancers.⁵⁻¹⁰ Current recommendations in the Nutrition and Your Health: Dietary Guidelines for Americans have suggested consumption of three servings of whole grains per day (U.S. Department of Health and Human Services and U.S. Department of Agriculture 2005). Additionally, consuming more whole grains is recommended by the American Cancer Society¹¹, Healthy People 2010 (U.S. Department of Health and Human Services 2000), and the American Heart Association.¹² Despite these recommendations, recent data from the National Health and Nutrition Examination Survey (NHANES) showed that children aged 6-19 years of age consumed an average of only 0.8-1.1 servings of whole grains per day.¹³ Clearly, few children in the United States are meeting these recommendations.

Ninety-five percent of American youth aged 5 to 17 years are enrolled in schools and spend 6 to 8 hours each day for most of the year within a school environment. Daily, over 30 million children participate in NSLP and the after-school snack program (FNS/USDA. 2006). School meals represent a strategic point of whole grain interventions for children, because the majority of schools in the US participate in the National School Lunch Program. Hence, schools could be considered as ideal venues for intervention purposes in an effort to combat obesity. Also, in order to support the

implementation of the 2005 Dietary Guidelines concerning whole grain consumption among students, assistance needs to be provided to the school food service professionals and teachers. The Center for Disease Control (CDC) has suggested an integration of school food service and nutrition education by coordinating the cafeteria experience with lessons taught in the classroom (United States Department of Health and Human Services, Public Health Service, CDC, 1996). Along similar lines, the United States Department of Agriculture's (USDA) Team Nutrition effort emphasizes the link between classroom education and the cafeteria. These recommendations collectively point toward educating students to make healthy food choices which would include whole grains. Hence, promoting the consumption of whole grain foods through nutrition education in schools could serve as an important step to support these efforts.

Many school-based nutrition intervention studies have shown an increased intake of fruits and vegetables among children.^{14, 15} Some of the most recently published successful programs have included nutrition education lessons in other subjects (e.g. maths and language).^{16, 17} A wide array of teaching methods have been used according to the learning objectives: from classroom discussions, worksheets and keeping food records to shopping exercises, tasting, creative aspects, and drama.^{18, 19} Previous literature reviews on theory-driven school nutrition education interventions have identified strategies directly relevant to a behavioral focus as being among some of the elements conducive to successful programs.²⁰ School-based interventions have used the Social Cognitive Theory (SCT) constructs to change and influence children's dietary intakes with the introduction of healthful foods.^{21, 22} In terms of increasing whole grain intake

among elementary age children, an excellent example of a successful educational intervention is ‘The Power of 3: Get Healthy with Whole Grain Foods’, which consisted of educational lessons on whole grains inclusive of education on whole wheat.²³ The research program was developed and pilot tested by researchers from the University of Minnesota.

1.2 Statement of Problem

Dietary guidelines from various government and health organizations have recommended and increased intake of whole wheat servings.^{7, 9, 24} Knowing that few children in the United States are meeting these recommendations suggests that nutrition education in schools seems to be an important place to start tackling this issue. Currently, curricula addressing the importance of whole grains are limited. The strongest evidence-based curriculum, the ‘Power of 3: Get Healthy with Whole Grain Foods’, showed significant improvements in increasing consumption of whole grains by elementary age school children. However, this curriculum may be too intensive and time consuming to be practical. Additionally, the study was conducted with the help of externally-trained personnel, so it may not be generalizable to non-research classroom teachers who would be implementing the extensive program.²⁵

Hence, a streamlined promotional whole wheat campaign may be more likely to actually be adopted in schools. However, no such program exists at this time.

1.3 Project Background and Specific Objective

When baseline interviews regarding local wellness policy implementation were conducted at a rural school district of northcentral Pennsylvania, the nutrition education goals were identified as not being fully implemented. A need to conduct nutrition education lessons in order to increase student choice of whole wheat items in the cafeteria was brought up by the school food service director. Because concise evidence-based lessons on whole wheat were not available, it was decided to develop and test two whole wheat interventions at a different dose or intensity and determine the relative ability of these interventions to increase the student cafeteria selection of whole wheat products.

The *Healthy Whole Wheat* educational curriculum was developed for this thesis with assistance from team members at The Pennsylvania State University and was specifically designed to link cafeteria and the classroom. The curriculum consisted of a set of short classroom educational promotional lessons on whole wheat, to be compared with identical materials consisting of posters to be displayed in the cafeteria. The objective of the Healthy Whole Wheat project was to determine the relative effectiveness of two interventions of varying intensity, involving education about and promotion of whole wheat products for increasing 4th and 5th grade student's selections of whole wheat products in the school cafeteria.

Two elementary schools from a single school district participated in the study. One of the elementary schools served as the intervention site while the other elementary school served as the control group. The goal of the study was to test if

students who received whole wheat education in the classroom setting increased their whole wheat choices in the cafeteria during the follow-up phase as compared to the control group. The second goal was to test if the students in the cafeteria promotions group increased their whole wheat choices in the cafeteria during the follow-up phase as compared to the control group. The third goal was to test the relative rate of change in the classroom education group compared to the cafeteria promotions group.

Chapter 2 will provide a review of literature which will begin with an overview on childhood obesity, health promotion in school settings, and the social cognitive theory as a basis for school nutrition education. The literature review will further focus on the school nutrition environment and grain-based interventions, the importance of whole grain consumption for health, barriers to whole grain consumption, whole grain policy regulations and current dietary recommendations. Chapter 3 will cover the methodology which will provide a description of the program's development and describe the study protocol. Chapter 4 will provide the results of the study. Chapter 5 will provide an overall summary discussion, including limitations of the study, implications and conclusions.

Chapter 2

LITERATURE REVIEW

2.1 Whole Grains

2.1.1 Whole Grain Guidelines

The whole grains component of the *Dietary Guidelines* has evolved over the past two decades. The 1990 guideline statement, “Choose a Diet with Plenty of Vegetables, Fruits, and Grain Products,” shifted the emphasis from consumption of food components, such as starch, and fiber to specific categories of foods that contained components such as fruits, vegetables and grain products.²⁶ The 1990 *Dietary Guidelines* recommended that most consumers include 6–11 grain servings daily, depending on daily calorie intakes. However, they did stop short of quantifying a recommended number of servings of whole grains, recommending only that consumers include “several” servings daily. The 1995 *Dietary Guidelines* then highlighted scientific evidence linking components in grains, fruits and vegetables, fiber and complex carbohydrates, to reduced risk of heart disease and some cancers. The 1995 guideline statement was reworded to “Choose a Diet with Plenty of Grain Products, Vegetables, and Fruits” to reflect the importance of grain products at the base of the Pyramid and their role as the largest source of energy in the

diet.^{27, 28} With the objective to create separate guidelines for grains and vegetables, the 2000 Dietary Guidelines Advisory Committee cited: “. . . it increases

attention to grains as distinct from vegetables and fruits, it simplifies the message, and it helps make clear that there are distinct advantages of the two broad categories of plant foods”.²⁹ The Committee incorporated a phrase about whole grains into the guideline statement reflecting the fact that “the health benefits of grains are now more correctly linked with the consumption of plenty of whole grains,” but did not specify the exact number of servings that should be consumed²⁹. As per the 2005 Dietary Guidelines for Americans, a daily intake of whole grain foods should consist of three or more one-ounce equivalents for adults or at least half of the grain sources should be from whole grains for people of all age groups (My Pyramid, 2005). In 2006, the Food and Drug Administration (FDA) published a draft guidance on “Whole Grain Label Statements”, which included a definition of whole grains and corresponding foods. However, currently there are no mandatory regulations for schools on offering whole grain foods to students.

2.1.2 Whole Grain Dietary Intakes and Recommendations

Despite the existing policy and regulatory guidelines as well as mounting scientific evidence supporting whole grain health benefits, various dietary surveys have indicated that most children and adults do not meet the recommended dietary guidelines of consuming three servings of whole grains a day. To determine the frequency of whole grain food consumption by American children aged 2 years or older, Albertson and Tobelmann ³⁰ (1995) examined the data from the Market Research Corporation of America. The results indicated that one-fifth of all the participants did not consume any whole grain foods during the reported eating occasions. Albertson and Tobelmann

(1995), therefore, recommended the importance of consumer education related to whole grain foods identification, health benefits and recommended dietary intakes. Data from the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) show that the average whole grain intake by children 6-11 years of age was 0.9 servings per day and for adolescents was one serving per day. According to this data, on average children and adolescents consume 1.27 servings of refined wheat bread each day. Switching entirely to whole-wheat bread would increase their daily whole-grain servings to 2.17.³¹ Although the serving size would be under the recommended intakes, it may still prove to be a considerable improvement. The data also indicated that ready-to-eat cereals (30.9%), corn and other chips (21.7%) and yeast breads (18.1%) were the major food sources approximating to a total of 71% of whole grain intake. Only 15% of children and adolescents consumed a mean of two or more servings of whole grains per day.³¹ The data also showed that two-thirds of the total grain servings were from 'home', while less than 15% were 'away from home'.^{10, 32} Likewise, intake of whole grains by American children and adolescents was very low, with 9% of those two to nineteen years of age consuming less than the recommended whole grains per day.³² The data clearly indicated that children's whole grain consumption was less than that of the recommended intakes. Considering these facts and, as stated previously that children spend more time in schools than at home, the availability of whole grain foods in school settings poses an increased importance.

2.1.3 Whole Grain Health Benefits

The 2000 *U.S. Dietary Guidelines for Americans* recommends to “choose a variety of grains, especially whole grains”. Recommendations from other U.S policy statements (USDHHS/USDA, 2005) and regulatory guidelines (USFDA/CFSAN, 1999) have suggested that higher intakes of whole grain foods reduce the risks for coronary heart disease (CHD), type 2 diabetes, overweight and obesity, and certain cancers. The following literature review will provide an overview of associations between whole grain intakes and reduced risks of chronic conditions.

2.1.3.1 Whole Grains and Coronary Heart Disease (CHD)

Considerable epidemiological and clinical evidence suggests a link between whole grain consumption and a reduced risk for coronary heart disease.³³ In an early study in 1977, Morris et al. followed forty five of 337 healthy middle aged men for 10-20 years and concluded that higher intakes of whole grain fibers were attributable to a reduction in heart disease. Anderson et. Al 2000 carried out a meta-analysis of 12 population-based cohort studies, which indicated that individuals with the highest intake of whole grains have an adjusted risk of CHD for 0.74 (9% CI 0.64, 0.84) compared with individuals with the lowest whole grain intakes. The study indicated that regular intake of whole grain foods was associated with a 26 percent reduction in risk for CHD. In another study, Health Professional Follow-up study, Rimm et a (1996) found significant inverse associations between dietary fiber and myocardial infarctions.

2.1.3.2 Whole Grains and Diabetes

Whole grain foods exhibit a rich glycaemic-index and hence consumption of these foods are thought to promote insulin resistance, obesity and type 2 diabetes.³⁴ As the whole grains are slower to digest, they are known to affect glucose and insulin responses.³⁵ Intact whole grains such as wheat, buckwheat, barley, rice and oats have a glycemic index (GI) ranging from 36-81, which may aid in maintaining blood glucose levels. People consuming whole grain breads are likely to exhibit lower blood sugar or, rather, a smaller rise in blood glucose after eating than those who consume white bread.³⁶ Collectively, some epidemiology studies³⁷⁻⁴¹ have shown about a 20 to 30 percent reduction in the risk for type 2 diabetes. The *Nurses Health Study*^{42, 43} examined the relationship between dietary GI, low fiber intake and risks for type 2 diabetes among 65173 women aged 40-65 years, followed for 6 years, from a cohort. Nine hundred and fifteen cases of type 2 diabetes were reported during the follow-up period. The results indicated that diets with a high glycemic load and low cereal fiber content were positively associated with the risk for type 2 diabetes. The combination of high glycemic load and low cereal fiber intake increased the risk for type 2 diabetes [RR 2.5 (95% CI 1.14, 5.51)] compared to the low glycemic load and high cereal fiber. The *Health Professional's Follow-up Study*³⁷ examined 42898 men for 12 years. At baseline, the men were free from cardiovascular disease. During the follow-up, 1197 cases of type 2 diabetes were documented. Adjusting for age, physical activity, energy intake, alcohol consumption, smoking, fruit and vegetable intake, BMI and any family history of diabetes, the RR was

0.70 (95% CI 0.57, 0.85) comparing the men with highest quintile of whole grain intake with the lowest.

2.1.3.3 Whole Grains and Cancer

Substantial scientific evidence suggests that whole grain intake reduces the risk of cancer. On consumption, whole grains mediate a glucose response known for being protective against colon and breast cancer⁴³. Whole grains also contain different antioxidants and phyto-estrogens which are suggested to be important in cancer preventions.⁴³ It is also known that, whole grains are important sources of insoluble fibers, which are important for increased bowel movement transit times, in order to facilitate fecal weight and, in the process, reduce the risk of bowel cancer.⁴⁴ The *Iowa Women's Health Study* reported a reduction in cancer risks for all cancers among the participants who had a high level of whole grain intake. The multivariate ratio was 0.86 (95% CI 0.76, 0.97) for the comparison of extreme intake of quintiles.⁴⁵ Similar findings from a *Norwegian County Study*³³ of whole grain food consumers reported a multivariate ratio of 0.79 (95% CI 0.62, 1.02). Also, whole grain consumption has been inversely associated with upper digestive cancers. Levi et al. (2000) reported the protective effects of whole grains on reduced risks of cancer of the pharynx, oral cavities, larynx and oesophagus.

2.1.3.4 Whole Grains and Obesity

Childhood obesity has steadily grown as a serious concern in the United States. Data from National Health and Nutrition Examination Survey (NHANES) shows that the percentage of overweight youth has nearly tripled over the past three decades, both among children and adolescents.² Sixteen percent of school-aged children and adolescents are overweight.⁴⁶ The causes of childhood obesity are likely to be complex and multi-faceted in nature. Children and adolescents are seemingly finding it difficult to maintain and achieve healthy body weight due to their sedentary lifestyles and easy access to low-nutrient, energy-dense food choices.⁴⁷ A lifestyle characterized by lack of physical activity and excessive inactivity, particularly television viewing, might also help cause obesity in children.⁴⁸ Children's diets tend to be low in fruits, vegetables, fiber and calcium-rich foods and higher than recommended in total fat, saturated fat, trans fat, salt and added sugars.¹² Various other environmental factors as well as genetic predispositions are known to contribute towards obesity. While dietary guidance from various US government and health organizations recommend a regular intake of 3 servings of whole-grain foods per day^{49, 50}, at present few children⁵¹ are meeting these recommendations. According to the 1994-1996 data from the Continuing Survey of Food Intakes by Individuals (CSFII), whole-grain intake among children and adults was approximately one serving per day, or about one-third of the recommended amount¹⁰

Several studies have examined the relationship between whole grain intake and obesity. Holt and Miller (1994) studied ten healthy participants who received equivalent carbohydrate proportions in four test meals of matching nutritional

composition, based on whole grains, cracked grains, or coarse or fine whole wheat flour. The plasma insulin response for the whole grain test meal was lower when compared to the refined or fine-flour test meal. The satiety responses, however, showed reverse readings, with the fine-flour test meal showing the lowest satiety response (area under curve 231.4; SE. 31.6) compared with the whole grain test meal which gave the highest satiety response (area under curve 318.4; SE. 29.4). In the *Nurses Health Study*, Liu et al. (2003) showed an association between the consumption of high fiber whole grain foods and a reduced risk of weight gain in women. Over the twelve year period of follow-up, the results indicated that women who consumed a higher amount of whole grain foods weighed less compared to women who consumed less of whole grain foods. In the *Health Professional's Follow-Up Study*, Koh-Banerjee et al. (2004) examined the association between whole grains intake and weight gain in men. The study results indicated that increased consumption of whole grain was associated with greater protection from long term weight gain in a dose response environment.

Increasing consumption of whole grains is theoretically, one of the best possible ways to influence BMI or obesity by reducing the energy density of the diet¹¹². However, additional epidemiological and clinical studies need to examine the relationship between whole grain intake and obesity.

2.1.4 Barriers to Whole Grain Consumption

Various attributes of whole grains may influence intake among school-aged children. Food preference information can be useful for research scientists in

conducting school-based interventions, and it may help school food service personnel in planning lunch menus. Researchers at the University of Minnesota conducted focus groups with children which indicated that familiarity, appearance and taste were important factors that influenced their acceptability of new foods such as whole grain foods.⁵² In another study, parents and peer influences were key factors that influenced whole grain food choices among adolescent children.⁵³ Urbick (2002) indicated that children tend to prefer familiar foods, hence, new foods that combine “familiar and unfamiliar elements within the same product” may result in greater acceptance by children over time.⁵⁴ A study conducted among Swedish school children aged 11-15 years of ages reported descriptions of the usual breakfasts and ideas to provide a tasty and healthy breakfast.⁵⁵ Only 32% of the bread items were high-fiber and offered on whole wheat or rye bread, while the remaining 68% were refined products. Also, most of the bread products, particularly the yeast breads, were made from red wheat which gives the bread a darker color and a strong bitter flavor compared to the refined breads. Research to examine effective ways to increase children’s whole grain intake through school meals has been limited.

As per previous literature review, some of the most common barriers to whole grain foods consumption are perceptions of taste, texture, appearance, cost and convenience.^{32, 56, 57} The 1999 *Earth Grains Research Survey* from grocery shoppers indicated that children dislike the taste and texture of whole grain foods, especially whole grain breads. One potential barrier contributing to lower whole grain consumption among children is the lack knowledge on whole grain health benefits and also the disability to identify whole grain products at the point of purchase.⁵⁸ A lower availability of whole

grain foods in schools was also thought to be one of the barriers.³² Based on the Institute of Medicine (IOM) report, school children tend not to eat whole grain foods because of their limited availability in schools, and also due to issues related to taste and texture (Food and Nutrition Board, 2007). Considering a school setting and financial implications, the cost of whole grain breads and pasta is comparatively higher than that for whole grain cereals and crackers.⁵⁹ According to the Whole Grains Council (2006), some potential barriers to a greater availability of whole grains in the school environment include the following: (1) less cooking from scratch is done in most of the schools today, (2) commodity foods more frequently consist of meat and dairy products, (3) the limited number of vendors who provide whole grain foods to schools, and (4) the lack of promotional campaigns related to whole grains.

Another barrier is the cost related to the purchase of whole grain foods by schools to be offered during school lunch. Over the past decade, the USDA has made several strides in improving the nutritional profile of USDA foods served through the National School Lunch Program. The USDA foods involve purchase and distribution via multiple agencies within the USDA. Currently, the USDA purchases commodity foods for all states and territories (except Kansas, which receives all entitlements as cash transfers).⁶⁰ USDA foods include both raw and processed foods, which go directly to schools or school districts. They send these foods to be processed into forms that end up on a child's lunch tray during the lunch and breakfast period.⁶¹ Foods available through USDA have included fruits, vegetables, meats, cheeses, dry and canned beans, fruit juices, vegetable oils, peanut products, rice, pasta, flour and other grain products.⁶² However, for the school year 2007-2008 only 3% of the foods purchased by the states

included grains and peanuts. Other than the USDA, there are a number of transactions that occur between various state agencies that are responsible for distributing USDA foods and the local school districts that purchase foods from them. The school food services make decisions on how the foods should be processed, and based on these decisions the USDA foods end up in the school cafeteria. The state level agencies work with the local school districts by entering into purchasing agreements with the processors. Unfortunately, during this process, the focus remains to retain the dollar value of the end product rather than to address the nutritional quality of the food products being served in the cafeteria. The few advantages for children consuming lunch via the school food service are that the benefits of processing USDA foods include greater appeal to children, improved food safety, while providing convenience, and reduced labor hours for processing. However, in this process, they also may decrease the nutritional quality of USDA Foods by adding fat, sodium, and sugars. Unfortunately, currently no agency at the state level or the school district level is responsible for regulating the nutritional content of processed USDA Foods.

Due to the limited availability of school funds and tight budgets, schools rely on USDA commodity foods as an important resource for running their school lunch program. Considering the limited funding, the provision of USDA foods frees up some revenue that schools would otherwise need to use to purchase commercial food products directly from the market and external vendors.

2.2 Health Promotion in School Settings

2.2.1 School Environment and Policy Initiatives

More than 95% of American youth are enrolled in schools⁶³ with fifty three million children and adolescents who spend approximately six hours/day in school on weekdays.⁶³ Also, in the US, the National School Lunch Program (NSLP) is the world's largest government-run feeding program, overseen by the USDA. This program provides 28 million children school lunch and 8 million children school breakfast on a daily basis (Food and Nutrition Service; USDA, 2006). The USDA recognized that schools meals establish "childhood eating patterns that influence lifelong eating habits" (Nestle, 2002). Since its inception, the mission of the program has been to improve the nutritional status of children. Through these meals and snacks, schools have presented an optimal setting in developing children's eating patterns by providing one third to one half of many students' daily nutritional needs.^{64, 65}

The Healthy School Nutrition Environments Initiative, introduced in 2001 by USDA as well as other governmental and non-governmental organizations, recommended that school districts develop and adopt nutrition policies addressing issues such as nutrition education, physical education and the sale of competitive foods in schools.^{64, 66} To address the problem of childhood obesity in the US, the federal government passed The Child Nutrition and WIC Reauthorization Act of 2004.⁶⁷ The law mandated that each Local Education Agency (LEA) that participates in the National School Lunch Program (NSLP) shall establish a local (school) wellness policy (LWP) no later than the

first day of the school year beginning after June 30, 2006, This provision requires that the local wellness policy include 5 components: (1) goals for nutrition education, physical activity, and other school-based activities to promote student wellness; (2) nutrition guidelines for all foods available on each school campus; (3) assurance that reimbursable school meals are not less restrictive than existing guidelines; (4) a plan for measuring implementation; and (5) involvement of school nutrition representatives, parents, students, administrators, and community members. The provision also entrusted the LEA's to develop their own policies based on their school's environment and needs. Currently, there is little information on how LEA's address this legislation.

2.2.2 School-based Nutrition Environment and Interventions

Unhealthy eating practices beginning in early life contribute to various chronic diseases, and young persons having unhealthy eating habits tend to maintain these habits as they age.⁶⁸ It thus seems efficacious to teach about healthy eating patterns to children when they are young, knowing that they spend maximum hours in the school environment. High-risk eating behaviors and physiological risk factors are difficult to change once they are established during youth.⁶⁸ Evaluations have suggested that school-based nutrition education can improve the eating behaviors of children and adolescents.⁶⁹⁻
⁷¹ School-based nutrition education has posed significant importance because children and adolescents frequently decide what to eat with little adult supervision.^{71, 72}

Previous school-based nutrition education interventions have been made, through social marketing techniques and recipe modification, to successfully modify the intake of

fruits and vegetables^{15,22}, fat, sodium⁷³, and low-fat milk⁷⁴ for children in school cafeteria settings. For example, Ellison et al. (1989) devised an environmental program targeting the foodservice departments of two boarding schools. The program demonstrated that changes in food purchasing and preparation practices markedly decreased sodium and modified the fat content of foods. Additionally, the use of these practices resulted in significant changes in the nutrient intake of students. Even without an educational component directed at students who maintained their usual dietary practices, changes by foodservice workers led to a 15% to 20% decrease in sodium intake and a 20% decrease in saturated fat intake. These modifications by school foodservice workers were well received by students, as the program provided them with palatable food options.

In another study relating to whole grains, a preliminary survey of school food service directors was conducted by researchers in the greater Minneapolis/St. Paul area.⁷⁵ Respondents included 114 school foodservice employees who participated in the Minnesota School Food Service Association (MSFSA) Nutrition Conference and Workshop during the winter and spring of 2003. The group included staff from elementary schools (46%), middle school and junior high schools (19%), and high schools (26%). The remaining 10% of the respondents worked in miscellaneous locations, including childcare and district offices. The survey results indicated that foodservice personnel would be receptive to including whole grain foods in their cafeterias.⁷⁵ The majority of respondents to the preliminary survey (72%) reported they were somewhat or very motivated to serve whole grain foods, and many (59%) were somewhat or very motivated to look for whole grain alternatives to add to school meals. The majority (77%) agreed that the inclusion of whole grain foods in school meals would

provide health benefits for their students. Although the results indicated positive perceptions about whole grains, only half of the respondents indicated that whole grain products had been served in their school cafeteria and one-third indicated that whole grain products were not being served.

Data for the School Nutrition Dietary Assessment (SNDA) III were collected using a nationally representative sample of school districts, schools and students in the year 2004-2005. According to the study, over 85 percent of schools offered lunches that met USDA standards for key nutrients such as proteins, calcium, iron and vitamins A and C. The study further explained that more than 70 percent of the schools met the USDA standards for each of the nutrients. The study indicated that grain/breads were almost always available, particularly cold cereals, on 78 percent of the school breakfast menus. The reports suggested that some of the product containing whole grain which may be included in the school cafeteria could include breads, pastas, muffins and desserts.

A study conducted by researchers⁷⁶ at University of Minnesota aimed at determining a series of whole wheat difference thresholds for use in a gradual adjustment intervention designed to improve children's liking of whole wheat bread rolls. A taste-test was conducted in which 103 elementary school children had to rate their liking of bread rolls containing various levels of whole wheat. The rolls with lower levels of wheat were liked more than rolls containing higher levels of wheat. The study concluded with children liking refined bread as compared to whole wheat bread. The researchers also determined 14 difference thresholds steps to increase the amount of whole wheat flour in the bread rolls from 0 to 91 percent.

Researchers at the University of Minnesota developed and tested two questionnaires designed to measure psychological determinants of whole grain intake among children and their parents⁷⁷. The developed questionnaires were pilot tested with 39 parent/child pairs from one of the recruited schools. The same questionnaires were subsequently used among 150 parent/child pairs from two schools that were the intervention sites. The study results indicated that although the general concept of fruits and vegetables was familiar among adults and children, identification of whole grain foods remained a significant barrier to the development of a questionnaire that could accurately measure psychosocial determinants related to whole-grain intake for children and their parents.

The same research group at the University of Minnesota conducted focus group interviews with 40 children from 6th grade, 18 parents and 11 teachers with the objective of identifying perceptions of whole-grain food, and factors influencing their intake, by the study participants.⁷⁸ Key findings from the study indicated that both parents and children needed education about being able to identify whole-grain foods. Results indicated that children felt that new school foods would need to look and taste good and be made familiar to them by being promoted through taste tests. The results also indicated that implications for the need for an effective school-based intervention with the objective of educating and promoting whole-grains among students.

2.2.3 Linking Cafeteria and Classroom

The American Dietetics Association (ADA), the Society for Nutrition Education (SNE), and the School Nutrition Association (SNA) all have indicated that the schools can play an important role in reversing obesity trends in children if the information disseminated in the nutrition classes and the foods sold in the school cafeteria were more compatible. Both the Center for Disease Control and Prevention (CDC) and the United States Department of Agriculture's (USDA) Team Nutrition have suggested an integration of school food service and nutrition education by coordinating cafeteria experience with lessons taught in the classroom.

The Child and Adolescent Trial for Cardiovascular Health (CATCH) elementary school program aimed at improving healthy eating and increasing physical activity. This randomized controlled study focused on reducing body weight and/or preventing weight gain among children and adolescents.⁷⁹ The CATCH program consisted of an alliance among children, parents, teachers, and school staff to teach skills and behaviors associated with maintaining healthy lifestyles. Four component areas were included, which consisted of classroom curricula, food service modifications, physical education changes, and family enforcement, all of which have been successful in targeting both children's behaviors and the schools environment. While the school cafeteria served healthy low-fat foods that were appealing to elementary school children, classroom teachers also included activities in their curriculum related to healthy eating and physical activity.

Another program entitled “Take Five,” which included educational classroom activities which were complemented by activities in the school cafeteria, sought to increase consumption of fruits and vegetables.⁸⁰ Once a week for 16 weeks classroom teachers presented students with “Take Five” nutritional information and preparation tips on the featured fruit and vegetable of the week. This was reinforced at lunch time in the cafeteria where students received fresh fruit and vegetable samples. Students also earned “points” by participating in the program, making them eligible for prizes. The program was evaluated using a pre/post-test design. Results showed that students’ attitudes about the acceptability of eating fruits and vegetables improved significantly ($p=.005$), as did their perception of their ability to eat five fruits and vegetables per day ($p<.001$). On the pre-test, only 12% of the students knew that they should eat five fruits and vegetables each day, while 42% knew on the post-test. Students demonstrated a high level of knowledge of the health benefits from eating fruits and vegetables on the pre-test (mean score of 55 points out of 75 points), and showed no significant increase on the post-test.

While other studies have been found linking cafeteria and classroom with a variety of targeted foods, one study was identified which was related to increasing the consumption of whole grains through connecting cafeteria and classroom.

A 6-week multi-component study was conducted by researchers at the University of Minnesota aimed at increasing the intake of whole grain foods by elementary school students in grades three to six. A total of 150 students participated in this study. This program was based on SCT as the guiding framework, consisting of 3-components: classroom, parent/family and school food service. The strength of this study was that the nutrition education regarding whole grain was extensive. Each of the five lessons was

designed to take approximately 45 minutes of teaching time. The learning objectives and activities included in the program were based on the results from the focus group interviews with children. Every week, parent newsletters were sent home with the students, and family events such as a tour of a bakery, grocery store and milling museum were included. The school lunch menus were modified by substituting refined grain products with whole or partial whole grain products. The results of the successful intervention indicated that whole grain consumption at the lunch meal increased by one serving ($p < 0.0001$), refined-grain consumption decreased by one serving, as compared to post-intervention ($p < 0.001$) and children's knowledge about whole grain foods increased in both the control and intervention groups ($p < 0.06$). The study was conducted by externally trained professionals, which may limit the generalizability to classroom teachers who may lack the nutrition background necessary to conduct the lessons.

The model of combining classroom education and cafeteria menu changes may be incorporated in introducing whole-grain foods in schools. These recommendations collectively point toward educating students to make healthy food choices which could include whole grains. Hence, promoting the consumption of whole grain foods through nutrition education in schools could serve as an important step in supporting these efforts.

2.2.4 School-based Nutrition Education -Theoretical Background

The Center for Disease Control and Prevention (CDC, 1996) has suggested that health promotion from the early stages in life, by fostering healthy eating practices and regular physical activity, has the potential for a major impact on health and well-being

during childhood and later stages in life. Nutrition during childhood contributes to maintaining good health and optimal learning capacities. Furthermore, food habits that persist during adolescence are more likely to track onto adulthood, which marks the importance of providing adequate nutrition education in school.⁶⁸

Previous literature reviews have identified various theory-driven educational strategies, showing a clear behavioral focus among the elements conducive to successful programs.⁸¹ Evaluations of school-based nutrition education programs, implemented mostly in the USA and in some European countries, have also supported this idea. A framework model often being referred to is the Social Cognitive Theory (SCT), as described by Bandura,⁸² which emphasizes a strong behavioral component as well as environmental and individual aspects, reinforcing self efficacy and decision making skills. Many successful school-based interventions based on the constructs of SCT have been used to change children's dietary intake.²¹ These interventions have focused on incorporating healthy foods in school meals. Social Cognitive Theory describes learning in terms of the interrelationship between behavior, environmental factors, and personal factors. According to SCT, the learner acquires knowledge as his or her environment converges with personal characteristics and personal experience. Because SCT is based on understanding an individual's reality construct, it is especially useful when applied to interventions aimed at personality development, behavior pathology, and health promotion.⁸³ Based on the SCT constructs collaborations among the school administration, teachers, food service personnel, and parents have successfully increased the intake of fruits and vegetables among school students.²² Further, the CDC has recommended an integration of school food service and nutrition education by

coordinating classroom lessons with the cafeteria experience (United States Department of Health and Human Services, Public Health Service, CDC, 1996). Considering that limited information is available about possible strategies to increase whole-grain consumption among children, SCT constructs may be useful in influencing student's food choices.

2.3 Conclusions from the Literature Review

Based on the review of literature, whole grain consumption by pre-adolescent children in the USA is less than the recommended levels. Whole grain foods can have a considerable impact on one's health. The review of literature indicates that health benefits result from long term exposure to whole grains by reducing risks of several chronic diseases. Additionally, behavioral interventions based on SCT have been successful in increasing fruit and vegetable intakes among children. Hence, the possibility of increasing children's consumption of whole grains is of particular interest. One way to increase whole-grain consumption would be to have children switch entirely from refined wheat bread to whole-wheat bread. Whole wheat has been introduced to elementary aged children as one of the many grains in 'The Power of 3' multi-component educational curriculum. However, to the best of our knowledge, a simplified and streamlined school based educational and promotional intervention, designed to increase the consumption of whole wheat food products in a school setting, does not exist in the literature.

Chapter 3

METHODOLOGY

3.1 Program Development

To determine the feasibility of changing student's whole wheat selections among 4th and 5th graders in an elementary school cafeteria, two whole wheat interventions were developed. These interventions included a classroom education component, consisting of four short classroom lessons including taste-testing, and the cafeteria promotions component, which consisted of whole wheat posters to be displayed in the cafeteria.

To guide the development of these interventions, the researcher conducted two whole wheat exploratory sessions with 4th and 5th grade students at two sites located near the experimental school district, in early August 2008. Fourteen students participated in these approximately hour long exploratory sessions. The objective of conducting these sessions was to use the information received from the 4th and 5th grade children to understand their familiarity, perceptions, acceptance and other background information related to whole wheat, which would subsequently aid in developing an educational curriculum on whole wheat. These exploratory sessions included questions about their whole wheat consumption and students' knowledge about the components of whole wheat. Students were given the opportunity to touch and taste the different components of the wheat kernel. Taste tests were provided with 3 types of bread i.e., whole wheat bread,

half and half (50: 50 Wheat + White) and white bread, to allow students to explore the breads based on taste, texture and appearance. Students filled out a survey to compare these breads. The sessions helped in determining that students could understand the terminology of wheat. Methods such as a 'show of hands' by students as a response to whole wheat related questions determined that they understood the components of whole wheat and were very enthusiastic about the taste tests. Students were interested in understanding the health benefits of whole wheat, including the importance of fiber.

Prior to the *Healthy Whole Wheat* intervention, the researcher conducted a group discussion with teachers from one of the elementary schools which served as the intervention site. A total of 6 teachers from 4th and 5th grades, one physical education teacher and the school's vice-principal participated in this group discussion. The purpose of conducting this discussion with teachers was to allow classroom teachers to share their perceptions, views and suggestions regarding the proposed whole wheat project. The discussion included questions about the level of knowledge about whole wheat that could be included in the curriculum, if students could understand the use of bar graphs in the lessons, managing of taste tests and hands-on activities, and the time involved in teaching the lessons. During the group discussion, teachers suggested that simple lessons on basic knowledge of whole wheat, including hands-on-activities like working with the school lunch menu, would be more exciting for kids. The teachers agreed that the lessons should be designed with an approximate teaching time of 30 minutes, and that 4th and 5th grade students would understand bar graphs. Teachers also suggested the inclusion of a concluding lesson which would summarize the lessons preceding in the curriculum.

Suggestions provided through this group discussion were subsequently incorporated in the development of the educational program. Additionally, teachers provided guidance on classroom education scheduling logistics.

Similarly, the food service director and three other food service employees participated in a group discussion to determine which items on the existing school lunch menu could be substituted with whole wheat. The school lunch menu typically consisted of one main entrée and two alternative choices that were offered every day during the school lunch. Collectively, the lunch menu consisted of food items such as salads with dinner rolls, sandwiches, hoagie rolls, hotdog buns, hamburger buns and french-bread pizza using white breads. For the study's purposes, the food service personnel agreed to a menu modification, offering a choice of whole wheat dinner rolls and whole wheat products as substituted for sandwich breads, whole wheat hoagies, hotdogs, hamburgers and a whole wheat pizza crust. While the food service personnel provided additional guidance in the scheduling logistics for the program, consisting of whole wheat poster displays and recording the cafeteria data, they also supported the researcher's idea of offering in-class taste-tests of the main entrée during the intervention period. The research team offered assistance in conducting in-class taste-tests by helping transport menu items from the cafeteria to the classroom during the intervention taste-tests. Based on the discussion with the food service director about collecting information on the student's whole wheat selections during the course of the study, the researcher developed cafeteria tracking sheets that the food service personnel used for recording the cafeteria data.

3.2 Program Description

The *Healthy Whole Wheat* educational program was developed as a part of the Local Wellness Policy Demonstration project with Penn State University, through funding from the USDA and the Pennsylvania Department of Education. A key message from the 2005 Dietary Guidelines for Americans is that half of an individual's daily the grain servings should be whole grains. The primary goal of the project was to determine the effectiveness of a 4-week school -based intervention involving classroom education about and cafeteria promotion of whole wheat products on increasing students' selections of whole wheat products in the school lunch room. The objective of this program was to increase the intake of whole wheat foods by elementary school students in 4th and 5th grades.

The overall objective of the *Healthy Whole Wheat* project was to determine the relative effectiveness of two interventions of varying intensity, involving a classroom education component and a cafeteria promotions component of whole wheat products, on increasing 4th and 5th grade students' selections of whole wheat products in the school cafeteria, compared to a control group.

3.2.1 Classroom Education Component

The *Healthy Whole Wheat* educational program included four 20-minute classroom educational lessons with the overall objective of getting children to choose whole wheat options during lunch in the school cafeteria. Each lesson had three main

components i.e., an outline and an instructional sheet for use by teachers to conduct the lessons, a classroom poster emphasizing main lesson messages and an identical mini-handout for students, and taste-testing activity of whole wheat products in the classroom. The instructional sheets were developed for classroom teachers and included semi-scripted lessons providing short promotional whole wheat messages to students. Teachers used the classroom poster to teach the lesson while take-home whole wheat mini-handouts emphasizing main lesson messages were developed for distribution among students in the classroom. During each educational session, students were given opportunities to taste test whole wheat products that were offered in the cafeteria. Additionally, students completed the whole wheat product survey on taste testing. There were several commitment messages included on the survey related to choosing whole wheat choices in the school cafeteria, talking to friends and family about making whole wheat food choices. Students were encouraged to make commitments on the whole wheat product survey.

3.2.1.1 Whole Wheat Lessons

The researcher provided the *Healthy Whole Wheat* educational materials to teachers of the classroom education group. Each lesson was given to the teacher one week prior to the actual intervention day. The researcher's intent was to provide adequate time for teachers to study the lesson plan to assure successful execution in the classroom. One lesson on whole wheat was taught by the classroom teachers every week, before the day's lunch period, for four weeks during the intervention phase. The curriculum lessons

can be found in Appendix A. The lessons encompassed multiple objectives which allowed students to identify and state different components of the wheat kernel, learn about whole wheat health benefits, identify products containing whole wheat on the school lunch menu, and learn tips regarding food labels to help identify whole wheat foods in other environments.

The first lesson focused on the whole wheat kernel. The objective of the lesson was for students to be able to identify and state different components of the wheat kernel. The lesson content described the components of wheat and discussed each component such as bran, germ and endosperm. The semi-scripted instructional sheet for teachers consisted of background information on the kernel components that teachers could share with the students. A whole wheat kit designed by the researcher was provided to each of the students in the classroom education group, which gave them an opportunity to see, touch and taste the different components of the kernel, and included samples of both whole wheat flour and white flour.

The second lesson focused on the health benefits of whole wheat. The objective of the lesson was for students to be able to state the health benefits of whole wheat foods. The lesson included bar graphs that represented the differences in nutrients between whole wheat flour and white flour. The semi-scripted instructional sheet for teachers included specific information about fiber and protein to be discussed with students. An additional whole wheat nutrient information sheet describing the various nutrients and their sources was provided to the teachers to help explain the bar graphs.

The third lesson focused on identification of whole wheat foods. The objective of the lesson was for students to be able to identify whole wheat containing food products

on the school lunch menu and also learn tips to identify whole wheat foods in other environments like grocery store. Students were given the opportunity for a hands-on activity that allowed them to identify which food items on their school lunch menu could be substituted with whole wheat products. Additionally, students learned tips and clues on being able to identify products containing whole wheat in the grocery store by looking at sample food labels.

Based on the teachers' suggestions, the last lesson was developed representing a summary of the previous three lessons.

3.2.1.2 In-class Taste-Tests

Every lesson conducted during the four week intervention phase included in-class taste-tests activities which were accompanied by a whole wheat product survey. The surveys asked for student opinions about the whole wheat products tasted in the classroom. The survey also asked students to agree to make commitments for making whole wheat choices in the cafeteria and to talk to friends and family about making whole wheat choices. An example of the whole wheat product survey can be found in Appendix B. As mentioned earlier, prior to the development of the program, a group discussion with the food service personnel was held to determine the menu items to be offered for in-class taste tests. However, during the course of the study, both the main entrée and the alternative choices were offered as a choice on whole wheat and white bread in the school cafeteria. A list of the weekly lunch choices offered for each

observation day can be found in Appendix C. For the classroom education component, it was decided that only the main entrée would be offered for the in-class taste-test activity.

On the first day of the intervention phase, students were given the opportunity to taste whole wheat bread as well as white bread in the classroom. The purpose was for students to experience the basic difference in the breads in terms of taste, texture, and appearance and to provide an overall rating on the whole wheat product survey. During the remaining three weeks of the intervention phase, the students taste tested the main entrée of the school lunch menu on whole wheat bread products. As the taste test was offered during the lessons before lunch time, students were given the opportunity to taste the day's lunch menu item. The purpose for offering taste tests was for students to experience the taste of whole wheat bread as a part of the school lunch menu item. The researcher's intent was to educate students about whole wheat as well as influence and increase students' selection of whole wheat food items in the school cafeteria. The purpose of the whole wheat product surveys during each taste-testing activity was to remind and encourage students to make commitments on the survey to help them remember that they need to make healthy choices in the cafeteria, and also to encourage them to talk to friends and family about healthy whole wheat.

3.2.2 Cafeteria Promotions Component

3.2.2.1 Whole Wheat Poster Display

Students in the cafeteria promotions group did not receive any classroom education on whole wheat; however, the students in the classroom education group were exposed to cafeteria promotions as well.

The program's cafeteria promotions consisted of whole wheat posters for display in the cafeteria display. For every week during the four week intervention phase, one whole wheat promotional poster was displayed. Additionally, the food service employees wore aprons carrying the *Healthy Whole Wheat* logo and point-of-purchase signage was used to display the whole wheat menu offerings. These posters were identical to the whole wheat handouts received by students in the classroom education group. The poster for the first week displayed information about the components of the whole wheat kernel, followed by the next week's poster that described the whole wheat health benefits, while the third week's poster described information on tips for identifying whole wheat foods based on the whole wheat food label information. The last week's poster displayed summary information from the previous three posters.

3.3 Study Protocol

3.3.1 Study Sample

Two rural elementary schools, belonging to one school district from northcentral Pennsylvania, were recruited to participate in this study. This study targeted 4th and 5th grade students. In these two elementary schools, there were a total of nine 4th and 5th

grade classes. Three classrooms consisting of a 5th grade and two 4th grades from one elementary school served as a control group (n=67). The other elementary school served as an intervention site. In this school, teachers of three classrooms consisting of a 4th grade and two 5th grades volunteered their classrooms to be in the classroom education group (n=67); teachers of three classrooms consisting of a 5th grade and two 4th grades volunteered their classrooms to be in the cafeteria promotions group (n=69). A total of 203 students participated in the study. The research study began in early October 2008 and ended in November 2008.

The Institutional Review Board of the Pennsylvania State University approved the study. The study protocol was presented to, reviewed by, and approved by the school district's school board Appendix D. Consent forms were distributed to all students in the classroom and cafeteria intervention groups to be given to their parents Appendix E. A passive "opt-out" consent process was used. Students agreed to participate through a verbal assent process. Participation was voluntary, and the students received no compensation for their involvement in the study.

3.3.2 Study Design

The *Healthy Whole Wheat* was a school based experimental design research study consisting of the first three week period for baseline data collection, the next four week period as the intervention phase and the last three week period as the follow-up phase. The layout the study design can be found in Table 3-1.

Table 3-1: Healthy Whole Wheat Study Design

	Baseline (B)	Intervention (I)				Follow-up (F)
	(B-1 to B-3)	I-1	I-2	I-3	I-4	(F-1 to F-3)
Classroom Education Group (No. of 4th and 5th graders: 67)						
Classroom Intervention: Hands-on Activities, Taste Tests		X	X	X	X	
Exposure to Cafeteria Promotions		X	X	X	X	
Cafeteria Observations	X X X	X	X	X	X	X X X
Cafeteria Promotions Group (No. of 4th and 5th graders: 69)						
Classroom Intervention: Hands-on Activities, Taste Tests						
Exposure to Cafeteria Promotions		X	X	X	X	
Cafeteria Observations	X X X	X	X	X	X	X X X
Control Group (No. of 4th and 5th graders: 67)						
Classroom Intervention: Hands-on Activities, Taste Tests						
Exposure to Cafeteria Promotions						
Cafeteria Observations	X X X	X	X	X	X	X X X

3.3.3 Cafeteria Data Collection

Cafeteria tracking sheets, to record whole wheat food items selected by children from the classroom education group, cafeteria promotions group, and the control group for both the elementary schools, were developed by the researcher for the school food service personnel. A sample of the cafeteria tracking sheet can be found in Appendix F.

During lunch period, students lined up in the cafeteria by class and grades. The school food service personnel offered a choice of whole wheat or white food items to the students of the participating 4th and 5th grade classes. The school food service personnel were trained not to prompt regarding selecting of wheat or white option. When a student reached the cafeteria counter, the food service staff asked the question “White or Wheat”. The food service employee recorded each student’s choice on the cafeteria tracking sheet. The food service personnel in both elementary schools were responsible for the final counting of the number of selections of items containing whole wheat and white bread and for reporting them on the tracking sheets. The research team observed the cafeteria lines to ensure cafeteria staff followed the study protocol. The whole wheat choices were offered to all the students of the classroom education group, cafeteria promotions group and the control group.

The tracking sheets were collected after lunch during baseline, intervention and follow-up phases from both elementary schools.

3.3.4 Group Interviews

After the completion of the research study, three teachers of the classroom education group from the intervention site participated in a group interview. The interview lasted for about an hour and was tape-recorded. The recordings were then transcribed by the researcher. The objective of conducting this interview was for teachers to provide feedback on the *Healthy Whole Wheat* educational program which could guide subsequent revisions.

Similarly, six food service employees from the intervention site including the food service director participated in a group interview. The interview lasted for about an hour and was tape-recorded. The recordings were then transcribed by the researcher. The objective of conducting this interview was for the food service personnel to provide feedback about the whole wheat cafeteria promotion.

The questions asked during the teacher and food service personnel group interviews can be found in Appendix G.

3.3.5 Research Hypotheses

The research hypotheses of the study were:

1. During the intervention phase, the proportion of students choosing whole wheat items in the classroom education group will be greater than the number of students choosing whole wheat items in the control group.

2. During the intervention phase, the proportion of students choosing whole wheat items in the cafeteria promotions group will be greater than the number of students choosing whole wheat items in the control group.

3. During the intervention phase, the proportion of students choosing whole wheat items in the classroom education group will be greater than the number of students choosing whole wheat items in the cafeteria promotions group.

4. During the intervention phase and the follow-up phase, the proportion of students choosing whole wheat items in the classroom education group will be greater than the number of students choosing whole wheat items in the control group.

5. During the intervention phase and the follow-up phase, the proportion of students choosing whole wheat items in the cafeteria promotions group will be greater than the number of students choosing whole wheat items in the control group.

6. During the intervention phase and the follow-up phase, the proportion of students choosing whole wheat items in the classroom education group will be greater than the number of students choosing whole wheat items in the cafeteria promotions groups.

3.3.6 Statistical Analysis

The data analysis model consisted of three phases i.e., the baseline, the intervention and the follow-up. Three groups, namely the classroom education group, the cafeteria promotions group and the control group were included in the model. For the overall model, within group and between groups comparisons were made. The comparisons were made to analyze the differences between each pair of percentages. For each percentage, a confidence interval was constructed. We are concluding a difference if the confidence intervals do not overlap. Typically, confidence intervals are constructed at a 95% level of confidence. However, since we are using these intervals to make multiple comparisons, it is necessary to limit the overall confidence at 95%. Therefore, each individual confidence interval has a confidence level higher than 95%, the exact level of confidence for each interval is based on the number of comparisons, and then Bonferroni correction was used to make each confidence interval to be approximately 99%. The data analysis was conducted using Microsoft Excel 2003.

Part I: Intervention Phase Analysis

For the data analysis of the intervention phase, we looked at two different effects. The first effect is the difference between each group at each individual time periods. The second effect is the change within each group across each time period.

a. Between Group Effect

For each observation in the intervention phase, 3 comparisons were made to determine differences between groups i.e., the classroom education group, the cafeteria promotions group and the control group.

For Intervention-1 time period, the following 3 comparisons were made:

1. Education vs. Control
2. Cafeteria vs. Control
3. Education vs. Cafeteria

A total of 12 comparisons were made for between group effects of the intervention phase, considering Intervention-1 through Intervention-4 time periods.

b. Within Group Effect

Within each group i.e., the classroom education group, the cafeteria promotions group and the control group, 6 comparisons were made.

For the classroom education group, the following comparisons were made:

1. Intervention 1 vs. Intervention 2
2. Intervention 1 vs. Intervention 3
3. Intervention 1 vs. Intervention 4
4. Intervention 2 vs. Intervention 3
5. Intervention 2 vs. Intervention 4
6. Intervention 3 vs. Intervention 4

A total of 18 comparisons were made for within group effects of the intervention phase, considering the classroom education group, the cafeteria promotions group and the control group

A combined total of 30 comparisons were made for the intervention phase analysis.

Part II: Analysis across Baseline, Intervention and Follow-up.

Although, 3 comparisons were made during the baseline period, there should be no within group differences during this time as the intervention did not start. To determine a baseline for each group, we computed weighted averages for each group. This process was done for the follow-up as well. Based on the within group analysis in part I (b), it was determined appropriate to use weighted averages across the intervention phase. Thus, every group has a weighted average i.e., the baseline weighted average, the intervention weighted average and the follow-up weighted average.

a. Between Group Effect

Three comparisons were made between groups within the intervention phase:

1. Intervention (Education) to Intervention (Cafeteria)
2. Intervention (Education) to Intervention (Control)
3. Intervention (Cafeteria) to Intervention (Control)

Three comparisons were made between groups within the follow-up phase:

1. Follow-up (Education) to Follow-up (Cafeteria)
2. Follow-up (Education) to Follow-up (Control)
3. Follow-up (Cafeteria) to Follow-up (Control)

A total of 6 comparisons were made for the between group effects.

b. Within Group Effect

For every group, 3 comparisons were made between phases i.e., baseline vs. intervention vs. follow-up. For the classroom education group, the following three comparisons were made:

1. Baseline (Education) to Intervention (Education)
2. Baseline (Education) to Follow-up (Education)
3. Intervention (Education) to Follow-up (Education)

As there were three groups i.e., the classroom education group, the cafeteria promotions groups and the control group, a total of 9 comparisons were made.

A combined total of 15 comparisons were made for analysis across Baseline, Intervention and Follow-up time periods.

Chapter 4

RESULTS

A total of two hundred and three (203) students participated in the *Healthy Whole Wheat* study. Descriptive statistics included student lunch participation among the classroom education group, cafeteria promotions group and the control group. Confidence intervals were computed to analyze cafeteria data to determine group differences. Data analysis was carried out in two parts i.e., the first part was to determine group differences in the intervention phase and the second to determine group differences in baseline, intervention and follow-up period.

4.1 Descriptive Statistics on Students Lunch Participation

Characteristics of students participating in the study, based on their treatment area are represented (Table 4-1). A total of 203 students participated in the study including the classroom education group (N=67, 33%), the cafeteria promotions group (N=69, 34%) and the control group (N=67, 33%). The number of students participating in the classroom education group consisted of female (N=31, 46%) students and male (N=26, 54%) students. The number of students participating in the cafeteria promotions group consisted of female (N=34, 51%) students and male (N=33, 49%) students. The number of students participating in the control group consisted of female (N=29, 42%) students and male (N=40, 58%).

Table 4-1: Student Characteristics: (Total Student Participation: N=203)

Group	Grades		Total	Gender		Total
	4 th	5 th		Males	Female	
Education	2	5	67	6	1	67
Cafeteria	8	1	69	5	4	69
Control	6	1	67	1	6	67

Specific grade-wise student lunch participation over time for the classroom education group, cafeteria promotions group and the control group can be found in Appendix H. On average, the overall student participation ranged from 85% to 95%. The number of students who did not participate represented the students who were either absent or did not order lunch for the day or brought a lunch from home.

Over the period of 10 weeks, the percentage of students who selected whole wheat items in the cafeteria across the three groups and across the three phases of intervention are represented (Table 4-2). The quantitative data determined the following:

1. For the classroom education group, the percentage of students making whole wheat food choices in the cafeteria increased from as low as 5% prior to the educational intervention to 82%.

2. For the cafeteria promotion group, the percentage of students making whole wheat food choices in the cafeteria increased from 5% prior to cafeteria promotions to 27%

4.2 Analysis of Intervention Phase

The observed percentages of student whole wheat selections in the cafeteria for the intervention phase are represented in Table 4-3. The confidence intervals for the intervention phase analysis are represented in Table 4-4.

Table 4-3: Percentage Selection of Whole Wheat Items during Intervention (I)Phase

Groups	Intervention (I)			
	I-1	I-2	I-3	I-4
Education	60%	67%	79%	82%
Cafeteria	18%	25%	24%	22%
Control	11%	11%	13%	4%

Table 4-4: Intervention Phase Analysis of Confidence Intervals

Groups	Intervention			
	I-1	I-2	I-3	I-4
	(99% CI)	(99% CI)	(99% CI)	(99% CI)
Education	^a 41% - 79%	^a 49% - 85%	^a 63% - 95%	^a 67% - 97%
Cafeteria	^b 5% - 32%	^b 8% - 42%	^b 7% - 40%	^b 6% - 37%
Control	^b 0% - 23%	^b 0% - 23%	^b 0% - 27%	^b 0% - 11%

Note: Values of different superscripts are significantly different from one another within weeks and groups.

4.2.1 Hypothesis: During the intervention phase, the proportion of students choosing whole wheat items in the classroom education group will be greater than the number of students choosing whole wheat items in the control group.

During I-1, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 41% - 79%) were greater than the number of students choosing whole wheat items in the control group (99% CI = 0% - 0.23%). During I-2, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 49% - 85%) were greater than the number of students choosing whole wheat items in the control group (99% CI = 0% - 23%). During I-3, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 63% - 95%) were greater than the number of students choosing whole wheat items in the control group (99% CI = 0% - 27%). During I-4, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 67% - 97%) were greater than the number of students choosing whole wheat items in the control group (99% CI = 0% - 11%). We noted that the observed percentages of student whole wheat selection for the classroom education group were higher than the control group at any time point from I-1 through I-4. Although we observed an increase in the percentage of students selecting whole wheat items in the classroom education group from I-1 through I-4, (Table 4-3) the difference in percentage was not statistically significant. The confidence intervals did not overlap and hence we can conclude that there is a difference between the whole wheat item selection by students in the classroom education group and the control group. We can conclude that the proportion of students choosing whole wheat items in the classroom education group were greater than the number of students

choosing whole wheat items in the control group. The results are summarized in Table 4-4.

4.2.2 Hypothesis: During the intervention phase, the proportion of students choosing whole wheat items in the cafeteria promotions group will be greater than the number of students choosing whole wheat items in the control group.

During I-1, the confidence intervals between the proportion of students choosing whole wheat items in the cafeteria promotions group (99% CI = 5% - 32%) overlapped with the number of students choosing whole wheat items in the control group (99% CI = 0% - 23%). During I-2, the confidence intervals between the proportion of students choosing whole wheat items in the cafeteria promotions group (99% CI = 8% - 42%) overlapped with the number of students choosing whole wheat items in the control group (99% CI = 0% - 23%). During I-3, the confidence intervals between the proportion of students choosing whole wheat items in the cafeteria promotions group (99% CI = 7% - 40%) overlapped with the number of students choosing whole wheat items in the control group (99% CI = 0% - 27%). During I-4, the confidence intervals between the proportion of students choosing whole wheat items in the cafeteria promotions group (99% CI = 6% - 37%) overlapped with the number of students choosing whole wheat items in the control group (99% CI = 0% - 11%). The observed percentages for the cafeteria promotions groups initially increased from 18% during I-1 to 25% during I-2 and then decreased to 24% during I-3 and further dropped to 22% during I-4 (Table 4-3). The confidence intervals overlapped and hence we cannot conclude that there is a difference between the whole wheat item selection by students in the cafeteria promotions group and the control group. We cannot conclude that the proportion of students choosing whole wheat items in

the cafeteria promotions group were greater than the number of students choosing whole wheat items in the control group. The results are summarized in Table 4-4.

4.2.3 Hypothesis: During the intervention phase, the proportion of students choosing whole wheat items in the classroom education group will be greater than the number of students choosing whole wheat items in the cafeteria promotions group.

During I-1, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 41% - 79%) were greater than the number of students choosing whole wheat items in the cafeteria promotions group (99% CI = 5% - 32%). During I-2, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 49% - 85%) were greater than the number of students choosing whole wheat items in the cafeteria promotions group (99% CI = 8% - 42%). During I-3, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 63% - 95%) were greater than the number of students choosing whole wheat items in the cafeteria promotions group (99% CI = 7% - 40%). During I-4, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 67% - 97%) were greater than the number of students choosing whole wheat items in the cafeteria promotions group (99% CI = 6% - 37%). We noted that the observed percentages of student whole wheat selection for the classroom education group were higher than the control group at any time point from I-1 through I-4 (Table 4-3). We noted that the observed percentages of student whole wheat selection for the classroom education group were higher than the cafeteria promotions group at any time point from I-1 through I-4. The confidence intervals did not overlap and hence we can conclude that there is a difference between the whole wheat item

selection by students in the classroom education group and the cafeteria promotions group. We can conclude that the proportion of students choosing whole wheat items in the classroom education group were greater than the number of students choosing whole wheat items in the cafeteria promotions group. The results are summarized in Table 4-4.

4.3 Analysis across Baseline, Intervention and Follow-up

Weighted averages for percentages of baseline were calculated. There were no within group differences during the baseline period, as the intervention did not start. As all the groups at baseline were the same, weighted averages were calculated for the intervention and follow-up phase (Table 4-5). The confidence intervals for the data analysis across baseline, intervention and follow-up are represented in Table 4-6.

Table 4-5: Percentage Selection of Whole Wheat Items across Phases

Groups	Phases (Weighted %)		
	Baseline	Intervention	Follow-up
Education	9% (0.02 - 0.14)	72% (0.62 – 0.80)	52% (0.41 – 0.62)
Cafeteria	8% (0.02 – 0.14)	22% (0.13 – 0.30)	12% (0.05 – 0.18)
Control	7% (0.01– 0.11)	9% (0.02 – 0.14)	6% (0 – 0.1)

Table 4-6: Analysis across Phases for Confidence Intervals

Groups	Phases (99% CI)		
	Baseline	Intervention	Follow-up
Education	2% - 14%	^a 62% – 80%	^a 41% – 62%
Cafeteria	2% – 14%	^b 13% – 30%	^b 5% – 18%
Control	1%– 11%	^b 2% – 14%	^c 0% – 1%

Note: Values of different superscripts are significantly different from one another within weeks and groups.

The following hypotheses represent between group effects:

4.3.1 Hypothesis: During the intervention phase and the follow-up phase, the proportion of students choosing whole wheat items in the classroom education group will be greater than the number of students choosing whole wheat items in the control group.

During intervention phase, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 62% - 80%) were greater than the number of students choosing whole wheat items in the control group (99% CI = 2% - 14%). During follow-up phase, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 41% - 62%) were greater than the number of students choosing whole wheat items in the control group (99% CI = 0% - 1%). The confidence intervals did not overlap and hence we can conclude that there is a significant difference between the whole wheat item selection by students in the classroom education group and the control group. We can conclude that during the intervention phase and the follow-up

phase, the proportion of students choosing whole items in the classroom education group will be greater than the number of students choosing whole wheat items in the control group.

4.3.2 Hypothesis: During the intervention phase and the follow-up phase, the proportion of students choosing whole wheat items in the cafeteria promotions group will be greater than the number of students choosing whole wheat items in the control group.

During intervention phase, the proportion of students choosing whole wheat items in the cafeteria promotions group (99% CI = 13% – 30%) were greater than the number of students choosing whole wheat items in the control group (99% CI = 2% - 14%). The confidence intervals overlapped during the intervention phase and hence we cannot conclude that there is a significant difference between the whole wheat item selection by students in the classroom education group and the control group. During follow-up phase, the proportion of students choosing whole wheat items in the cafeteria promotions group (99% CI = 5% – 18%) were greater than the number of students choosing whole wheat items in the control group (99% CI = 0% - 1%). The confidence intervals overlapped during the follow-up phase and hence we can conclude that there is a significant difference between the whole wheat item selection by students in the classroom education group and the control group. We cannot conclude that during the intervention phase, the proportion of students choosing whole items in the cafeteria promotions group were greater than the number of students choosing whole wheat items in the control group. However, we can conclude that during the follow-up phase, the proportion of students

choosing whole items in the cafeteria promotions group were greater than the number of students choosing whole wheat items in the control group.

4.3.3 Hypothesis: During the intervention phase and the follow-up phase, the proportion of students choosing whole wheat items in the classroom education group will be greater than the number of students choosing whole wheat items in the cafeteria promotions groups.

During intervention phase, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 62% – 80%) were greater than the number of students choosing whole wheat items in the cafeteria promotions group (99% CI = 13% – 30%). During follow-up phase, the proportion of students choosing whole wheat items in the classroom education group (99% CI = 41% – 62%) were greater than the number of students choosing whole wheat items in the cafeteria promotions group (99% CI = 5% – 18%). The confidence intervals did not overlap and hence we can conclude that there is a significant difference between the whole wheat item selection by students in the classroom education group and the cafeteria promotions group. We can conclude that during the intervention phase and the follow-up phase, the proportion of students choosing whole items in the classroom education group were greater than the number of students choosing whole wheat items in the cafeteria promotions group.

4.3.4 Analysis for within Group Effects

The baseline percentages were similar across the classroom education group 9% (99% CI = 2% – 14%), the cafeteria promotions group 8% (99% CI = 2% – 14%) and the control group 7% (99% CI = 1% – 11%).

For the classroom education group, an observed difference was seen in the direction we expected from baseline 9% (99% CI = 2% – 14%) to intervention phase 72% (99% CI = 62% – 80%). However, during follow-up, the percentage of the classroom education group dropped to 52% (99% CI = 41% – 62%). Although the observed difference was not statistically significant, we cannot conclude a difference due to the small sample size (n=203). The percentage for the classroom education group attenuated overtime from baseline to follow-up, but did not return to baseline. For the cafeteria promotions group, there was an increase in the proportion of students choosing whole wheat from baseline 8% (99% CI = 2% - 14%) to the intervention phase 22% (99% CI = 13% - 30%). However, the percentage of students choosing whole wheat options dropped to 12 % (99% CI = 5% - 18%) during follow-up. The observed difference was not statistically significant. For the control group, the baseline percentages were similar across baseline 7% (99% CI = 0.01 – 0.11), increased at the intervention 9% (99% CI = 0.02 – 0.14) and decreased at follow-up 6% (99% CI = 0.0 – 0.1). However, this difference did not reach statistical significance.

4.4 Post-Intervention Program perceptions from Teachers and Food Service

Personnel

4.4.1 Teacher Perceptions

The transcripts of the post-intervention interviews conducted with both the teachers and the food service personnel were analyzed by the researcher. As described in the methodology section, the interviews were tape-recorded and were then transcribed by the researcher.

Teachers provided overall positive feedback concerning the *Healthy Whole Wheat* curriculum. All the teachers agreed that the both the teacher instructional sheets and the whole wheat handouts/posters provided along with each of the lesson were helpful for teaching in the classroom. About the teacher's instructional sheet, one teacher stated that "We didn't have to go research it ourselves as it was just handed to us and it went along very well with the lesson plan." The teachers agreed that the instructional sheets were very thorough and they were easy from which to teach. Another teacher stated that "Being a teacher, passing on to a parent volunteer, I thought it was very easy, and even for a volunteer just to kind of read over. She felt very comfortable." The curriculum proved to be very helpful for students to understand the components of the whole wheat kernel. The teachers appeared to be positive about the whole wheat kit, as well as the usage of bar graphs. Regarding the kit, one teacher stated that "It was neat that they could each taste each part of the grain just so that they could tell a difference for the future lessons." About the bar graphs on the poster and student handouts, one teacher commented that "Visual representation of the point that we were trying to make throughout the lesson helped them understand and remember that." Another teacher stated that "The poster broken down into specific vitamins and minerals, made words become more familiar with the kids." Knowledge regarding reading whole wheat food labels was useful not only to students, but to teachers as well. When asked about whole wheat labels, one teacher stated that "I think it helped looking at the labels, that you have to look for the whole wheat flour, because I actually myself didn't know that and I think some of the students started going to the grocery store with their parents and now they know exactly what to look for and what might look healthy but it actually isn't healthy.

That was a good example to see that.” Two other teachers admitted that they learned a lot about whole wheat labels from the simplified whole wheat curriculum. The teachers agreed that providing classroom education, and the opportunity to taste the menu item before lunch time, helped students make decisions to choose whole wheat items in the cafeteria. All the teachers agreed that, based on the curriculum, they were willing to invest two hours into teaching about whole wheat, seeing that it helped students in changing their cafeteria selections. One teacher stated that, “If we want them to be healthier eaters throughout their lives, that was worth it.” Teachers mentioned that most of the students took their handouts home, talked to their families about the whole wheat lessons, and bought whole wheat products at home. When the teachers were asked to share student responses, one teacher stated that “I know a couple of the students who said that they had mentioned it to their parents that the wheat lessons had taken place and to get more products of whole wheat or at least try them.” Another teacher stated that “I had a couple of students who said they bought bread that was whole wheat bread now from the grocery store.”

The teachers thought that the objectives and content of the lessons were clearly stated and were at the right level for the 4th and 5th graders. Regarding the whole wheat lesson contents and objectives, one of the teacher stated that “I would be interested to see if they could remember whole wheat information after a couple months. But you know that’s the kids brain too, that when they are going to be done with it, they forget it.” Teachers agreed unanimously that it would be the responsibility of the physical education (PE) teacher to develop and implement a curriculum like this. However, in terms of responsibilities for the PE teacher, one teacher stated that “I don’t know if he will be able

to with the curriculum he has.” Another teacher stated that “I see more of the PE teacher in developing and implementing these lessons.” The teachers thought that it was not their responsibility to develop and implement a curriculum. However, if the food service personnel or the PE teacher provided them with specific lesson plans, they would be willing to teach health lessons in their classroom.

4.4.2 Food Service Personnel Perceptions

Initially, before this research study began, the food service personnel had tried offering whole wheat items on the school lunch menu, but student acceptance was low. The food service director had also stated that “some of the children had never tried whole wheat.” This had discouraged the food service director in terms of spending school food service funds and food wastage, hence, whole wheat bread was never ordered. The food service director indicated that one major obstacle for offering whole wheat choices in the school cafeteria was the overall cost issue. Because students did not make whole wheat choices, there was loss of revenue for the school. The food service director was willing to offer whole wheat food items only if it was either made a mandate in the schools through school policy, or if additional funding was assured. The food service personnel thought that the whole wheat cafeteria promotions were beneficial, but only to the students who received education about whole wheat in class. The obstacles stated by the food service personnel in implementing the cafeteria promotions of offering whole wheat choices were: 1) indecision on the number of items to be made from whole wheat, 2) asking each student if they wanted a wheat or white option made the serving of food in the cafeteria

slower, and 3) dealing with the logistics of ordering whole wheat bread and remembering to order the bread every week. Additional promotional methods recommended by the food service personnel to encourage the selection of whole wheat items in the cafeteria were: 1) offering whole wheat product coupons to children for them to take home so that their parents can buy the items at home, 2) 'dressing-up' like a wheat bread slice in the cafeteria, and 3) conducting contests among classrooms and grades. According to the food service director, the only way whole wheat foods could be offered regularly was if students were provided with nutrition education in every classroom of the elementary schools. Concerning whole wheat food choices offered during the program, the food service personnel indicated that students would not accept a hot dog on a wheat roll because it was too dark in color. They also indicated that most of the students were not fond of the fish sandwich, hence offering it on wheat roll would not have made a difference. The food service personnel indicated that due to staffing issues in the cafeteria in terms of the number of food service personnel, it would be difficult to offer taste-tests in the classrooms. The food service personnel agreed to offer taste-test in the classrooms only if an outside person or an aid provided help in the process.

Chapter 5

DISCUSSIONS AND CONCLUSIONS

The United States Department of Agriculture's (USDA) Team Nutrition and the Center for Disease Control and Prevention (CDC) have suggested an integration of school food service and nutrition education by coordinating cafeteria experience with lessons taught in the classroom. Various governmental organizations have indicated that the schools play a pivotal role in reversing obesity trends, if the information disseminated during the nutrition classes and the foods sold in the school cafeteria were more coordinated and compatible. Schools are a critical part of the social environment that shape young persons' behaviors and can therefore play a central role in helping improve their social habits and diet. Many school based behavior change interventions based on knowledge, attitude and practice have been successful in providing effective approaches in the prevention of unhealthy behaviors such as alcohol consumption, drugs and tobacco use among youth.^{84, 85} There have also been studies in the nutrition field that test for knowledge, attitude and practice constituting a triad of interactive factors characterized by dynamism and unique interdependence. Some of the study areas represent HIV/AIDS prevention programs, breast cancer screening among women and breastfeeding to name among many.¹¹⁸⁻¹²⁰ Also, there is strong evidence showing that interventions based on

the testing of three components have been effective in increasing fruit and vegetable intake, and decreasing the amount of fat intake in children and youth.^{15, 22}

One other intervention resulted in an increase of whole grain food consumption by testing their knowledge and attitude towards whole grains in Minnesota. The strongest evidence-based curriculum of Minnesota, the ‘Power of 3: Get Healthy with Whole Grain Foods’ showed significant improvements in increasing consumption of whole grains by elementary aged school children. However, the study was conducted with the help of externally trained personnel and its curriculum appears to be too intensive and time consuming to be practical. The Minnesota whole grain study consisted of a five-lesson curriculum and each lesson required about 45 minutes of teaching time. Crowded curriculum has been known as a negative factor that influences teacher decisions on school, classroom and curriculum. Hence, considering that a promotional whole wheat campaign may be more likely to be adopted in schools rather than the use of an intensive and time consuming curriculum, the *Healthy Whole Wheat* program was developed. Our study consisted of streamlined whole wheat classroom sessions that were developed by the researcher and provided to teachers to teach in the classrooms. The nutrition education provided in schools may not have to be intensive to produce an effect. The outcomes of the *Healthy Whole Wheat* study provide evidence that a simple and streamlined school-based nutrition education intervention can be effective in increasing 4th and 5th grade students’ selections of whole wheat products in the school lunch room.

The primary objective of the *Healthy Whole Wheat* study was to determine the effectiveness of an intervention involving education about and promotion of whole wheat products on increasing 4th and 5th grade students’ selections of whole wheat products in

the school lunch room. Our study was designed to determine the relative effectiveness of two interventions of varying intensity involving a classroom education component consisting of four streamlined lessons and a cafeteria promotions component of whole wheat products. Our study goals were as follows: 1) to test if students who received whole wheat education in the classroom setting increased their whole wheat choices in the cafeteria as compared to the control group; 2) to test if the students in the cafeteria promotions group increased their whole wheat choices in the cafeteria as compared to the control group; and 3) to test the relative rate of change in the classroom education group compared to the cafeteria promotions group.

5.1 Program Successes and Behavior Change among Students

Our *Healthy Whole Wheat* study consisted of the classroom education component which comprised of four 20 minute classroom sessions focusing on whole wheat which were taught by classroom teachers over a period of four weeks during the intervention phase. For our study, the classroom education component was combined with in-class taste-tests of the actual menu items offered in the school cafeteria, substituting wheat products for normally offered white products. Additionally, students were encouraged to make commitments on the whole wheat product survey to help them remember to make healthy choices not only in the cafeteria but also talk to friends and family about healthy whole wheat. While the streamlined nature of the classroom sessions was helpful for program implementation by the classroom teachers, the brief, promotional and educational messages combined with the opportunity to taste test cafeteria offerings before the school lunch as well as the stated commitment, resulted in students making the

choice in the cafeteria line. In the present study, analysis of the quantitative data, over a period of 10 weeks, determined that for the classroom education group, the percentage of students making whole wheat food choices in the cafeteria increased from as low as 5% during baseline to 82% during the intervention phase and then lowered to 44% during the follow-up phase. Our study concluded that the proportion of students choosing whole wheat items in the classroom education group during the intervention phase (99% CI = 62% - 80%) and the follow-up phase (99% CI = 41% - 62%), was greater than the number of students choosing whole wheat items in the control group. These key findings from our *Healthy Whole Wheat* study indicated that educating children seems to result in behavior changes related to whole wheat. An emphasis on educating students through consistent nutrition messages about the components of whole wheat, nutrients in whole wheat and teaching health benefits seemed to influence student's choices in the cafeteria.

Successful school-based interventions^{21, 22} to change children's dietary intake have been based on the constructs of the Social Cognitive Theory (SCT) which involved incorporation of healthful foods in the school meals. The *Healthy Whole Wheat* study was based on 'The Power of 3: Get Healthy with Whole Grain Foods', a multi-component school-based intervention that aimed to increase the consumption of whole grains by 4th and 5th grade children. The 'Power of 3: Get Healthy with Whole Grain Foods' pilot study was an excellent and intensive intervention program which contained three main components addressing environmental, personal and behavioral factors derived from Social Cognitive Theory (SCT): a five-lesson classroom curriculum, school cafeteria menu changes, and family involvement. The present *Healthy Whole Wheat* study was also based on the SCT constructs which comprised of two components: a four-lesson

classroom education component which was inclusive of in-class taste-tests accompanied by a product survey consisting of commitment statements and cafeteria promotions component in which whole wheat promotional posters were displayed in the cafeteria. In addition to the theoretical constructs, ‘The Power of 3: Get Healthy with Whole Grain Foods’ involved school menu modifications by incorporation of healthful whole grain based foods in the school meals. This multi-component nutrition education program focused on a variety of whole grains which successfully increased the intake of whole-grain foods by children. However, the researchers of this study speculated that because the program was conducted with the help of external professionals, it limited the feasibility of the classroom teachers implementing the program. In comparison, the *Healthy Whole Wheat* school-based study was based on the SCT constructs, but as opposed to being intensive in nature, the whole wheat curriculum consisted of streamlined and simplified lessons which were taught by the classroom teachers. ‘The Power of 3: Get Healthy with Whole Grain Foods’ study consisted of an intensive five lesson curriculum with each lesson taking approximately 45 minutes of classroom time. In comparison, the *Healthy Whole Wheat* curriculum consisted of four brief lessons taking approximately 20 minutes of teaching time. Although the *Healthy Whole Wheat* curriculum was not as intensive as was ‘The Power of 3: Get Healthy with Whole Grain Foods’, our research was successful in increasing the consumption of whole wheat products in the cafeteria by elementary aged students. In our present study, the knowledge gained by children on whole wheat was not tested among children, but the objective of increasing student whole wheat selections in the cafeteria was greater in the classroom education group. However, in ‘The Power of 3: Get Healthy with Whole Grain

Foods' study, children in both the intervention and comparison schools demonstrated an increased ability to identify a whole-grain food, which reflected knowledge; also, a greater upward trend was noted for children in the intervention school ($P = 0.06$).

Many other school-based nutrition education interventions focusing on eating behavior change have been made, through recipe modification, to successfully modify the intake of fruits and vegetables^{15, 22}, fat, sodium⁷³, and low-fat milk⁷⁴ for children in school cafeteria settings. Other research studies like "Take Five", included educational classroom activities which were complemented by activities in the school cafeteria, sought to increase consumption of fruits and vegetables. In "Take Five", the classroom teachers presented students with the "Take Five" nutritional information and food preparation tips based on the weekly-featured fruit and vegetable, which was also reinforced in the cafeteria at lunch time. The study results indicated a change in knowledge about fruits and vegetables from 12% during pre-test to 44% during post-test.

'The Power of 3: Get Healthy with Whole Grain Foods' combined classroom education with school cafeteria menu modification aimed at increasing the intake of whole grain foods by elementary school students in grades three to six. Menu modifications were incorporated by substituting refined grain products with whole or partial whole grain products. The intervention successfully indicated that whole grain consumption at the lunch meal increased by one serving ($p < 0.0001$), refined-grain consumption decreased by one serving, as compared to post-intervention ($p < 0.001$). The "Take Five" study incorporated sample tasting of fruits and vegetables in the school cafeteria in addition to the classroom educational activities. Study results indicated that student's attitudes about the acceptability of eating fruits and vegetables in the school

cafeteria improved significantly ($p=.005$), as did their perception of their ability to eat five fruits and vegetables per day ($p<.001$). In our study, although, taste-tests of whole wheat food products were not tested for specific effects, this added component to the curriculum appeared to have positive results in getting student acceptance of whole wheat in the school cafeteria. The students in the classroom education group also had an opportunity of taste-testing whole wheat items offered in the cafeteria, before they were offered as choices in the school lunch. Although the unit of analysis for measurements in increase of whole grain consumption in the Minnesota study, and fruit and vegetable intake in the “Take Five” study were different as compared to our study, our study did demonstrate an increase in the whole wheat product consumption by children in the school cafeteria. Our study determined that for the classroom education group, the percentage of students making whole wheat food choices in the cafeteria increased from as low as 5% prior to the educational intervention to a statistically significant 82% during intervention, however, the percentage sustained to 44% during the follow-up phase but at least did not drop to a low percentage as observed during baseline.

Although the students in the cafeteria promotions group did not receive classroom education, they were exposed to promotional messages on whole wheat in the form of poster displays in the cafeteria. Both students from the classroom education group and the cafeteria promotions group were exposed to the whole wheat poster displays in the cafeteria. Our study showed that for the cafeteria promotions group, the percentage of students making whole wheat food choices in the cafeteria appeared to increase from as low as 5% during baseline to 25% during intervention to the highest of 27% during the follow-up phase, these observed effects were not significantly different from the control

group. The cafeteria promotional component, however, failed to produce significant changes in the selection of whole wheat food items by students in the cafeteria promotion group during follow-up with the percentage drop to 5%. One intervention study, TACOS (Trying Alternative Cafeteria Options in Schools), engaged students in the promotion of low-fat food choices at two secondary schools in Minneapolis which led to significant drops in sales of high-fat food items from the school cafeterias. The peer promotion strategies included taste tests, food choice self-assessments, and development of media material to disseminate information such as posters and videos. These strategies were effective in influencing the purchasing and eating behaviors of youth in the two intervention schools even in the absence of a classroom curriculum component that reinforces low-fat choices.⁸⁶ However, studies based on only cafeteria promotions through posters do not exist. Overall, considering the cafeteria promotions component, our study noted a slight increase among student's selection of whole wheat choices; however this was not statistically significant. However, whole wheat studies based on only promotional strategies need further exploration.

For the *Healthy Whole Wheat* study, lesson components were inclusive of the taste-tests accompanied by the whole wheat product survey and whole wheat poster displays. These components were collectively built in the *Healthy Whole Wheat* curriculum and together they were successful. Children in the *Healthy Whole Wheat* project were encouraged to make commitments on the whole wheat product survey to talk to their family and friends about the whole wheat health benefits. While children participating in the *Healthy Whole Wheat* project were encouraged to talk to their parents, we did not examine how this might have influenced their choices outside the school

environment. Hence, in our present study, determining which individual component was the key factor for influencing cafeteria selections is beyond the scope of this research and a topic for further research study. Previous nutrition interventions have indicated that although creative family-oriented activities were conducted, the overall parent involvement with programs has been low. ‘The Power of 3: Get Healthy with Whole Grain Foods’ indicated that the intervention failed to produce significant changes related to availability of whole grain foods in the home and perceptions of health benefits for parents. No differences in the perceptions of whole grain health benefits or reported availability of whole grain foods in the home were noted for parents.

The quantitative data over a period of 10 weeks determined that for the control group, the percentage of students making whole wheat food choices in the cafeteria increased from as low as 6% during baseline to 13% during intervention to a low of 4% during the follow-up phase. These slight increases in the percentages were not statistically significant. A possible explanation for this slight insignificant increase could be due to repeated exposure of whole wheat offerings in the cafeteria. However, this effect did not sustain through the follow-up phase as the students did not receive any classroom education nor were they exposed to any kind of whole wheat cafeteria promotions. Based on our study, the lack of significant change in the control group suggests that changes seen in the treatment groups were more likely based on the intervention.

Considering the overload on school teachers in terms of teaching school curriculum and limited time availability, the results of our study have shown that with a minimum intensity intervention, students can be educated as well as encouraged to make

healthy choices in the cafeteria. Hence, what minimum level of educational intervention needs to be done to get acceptance of whole wheat by students, needs further exploration.

5.2 Program Perceptions and Implementation Effects

As mentioned earlier, the teachers gave an overall positive feedback about our study. The teachers appreciated the fact that the lesson plans were very specific and concise and that they did not have to do further research on the topic area. One of the teachers had asked a parent volunteer to teach the lesson in the classroom. The parent volunteer successfully conducted the classroom session without any barriers. Based on the comments received by teachers about the *Healthy Whole Wheat* study, our study indicated that streamlined campaigns could be effective in changing behavior. Teachers wanted lessons that were easy to implement while considering the amount of teaching time that teachers can invest in their already existing schedules, realistic and simple for students to understand and remember. However, the teachers indicated that it would be more appropriate if the whole wheat classroom sessions were carried out by the health and physical education teachers.

Initially, the food service director was concerned about offering the whole wheat options in the cafeteria as it would slow the cafeteria line. Other concerns were related to past resistance of children towards whole wheat choice offerings and the higher costs of whole wheat products involved with offering additional choices in the cafeteria. The food service personnel indicated that classroom education was successful to help overcome resistance of whole wheat products by children. However, the food service director also indicated concerns about funding issues when offering whole grain products in the

cafeteria. The food service director felt that if students did not select whole wheat options that were added to the menu, the school food program would lose money. The food service director was willing to offer whole wheat food items only either if it was made a mandate in the schools through the school policy or if the additional funding was assured. Actually, whole wheat is a food item that could be selected if selected as a commodity food option at the state level. However, for this option would be viable, only if it could be certain that children would accept the whole wheat products offered as a result of the commodity wheat. So the appropriate solution would be to offer education in schools to influence their selection of whole grain products, while increasing the whole wheat products offered and decreasing the costs through incorporating whole wheat commodities available to schools. Our study indicated that effects of classroom education were immediate and held throughout the intervention period of the study. It should also be noted that even though for the classroom education group, there was a decrease in the proportions of students selecting whole wheat product during the follow-up when there was no classroom education, this decrease was not equivalent to the baseline percentage. It is not unusual for studies to show a drop off during the follow-up phases of the studies.^{16, 87}

Overall, in the *Healthy Whole Wheat* study, we observed that combining short whole wheat classroom lessons, cafeteria promotions based on simple whole wheat messages tied to school menu modifications produced significant increases in the proportion of students choosing whole wheat items in the cafeteria. The food service director and teachers were willing to work together if concise lessons plans connecting classroom and cafeteria were provided to them. Both the teachers and the food service

director recognized the benefits for kids and all were supportive of the program. However, what efforts are needed on an on-going basis, to maintain the achieved effects need further exploration.

5.3 Strengths and Limitations

Our study represents a simplified and streamlined school based educational and promotional intervention, comparing two levels of education, designed to increase the consumption of whole wheat food products in a school setting. The *Healthy Whole Wheat* curriculum was designed to be streamlined curriculum and comprised of short promotional whole wheat sessions. Trained nutrition professionals from outside the school environment were not needed for implementation of the project. The teachers taught the lessons themselves in the classroom. An additional strength of our study was the fact that the classroom education group, cafeteria promotions group and the control group were in the same school district and hence the food offered in the school cafeteria was the same. The district menus and policies were the same and did not therefore introduce any flaws in our study. As our study required minimal intervention in terms of menu modifications, classroom education and promotion of whole wheat products, we managed to get very good cooperation with the school teachers, the school food service staff and the school administration. In addition, we compared two intervention doses of varying intensities consisting of classroom education and cafeteria promotions and we combined quantitative and qualitative methods to understand the results.

Some limitations must be considered when interpreting the results of the study.

Children's knowledge gain on whole wheat was not tested but our research focused on behavior changes relative to the whole wheat choices offered in the school cafeteria. Another limitation is that the study participants were not randomly selected. One of the participating school districts asked for help getting whole wheat into their school food service menu and teachers volunteered their classrooms to be in the classroom education group and the cafeteria promotions group. The nature of the small convenience sample from a single school district limits the ability to generalize the results to a broader group of children. The children who participated in the study were not representative of a more general population based on ethnicity which limits the ability to apply the findings on a diversified population. Researchers may face barriers which may be unique to the prospective school environment for e.g., demographic location such as urban or rural etc., and that in turn may affect the recruitment and selections of student participants.

5.4 Conclusions and Implications

Findings from the current study have demonstrated that whole wheat foods can be successfully incorporated in the school environment. Pairing short promotional classroom education lessons with in-class taste testing of school lunch menu items can increase consumption of whole wheat items in the school cafeteria. Our study demonstrated a statistical increase in the whole wheat selection by students receiving classroom education. Although, the combined components of the *Healthy Whole Wheat* curriculum worked successfully in increasing whole wheat product consumption among 4th and 5th graders, additional research is needed to determine the effects of individual components.

Our study demonstrated that a short, behaviorally based intervention successfully influenced student cafeteria choices of whole wheat products. However, what minimum level of intervention needs to be done on an ongoing basis to maintain an increased whole wheat selection among children needs further exploration. Strategies need to be explored to develop effective educational lessons which would in turn encourage schools to avail commodity foods like whole wheat. Additionally from a policy making stand point, higher reimbursement for school lunches is recommended. Additional research to determine comparative effects of the classroom components, lessons, taste testing and commitments is suggested. Also longer term follow up to determine degree of maintenance of effects over time as well as minimum level on on-going intervention to achieve maintenance is also suggested.

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Appendix A

Healthy Whole Wheat Curriculum

Whole Wheat Elementary Education Curriculum

Session #1: THE WHOLE WHEAT KERNEL

Time: Approximately. 30 minutes

Materials -

Materials for Teachers: a) The Whole Wheat Kernel: Instructional Sheet
b) Healthy Whole Wheat Kit

Materials for Students: a) Healthy Whole Wheat Kit which includes:
1. The Whole Wheat Kernel handout
2. Samples of Wheat Kernel, Wheat Germ, Wheat Bran, Whole Wheat flour, White flour
3. Bread Survey
4. Paper Napkins
5. Paper Plate

Materials for the Classroom: a) Poster - The Whole Wheat Kernel
b) Trash Bags

Materials for Taste Tests: Whole Wheat Bread: 'bite' size samples
White Bread: 'bite' size samples

Objective:

Students will be able to:

Identify and state different components of the wheat kernel



The Whole Wheat Kernel: Instructional Sheet

Classroom Session 1

Objective: The students will be able to identify and state different components of the wheat kernel.

I. Introduction: (1 min)

- ◆ Tell students that the main purpose of the session is to become familiar with the whole wheat kernel and learn about its different components.
- ◆ Tell students that they will be learning about the whole wheat kernel and then will be able to taste and “evaluate” whole wheat and white breads.

II. Session Activities: (25 - 30 minutes)

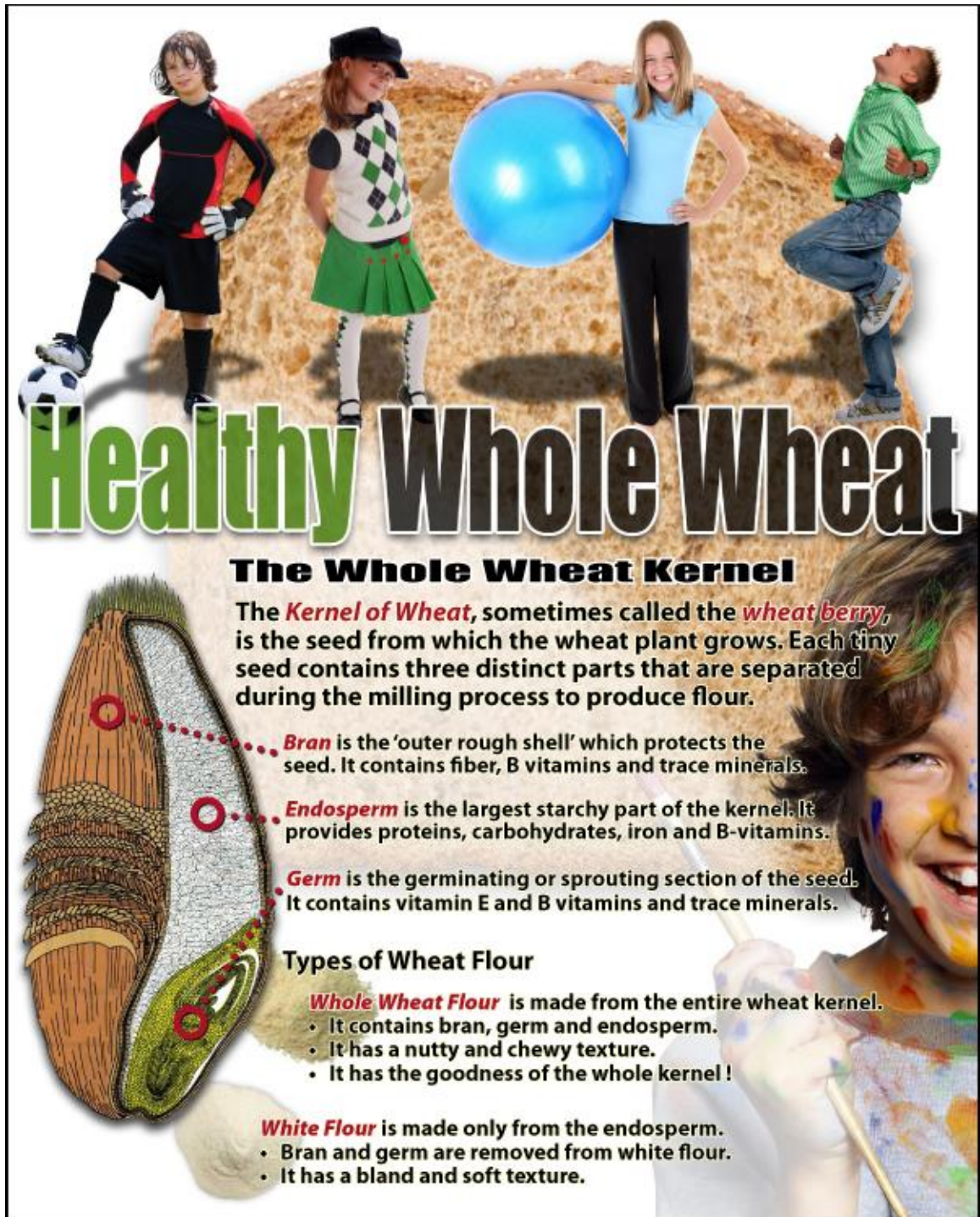
A. Activity 1 (15 minutes): The Whole Wheat Kernel

- ◆ Ask students if they have ever seen, touched or tasted a wheat kernel. Discuss.
- ◆ Pass out the Healthy Whole Wheat Kit to students and ask them to remove *The Whole Wheat Kernel handout* and *Samples of Wheat Kernel, Wheat Germ, Wheat Bran, Whole Wheat flour, White flour* from the kit.
- ◆ Discuss the different components of the whole wheat kernel; bran, endosperm, and germ, by holding up or referring to the poster and student handouts. Tell students to touch and taste the samples of wheat kernels, wheat germ, wheat bran, wheat flour and white flour.
- ◆ Ask students to describe the taste of wheat kernels, wheat germ, wheat bran, wheat flour and white flour.
- ◆ Discuss the difference between whole wheat flour and white flour as per the information provided on the poster.
- ◆ Tell students that whole wheat products or bread generally have much higher amounts of fiber, proteins and trace minerals compared to white bread.

B. Activity 2 (15minutes): Taste Testing of Whole Wheat & White Bread

- ◆ Ask the students to remove the *Bread Survey* from the Healthy Whole Wheat Kit.
- ◆ Tell students that they will now act as judges to complete a bread survey.
- ◆ Explain to the students that they will be using the 1 through 10 scale to rate the Taste, Texture, Appearance and Overall Rating for the whole wheat and white bread. Explain the 1 through 10 scale as necessary.
- ◆ Pass out *Whole Wheat Bread: ‘bite’ size samples* and ask students to taste the bread, think about their evaluation, and provide a rating on the *Bread Survey*.
- ◆ Pass out *White Bread: ‘bite’ size samples* and ask students to provide a rating on the *Bread Survey*

- ◆ Encourage students to consider making a commitment as indicated on the bottom of the Bread Survey sheet and check options provided on the Commitment line, if they choose to do so.
- ◆ Discuss the day's lunch menu options where students will have an option to choose whole wheat dinner roll vs. white roll , including the whole wheat peanut butter and jelly option.



Healthy Whole Wheat

The Whole Wheat Kernel

The *Kernel of Wheat*, sometimes called the *wheat berry*, is the seed from which the wheat plant grows. Each tiny seed contains three distinct parts that are separated during the milling process to produce flour.

- Bran** is the 'outer rough shell' which protects the seed. It contains fiber, B vitamins and trace minerals.
- Endosperm** is the largest starchy part of the kernel. It provides proteins, carbohydrates, iron and B-vitamins.
- Germ** is the germinating or sprouting section of the seed. It contains vitamin E and B vitamins and trace minerals.

Types of Wheat Flour

Whole Wheat Flour is made from the entire wheat kernel.

- It contains bran, germ and endosperm.
- It has a nutty and chewy texture.
- It has the goodness of the whole kernel !

White Flour is made only from the endosperm.

- Bran and germ are removed from white flour.
- It has a bland and soft texture.

Bread Survey

Directions: Please use a scale of 1 to 10 to indicate the degree to which you Like or Don't Like each tasted item.
There are no right or wrong answers.

Don't Like

Like

1 2 3 4 5 6 7 8 9 10

Type of Bread	Taste	Texture	Appearance	Overall Rating
Whole Wheat Bread				
White Bread				

List one thing you liked about the whole wheat bread:

List one thing you didn't like about the white bread:

My Healthy Whole Wheat Commitments: Use a (✓) for all your commitments!

- I am going to choose healthy whole wheat for lunch.
- I will talk to my friends about healthy whole wheat.
- I will talk to my family about healthy whole wheat.

Session #2: THE WHOLE WHEAT HEALTH BENEFITS

Time: Approximately. 30 minutes

Materials –

Materials for Teachers: a) The Whole Wheat Health Benefits: Instructional Sheet
 b) The Whole Wheat Kernel sheet (from Session#1)
 c) The Nutrient information sheet
 d) Sandwich Survey

Materials for Students: a) Healthy Whole Wheat Nutrients for Good Health Sheet
 b) Sandwich Survey

Materials for the Classroom: a) Poster - Whole Wheat: Go Get the Healthy Choice
 b) Paper Plates
 c) Paper Napkins
 d) Trash Bags

Materials for Taste Tests: Sandwich on Whole Wheat Bread: ‘bite’ size samples

Objective:

Students will be able to:
State the health benefits of whole wheat foods.



The Whole Wheat Health Benefits: Instructional Sheet

Classroom Session 2

Objective: The students will be able to state the health benefits of whole wheat foods

I. Introduction: (1 min)

- ◆ Review the components of whole wheat (bran, endosperm and germ) by referring to The Whole Wheat Kernel sheet from Session #1. Ask students if they remember the difference between white flour and whole wheat flour. Discuss their answers.
- ◆ Tell students that the main purpose of Session 2 is to learn about the nutrition and health benefits of whole wheat foods.

II. Session Activities: (25 - 30 minutes)

A. Activity 1 (15 minutes): Whole Wheat: Go Get the Healthy Choice

- ◆ Ask students if they know any benefits of consuming whole wheat foods. Discuss their answers.
- ◆ Pass out the *Whole Wheat: Go Get the Healthy Choice* handout to students.
- ◆ Discuss the nutrients that are commonly present in whole wheat and white bread and then state that whole wheat has many health benefits as it has higher amounts of fiber, protein and other nutrients, by holding up or referring to the *Whole Wheat: Go Get the Healthy Choice* poster.
- ◆ Encourage students to look at the graph plots.
 - Point out the different colors for the bars in the graphs. Tell students that the white bar is for white flour and the brown bar is for whole wheat flour. Ask them which bars are higher. Tell them that means that whole wheat flour has more of those nutrients.
 - Discuss that fiber and protein from the first bar graph are measured in different (larger) units than the others and that is why they are on a different graph.
 - Tell them that fiber is important not only for their “digestive health” and to keep regular, but it has long term benefits and has been shown to reduce risk of cancer and heart disease as well as keeps people feeling full and that helps reduce obesity.
 - Protein is in both white and wheat flour and is the raw material to build muscles and other body tissues.

- Eating meat provides more protein than bread contains, but bread does have some protein and is a good food because it also has the other nutrients you see on the second table.
- The important point in the tables is that whole wheat has more of almost every nutrient. For additional information on the functions of the other nutrients, a nutrient information sheet has been included in the teacher materials.

B. Activity 2 (15minutes): Taste Testing of Sandwich on Whole Wheat bread.

- ◆ Tell students that the objective of this activity for each student will be to taste a sandwich on whole wheat; act as judges and complete a sandwich survey.
- ◆ Pass out the *Sandwich Survey*.
- ◆ Explain to the students that they will be using the 1 through 10 scale to rate the Taste, Texture, Appearance and Overall Rating for the whole wheat and white bread. Explain the 1 through 10 scale as necessary.
- ◆ Pass out Sandwich on Whole Wheat Bread and ask students to provide a rating on the *Sandwich Survey*.
- ◆ Ask students to describe why they like or don't like the whole wheat sandwich.
- ◆ Encourage students to consider making a commitment as indicated on the bottom of the *Sandwich Survey* and check options provided on the Commitment line, if they choose to do so. Encourage students to write down more commitments other than or in addition to the ones listed on the *Sandwich Survey*.
- ◆ Behavioral science suggests that asking people to make a commitment to a behavioral change can help in making that change. Discuss the commitments listed on the survey sheet and go over each one asking students if they would like to commit to each one. You may need to explain that a commitment is like a promise to yourself.
- ◆ Discuss the day's lunch menu options by telling students that they will be offered an option to choose the chicken sandwich and peanut butter and jelly sandwich on whole wheat and white bread.

The Whole Wheat Nutrients: Information Sheet

Classroom Session 2

Riboflavin

Role: Riboflavin plays an important role in energy metabolism, aids in normal vision, and helps in maintaining health and integrity of the skin.

Source: Meat, green leaves, milk, yogurt and whole-grain cereals

Vitamin B6

Role: Vit. B6 helps to make red blood cells, facilitates metabolism and in the absorption of fats and proteins in the body.

Source: White beans, cabbage, whole-grain cereals, avocados, walnuts, eggs, leafy green vegetables, meat, fish, sweet potatoes, and legumes

Thiamin

Role: Thiamin plays an important role in energy metabolism, supports appetite and the functions of the nervous system.

Source: Whole-grain cereals, beans, meat, fish and poultry

Vitamin E

Role: Vit. E facilitates resistance to diseases and protects cell structures in the body.

Source: Whole-grain cereals, leafy vegetables, peanuts, egg yolks, dark green vegetables, vegetables oils, seeds and nuts.

Niacin

Role: Niacin plays an important role in energy metabolism, aids in normal functioning of nervous and digestive systems, supports integrity of skin and health.

Source: Whole-grain cereals, egg, meat, poultry, fish, milk and peanuts.

Zinc

Role: Zinc helps maintain a healthy immune system and facilitates the digestion and transport of vitamin A.

Source: Whole-grain cereals, meat, chicken, fish, milk, nuts, garlic, oysters, egg yolks, legumes, leafy green vegetables and seafood.

Iron

Role: Iron helps to transport oxygen to the blood and builds new blood cells.

Source: Red meat, poultry, meat, fish, liver, seafood, eggs, peanuts, beans, dried fruit, whole-grain cereals and alfalfa.

Manganese

Role: Manganese is needed for normal utilization of several other vitamins in the body. It aids in proper fat metabolism, building skeletal and connective tissues, production of energy, proper brain function, and processing blood sugar.

Source: Wheat bran, legumes, nuts, lettuce, leafy green vegetables, blueberries, pineapple

and seafood.

Magnesium

Role: Magnesium aids in proper functioning of the nervous system. It helps in strengthening muscles, helps in bone development and teeth maintenance.

Source: Seafood dark green vegetables, cereals, nuts and legumes.

Healthy Whole Wheat

Whole Wheat: Go Get the Healthy Choice

Wholesome Health Benefits of Whole Wheat
 May reduce risk for: Obesity — Diabetes — Cancer — Heart Disease

Whole Wheat has more Fiber and Protein than White!

Whole Wheat vs. White Flour

Component	Whole Wheat (Grams/100g)	White Flour (Grams/100g)
Fiber	~6.5	~1.5
Protein	~10.5	~7.5

Fiber helps to satisfy appetite for a longer time and helps digest and eliminate foods.
Protein helps you build stronger muscles.

Whole Wheat has more Vitamins and Minerals than White!

Whole Wheat vs. White Flour

Component	Whole Wheat (Milligrams/100g)	White Flour (Milligrams/100g)
Riboflavin	~2.5	~1.5
Vitamin B6	~3.5	~1.5
Thiamin	~4.5	~1.5
Vitamin E	~5.5	~1.5
Niacin	~6.5	~1.5
Vitamin B12	~7.5	~1.5
Iron	~8.5	~1.5
Zinc	~9.5	~1.5
Magnesium	~10.5	~1.5
Manganese	~11.5	~1.5

Vitamins have different actions in the body and are necessary for good health and life.
Minerals are important in regulating various body functions.

Sandwich Survey

Directions: Please use a scale of 1 to 10 to indicate the degree to which you Like or Don't Like each tasted item.
There are no right or wrong answers.

Don't Like
Like
 1 2 3 4 5 6 7 8 9 10

	Taste	Texture	Appearance	Overall Rating
Whole Wheat Chicken Sandwich				

List one thing you liked about the bread on the sandwich:

List one thing you didn't like about the bread on the sandwich:

My Healthy Whole Wheat Commitments: Use a (✓) for all your commitments!

- I am going to choose healthy whole wheat and/or whole grain choices for lunch.
- I will talk to my friends about healthy whole wheat food choices.
- I will talk to my family about healthy whole wheat food choices.

Session #3: IDENTIFY WHOLE WHEAT FOODS

Time: Approximately. 30 minutes

Materials –

Materials for Teachers:

- a) Identify Whole Wheat Foods: Instructional Sheet
- b) The School Lunch Menu with highlighted Whole Wheat Food items.
- c) Take a Look at the Whole Wheat Food Labels: Handout
- d) Sandwich Survey

Materials for Students:

- a) The School Lunch Menu
- b) Take a Look at the Whole Wheat Food Labels: Handout
- c) Sandwich Survey

Materials for the Classroom:

- a) Take a Look at the Whole Wheat Food Labels: Poster
- b) Paper Plates
- c) Paper Napkins
- d) Trash Bags

Materials for Taste Tests: Sandwich on Whole Wheat Bread: ‘bite’ size samples

Objective:

Students will be able to:

Identify whole wheat containing food products on the school lunch menu.

Learn tips to identify whole wheat foods in other environments like grocery store.



Identify Whole Wheat Foods: Instructional Sheet

Classroom Session 3

Objective: The students will be able to identify whole wheat containing food products.

I. Introduction: (1 min)

- ◆ Review and initiate a discussion about the main points from the previous sessions about the components of the whole wheat kernel; bran, endosperm and germ. Remind students that whole wheat has higher amounts of fiber, proteins and nutrients as compared to white. Ask students if they remember anything about the health benefits of whole wheat. Discuss lowering risk of many health problems referring to the poster and the handout.
- ◆ Tell students that the main purpose of the session today is to identify whole wheat containing food products.

II. Session Activities: (25 - 30 minutes)

A. Activity 1 (15 minutes): Good Health & Healthy Whole Wheat Nutrients

- ◆ Tell students that the objective of this activity is for each student to identify whole wheat containing food products on the school lunch menu.
- ◆ Tell students that they will also learn tips on how to identify whole wheat foods by looking at food labels.
- ◆ Tell students that in the past most cafeteria foods were made with white flour but food service people were going to be trying to add more whole wheat in the future if students will accept them.
- ◆ Pass out the *School Lunch Menu* to students and ask students if they can identify menu items on the *School Lunch Menu* that could be substituted to include whole wheat products. You can refer to the *School Lunch Menu with highlighted Whole Wheat food items*.
- ◆ Ask students if they have ever tasted whole wheat products other than bread. Discuss their response.
- ◆ Pass out *Take a Look at the Whole Wheat Food Labels* handout to students.
- ◆ Encourage students to look at the examples of the ‘Ingredients’ list provided on *Take a Look at the Whole Wheat Food Labels* handout.
 - Tell students that just because bread is labeled “Wheat Bread” doesn’t automatically mean that they are getting a more nutritious loaf.
 - Tell students that to make sure they choose a 100% whole wheat bread, they should always look at the first ingredient. Refer to the poster and tell students that the first ingredient should be listed as ‘Whole Wheat Flour’

- or ‘Stone Ground Whole Wheat Flour’ or sometimes even ‘100% Whole Wheat Flour’ and ‘100% Stone Ground Wheat Flour’
- Referring to the poster tell students that some breads, which are seen as whole wheat are made with a combination of white and whole wheat flour and the ingredient list will list both. Inform students that these breads should not be mistaken for whole wheat breads.
- Tell students that sometimes bread labeled as “wheat bread” is really made with white flour with brown coloring added. This bread would not have the extra benefits of whole wheat bread. Inform students that these breads should not be mistaken for whole wheat breads.
- ◆ Discuss the ‘Clues to identify Whole Grain products’ provided on *Take a Look at the Whole Wheat Food Labels* handout with students.

B. Activity 2 (15minutes): Taste Testing of Sandwich on Whole Wheat bread

- ◆ Tell students that the objective of this activity for each student will be to taste a sandwich on whole wheat; act as judges and complete a sandwich survey.
- ◆ Pass out the *Sandwich Survey*.
- ◆ Explain to the students that they will be using the 1 through 10 scale to rate the Taste, Texture, Appearance and Overall Rating for the whole wheat bread. Explain the 1 through 10 scale as necessary.
- ◆ Pass out *Sandwich on Whole Wheat Bread* and ask students to provide a rating on the *Sandwich Survey*.
- ◆ Ask students to describe why they like or don’t like the whole wheat sandwich.
- ◆ Encourage students to consider making a commitment as indicated on the bottom of the *Sandwich Survey* and check options provided on the Commitment line, if they choose to do so. Encourage students to write down more commitments other than or in addition to the ones listed on the *Sandwich Survey*.
- ◆ Discuss the day’s lunch menu options by telling students that they will be offered an option to choose the fish sandwich and peanut butter and jelly sandwich on whole wheat and white bread.

Healthy Whole Wheat

Take a Look at Whole Wheat Bread Labels

Take a closer look at the Ingredients list....

INGREDIENTS: **WHOLE WHEAT FLOUR,** WATER, HIGH FRUCTOSE CORN SYRUP, WHEAT GLUTEN, SOYBEAN AND/OR CANOLA OIL, YEAST, SALT, HONEY.

Because ingredients are listed in order by amount, always look for the FIRST ingredient to be **Whole Wheat to help determine if the product is whole grain.**

INGREDIENTS: **MULTI-GRAIN FLOUR,** WATER, BULGER WHEAT, WHEAT GLUTEN, BROWN SUGAR, HONEY, YEAST, SALT, SOY LECITHIN, SOY FLOUR.

Foods labeled with the words *multi-grain, 100% wheat, cracked wheat, seven-grain, or bran* are usually **NOT whole-grain products.**

INGREDIENTS: **ENRICHED WHITE FLOUR,** WATER, HIGH FRUCTOSE CORN SYRUP, SOYBEAN AND/OR CANOLA OIL, WHEAT FLOUR, YEAST, SALT, HONEY.

This label is for white bread without the benefits of whole grain although the color could be white or brown. Brown coloring may be added to make it look like whole wheat but it's really not.

Sandwich Survey

Directions: Please use a scale of 1 to 10 to indicate the degree to which you Like or Don't Like each tasted item.
There are no right or wrong answers.

Don't Like

Like

1 2 3 4 5 6 7 8 9 10

	Taste	Texture	Appearance	Overall Rating
Whole Wheat Fish Sandwich				

List one thing you liked about the bread on the sandwich:

List one thing you didn't like about the bread on the sandwich:

My Healthy Whole Wheat Commitments: Use a (✓) for all your commitments!

- I am going to choose healthy whole wheat and/or whole grain choices for lunch.
- I will talk to my friends about healthy whole wheat food choices.
- I will talk to my family about healthy whole wheat food choices.

Session #4: ALL ABOUT WHEAT

Time: Approximately. 30 minutes

Materials for Teachers:

- a) All About Wheat: Instructional Sheet
- b) The Whole Wheat Kernel: Session 1 Handout
- c) Whole Wheat: Go Get the Healthy Choice: Session 2 Handout
- d) Take a Look at Whole Wheat Bread Labels: Session 3 Handout
- e) Pizza Survey

Materials for Students:

- a) Things to Remember about Whole Wheat: Handout
- c) Pizza Survey

Materials for the Classroom:

- a) Things to Remember about Whole Wheat: Poster
- b) Paper Plates
- c) Paper Napkins
- d) Trash Bags

Materials for Taste Tests: French Bread Pizza on Whole Wheat Bread: 'bite' size samples

Objective:

Students will be able to:

Discuss about components of whole wheat kernel, understand the health benefits of whole wheat and be able to identify whole wheat products by reading the food labels.



All About Wheat: Instructional Sheet

Classroom Session 4

Objective: The students will be able to understand and remember that whole wheat products are healthier than white.

I. Introduction: (1 min)

- ◆ Review and initiate a discussion about the main points from the previous three sessions. Remind students that in Session 1 they learned about the main components of wheat, in Session 2 they learned about the whole wheat health benefits and in Session 3 they learned how to identify whole wheat products by looking at food labels.
- ◆ Tell students that the main purpose of today's Session 4 is to review what they learned in the previous 3 sessions, which will in turn help them to remember that whole wheat products are healthier than white.

II. Session Activities: (25 - 30 minutes)

A. Activity 1 (15 minutes): Things to Remember about Whole Wheat

- ◆ You may use posters/handouts from the previous sessions in the classroom to remind students everything about whole wheat.
- ◆ Pass out *Things to Remember about Whole Wheat* handout to students.
- ◆ Tell students that the objective and main points from each session will be reviewed. While encouraging students to look at the *Things to Remember about Whole Wheat* handout, you may start by reminding students with the titles of previous sessions followed by stating objectives and discussing the main points.
 - **Session 1:** The Whole Wheat Kernel
 - Objective:* The students were able to identify and state different components of the wheat kernel.
 - Main points:* Remind students that they had touched and tasted samples of whole wheat kernels, wheat bran, germ, wheat flour and white flour.
 - Ask students if they remember the touch and taste of these samples.
 - Tell students that Bran is the outer rough shell which protects the kernel.
 - Tell students that Endosperm is the starchy part of the kernel.
 - Tell students that Germ is the germinating sections of the seed.
 - Remind students that the whole wheat flour is made from the whole kernel while white flour is made from only endosperm. Hence, whole wheat flour is healthier as it contains all the beneficial nutrients.
 - **Session 2:** The Whole Wheat Health Benefits
 - Objective:* The students were able to state the health benefits of whole wheat foods.

Main points: Remind students that they had looked at graph plots of nutrients that are commonly present in whole wheat and white bread. Whole wheat has many health benefits as it has higher amounts of fiber, protein and other nutrients

- Tell students that fiber is important not only for their “digestive health” but it has long term benefits and has been shown to reduce risk of cancer and heart disease. It also keeps people feeling full and that helps reduce obesity.
- Protein is the raw material needed to build muscles and other body tissues.
- Remind students that vitamins have different actions in the body which help maintain good health while minerals are important in regulating various body functions.
- Tell students that in general, the whole wheat has greater amounts of fiber, protein, vitamins and minerals, as compared to white. You may refer to the graphs on the poster and state the vitamins and minerals.

- **Session 3: Identify Whole Wheat Foods**

Objective: The students were able to identify whole wheat containing food products.

Main points: Remind students that they had looked the school lunch menu to discuss possible menu items that could be substituted with healthy whole wheat. Remind them that they also looked at food labels to understand which food products contained whole wheat.

- Tell students that because ingredients are listed by order of amount, always look for the first ingredient to be Whole Wheat to help determine if the product was whole grain.
- Foods labeled with the words “multi-grain,” “100% wheat,” “cracked wheat,” “seven-grain,” or “bran” are usually NOT whole-grain products.
- Remind students that sometimes brown coloring may be added to white bread to make it look like whole wheat but it’s really not. It is misleading because it seems to indicate it has the nourishment of whole wheat which it does not.

B. Activity 2 (15minutes): Taste Testing of French Bread Pizza on Whole Wheat Bread

- ◆ Remind the students that in the past weeks some of you made commitments to try whole wheat food choices in the cafeteria and talk about it. Ask students for a show of hands of those who made the whole wheat choice last week. Try to start a discussion about their thoughts about the whole wheat items at lunch in the cafeteria. Ask if anyone talked about whole wheat at home. What was the reaction? Were any of your parents interested in trying whole wheat products at home?
- ◆ Tell students that the objective of this activity for each student will be to taste a French bread pizza on whole wheat bread; act as judges and complete a sandwich survey.

- ◆ Pass out the *Pizza Survey*.
- ◆ Explain to the students that they will be using the 1 through 10 scale to rate the Taste, Texture, Appearance and Overall Rating for the whole wheat bread. Explain the 1 through 10 scale as necessary.
- ◆ Pass out French Bread Pizza on Whole Wheat Bread and ask students to provide a rating on the *Pizza Survey*.
- ◆ Ask students to talk about their opinions of the whole wheat bread on the pizza and why they like or don't like the whole wheat pizza. Ask if the experience of the pizza is different from the experience of the whole wheat bread that they tasted.
- ◆ Encourage students to consider making a commitment as indicated on the bottom of the *Pizza Survey* and check options provided on the Commitment line, if they choose to do so. Encourage students to write down more commitments other than or in addition to the ones listed on the *Pizza Survey*.
- ◆ Discuss the day's lunch menu options by telling students that they will be offered an option to choose the French bread pizza and peanut butter and jelly sandwich on whole wheat or on white bread.

Things to Remember about Whole Wheat



The Whole Wheat Kernel

- The **main components** of *wheat* are **bran, germ and endosperm**.

Whole Wheat: Go Get The Healthy Choice

- Wholesome health benefits of whole wheat: **reduces health risks** for obesity, diabetes, cancer and heart disease.
- Whole wheat foods have **more fiber, protein, vitamins and minerals** than white.
- Fiber from whole wheat helps to **satisfy the appetite** for a longer time.
- Protein helps the body to **build stronger muscles**.
- Vitamins and minerals **aid in healthy functions** of the body.

Take a Look at Whole Wheat Bread Labels

- The **first ingredient** in the ingredients list should be **whole wheat** to be sure the **product is whole grain**.



**Make a commitment to choose whole wheat over white.
Whole wheat makes us healthy and strong!**

Pizza Survey

Directions: Please use a scale of 1 to 10 to indicate the degree to which you Like or Don't Like each tasted item.
There are no right or wrong answers.

Don't Like

Like

1 2 3 4 5 6 7 8 9 10

	Taste	Texture	Appearance	Overall Rating
Whole Wheat French Bread Pizza				

List one thing you liked about the whole wheat pizza bread:

List one thing you didn't like about the whole wheat pizza bread:.....

My Healthy Whole Wheat Commitments: Use a (✓) for all your commitments!

- I am going to choose healthy whole wheat and/or whole grain choices for lunch.
- I will talk to my friends about healthy whole wheat food choices.
- I will talk to my family about healthy whole wheat food choices.

Appendix B

Example of Whole Wheat Product Survey

Sandwich Survey

Directions: Please use a scale of 1 to 10 to indicate the degree to which you Like or Don't Like each tasted item. There are no right or wrong answers.

Don't Like
Like
 1 2 3 4 5 6 7 8 9 10

	Taste	Texture	Appearance	Overall Rating
Whole Wheat Chicken Sandwich	10	10	10	10

List one thing you liked about the bread on the sandwich: looks so good

List one thing you didn't like about the bread on the sandwich: I like everything

My Healthy Whole Wheat Commitments: Use a (✓) for all your commitments!

- I am going to choose healthy whole wheat and/or whole grain choices for lunch.
- I will talk to my friends about healthy whole wheat food choices.
- I will talk to my family about healthy whole wheat food choices.



Appendix C

Weekly Whole Wheat Food Choices

Healthy Whole Wheat: Weekly Whole Wheat Food Choices

	Main Entree	Alternatives	Alternatives
Baseline			
Week 1	Popcorn Shrimp with Dinner Roll		Peanut Butter Jelly Sandwich
Week 2	Ham and Cheese Sandwich		Peanut Butter Jelly Sandwich
Week 3	French Bread Pizza		Peanut Butter Jelly Sandwich
Intervention			
Week 3	Chicken Nuggets	Chef's Salad with Dinner Roll	Peanut Butter Jelly Sandwich
Week 4	Chicken Sandwich	Hamburg er	Peanut Butter Jelly Sandwich
Week 6	Fish Sandwich	Bologna and Cheese Sandwich	Peanut Butter Jelly Sandwich
Week 7	French Bread Pizza	Chef's Salad with Dinner Roll	Peanut Butter Jelly Sandwich
Follow-up			
Week 8	Hamburg er	Hotdog	Peanut Butter Jelly Sandwich
Week 9	Meatball Hoagie	Chicken sandwich	Peanut Butter Jelly Sandwich
Week10	Fries and Dinner Roll	Deli Hoagie	Peanut Butter Jelly Sandwich

Note: Both the main entrée and the alternatives were offered at the point of purchase as a choice on wheat and white bread.

Appendix D

School Board Approval



[REDACTED] **Area School District**

[REDACTED]

[REDACTED]

April 23, 2008

Dr. Claudia Probart
Penn State Nutrition Center
College of Health & Human Development
5 Henderson Building
University Park, PA 16802

Dear Dr. Probart:

At the meeting of the [REDACTED] Area School Board, held on Tuesday, April 22, 2008, your nutrition education research project at [REDACTED] Elementary School for the fall of 2008 was approved by the [REDACTED] Area School District Board of School Directors.

Please coordinate your activities with Mrs. [REDACTED], Director of Food Services. We look forward to hearing the results of your study.

Sincerely yours,

[REDACTED]

Superintendent of Schools

[REDACTED]

Appendix E

Parent Consent Form

PENNSTATE



Department of Nutritional Sciences

College of Health and Human Development
The Pennsylvania State University
110 Chandlee Laboratory
University Park, PA 16802-6109

814-863-0772
Fax: 814-863-6103

Dear Parent/Guardian:

This fall, The [REDACTED] Elementary School has permitted a Penn State graduate research assistant to provide materials to teachers for conducting classroom-based nutrition educational sessions on whole wheat. This educational project is being conducted for research purposes. The goal of this proposed project is to determine the effectiveness of an intervention involving education about and promotion of whole wheat products which may encourage students to select food containing whole wheat/grain products in the school cafeteria.

A total of 4 classroom sessions, about 30 minutes each, inclusive of hands-on activities will be administered during the four week time period. To help reinforce concepts taught in the classroom, students will be encouraged to participate in the sessions through various hands on activities and taste testing. These taste tests may be new and different to your child (i.e. whole grains and whole wheat). Therefore it is important to know if your child has any food allergies or intolerances that will prevent him/her from participating in these activities. Students will be encouraged to try new foods but will not be required to do so. In case, your child would not be a participant, he/she can still sit in the class and listen to lessons on whole wheat or will be allowed to read any other books.

To be a participant in the study, the inclusion criterion requires your child to be in the 4th or 5th grade. As per the design of the study, your child will be randomly (like a flip of a coin) included either in a control group i.e., your child will not participate in the classroom sessions OR if assigned to the intervention group, i.e., your child may participate in the educational classroom sessions. Your child will not be asked to fill out any kind of surveys for research purposes. For evaluation purposes, school lunch cafeteria data will be collected and your child's name will not be linked in any way to his/her menu item selections.

Your child's participation in this research will be confidential. Your child's participation in the research is voluntary and he/she may withdraw at anytime. If you prefer that your child does not participate in the study, please fill out the attached opt-out clip and return it to the school with your child, on or before **October 3rd, 2008**. If this opt-out slip is not received from your child, he/she may be asked to participate in the project as described above. A verbal assent for your child will be used prior to conducting the experiment.

If you have questions about this project, you may contact Dr. Claudia Probart, Associate Professor of Nutrition at Penn State University at 814-865-7054 or via e-mail at ckp1@psu.edu.

Sincerely,
Claudia Probart, PhD, RD
Associate Professor
Department of Nutritional Sciences
103 Chandlee Laboratory
Penn State University
State College, PA 16802
Email: ckp1@psu.edu
Tel#: 814-865-7054

Whole Wheat Elementary Education Project: Opt-Out Slip

Only complete this form if you DO NOT want your child to participate in this evaluation research.

I DO NOT want my child to participate.

Parent/Guardian Signature: _____

Parent/Guardian Name (PRINT): _____

Child's Name (PRINT): _____

Date: _____

Appendix F

Cafeteria Tracking Sheet

Appendix G

Post-Interview Questions

Interview Questions

Questions for Teachers

Copies of the four developed lesson plans inclusive of teacher's instruction sheets, student handouts and student survey's, will be given to teachers.

Referring to individual lesson plans, the following discussion and questions will be asked to teachers:

I'd like to talk to you about how the whole wheat lessons worked for you. I am going to give you copies of each lesson and accompanying materials so we can discuss them.

Now, one lesson at a time, I would like to ask you some questions:

Q1. What worked for you about lesson one?

Q2. Did the "Teacher's Guide" provide enough information for you to teach the lesson?

Q3. Did the Handout and Poster convey the message to meet the objectives?

Q4. Do you think the students met the objectives?

Q5. What was your opinion of the taste test section? How did that work for you? How likely would you have been to incorporate this component, if our research team hadn't been there to manage it?

Q6. What was your opinion of the Commitment section?

Q7. Did you add anything to the lesson? Did you skip anything? Would you change anything in the lesson?

Q8. Do you think that the objectives of each lesson were met?

Q9. Was the time spent, worth the learning achieved by students?

Q10. Could you think of any student responses to share with me?

Q11. Could you provide any suggestions about how you could cooperate with the food service personnel's for future promotions?

(repeat above questions for each of the four lessons)

Questions for Food Service Personnel

Q1. What is your opinion about whole wheat cafeteria promotions i.e., whole wheat posters, use of aprons and menu item signage?

Q2. Question for Food Service Director: Would you be willing to offer more whole wheat and/or whole grain choices in the school cafeteria (based on the results of the research study)?

Q3. What were some of the obstacles that you encountered prior to offering whole wheat food options in the cafeteria?

Q4. What were some obstacles you faced when offering whole wheat food options during the project implementation? What steps would you suggest to avoid these obstacles?

Q5. Would you recommend additional promotional methods to target students, other than the posters, aprons and signage?

Q6. Can you think of student responses or comments when asked 'white or wheat' in the cafeteria, that you can share with me?

Q7. Could you provide any suggestions about how you could cooperate with the teachers for future promotions?

Appendix H

Student Lunch Participation

Table: Grade-wise Student Lunch Participation for Classroom Education Group

Classroom Education Group	5 th Grade (N = 22)	5 th Grade (N = 21)	4 th Grade (N = 24)
	Lunch Participation N (%)	Lunch Participation N (%)	Lunch Participation N (%)
Baseline			
Week 1	19 (86.3%)	17 (80.9%)	21 (87.5%)
Week 2	19 (86.3%)	16 (76.2%)	18 (75%)
Week 3	20 (90.9%)	19 (90.5%)	22 (91.6%)
Intervention			
Week 4	18 (81.8%)	18 (85.7%)	21 (87.5%)
Week 5	21 (95.4%)	19 (90.5%)	20 (83.3%)
Week 6	21 (95.4%)	19 (90.5%)	17 (70.8%)
Week 7	18 (81.8%)	19 (90.5%)	18 (75%)
Follow-up			
Week 8	20 (90.9%)	18 (85.7%)	18 (75%)
Week 9	18 (81.8%)	18 (85.7%)	20 (83.3%)
Week 10	19 (86.3%)	19 (90.5%)	19 (79.2%)

Table: Grade-wise Student Lunch Participation for Cafeteria Promotions Group

Cafeteria Promotions Group	5 th Grade (N = 21)	4 th Grade (N = 24)	4 th Grade (N = 24)
	Lunch Participation N (%)	Lunch Participation N (%)	Lunch Participation N (%)
Baseline			
Week 1	19 (90.5%)	19 (79.2%)	22 (91.6%)
Week 2	18 (85.7%)	19 (79.2%)	20 (83.3%)
Week 3	18 (85.7%)	21 (87.5%)	22 (91.6%)
Intervention			
Week 4	19(90.5%)	20 (83.3%)	21 (87.5%)
Week 5	16 (76.2%)	20 (83.3%)	20 (83.3%)
Week 6	17 (80.9%)	20 (83.3%)	21 (87.5%)
Week 7	17 (80.9%)	23 (95.8%)	23 (95.8%)
Follow-up			
Week 8	17 (80.9%)	22 (91.6%)	21 (87.5%)
Week 9	18 (85.7%)	18 (75%)	19 (79.2%)
Week 10	20 (95.2%)	21 (87.5%)	23 (95.8%)

Table: Grade-wise Student Lunch Participation for Control Group

Control Group	5 th Grade (N = 31)	4 th Grade (N = 18)	4 th Grade (N = 18)
	Lunch Participation N (%)	Lunch Participation N (%)	Lunch Participation N (%)
Baseline			
Week 1	27 (87.1%)	13 (72.2%)	15 (83.3%)
Week 2	21 (67.8%)	14 (77.8%)	17 (94.4%)
Week 3	19 (61.3%)	15 (83.3%)	16 (88.9%)
Intervention			
Week 4	24 (77.4%)	14 (77.8%)	17 (94.4%)
Week 5	24 (77.4%)	13 (72.2%)	17 (94.4%)
Week 6	23 (74.2%)	14 (77.8%)	15 (83.3%)
Week 7	23 (74.2%)	14 (77.8%)	16 (88.9%)
Follow-up			
Week 8	21 (67.8%)	12 (66.7%)	16 (88.9%)
Week 9	26 (83.9%)	15 (83.3%)	15 (83.3%)
Week 10	26 (83.9%)	14 (77.8%)	16 (88.9%)