

AN ABSTRACT OF THE THESIS OF

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Title: A Case Study: Nutrition Quality of School Lunches Selected and Consumed by
Third Graders from Food Pyramid Choices Menus Before and After a Nutrition Education
Intervention.

Abstract Approved: _____

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The Oregon Department of Education's Child Nutrition Programs have developed a food-based meal planning system, Food Pyramid Choices Menus (FPCM), to effectively meet the nutrient requirements of the School Meals Initiative for Healthy Children (SMI). FPCM offers students the opportunity to self-select their lunches from a variety of entrees, fruits, vegetables, grains, milks, and condiments. This study was designed to determine the nutritional quality of lunches selected and eaten by 40 third graders (17 in the intervention group and 23 in the control group) participating in FPCM before and after a Team Nutrition education intervention. The intervention class received a four consecutive week series of lessons from the Team Nutrition: Food Works for grades 3-5.

Variety of fruits, vegetables, and grains as well as percentage of kcals from total fat and saturated fat, and amounts of cholesterol, fiber, vitamin C, and vitamin A, as selected and eaten before and after the nutrition education intervention, were assessed and

reported. The students self-selected their lunches from FPCM and the types and amounts of foods selected and eaten were recorded. The variety of fruits, vegetables, and grains as well as the nutrient content for each student's lunches were averaged over the number of days that each student ate lunch during each week of the study. Variety of fruits, vegetables, and grains, as selected, were compared within the intervention group before and after the nutrition education intervention. The nutrient content of lunches, as selected and eaten, was compared between the intervention and control groups as well as within the intervention group, before and after the nutrition education intervention.

For the students receiving the nutrition education intervention, 53% selected a greater number of different fruits and vegetables and 47% selected a greater number of different grain products after the nutrition education intervention than before. They also consumed significantly more kcals from fruits after the nutrition education intervention than before (57 kcal vs 30 kcal, $p=.001$).

The students receiving the nutrition education consumed significantly more vitamin A after the nutrition education intervention than before (226 RE vs 145 RE, $p=0.02$). They also consumed significantly more fiber after the nutrition education intervention than before (3 g vs 2 g, $p=.00$). They did not select or consume significantly more vitamin C after the nutrition education intervention. However, the amounts of vitamin C they selected and ate, before and after the intervention, were significantly above the SMI standards. In addition, the mean daily percent of kcals from total fat and saturated fat and the mean daily amount of cholesterol, selected and eaten by the intervention group, did not change significantly after the nutrition education intervention.

The mean daily amounts of vitamin A, vitamin C, and cholesterol and the mean percent

of kcals from fat and saturated fat, as selected and eaten, were not significantly different between the intervention and control groups before the nutrition education intervention. However, the control group ate significantly more fiber than the intervention group before the nutrition education intervention (3 g vs 2 g, $p=.03$).

After the nutrition education intervention, the intervention group selected and ate significantly more vitamin A than did the control group ($p=.01$). However, there was no significant difference in the mean daily amounts of vitamin C, fiber, cholesterol, or the mean daily percent of kcals from total fat or saturated fat, as selected or eaten, between the intervention group and control group after the nutrition education intervention. In conclusion, including a school-based nutrition education intervention program may improve the nutritional quality of school lunches selected and consumed by third graders participating in the FPCM system.

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**A Case Study: Nutrition Quality of School Lunches
Selected and Consumed by Third Graders from
Food Pyramid Choices Menus
Before and After a Nutrition Education Intervention**

by

Caryl L. Batdorf

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

 Caryl L. Batdorf, Author

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A Case Study: Nutrition Quality of School Lunches
Selected and Consumed by Third Graders
From Food Pyramid Choices Menus
Before and After a Nutrition Education Intervention

INTRODUCTION

The National School Lunch Program (NSLP) is a federally sponsored nutrition program available in over 83% of our nations public and private schools. In 1992, the United States Department of Agriculture (USDA) sponsored The School Nutrition Dietary Assessment Study (SNDAS) to evaluate the nutrients and foods provided in school meals. Five hundred and forty-five schools were randomly selected for the study. Results showed that the amount of energy, cholesterol, vitamin A, and vitamin C offered in the average NSLP meal exceeded the standard for each age group. However, the average percent of kcals from total fat, saturated fat, and carbohydrate did not meet the recommended amounts (1,2).

The Oregon Department of Education's Child Nutrition Programs (ODE-CNP) has developed a food-based meal planning system, Food Pyramid Choices Menus (FPCM), to effectively meet the nutrient requirements set forth in the Child Nutrition Programs: School Meals Initiative For Healthy Children (SMI) Final Rule (3). FPCM offers the students the opportunity to make individual choices, from a variety of foods, about what they select and eat for lunch. More than 100 Oregon elementary schools have implemented FPCM. Preliminary reports state that children appear to be eating more fruits, vegetables, and grains, that children throw less food away, and that the system meets the needs of more specialized groups of children (4).

Resent unpublished data from a randomized study of Oregon elementary schools which have implemented FPCM showed that each school and district varied somewhat in the foods and nutrients offered. On average, FPCM schools are offering meals that meet the SMI requirements and the opportunity for students to self-select nutritious lunches (5). However, Georgiou et al. (1998) found that third grade students did not consume FPCM lunches that met the SMI standards for percent of kcals from fat and percent of kcals from saturated fat (6).

Many school-based nutrition education programs have been developed and implemented with documented success at improving the eating behaviors of children. Team Nutrition is a behaviorally-based nutrition education program developed by Scholastic, Inc. in partnership with the USDA to encourage healthy eating behaviors in our nation's school children. It includes both classroom and school cafeteria components (7).

Nutrition education is not a regular part of the FPCM system. In addition, no Oregon schools participating in FPCM have documented the integration of a school cafeteria component into their classroom-based nutrition education. Therefore, it is the purpose of this study to identify possible improvements in the nutritional quality of lunches selected and eaten by third graders participating in FPCM after receiving a school-based nutrition education intervention which includes school cafeteria activities.

Forty third-grade students participated in the study. They self-selected their lunches from the school cafeteria which offered FPCM. Their lunches were analyzed for daily variety of fruits, vegetables, and grains selected as well as for amounts of vitamin A,

vitamin C, fiber, cholesterol, percent of kcals from total fat, and percent of kcals from saturated fat selected and eaten. Statistical comparisons of average daily variety and nutrient content were made between the intervention and control groups as well as within the intervention group before and after the nutrition education intervention.

The first hypothesis was that third graders would select a greater variety of fruits and vegetables from FPCM after a nutrition education intervention. The second hypothesis was that third graders would select a greater variety of grains from FPCM after a nutrition education intervention. The third hypothesis was that third graders would consume a greater proportion of lunch kcals from the fruits, vegetables, and grain products components of FPCM, after a nutrition education intervention than before. The fourth hypothesis was that third graders would consume lunches from FPCM with larger amounts of vitamin C, vitamin A, and fiber after a nutrition education intervention than before. The fifth hypothesis was that third graders would consume lunches from FPCM with a smaller percentage of kcals coming from total fat and saturated fat and a smaller amount of cholesterol after a nutrition education intervention than before. The sixth hypothesis was that there would be no pre-intervention difference between the average nutrient content (vitamin A, vitamin C, fiber, percent of kcals from total fat, percent of kcals from saturated fat, and cholesterol) of lunches selected and eaten by third graders in the intervention group and control group. The seventh hypothesis was that after a nutrition education intervention, the average amount of vitamin A, vitamin C, and fiber in lunches as selected and consumed would be higher and the average percent of kcals from total fat and saturated fat and the amount of cholesterol would be lower in the intervention

group than in the control group. The eighth hypothesis was that parents of the third graders would observe that students were more willing to try new fruits and vegetables at home after a nutrition education intervention than before.

LITERATURE REVIEW

History of the National School Lunch Program

In 1946 the National School Lunch Act (NSLA) was signed into law by President Harry S. Truman and created the NSLP. The primary purpose of the lunch program was to eliminate nutrient deficiency diseases among school children and to provide an outlet for surplus agricultural commodities (8,9).

Meal patterns and standards were established to provide approximately one-third of the Recommended Dietary Allowance (RDA) for specific nutrients, over a period of time, for school-aged children (8,10). The NSLP required that all reimbursable lunches include one serving of meat or meat alternate, one serving of fluid milk, one serving of bread or bread alternate each day (for a total of eight per week), and servings of two different fruits and/or vegetables. Minimum serving sizes differed according to the grade level of the child (11).

Present Regulations and Practices

The SNDAS was conducted, in part, to describe the food and nutrient composition of the NSLP meals as offered to students and to analyze the dietary intakes of students participating in the program. Results from the study showed that 83% of all public and private schools participate in the NSLP and that an average of 56% of the students in those schools eat school lunches on a regular basis. In the fiscal year 1992, 24.5 million students participated in the lunch program.

The study compared the nutrients offered and consumed by students with the 1989 RDA, the 1990 Dietary Guidelines for Americans (DGA), and the National Research Council's Diet and Health Recommendations. Study results showed that, on average, NSLP lunches offered 6-10 year old participants with the program's goal of at least one-third the RDA for most nutrients including vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B-6, folate, vitamin B-12, calcium, iron, phosphorous, magnesium, zinc, and energy based on appropriate age group. In addition, the lunches offered less than the recommended amount of cholesterol. However, the lunches offered more than the recommended amount of total fat, saturated fat, and sodium and less than the recommended amount of carbohydrate. In the study, the percent of kcals offered at lunch from carbohydrate, total fat, and saturated fat were 47%, 38%, and 15%, respectively, compared to the recommendations of 55%, 30%, and 10%, respectively. In addition, the percent of kcals from carbohydrate, total fat, and saturated fat consumed were 48%, 36%, and 14%, respectively. The children consumed, on average, 34% of the RDA for energy, 101% of the RDA for protein, more than 30% of the RDA for the key nutrients listed above, 78 mg cholesterol, and 1313 mg sodium (1,2).

The joint publication of the 4th edition of the DGA by the USDA and the Department of Health and Human Services (DHHS) in 1995 has brought renewed Congressional support for school menus to reflect the nutrition principles of the DGA (12,13). The Healthy Meals for Americans Act, passed in 1994, and required schools to implement the DGA by 1996 unless they had been issued a special 2-year waiver (3).

The USDA's regulations, SMI Final Rule, allowed schools flexibility in their approach to meal planning and preparation. Schools were given the option to use computerized

systems or a manual system (food-based meal pattern) to plan meals but, either way, there must be documentation that the menus meet the nutrient standards over a 5-day period(4).

The current nutrient standards set forth in the SMI Final Rule state that daily lunches, as planned and averaged over one week, must provide one third the RDA for protein, calcium, iron, vitamin A, vitamin C, and energy based on appropriate age group, and must meet the 1995 DGA for total fat and saturated fat. The minimum nutrient requirements for the lunches on a weekly average for the age group 7-10 years are: 667 kcals, 9.3 g protein, 267 mg calcium, 3.3 mg iron, 233 RE vitamin A, 15 mg vitamin C, no more than 30% of kcals to come from total fat, and no more than 10% of kcals to come from saturated fat. In addition, the SMI includes the recommendations to reduce the levels of sodium and cholesterol and to increase the level of dietary fiber served in school lunch, although no specific levels are given (3). The SNDAS recommended a target lunch intake for cholesterol of less than 100 mg and for sodium less than 800 mg (2). The American Health Foundation (AHF) recommends an average daily intake of dietary fiber during childhood and adolescence to be approximately equivalent to the child's age plus 5 g per day. Following the "age + 5" recommendation, the average recommended intake for 7-10 year olds is 13.5 g/d or 4.5 g/lunch (14).

In May 1996, Congress enacted the Healthy Meals for Children Act (15) which amends the SMI Final Rule, authorizing schools to use "any reasonable approach" to plan and prepare meals. This includes meal patterns which were being used during the School Year 1994-1995 (3,15). The legislation made no change to the nutrient standards set forth in the SMI Final Rule, nor did it change the requirement that school meals comply with the DGA by July 1996, or by June 30, 1998 for schools granted a waiver.

While it appears that school lunch reform has not ended, it is clear that Congress' intent is for schools to offer meals that are healthful and nutritious as soon as possible. Given this, it is important that all schools, even those with waivers, begin implementing the SMI regulations, or begin developing implementation plans to ensure compliance (3).

Oregon's Plan for Compliance

The ODE-CNP has developed a food-based meal pattern which they believe is an effective approach to planning meals that meet the SMI standards. The SMI Final Rule standards include decreasing the percent of total kcals from fat and saturated fat offered to 30% or less and 10% or less, respectively, and increasing the percent of total kcals from carbohydrates offered to more than 55%. One way FPCM is set up to encourage students to consume lunches that are lower in total fat and saturated fat and higher in complex carbohydrate is to offer the students a greater variety of fruits, vegetables, and grains from a salad bar type service. The meal pattern is called Food Pyramid Choice Menu (FPCM) and has been implemented in more than 100 Oregon elementary schools. The meal pattern requires participating schools to offer, each day: 3-7 healthy entree choices, 6-10 fruits and vegetables, 3 or more grain products, and flavored and unflavored milk.

Preliminary reports from ODE-CNP on the FPCM system state the following observations: 1.) children appear to be eating more fruits, vegetables, and grains, 2.) children throw less food away, and 3.) the system meets the needs of more specialized groups of children (i.e., vegetarians, specific ethnic preferences, and children with medical

conditions such as diabetes, food allergies, or lactose intolerance). In addition, participants are more satisfied with the ability to make choices about what they select and eat for lunch (4).

In a recent randomized study of Oregon elementary schools which have implemented FPCM, Georgiou found that each school and district varied somewhat in the foods and nutrients offered. On average, FPCM schools were found to offer meals that meet the SMI Final Rule standards and the opportunity for students to self-select nutritious lunches (5). In another study, Georgiou et al. found that third grade students at Troutdale Elementary School and Glenfair Elementary School, in the Reynolds School District, were offered FPCM lunches that, on average, met the SMI Final Rule standards for energy, protein, vitamin A, vitamin C, calcium, and iron, met the SNDAS recommendation for cholesterol, and met the AHF recommendation for dietary fiber. However, the offered lunches did not meet the standards for percent of kcals from fat, percent of kcals from saturated fat, or the SNDAS recommendation for sodium. Results showed the mean daily nutrient content of one week's lunches, as offered, to be: 695 kcals, 28 g protein, 434 RE vitamin A, 41 mg vitamin C, 465 mg calcium, 3.7 mg iron, 42 mg cholesterol, 54% of total kcals from carbohydrates, 33% of total kcals from fat, 13% of total kcals from saturated fat, 5.7 g fiber, and 1162 mg sodium. In addition, results showed that the third graders consumed lunches that, on average, contained 35% of kcals from total fat and 13% of kcals from saturated fat.

Nutrition Education

The USDA's Nutrition Education and Training (NET) Program urges "nutrition education to be a major education component of all child nutrition programs and offered in all schools" by the year 2000 (16). In addition, the Society for Nutrition Education, the American Dietetic Association, and the American School Food Service Association have published a joint position statement in which they state that comprehensive nutrition programs which include effective nutrition education be provided to all the nation's students (17).

The primary rationale for educating children about nutrition is that healthy eating patterns in childhood promote optimal health, growth, and intellectual development (18,19), prevent immediate health problems such as iron deficiency anemia (20) and obesity (21), and may prevent long-term health problems, such as coronary heart disease, cancer and stroke (22,23,24).

School based nutrition education can help children attain full educational potential and good health by providing them with the skills, social support, and environment they need to adopt lifelong, healthy eating behaviors (25-29). Because diet influences the potential for learning as well as health, an objective of the first National Education Goal (26) is that children "receive the nutrition and health care needed to arrive at school with healthy minds and bodies".

Children need nutrition education to help them develop lifelong eating patterns consistent with the Dietary Guidelines for Americans and the Food Guide Pyramid. Schools are ideal settings for nutrition education for several reasons. Schools can reach almost all children (25). In addition, schools provide opportunities to practice healthy

eating. More than one-half of the youths in the United States eat one of their three major meals in school, and one in ten children and adolescents eat two of three main meals in school (2). Schools can also teach students how to resist negative social pressures. Eating is a socially learned behavior that is influenced by social pressures. School-based programs can directly address peer pressure that discourages healthy eating and harness the power of peer pressure to reinforce healthy eating habits. Skilled personnel are also available within schools. After appropriate training, teachers can use their instructional skills and food service personnel can contribute their expertise to nutrition education. In addition, previous studies suggest that school-based nutrition education can improve the eating behaviors of children (27-29).

Approaches to Nutrition Education

In the past twenty years, many school-based nutrition education programs have been developed to improve the eating behaviors of children. These programs have been based on two different approaches to nutrition goals in terms of both nutrition content and educational outcomes. In one approach, the goal has been to enhance the knowledge, skills, and attitudes needed by children to understand nutrition issues and to select a diet that is good for their general health. Knowledge-based nutrition education is based on the premise that nutrition education does help the student learn how to apply knowledge from nutrition science and the relationship between diet and health to their food practices. The educational outcomes of these programs might include changes in knowledge,

attitudes, and/or dietary intake. Many suggest that this approach is appropriate in schools since it models other content areas and allows nutrition education to be integrated into other subjects in the school curriculum.

In the second approach, the nutrition goals have focused on knowledge, skills, and behaviors to reduce disease risk and enhance health. The educational outcomes include changes in specific behaviors, such as eating patterns that are lower in fat or sodium and higher in fiber, or the acquisition of specific knowledge and skills needed to establish desired behaviors. These behaviorally oriented programs grew out of the health education and social psychology or behavioral science fields. Many health educators support this approach because health behaviors often go together and they do affect risk factors for chronic disease (27,28).

Social Cognition Theory

The majority of programs that result in positive behavior change are behaviorally based and theory driven. The most common theory used in successful behavior change programs for children is social learning theory, recently renamed social cognitive theory (SCT) (29).

Social cognition theory is a theoretical framework, developed by Albert Bandura, of human behavior at an interpersonal level (the individual exists within environments where other people's thoughts, advice, examples, assistance, and emotional support affect their own feelings, behaviors, and health). SCT suggests that personal factors, environmental influences, and behavior continually interact and influence behavior changes. A basic premise of SCT is that people learn not only through their own experiences, but also by

observing the actions of others and the results of those actions. The concept of self-efficacy (one's perception of one's ability to make a change or accomplish a task) is also central to this theory and underscores the importance of experimental learning, skill building, and goal setting in achieving behavior change (29,30).

Previous Studies

In general, two types of nutrition education programs have been developed and studied, 1.) general nutrition education studies which were knowledge-based and 2.) disease reduction/health enhancement studies which were behaviorally oriented and generally based in SCT (27-29). Research studies on nutrition education programs that have been published in peer-review journals, were classroom-based and targeted elementary aged students, were teacher or researcher delivered, had both comparison and treatment groups, examined behavioral outcomes, and provided sufficient measurement data to evaluate variables of interest are reviewed below.

General Nutrition Education Programs

General nutrition education programs which focus on knowledge, attitudes and skills include the Nutrition Education and Training (NET) Program, "Nutrition in a Changing World", and "Food...Your Choice". These three programs will be discussed below.

In 1977 the Child Nutrition Amendments to the School Lunch Act established the NET Program. The purpose of the NET Program was "to teach children through a positive daily lunchroom experience and appropriate classroom reinforcement, the value of a nutritionally balanced diet and to develop curricula and materials and train teachers and school foodservice personnel to carry out this task". During its first two years the NET

Program funded approximately 3,000 school-based projects such as using the cafeteria as a learning laboratory, conducted 5,000 workshops for teachers, and developed numerous curricula and materials. At the end of two years, a national evaluation was performed and found that, overall, NET Program projects had positive effects on children's knowledge. In addition, there were some positive effects on their attitudes in the early grades, such as willingness to select and taste new foods. There was no significant impact on students' reported food selection and preferences but there were some positive effects in the form of reduced plate waste of meat, milk, and bread (31).

St. Pierre et al. reported an evaluation of the NET Program in Nebraska. The curriculum for grades 1-6 emphasized familiarity with fruits and vegetables and positive attitudes towards the school lunch. The results showed that children in grades 1-3 showed gains in curriculum-specific knowledge and an increased preference for vegetables. However, there was no consistent effect on the amount of food actually wasted by either treatment or control children during the school lunch period (32).

"Nutrition in a Changing World" is a comprehensive, sequential, and developmentally appropriate nutrition education program taught at the elementary level and accompanied by activities in the lunchroom. The curriculum stresses the importance of eating a variety of foods and increasing the consumption of vegetables and whole grains. Byrd-Bredbenner et al. reported that the study showed the curricula led to significant knowledge gains at all grade levels. In addition, positive effects on attitude, such as willingness to try new foods, were seen in grades K-3 while mixed effects were seen in grades 3-6. The most positive effects on attitudes were seen in grade 4 and the least positive effects were seen in grade 6 (33).

Shannon et al. found that “Nutrition in a Changing World” did not have a significant effect on increasing the consumption of vegetables and whole grains. Interestingly, they found that students in the intervention group consumed significantly more of two menu items (green beans and potatoes) and students in the control group consumed significantly more of one menu item (corn). Familiarity with the food items was identified as an important dimension of food preference in the students. In addition, parents from the intervention group reported that children asked more often for snacks of high nutrient density (vegetables, fruits, meats, dairy products, cereals and breads) and less often for those of low nutrient density (sweets and candy, soda, cookies and cakes, potato chips, “junk foods”, sugary cereals) after the nutrition education (34).

The “Food... Your Choice” curriculum is also a comprehensive, sequential, and developmentally appropriate general nutrition education program which provides activities at all grade levels and which can be integrated into subjects that were already being taught. The curriculum is designed to teach students to eat well balanced, adequate diets from a variety of foods. The results at the elementary level showed that there were significant gains in knowledge, positive attitude changes toward the consumption of fruits and vegetables, and the students in the treatment group consumed significantly more fruits and vegetables, protein foods, and vitamin A-containing foods compared to the control group (35).

Behaviorally Oriented Nutrition Education Programs

Many school-based nutrition education programs have been developed which focus on reducing chronic disease risk and enhancing health behaviors. “Know Your Body,

“Hearty Heart & Friends”, “Go For Health”, “CATCH”, the “5-a-Day Power Plus Program”, and the “Integrated Nutrition Project” are discussed below.

“Know Your Body” is an intensive, multi component, year-long, developmentally appropriate nutrition education program for each of grades K through 7. It was designed to reduce risk for the development of chronic diseases among children and included screening for serum lipids, percent body fat, and blood pressure. The curriculum was taught for 30 to 45 minutes each week for five consecutive school years. Changes in the school lunch program were also often incorporated. A longitudinal cohort study in New York showed that at the end of five years, there were significant improvements in serum total cholesterol, in total fat intake and in complex carbohydrate intake. There were also significant gains in health knowledge (36)

“Hearty Heart & Friends” was developed as part of the “Minnesota Heart Health Program”(MHHP). The emphasis is on identifying foods and influencing food choices which are low in fat and salt, and high in complex carbohydrate. In grades 3 and 4 the curriculum involved modeling desired behavior, self-monitoring, and rewards from teachers. Reported results from group-administered 24-hour recalls showed significant changes in the treatment groups’ choices of foods in 5 of 12 target food groups. The students reported choosing less sugared cereals, fried food and added salt, and more fruit and dark green vegetables. The treatment group also showed significantly greater knowledge, preference and behavior with regard to salt, fat, and complex carbohydrate consumption, than the control group (37).

“Go for Health”, another program directed at heart health, also targeted grades 3 and 4. Two schools were assigned to receive a nutrition education intervention and two

to control conditions. Nutrition education interventions were based in SCT to promote a healthy diet and were designed to develop behavioral capacity, expectations, and self-efficacy. Methods included modeling (through story telling, role playing and demonstrations), self monitoring of behavior, contracting to try new behaviors, skill development, verbal praise, and material rewards. Results from the study showed that intervention students demonstrated significant positive changes in their knowledge and skills, behavioral expectations (which item in a pair they would choose to eat in various scenarios), self-efficacy, and use of salt. The students selection of “heart healthy” food did not change significantly. However, intervention activities in the school foodservice resulted in reductions in the sodium content of offered lunches by 28-44% (38).

The Child and Adolescent Trial for Cardiovascular Health (CATCH) is the largest multisite school-based intervention ever funded by the National Institutes of Health. The main trial to test the effectiveness of the interventions was conducted from 1991-1994 in 96 elementary schools across four study sites. It builds on the MHHP and “Go For Health” programs, discussed above, to promote cardiovascular health among students. Learner outcomes during the 3 years of the intervention include being able to identify and choose lower-fat and lower-sodium foods as the most healthful foods to eat. Students are provided opportunities to set goals for healthy behavior changes and to receive teacher reinforcement and peer support for achieving them. Dietary intake data, were collected on the students in third, fourth, and fifth grade using a food record assisted 24-hour dietary recall. Data collection during the main trial of CATCH will provide an estimate of actual school meals consumed by the students before and after the intervention (39,40). Results are not yet available.

“The 5-a-Day Power Plus Program” was funded by the National Cancer Institute (NCI) with the goal of increasing fruit and vegetable consumption among fourth- and fifth-grade students in the St. Paul, Minnesota schools. The intervention was conducted in 20 elementary schools and consisted of classroom-based behavioral curricula, parental involvement, school food service changes, and industry support and involvement. Results from the study showed that intervention increased lunchtime fruit consumption, lunchtime vegetable consumption among girls, and daily fruit consumption as well as the proportion of total daily kcals from fruits and vegetables (41).

The “Integrated Nutrition Project” (INP) is an ongoing school-based nutrition education program focused on increasing consumption of fruits, vegetables, and whole grains in children. The primary intervention consisted of weekly hands-on activities taught in the classroom by resource teachers and lunchroom activities taught by parents. The intervention was conducted in 20 elementary classrooms in 3 Denver public schools. Data from student surveys, interviews, and lunchroom plate waste were compared to 17 control classrooms in year four of the intervention. Classroom activities were designed to reinforce concepts in math, science, literacy, and social studies. The study found that students in the intervention classrooms achieved significantly greater gains in knowledge and self-efficacy with regards to fruit and vegetable consumption and they consumed more servings of fruits and vegetables in the lunchroom. In addition, teachers responded positively to using resource teachers and trained parent-teachers as well as the hands-on activities (42).

In the school environment, classroom lessons alone might not be enough to effect lasting changes in students’ eating behaviors (16); students also need access to healthy

food and the support of people around them (27). The “CATCH”, “Go For Health Program”, NET Program, “5-a-Day Power Plus Program”, “Integrated Nutrition Project” and others have included environmental or community components (healthy meals, physical activity, parental and community involvement) with their programs (27,28,29,31,35-41).

Team Nutrition

Team Nutrition is a school-based nutrition education program developed by the USDA to encourage students to make healthy food choices (16,44). Team Nutrition is intended to support the USDA’s SMI Final Rule through multifaceted nutrition education and training and technical assistance components. The foundation for the nutrition education is a set of classroom modules, developed by Scholastic, Inc. in partnership with the USDA, for administration at three grade levels (Pre-K and Kindergarten, grades 1-2, and grades 3-5). Each module consists of eight to nine lessons that include activities to involve students, peers, parents, teachers, and cafeteria staff.

The Team Nutrition curriculum is grounded in social learning theory (7). The objectives direct activities to offer knowledge which can influence behavior, allow students to act out desired behavior, observe others modeling desired behavior, set short-term and long-term goals, and increase self-efficacy in practicing healthful behavior.

To evaluate the efficacy of the Team Nutrition approach, The Team Nutrition Pilot Implementation Project was conducted in five large school districts across the country. It addresses the following question: “Can Team Nutrition have a positive impact when implemented as intended?” While student outcome data are still being analyzed, initial

pilot implementation observations offer some important information. First, parents, teachers, and district administrators believe that good nutrition is an important life skill that deserves attention in schools. Second, despite significant time constraints imposed by the evaluation schedule and competing curriculum demands, the pilot schools were able to implement Team Nutrition both comprehensively and intensively. Third, parent involvement is a Team Nutrition goal and challenge. Fourth, changes in the school lunch menu and food preparation is an ongoing, incremental process. Fifth, participation in Team Nutrition resulted in satisfaction among parents, teachers, food service staff and project coordinators who also reported Team Nutrition benefits for students. Sixth, a variety of lessons point the way for facilitating smoother implementation in the future (7).

METHODS

Study Design

This was a pre- and post-nutrition education intervention study of food selection and consumption among third graders who participated in nutrition education intervention and a control group who did not.

To assess third grade students' selection and consumption of foods and nutrients before and after a Team Nutrition education intervention, three third grade classes, at a school offering FPCM, were assigned to one of two groups. These groups were: 1.) class receiving nutrition education intervention and 2.) classes not receiving nutrition education intervention. The class assigned to receive nutrition education was selected by the school's principal because of the teacher's willingness to participate. Variety and quantity of fruits, vegetables, and grains, as well as percentage of kcals from total fat and saturated fat, and amounts of cholesterol, fiber, vitamin A, and vitamin C, as selected and consumed, were compared between the two groups and within the intervention group before and after a four week nutrition education intervention.

Subjects

The research was approved by the Oregon State University (OSU) Institutional Review Board for the Protection of Human Subjects. Three third-grade classes from Glenfair Elementary School in Reynolds School District were selected by the Oregon Department of Education's Child Nutrition Programs consultants and Department of Nutrition and Food Management researchers. There were twenty-two students in each classroom. One of the classrooms was selected to receive the nutrition education

intervention by the school principal. The other two classrooms were treated as one control group. Of the sixty-six students in the three third grade classes, fifty-two (78.8%) agreed to participate in the study. Participation was voluntary and school administrators, students, and their parents, who agreed to participate, signed consent forms (Appendix A).

Data Collection Before Nutrition Education

Preliminary menu analysis showed that Reynolds School District complied with FPCM and RDA requirements (5). However, as reported by Georgiou et al. (1998), the offered lunches were higher than the SMI standard for percent of kcals from total fat and percent of kcals from saturated fat (6). One week's menus, as offered, were analyzed for energy and nutrient content using Nutrikids (Lynchbrite Systems, Inc.) dietary analysis software (6). The mean daily energy and nutrient content of one week's lunches as offered to the third graders is shown in Appendix B. The identical menu was served during the two weeks of data collection for this study. The foods offered on the menu for the two weeks, one before and one after the nutrition education intervention, are shown in Appendix C.

To prepare for data collection, a pilot study to assess the data collection procedures and forms was conducted at Adams Elementary School in the Corvallis School District. About twenty third grade lunches were recorded on data collection forms. Procedures for weighing and measuring food items and for data collection were agreed upon by four data recorders. The pilot study helped to validate data collection procedures and to gain accuracy and consistency among data recorders. Special data collection forms were developed for recording the weights of pre-measured food samples, the foods "selected" by students and the foods "wasted" by students. See Appendices D, E and F, respectively.

The data for the current study were collected in the following manner. Each day of data collection, samples of all foods prepared and offered were pre-measured and weighed. Food items were weighed using an Ohaus portable advanced electronic balance, CT series scale, measuring to the nearest half gram. For food items that could be counted as units, five samples of each were weighed and an average weight for each item was calculated. These food items included entrees, milks, the hot vegetable selection, breads, rolls, crackers, grapes, apples, oranges, banana halves, carrot and celery sticks, broccoli and cauliflower pieces, pickles, sunflower seeds packages, and cupcakes.

For food items that were selected in volumes instead of by count, several different pre-measured portions were prepared and set aside for data recorders to use in visual comparison to the quantities selected by the students. Student lunch trays were used for these sample portions so that quantities could be visually compared with those selected by students within the partitions for better accuracy. Five samples of each pre-measured portion were weighed and an average weight for each was calculated. These food items included fruit salad, cranberries, pineapple chunks, butter, and salad greens. Typical volumes included tablespoon, quarter cup, half cup, and one cup.

Students served themselves condiments such as mustard, catsup, and ranch salad dressing. Condiments were dispensed from pumps into paper portion cups of known volume. Several different pre-measured portions of each condiment were prepared and set aside for data recorders to use in visual comparisons to the quantities selected by the students. Again, five samples of each known volume were weighed and an average weight was calculated. Typical pre-measured volumes of condiments were teaspoon, tablespoon, quarter cup, and half cup.

Baseline data collection began two weeks prior to the planned nutrition education intervention. The lunches that participating third grade students selected and consumed, during one week, were recorded and analyzed for variety and energy and nutrient content using the following method. For five consecutive days of one week participating students received a lunch tray with their name/number tag on it. Then they self-selected their lunches as usual. At the end of the lunch line, students handed their trays over to a researcher who took the trays out of students' sight and recorded the students number, as well as the types and amounts of foods selected on the tray. The amounts of foods selected were counted or estimated by visual comparison with pre-measured samples. Data were recorded on preprinted forms to expedite the process (Appendix E). The tray was then returned to the student so he/she could sit and eat lunch as usual. The amount of time that the trays were out of students' sight was from thirty seconds to two minutes.

After the students were through eating, they left their trays on the table so the researchers could record the students' number, as well as the types and amounts of foods left on the trays, again, using a preprinted form (Appendix F). The amounts of each food item left on each tray was weighed with an Ohaus portable advanced electronic balance, CT series scale, measuring to the nearest half gram.

At the end of lunch each day, each students' data forms, one for the "selected" and one for the "wasted", were matched together by student number. The difference between the amount of food selected and the amount of food left is the amount of food consumed.

Nutrition Education

One week after the baseline data collection was completed, the intervention class received a four consecutive week series of Team Nutrition education. Team Nutrition: Food Works for grades 3-5 was used. Lesson 1: *Food Grows*, Lesson 2: *Bodies Grow*, Lesson 3: *Read All About It*, and Lesson 8: *The Great Nutrition Adventure* were presented on Monday afternoon of each week.

Lesson 1: *Food Grows* was presented first. The objective of this lesson was that students would discover where food comes from and explore the role plants and animals play in the bigger picture of life on earth. The activities of this lesson included: 1.) students discussed the foods they ate for lunch and traced those foods through the food chain, 2.) they identified what environmental conditions plants need for healthy growth (sunlight, water, soil), 3.) they grew four strawberry plants (one with all three conditions, one without sunlight, one without water, and one without soil) and they recorded their observations, 4.) they were given handouts to take home which asked their parents to take them to the grocery store and identify produce as roots, stems, leaves, fruits, flowers, and seeds.

The second week, Lesson 2: *Bodies Grow* was presented. The objective of this lesson was for students to learn how the Food Guide Pyramid could help them construct a healthy diet. The activities for this lesson included: 1.) the students reviewing the conditions that plants need to grow healthy and relate those to the conditions humans need to grow healthy, 2.) discussing the Food Guide Pyramid and serving sizes, 3.) student participation in a variety of food activities which included planning a healthy meal using food models, weighing and measuring foods to identify serving sizes, taste testing a

variety of fruits and vegetables, and preparing a recipe for a healthy fruit drink, and 4.) receiving handouts to take home which explained the Food Guide Pyramid to their parents and which offered healthy snack ideas.

Lesson 3: Read All About It was presented the third week. The objective of this lesson was for students to analyze their diets and set goals to bring their diets in line with the recommendations in the Food Guide Pyramid. The primary activity this week was to have the students keep a food diary for one day. Then they compared their food diary to the recommendations of the Food Guide Pyramid and wrote one dietary goal for themselves based on their comparison. The parent handout this week included information about fun exercises and activities that parents and kids can do at home.

The fourth lesson was Lesson 8: *The Great Nutrition Adventure*. The objective of this lesson was for students to revisit all they have learned about healthy eating, and share this information with family and friends. A guest speaker, Connie Evers, R.D., was invited to come to the class and present an overview of the food chain and the Food Guide Pyramid. She then had the students create an edible food picture. Lesson plans for each lesson are presented in Appendix G.

Data Collection After Nutrition Education

Three weeks after completing the Team Nutrition education, the types and amounts of foods students selected and consumed were again recorded and analyzed for variety and energy and nutrient content, in the same method as the baseline data collection. The same menu was offered for both weeks, before and after the nutrition education intervention. Food selection and consumption were compared between the group receiving the nutrition

education intervention and the group not receiving nutrition education before and after the intervention. Food selection and consumption were also compared for the group receiving the nutrition education intervention before and after the intervention.

Parents' Questionnaire

To assess whether parents had observed changes in their child's food behaviors at home, a Parent's Questionnaire was developed. First, a pilot questionnaire was distributed to five mothers of third grade students at Salem Academy Elementary School in Salem, Oregon. The mothers were asked to complete the questionnaire to the best of their ability and offer comments about how easy and clear the questions were to answer. A finalized questionnaire was developed and is presented in Appendix H. The finalized Parent's Questionnaire was sent home with each of the students in the class receiving nutrition education on the last Monday of the nutrition education intervention. The students were asked to have their parents return the questionnaire by Friday of that week. The returned questionnaires were analyzed with respect to the students' willingness to add new fruits and vegetables to their diets.

Data Analysis

The nutrient content of lunches as selected and eaten by the third graders was analyzed using the ESHA's Food Processor nutrient analysis software (45). Only students who had complete dietary data for at least three days each week were included in the study. Complete data means that there were both "selected" and "wasted" forms for each day's

lunch. The number of students who had complete data for three or more days per week was seventeen in the class receiving the nutrition education and twenty-three in the two classes not receiving the nutrition education.

Separate dietary data files were created for each day and for each student for foods selected and eaten. The dietary data were analyzed for energy, percent of kcals from total fat, percent of kcals from saturated fat, cholesterol, fiber, vitamin A, and vitamin C using ESHA's Food Processor nutrient analysis software. These files were converted to ASCII files to complete SPSS Unix (Release 6.1,1997) statistical analysis. SPSS Unix statistical software was used to obtain descriptive data and for statistical analysis comparing nutrients selected and eaten between the two classes and within the class receiving the nutrition education intervention before and after the intervention. Each student's dietary data were summed and then divided by the number of days that they participated in the study; yielding the individual's mean daily average for each nutrient. The individual students' mean daily averages for each nutrient were calculated for the classes to obtain mean daily averages of each nutrient for the class receiving the nutrition education intervention and the class not receiving the nutrition education intervention.

The files were also aggregated by food category (i.e. fruits, vegetables, and grains). SPSS Unix statistical software was used to compare the proportion of kcals from fruits, vegetables, and grains before and after the nutrition education intervention.

Additional dietary data files were created to analyze variety of different fruits, vegetables, and grains selected. Again, SPSS Unix statistical software was used to compare variety of each category of food selected within the class receiving the nutrition education intervention before and after the intervention.

A Wilcoxon Matched-Pairs Ranked Sum test was used to compare the mean daily variety of different fruits, vegetables and grain products selected before and after the nutrition education intervention in hypothesis 1 and 2. In hypothesis 3, 4 and 5, one sample, two-sided t-tests were used to compare the mean differences in daily kcals eaten from fruits, vegetables, and grains and nutrients eaten before and after the nutrition education intervention for the intervention group. The mean differences were compared to 0.0. Two sample, two-sided t-tests were used to detected differences in nutrients selected and eaten between the intervention group and control group and within the intervention group, before and after the nutrition education in hypothesis 6 and 7. No statistical analysis was done on the parents' observations as addressed in the Parent's Questionnaire since only five of the twenty-two (22.7%) sent home were returned. This was not a large enough return to run significant statistical tests.

LIMITATIONS

The subjects in this study were free living third grade students. They ate lunch and played with the the other third grade students in the school. They most likely shared information about their school days and experiences with each other. Therefore, the students receiving nutrition education may have influenced students in the group not receiving nutrition education. This may be a desirable effect of education but it is a confounding factor in research.

The Reynolds School District was selected for this study by the ODE-CNP consultants because of their compliance with the FPCM system. Glenfair Elementary School and the classroom selected for nutrition education were selected by the researchers, the Food Service Manager and the school's principal because of their willingness to participate. Because the study sample was not randomly selected it may not be representative of schools and third grade students in Oregon participating in FPCM and results cannot be extrapolated to a population larger than the third grades at Glenfair Elementary School in the Reynolds School District.

Students usually serve condiments such as Ranch dressing and catsup directly onto their lunch tray or food items. In this study, they were required to serve the condiments into containers of known volume. This aided the researchers with accuracy in estimating volume, with sanitation, and with speed in recording information. However, it may have influenced students selection of volume and type of condiments.

Another limitation of this study is the accuracy with which food items were weighed and measured. It was not feasible to weigh and measure each selected food item on each

tray because of the amount of time required to do that. Therefore, the amount of food selected was compared to average weights and measures of similar quantities.

The non-edible peels of two food items, oranges and bananas were included in the recorded weights of foods “selected” and “wasted”. These foods were offered with the non-edible peels included and, therefore, “selected” weights included the non-edible peels. The weight of the “wasted” foods also included the non-edible peels and this was subtracted from the amount “selected” to yield the amount “eaten”. This resulted in an overestimation of the energy and nutrients “selected”, but not of “eaten” from these food items. The amounts of foods as selected and as eaten were entered into ESHA’s Food Processor.

The “selected” value for vitamin C is overestimated in this study. The average non-edible peel of an orange wedge accounts for about 10 mg vitamin C per wedge. The average edible portion of orange wedge provides approximately 13 mg vitamin C. However, the amount of “selected” vitamin C was reported here as 23 mg vitamin C per wedge. Because approximately 51% of the vitamin C that was eaten came from the fruit component of the lunch (6), an overall value for vitamin C “selected” was about 135% of actual vitamin C “selected”.

Another limitation of this study was the presence of researchers in the data collection process. To record the types and amounts of food selected, the students’ lunch trays were taken from them after they had self-selected their lunches. The trays were taken out of sight of the children for a short period of time which meant that the students had to wait while we recorded the data. The researchers did not wear lab coats and worked as quickly as possible in order to minimize the interruption in the students’ usual routine and the

feeling of being studied. To record the types and amounts of food wasted, researchers waited until the students had left the cafeteria before beginning. This was done to provide minimal influence on the students normal behavior.

Team Nutrition's Food Works for grades 3-5 includes eight lesson plans with classroom, lunchroom, and home activities. Because of time limitations, only four of the eight lessons were presented. In addition, only a one-hour period on Monday afternoons was allocated for the researcher to present the nutrition education, which meant that the classroom teacher had to include some of the planned activities throughout the week (cafeteria tour, recording observations of growing plants, helping students complete their food diary). The teacher was very busy and did not always follow through with the planned activities. Because all eight lessons and the full content of those lessons were not presented as intended, this may have had an influence on the nutrition information learned by the students.

Another limitation with the nutrition education component was that the students in the intervention class had a wide range of learning capabilities; from those identified as Talented and Gifted to those identified with moderate learning disabilities. I presented the same materials in the same manner to all students. Therefore, I may have missed the opportunity to effectively teach the material to specific students.

The Parent's Questionnaire was sent home with all twenty-two students on the last Monday of the four week intervention. Only five questionnaires were returned. This is not a significant enough response to conduct statistical analysis on. In addition, the response may be indicative of the parents' participation in reading the materials sent home

to them and the activities that were suggested for them to do with their children. Again, this may have influenced the amount and extent of material learned by the students.

RESULTS

Participation

In January 1997, sixty-six third grade students were enrolled at Glenfair Elementary School. There were three third grade classrooms with twenty-two students in each class. In the class selected to receive the nutrition education intervention, twenty (91 %) of the students returned both the parent and student consent forms, agreeing to participate in the study. In the two classes not receiving the nutrition education intervention, thirty-two (73 %) of the students returned both the parent and student consent forms, agreeing to participate in the study (Table 1).

After final analysis, seventeen (77%) of the students in the class receiving the nutrition education intervention had three or more days per week of complete dietary data for before and after the nutrition education. Twenty-three (52%) of the students in the two classes not receiving nutrition education had three or more days per week of complete dietary data. Therefore, of the students enrolled in the three third grade classrooms, complete dietary data were available for forty students (61 %) before and after the nutrition education.

Table 1

Participation in the Study at Glenfair Elementary School for Intervention and Control Groups.

Group	Student Enrollment	Students Agreeing to Participate	Students with Three or More Days of Complete Data Before and After Nutrition Education
Intervention 1	22	20 (91%)	17 (77%)
Control 2	44	32 (73%)	23 (52%)

1. Intervention group consisted of one classroom that received a four week nutrition education intervention from Team Nutrition "Food Works" for grades 3-5.
2. Control group consisted of two classrooms that did not receive a nutrition education intervention.

Variety of Fruits, Vegetables, and Grains Selected from FPCM

The first hypothesis was that third graders would select a greater variety of fruits and vegetables from FPCM after a nutrition education intervention than before. Table 2 shows the comparison of daily number of different fruits and vegetables selected by the intervention group before and after the nutrition education intervention. There was no difference in the median quartile for daily number of different fruits and vegetables selected before (1.40) and after (1.40) the nutrition education intervention ($p=0.07$). However, more than half of the intervention students selected a greater number of different fruits and vegetables after the nutrition education intervention than before (Table 3). Fifty-three percent of the students selected a greater number of different fruits and vegetables, daily, after the nutrition education than before while 29% selected the same number and 18% selected a smaller number of different fruits and vegetables (Table 3).

The second hypothesis was that third graders would select a greater variety of grains daily from FPCM after a nutrition education intervention than before. Table 4 shows the comparison of daily number of different grains selected per day by the intervention group before and after the nutrition education. There was no significant difference in the median quartile for daily number of different grains selected before (0.25) and after (0.40) the nutrition education ($p=0.20$). Forty-seven percent of the students, however, did select a greater number of different grain products after the nutrition education than before, while 24% selected the same number and 29% selected a smaller number of different grains (Table 5).

Table 2

Quartiles of Daily Number of Different Fruits and Vegetables Selected Before and After Nutrition Education for Intervention Group. (n=17)

Variety	25th Percentile	50th Percentile (Median)	75th Percentile
Daily Number of Different Fruits and Vegetables Selected Before Nutrition Education Intervention	1.00 ^{1,2}	1.40	1.55
Daily Number of Different Fruits and Vegetables Selected After Nutrition Education Intervention	1.00	1.40	2.13

1. Wilcoxon Matched-Pairs Signed Ranks Test was used to compare the mean daily number of different fruits and vegetables selected before and after the nutrition education intervention. Analysis were done using SPSS UNIX software (Release 6.1).
2. Wilcoxon Matched-Pairs Signed Ranks Test, Two-sided $p=0.07$.

Table 3

Number of Intervention Group Students Selecting a Greater Number, the Same Number, and a Smaller Number of Fruits and Vegetables After Nutrition Education Than Before Nutrition Education. (n=17)

	Cases (n=17)
Number of Students Selecting a Greater Number of Fruits and Vegetables After Nutrition Education Than Before Nutrition Education	9 (53%)
Number of Students Selecting the Same Number of Fruits and Vegetables After Nutrition Education As Before Nutrition Education	5 (29%)
Number of Students Selecting a Smaller Number of Fruits and Vegetables After Nutrition Education Than Before Nutrition Education	3 (18%)

Table 4

Quartiles of Daily Number of Different Grains Selected Before and After Nutrition Education for Intervention Group. (n=17)

Variety	25th Percentile	50th Percentile (Median)	75th Percentile
Daily Number of Different Grains Selected Before Nutrition Education Intervention	0.00 ^{1,2}	0.25	0.58
Daily Number of Different Grains Selected After Nutrition Education Intervention	0.10	0.40	0.68

1. Wilcoxon Matched-Pairs Signed Ranks Test was used to compare the mean daily number of different grains selected before and after the nutrition education intervention. Analysis were done using SPSS UNIX software (Release 6.1).
2. Wilcoxon Matched-Pairs Signed Ranks Test, Two-sided p=0.20.

Table 5

Number of Intervention Group Students Selecting a Greater Number, the Same Number, and a Smaller Number of Grains After Nutrition Education Than Before Nutrition Education. (n=17)

	Cases (n=17)	
Number of Students Selecting a Greater Number of Grains After Nutrition Education Than Before Nutrition Education	8	(47%)
Number of Students Selecting the Same Number of Grains After Nutrition Education As Before Nutrition Education	4	(24%)
Number of Students Selecting a Smaller Number of Grains After Nutrition Education Than Before Nutrition Education	5	(29%)

Kcals Consumed from Fruits, Vegetables, and Grains

The third hypothesis was that third graders would consume a greater proportion of lunch kcals from fruits, vegetables, and grain products after a nutrition education intervention than before. Table 6 shows the mean difference between daily kcals eaten from fruits, vegetables, and grains before and after the nutrition education intervention and compares the difference to 0. The intervention students ate 26 ± 29 kcals more from fruits after the nutrition education intervention than before ($p=0.001$). Eighty-eight percent (15 of the 17) of the intervention students increased their consumption of kcals from fruits after the nutrition education and 12% (2 of the 17) decreased their consumption of kcals from fruits.

The third graders consumed 3 ± 4.7 kcals more per day from vegetables after the nutrition education intervention than before ($p=0.065$). Although this is a small increase in kcals, it may be more meaningful than appears. Georgiou et al. (6) found that, on average, third graders only consumed 2% of total lunch kcals from vegetables (9 kcals per day). A little more than half (10 of the 17) of the intervention students increased their consumption of kcals from vegetables after the nutrition education than before.

Table 6 also shows that the intervention students did not significantly increase their consumption of kcals from grains after the nutrition education intervention ($p=0.842$). Therefore, the third hypothesis was confirmed for kcals eaten from fruits but not for kcals eaten from vegetables or grains.

Table 6

The Mean Difference Between Kcals Eaten from Fruits, Vegetables, and Grains Before and After Nutrition Education for Intervention Group. (n=17)

Food Category	Mean Daily Kcals Eaten Before Nutrition Education (n=17) ¹			Mean Daily Kcals Eaten After Nutrition Education (n=17) ¹			Mean Difference (Kcals Eaten After Nutrition Education - Kcals Eaten Before Nutrition Education) ¹ (n=17)	p-value ²
	Mean	±	SD	Mean	±	SD	Mean ± SD	
Fruits (kcals)	31		19	57		32	26 ± 29	0.001
Vegetables (kcals)	3		2.7	6		4.8	3 ± 4.7	0.06
Grains (kcals)	60		39	62		39	2 ± 33	0.84

1. Nutrient analysis done by ESHA Nutrient Analysis Software (ESHA Research, Salem, OR): The Food Processor.
2. One sample, two sided t-tests were used to compare the mean differences in daily kcals eaten before and after the nutrition education to 0.0. Analysis were done using SPSS UNIX software (Release 6.1).

Vitamin A, Vitamin C, and Fiber Eaten Before and After Nutrition Education

The fourth hypothesis was that third graders would consume lunches from FPCM with larger amounts of vitamin A, vitamin C, and fiber after a nutrition education intervention than before. Table 7 shows the mean difference between the daily amounts of vitamin A, vitamin C, and fiber eaten before and after the nutrition education for the intervention group and compares the difference to 0.0. The intervention students ate significantly more vitamin A (76 RE) per day, from the same menus, after the nutrition education intervention than before ($p=0.02$). The intervention students did not eat a significantly different amount of vitamin C (3 mg) after the nutrition education than before ($p=0.41$). For fiber, the intervention students ate significantly more fiber (0.9 g) after the nutrition education than before ($p<0.001$). Therefore, hypothesis four was confirmed for vitamin A and fiber but not for vitamin C.

Table 8 shows the number and percent of intervention students consuming vitamin A at various levels before and after nutrition education. After the nutrition education intervention, five more students (29%) ate at least 100 % of the SMI standard for vitamin A and five fewer students ate less than 75% of the SMI standard.

Table 9 shows the number and percent of intervention students consuming vitamin C at various levels before and after the nutrition education. After the nutrition education, two more students (12%) ate between 75- and 100% of the SMI standard for vitamin C. One less student (6%) ate at least 100% of the standard and one less student (6%) ate less than 50% of the standard.

Table 10 shows that all of the intervention students ate less than 75% of the AHF recommendation for dietary fiber (4.5 g) per lunch before the nutrition education

intervention. After the intervention, two students (12 %) increased their consumption of fiber to at least 100% of the AHF recommendation and 4 students (24 %) increased their consumption of fiber to between 75- 100 % of the AHF recommendation (3.4 g - 4.5). Six more students ate more than 50% of the AHF recommendation for dietary fiber after the nutrition education intervention.

Table 7

The Mean Difference Between the Daily Amounts of Vitamin A, Vitamin C, and Fiber Eaten Before and After Nutrition Education for Intervention Group. (n=17)

Nutrient	Eaten Before Nutrition Education (n=17)			Eaten After Nutrition Education (n=17)			Mean Difference (Eaten After Nutrition Education- Eaten Before Nutrition Education) (n=17) Mean \pm SD	p-value
	Mean	\pm	SD	Mean	\pm	SD		
Vitamin A (RE) ¹	145		17	226		31	76 \pm 29	0.02 ²
Vitamin C (mg)	20		3	23		4	3 \pm 3	0.41
Fiber (g)	2		.2	3		.2	0.9 \pm .2	0.000

1. Nutrient analysis done by ESHA Nutrient Analysis Software (ESHA Research, Salem, OR): The Food Processor.
2. One-sample, two sided t-tests were used to compare mean differences in nutrient content of lunches eaten before and after the nutrition education to 0.0. Analysis were done using SPSS UNIX software (Release 6.1).

Table 8

Number and Percent of Students Consuming Vitamin A at Various Levels Before and After Nutrition Education for Intervention Group.

Intervention Period	Number (%) of Students Consuming \geq 100% SMI Standard (224 RE) ¹	Number (%) Students Consuming 75-100% SMI Standard (168-224 RE)	Number (%) Students Consuming < 75% SMI Standard (168 RE)
Before Nutrition Education Intervention (n=17)	1 (6)	7 (41)	9 (53)
After Nutrition Education Intervention (n=17)	6 (35)	7 (41)	4 (24)

1. The U.S. Department of Agriculture and Child Nutrition Programs: School Meals Initiatives for Healthy Children: Final Rule. Federal Register, Vol.60, No.113, June 13, 1995.

Table 9

Number and Percent of Students Consuming Vitamin C at Various Levels Before and After Nutrition Education for Intervention Group.

Intervention Period	Number (%) of Students Consuming \geq 100% SMI Standard (15 mg) ¹	Number (%) Students Consuming 75-100% SMI Standard (11-15 mg)	Number (%) Students Consuming < 75% SMI Standard (11 mg)
Before Nutrition Education Intervention (n=17)	10 (59)	1 (6)	6 (35)
After Nutrition Education Intervention (n=17)	9 (53)	3 (18)	5 (29)

1. The U.S. Department of Agriculture and Child Nutrition Programs: School Meals Initiatives for Healthy Children: Final Rule. Federal Register, Vol.60, No.113, June 13, 1995.

Table 10

Number and Percent of Students Consuming Fiber at Various Levels Before and After Nutrition Education for Intervention Group.

Intervention Period	Number (%) of Students Consuming $\geq 100\%$ of the AHF recommendation. (≥ 4.5 g Fiber) ¹	Number (%) of Students Consuming 75-100% of the AHF recommendation. (3.4-4.5 g Fiber)	Number (%) of Students Consuming 50-75% of the AHF recommendation. (2.3-3.4 g Fiber)	Number (%) of Students Consuming $< 50\%$ of the AHF recommendation. (< 2.3 g Fiber)
Before Nutrition Education Intervention (n=17)	0.0	0.0	0.0	17 (100)
After Nutrition Education Intervention (n=17)	0.0	0.0	6 (35)	11 (65)

1. An increase in fiber intake is recommended by the School Meals Initiative for Healthy Children (USDA:CNF 1995). However, no specific level is recommended. The AHF recommendation of "age + 5" or 4.5 g dietary fiber/ lunch for 7-10 year olds, is used as a comparison (Williams, 1995).

Total Fat, Saturated Fat, and Cholesterol Eaten Before and After Nutrition Education

The fifth hypothesis was that third graders would consume lunches from FPCM with a smaller percentage of kcals from total fat and saturated fat and a smaller amount of cholesterol after a nutrition education intervention than before. Table 11 shows the mean difference between the daily percent of kcals from fat and saturated fat, as well as amount of cholesterol eaten before and after the nutrition education intervention for the intervention group and compares the difference to 0.0. There was no difference between the mean percent of kcals from fat eaten before (33%) and after (33%) the nutrition education intervention ($p=0.97$). In addition, the mean percent of kcals from saturated fat before (12%) and after (12%) the nutrition education intervention was not different ($p=0.57$). Table 11 also shows that there was no significant difference between the mean amount of cholesterol eaten before (29 mg) and after (27 mg) the nutrition education intervention ($p=0.42$). Therefore, the fifth hypothesis was not confirmed for total fat, saturated fat, or cholesterol.

Table 11

The Mean Differences Between the Daily Percent of KCals from Total Fat and Saturated Fat, and Amount of Cholesterol Eaten Before and After Nutrition Education for Intervention Group.

Nutrient	Mean Daily Amount Eaten Before Nutrition Education (n=17)			Mean Daily Amount Eaten After Nutrition Education (n=17)			Mean Difference (Eaten After Nutrition Education - Eaten Before Nutrition Education) (n=17)	p-value
	Mean	±	SD	Mean	±	SD	Mean	
¹ Total Fat (% of kcals)	33		1	33		1	0.0	² 0.97
Saturated Fat (% of kcals)	12		0.6	12		0.7	0.0	0.57
Cholesterol (mg)	29		3	27		3	-2	0.42

1. Nutrient Analysis done by ESHA Nutrient Analysis Software (ESHA Research, Salem, OR): The Food Processor.
2. One sample, two-sided t-tests were used to compare mean differences in nutrient content of lunches eaten before and after the nutrition education to 0.0. Analysis were done using SPSS UNIX software (Release 6.1).

Average Nutrient Content of Lunches Selected and Eaten by the Intervention and Control Groups Before Nutrition Education

The sixth hypothesis was that there would be no pre-intervention difference between the average nutrient content (vitamin A, vitamin C, fiber, percent of kcals from total fat, percent of kcals from saturated fat, and cholesterol) of lunches selected and eaten by third graders in the treatment group and the control group. Table 12 compares the average daily nutrient content of lunches selected before the nutrition education intervention between the treatment and control groups. Before the nutrition education intervention, there was no significant difference in the average daily amount of any nutrient selected between the intervention and control groups.

Table 13 compares the average daily nutrient content of lunches eaten before the nutrition education intervention between the intervention and control groups. The control group ate significantly more fiber (2.79 g per day) than the intervention group (2.15 g per day) before the nutrition education ($p=0.03$). There were no other differences in nutrient intake between the two groups before the intervention. Therefore, the sixth hypothesis was confirmed for all nutrients except fiber eaten.

Table 12

Mean Daily Nutrient Content of FPCM Lunches **Selected** by Third Graders
Before Nutrition Education for Intervention and Control Groups

Nutrient	Mean Daily Amount For Intervention Group Before Nutrition Education n=17			Mean Daily Amount For Control Group Before Nutrition Education n=23			p-value
	Mean	±	SD	Mean	±	SD	
Vitamin A (RE) ¹	245		19	257		15	² 0.63
Vitamin C (mg) ^{1,3}	31		4	31		4	0.95
Fiber (g)	3		0.2	4		0.2	0.32
Percent of Kcals from Fat	34		1	35		0.8	0.62
Percent of Kcals from Saturated Fat	13		0.5	13		0.4	0.83
Cholesterol (mg)	46		2	42		2	0.08

1. Nutrient analysis done by ESHA Nutrient Analysis Software (ESHA Research, Salem, OR): The Food Processor.
2. Two-sample, two sided t-tests were used to detect the differences in nutrient content of lunches selected and eaten between the treatment group and non-treatment group. Statistical analysis was done using SPSS UNIX software (Release 6.1).
3. Value of vitamin C (mg) selected was somewhat overestimated due to measurement error, see limitations (page 30).

Table 13

**Mean Daily Nutrient Content of FPCM Lunches Eaten by Third Graders
Before Nutrition Education for Intervention and Control Groups**

Nutrient	Mean Daily Amount For Intervention Group Before Nutrition Education n=17			Mean Daily Amount For Control Group Before Nutrition Education n=23			p-value
	Mean	±	SD	Mean	±	SD	
Vitamin A (RE) ¹	145		17	146		16	0.87 ²
Vitamin C (mg) ^{1,3}	20		3	19		3	0.85
Fiber (g)	2		0.2	3		0.2	0.03
Percent of Kcals from Fat	33		1	34		1	0.47
Percent of Kcals from Saturated Fat	12		0.6	13		0.5	0.86
Cholesterol (mg)	29		3	25		2	0.31

1. Nutrient analysis done by ESHA Nutrient Analysis Software (ESHA Research, Salem, OR): The Food Processor.
2. Two-sample, two sided t-tests were used to detect the differences in nutrient content of lunches selected and eaten between the treatment group and non-treatment group. Statistical analysis was done using SPSS UNIX software (Release 6.1).
3. Value of vitamin C (mg) selected was somewhat overestimated due to measurement error, see limitations (page 30).

Average Nutrient Content of Lunches Selected and Eaten by the Intervention and Control Groups After Nutrition Education

The seventh hypothesis was that after a nutrition education intervention, the average amounts of vitamin A, vitamin C, and fiber selected and eaten would be higher and the average percent of kcals from total fat, the percent of kcals from saturated fat, and the amount of cholesterol would be lower in the intervention group than in the control group. Table 14 compares the average daily nutrient content of lunches selected after the nutrition education intervention between the treatment and control groups. Table 15 compares the average daily nutrient content of lunches eaten after the nutrition education intervention between the treatment and control groups.

After the nutrition education intervention, the intervention group selected significantly more vitamin A (337 RE) than the control group (226 RE) ($p=0.01$). In addition, the treatment group ate significantly more vitamin A (226 RE) than the control group (126 RE) ($p=0.01$).

There were no significant differences in other nutrients selected or eaten after the nutrition education intervention. Therefore, hypothesis 7 is confirmed for vitamin A selected and eaten but not confirmed for vitamin C, fiber, cholesterol or percent of kcals from fat and saturated fat.

Table 14

**Mean Daily Nutrient Content of FPCM Lunches Selected by Third Graders
After Nutrition Education for Intervention and Control Groups**

Nutrient	Mean Daily Amount For Intervention Group After Nutrition Education n=17			Mean Daily Amount For Control Group After Nutrition Education n=23			p-value
	Mean	±	SD	Mean	±	SD	
Vitamin A (RE) ¹	337		36	226		18	² 0.01
Vitamin C (mg) ^{1,3}	35		5	35		4	0.95
Fiber (g)	4		0.4	4		0.2	0.65
Percent of Kcals from Fat	33		2	33		0.7	0.70
Percent of Kcals from Saturated Fat	13		0.7	12		0.3	0.43
Cholesterol (mg)	43		3	46		2	0.53

1. Nutrient Analysis done by ESHA Nutrient Analysis Software (ESHA Research, Salem, OR): The Food Processor.
2. Two-sample, two-sided t-tests were used to detect the differences in nutrient content of lunches selected and eaten between the intervention group and control group. Statistical analysis was done using SPSS UNIX software (Release 6.1).
3. Value of vitamin C (mg) selected was somewhat overestimated due to measurement error, see limitations (page 30).

Table 15

Mean Daily Nutrient Content of FPCM Lunches Eaten by Third Graders
After Nutrition Education for Intervention and Control Groups

Nutrient	Mean Daily Amount For Intervention Group After Nutrition Education n=17			Mean Daily Amount For Control Group After Nutrition Education n=23			p-value
	Mean	±	SD	Mean	±	SD	
Vitamin A (RE) ¹	226		31	126		18	0.01 ²
Vitamin C (mg) ^{1,3}	23		4	18		3	0.29
Fiber (g)	3		0.2	3		0.2	0.34
Percent of Kcals from Fat	33		1	33		1	0.91
Percent of Kcals from Saturated Fat	12		0.7	12		0.5	0.89
Cholesterol (mg)	27		3	29		3	0.73

1. Nutrient Analysis done by ESHA Nutrient Analysis Software (ESHA Research, Salem, OR): The Food Processor.
2. Two-sample, two-sided t-tests were used to detect the differences in nutrient content of lunches selected and eaten between the intervention group and control group. Statistical analysis was done using SPSS UNIX software (Release 6.1).
3. Value of vitamin C (mg) selected was somewhat overestimated due to measurement error, see limitations (page 30).

Parental Observations of Third Graders' Willingness to Try New Fruits and Vegetables at Home After Nutrition Education

The eighth hypothesis was that parents of third graders would observe that students were more willing to try new fruits and vegetables at home after a nutrition education intervention than before. Table 16 shows that of the twenty two students in the treatment class, only five returned the Parent's Questionnaire. All five parents agreed to complete the questionnaire but one of those five only answered the first seven questions of their questionnaire.

It is not possible to confirm or deny the eighth hypothesis because only five of the twenty-two parents returned the Parent's Questionnaire and one of those five questionnaires was not completely filled out. Ms. Tuma, the teacher, told me that this response rate was about average for any materials that she sends home and needs a response back on for her students.

It is interesting that most of the parents that did respond, answered that their child had talked about nutrition and the Food Guide Pyramid over the past month. In addition, most parents answered that their child had talked about eating more fruit, was willing to eat most fruit, and had asked the parent to buy specific fruit over the past month. In contrast, most parents answered that their child had not talked about eating more vegetables nor had the child asked the parent to buy any specific vegetables. Most parents did answer that their child was willing to eat most vegetables. The majority of responding parents answered that they had not noticed a change in their child's consumption of fruits or vegetables.

Parental Observations of Third Graders Willingness to Try New Fruits and Vegetables for the Class Receiving the Nutrition Education Intervention. (n=22) 1

Question	No Response	Response "YES"	Response "NO"	Response "NOT SURE"
Do you agree to complete the questionnaire?	17	5	0	0
Has your child talked about nutrition over the past month?	17	4	0	1
Has your child talked about the Food Guide Pyramid in the past month?	17	3	1	1
Has your child talked about eating more <u>fruit</u> in the past month?	17	3	2	0
Is your child willing to eat most <u>fruits</u> ?	17	4	1	0
Have you noticed a change in your child's willingness to eat <u>fruit</u> over the past month?	17	1	3	1
Has your child changed his/her consumption of <u>fruit</u> over the past month?	17	1	3	1
Has your child asked you to buy any specific <u>fruit</u> over the past month?	17	3	2	0
Has your child talked about eating more <u>vegetables</u> over the past month?	18	1	2	1
Is your child willing to eat most <u>vegetables</u> ?	18	3	1	0

Table 16 (Continued)

Question	No Response	Response "YES"	Response "NO"	Response "NOT SURE"
Have you noticed a change in your child's willingness to eat <u>vegetables</u> over the past month?	18	1	2	1
Has your child changed his/her consumption of <u>vegetables</u> over the past month?	18	1	2	1
Has your child asked you to buy any specific <u>vegetables</u> over the past month?	18	1	2	1

1. The Parent's Questionnaire was sent home with all twenty-two students in the class receiving the nutrition education intervention. Five Parent's Questionnaires were collected and one of those was not filled out completely.

DISCUSSION

The link between diet and health and development of children is well recognized (17-23). Over the past two decades, considerable attention has been given to developing school-based nutrition education programs which promote healthy eating behaviors in children. TEAM Nutrition: *Food Works* was developed by the USDA to support the SMI and improve the eating behaviors of school children. Team Nutrition adheres to the belief that schools are the ideal setting for nutrition education since schools can reach almost all children with trained personnel. In addition, schools offer the opportunities to practice healthy eating in the school cafeteria while helping students harness peer pressure that encourages healthy eating and resisting peer pressure that discourages healthy eating.

The majority of behaviorally based studies reviewed, resulted in positive behavior changes and were grounded in SCT. Team Nutrition is based in SCT which assumes that behavior is influenced by a variety of factors including interpersonal, intrapersonal, institutional, and community variables. Thus, the program was designed to address all of these factors by attempting to reach children through multiple sources - teachers, peers, parents, and food service. The distinguishing elements of the program include the focus on nutrition-related behavior changes among students, the interactive nature of the classroom lessons, and the connection made between the classroom and the cafeteria.

Variety of and Kcals from Fruits, Vegetables, and Grains Selected and Consumed from FPCM

One of the primary objectives of the TEAM Nutrition curriculum is to increase students' knowledge and self-efficacy toward consumption of fruits, vegetables, and whole

grains. Lessons 1, 2, and 3 from TEAM Nutrition: *Food Works* focused on the importance of eating fruits, vegetables, and grains, being able to identify where these foods fit in the food chain and where they fit in the Food Guide Pyramid, how to plan a well balanced diet which includes these foods, evaluating one's diet and setting goals to improve one's diet, and of tasting new and different fruits, vegetables, and grains.

FPCM standards include that participating schools offer 6-10 different fruits and vegetables and more than 3 different grains every day. Glenfair Elementary School offered the same menu for both weeks, before and after the nutrition education intervention, of data collection. The menu included 5-6 different vegetables, 3-5 different fruits, and 3 different grains every day (See Appendix C).

After the nutrition education intervention, more than half (53%) of the intervention students in this study selected a greater number of different fruits and vegetables and about half (47%) selected a greater number of different grain products per day. In addition, the intervention students ate significantly more kcals (26 kcals) from fruit after the intervention. Eighty-seven percent of the students increased their consumption of kcals from fruit after the intervention. Although the intervention students, on average, did not eat significantly more kcals from vegetables after the intervention, 59% of the intervention students increased their consumption of kcals from vegetables. After the intervention, the fruits selected more frequently were grapes, apples, pineapple, and bananas and the vegetables selected more frequently were corn, carrots, and salad greens. The intervention students did not significantly increase their selection of different number of grains or their consumption of kcals from grains after the nutrition education intervention.

Comparable impacts have been found in other school-based nutrition education programs. The “Food...Your Choice” program, which is a general nutrition education program, designed to teach students to eat balanced, adequate, diets from a variety of foods, resulted in significant gains in knowledge, positive attitude changes toward eating more fruits and vegetables, and significant increases in consumption of fruits and vegetables over the entire day (34). “Hearty Heart & Friends” program, which emphasized selecting foods low in fat and salt and high in complex carbohydrates, showed that after receiving the nutrition education, intervention students reported choosing more fruit and dark green vegetables over the entire day than the students in the control group (35). In “The 5-a-day Power Plus” program, which emphasized eating more fruits and vegetables, intervention students increased lunchtime fruit consumption, lunchtime vegetable consumption among girls, daily fruit consumption, as well as increased the proportion of total daily kcals from fruits and vegetables (39). The “INP”, which emphasizes increased consumption of whole grains, vegetables, and fruits, resulted in the intervention students achieving significantly greater gains in knowledge and self-efficacy with regards to fruit and vegetable consumption and they consumed more servings of fruits and vegetables in the lunchroom (40).

Like “The 5-a-day Power Plus” and “INP”, most of the improvement seen in this study came from increased consumption of fruit. An increased consumption of fruit may have been more likely to change than an increased consumption of vegetables because of differences in availability, ease, taste, or attractiveness. Fruits are generally easier to eat than vegetables because many come in their own “packages” and fruits may be more

appealing to children, since they are sweet and juicy (39). Shannon et al. reported that vegetables are generally the foods least well accepted by children (33).

Vitamin A, Vitamin C, and Fiber Content of FPCM Lunches Eaten Before and After Nutrition Education for Intervention Students

The intervention students in this study ate significantly more vitamin A, from the same menu, after the nutrition education intervention than before. Mean vitamin A consumption met the SMI standard of 224 RE per day after, but not before, the intervention. In comparison, the SNDAS reported that 6-10 year olds, nationwide, consumed 251 RE vitamin A per day from school lunches (44).

For fiber, the SMI recommends that school lunches offer an increase in fiber but does not specify an amount. The AHF recommends an average daily dietary fiber intake for children and adolescents to be "age + 5 g". For 7-10 year olds that would equate to an average of 13.5 g per day or 4.5 g per lunch (14). The intervention students in this study ate significantly more dietary fiber after the nutrition education than before. Six more intervention students ate at least 75% of the AHF recommendation after the nutrition education than before. The increase is most likely due to the increased consumption of kcals from fruits as discussed above.

Interestingly, the intervention students did not significantly increase their consumption of vitamin C after the nutrition education. They did, however, meet the SMI standard for vitamin C of 15 mg per day before and after the intervention. The findings that more than half the intervention students increased the variety of fruits and vegetables selected, without significantly increasing vitamin C intake after the intervention, suggests that the fruits and vegetables selected were not significant sources of vitamin C. They were,

however, significant sources of vitamin A and fiber. As discussed above, the fruits selected more frequently after the intervention were not significant sources of vitamin A or vitamin C but two of the vegetables selected more frequently (carrots, salad greens) are significant sources of vitamin A. Therefore, the intervention students selected a greater quantity of these foods after the nutrition education intervention than before which, in turn, effected the amount of vitamin A they consumed.

Perry et al. reported that “The 5-a-day Power Plus” program resulted in higher intakes of vitamin A, vitamin C, and fiber from school lunch for intervention students. The significant intervention effects were attributed to the increased consumption of fruits and vegetables, particularly among girls (36).

Total Fat, Saturated Fat and Cholesterol Content of FPCM Before and After Nutrition Education for Intervention Students

The intervention students in this study ate the same percent of kcals from fat (33%) before and after the nutrition education intervention. They also ate the same percent of kcals from saturated fat (12%) before and after the nutrition education intervention. One possible explanation for not seeing an improvement in the percent of kcals eaten from fat and saturated fat may be that the lunch offered to the students, both before and after the intervention, contained 33% of kcals from total fat and 13% of kcals from saturated fat. It may mean that to achieve the desired intake, 30% or less of kcals from total fat and 10% or less of kcals from saturated fat, the lunch as offered needs to contain the recommended amounts of these nutrients.

Another reason for not seeing a decrease in the percent of kcals from total fat and the percent of kcals from saturated fat may be that the nutrition education materials selected

for this intervention did not emphasize reducing the amount of these nutrients. The lessons selected from the Team Nutrition: *Food Works* for this intervention emphasized increasing the selection the fruits, vegetables and whole grains. Other lessons included in the curriculum do address the importance of eating a low fat diet and offer activities to help students learn to how to choose a healthy diet which meets the recommendations for total fat, saturated fat, and cholesterol.

The SNDAS reported that 6-10 year olds consumed 36% of lunch kcals from fat and 14% of lunch kcals from saturated fat (44). The reason that the students in my study came closer to eating lunches that met the SMI standards than did the students in the SNDAS may be because FPCM lunches as offered comes closer to the SMI standards than did the SNDAS lunches.

Other studies have reported mixed results in changing fat and saturated fat consumption with nutrition education interventions. The “Know Your Body” study, which focused on reducing fat, cholesterol, and sodium intake, reported that students significantly reduced their intakes of total fat after the intervention (35). In addition to the outcomes from the “Hearty Heart & Friends” program discussed above, students reported choosing fewer fried foods and having less preference toward fat containing foods after the intervention (36). In the “Go for Health” study, which encouraged students to select foods low in fat, cholesterol, and sodium from the school lunch, intervention students did not significantly change their selection of low fat, low saturated fat, or low cholesterol foods (37,38). In addition to the outcomes from “The 5-a-day Power Plus” program, discussed above, intervention students did not significantly change the percent of kcals from fat or percent of kcals from saturated fat eaten in school lunch after the intervention

than before. The intervention did, however, impact the percent of kcals from fat and saturated fat on 24-hour intake among Asian-American and African-American students . Perry et al. attributed the positive changes “to the parent and student possibly generalizing the intervention as involving a healthy diet and substituting fruit for higher-fat foods at home” (39).

The intervention students in my study ate approximately the same amount of cholesterol before and after the intervention. The SMI recommends that school lunches decrease the amount of cholesterol offered, but does not specify an amount. The SNDAS recommended a target lunch intake for cholesterol of less than 100 mg per day and reported that 6-10 year olds, nationwide, consumed an average of 78 mg cholesterol per day from school lunch (44). Georgiou et al. reported that the FPCM lunches offered to students contained 42 mg cholesterol. The students in my study did not significantly decrease the amount of cholesterol consumed after the nutrition education intervention than before, however, they consumed significantly less than the SNDAS recommended amount and the amount consumed by other 6-10 year olds (44).

Nutrient Content of Lunches Selected and Eaten Before and After Nutrition Education for Intervention and Control Groups

Before the nutrition education intervention, the intervention group students in this study did not “select” significantly different amounts of vitamin A, vitamin C, fiber, cholesterol, or percent of kcals from fat or saturated fat than the control group students. In addition, they did not “consume” significantly different amounts of vitamin A,

vitamin C, cholesterol, or percent of kcals from fat or saturated fat. They did, however, “consume” significantly less fiber than the control group did before the intervention.

After the nutrition education intervention, the intervention group students “selected” and “consumed” significantly more vitamin A than did the control group students. There were no significant differences in other nutrients studied, as selected or consumed, after the nutrition education intervention, between the intervention and control group.

Therefore, in addition to increasing their consumption of vitamin A, the intervention group, significantly increased their consumption of fiber after the nutrition education intervention, which means that they increased their consumption of fiber up to the level of the control group. As discussed earlier, the increased consumption of vitamin A and fiber is most likely due to the increased selection of different fruits and vegetables and the increased intake of kcals from fruit.

Parental Observations of Intervention Students’ Willingness to Try New Fruits and Vegetables at Home

The Parent Questionnaire return was low (23%). Those parents who did return the completed questionnaires responded that their child had talked about nutrition, the FGP, and eating more fruit over the past month. They also responded that their child was willing to eat most fruits and vegetables and had asked the parent to purchase specific fruit over the past month.

Comparable results have been reported in other studies. Shannon et al. reported that parents of students in the “Nutrition in a Changing World” program returned completed questionnaires at a rate of 46-55 % for grades 1 through 4 and a rate of 24 - 37 % for grades 5 and 6. Those parents who did return completed questionnaires indicated that the

nutrition education program had a positive influence on their children's request for food. Eighty-five percent of the respondents reported that their children were asking for more of some foods following nutrition instruction, and 95% said their children were asking for less of other items. Foods asked for more often were generally of high nutrient density (i.e. fruits, vegetables, meats, dairy products, cereals and grains) and those asked for less often were of low nutrient density (i.e. sweets and candy, soda, cookies and cakes, potato chips, "junk foods", sugary cereals) (33).

Perry et al. reported that parents of students in "The 5-a-day Power Plus" program reported that they had heard about "The 5-a-day Power Plus" program from their children. However, there were no significant differences between the intervention group and the control group in other variable such as "Do you have specific fruits and vegetables in your home?" and "How important is it that your child eats 5 or more servings of fruits and vegetables every day?" (36).

Generalization of Results

Since the sample size was relatively small and not randomly selected, the results may not be generalizable to the population of Oregon third graders participating in FPCM. The collected data for each child represents three to five days of each week and, therefore, is representative of what study participants usually select and consume from FPCM.

Recommendations for Further Research

Results from this study concur with many other studies that show school-based nutrition education programs which are behaviorally based can improve the nutritional

quality of school lunches selected and consumed by children in schools participating in FPCM. Additional studies should utilize the Team Nutrition: *Food Works* to its full intended use within FPCM such as presenting all activities within all eight lessons. For example, presenting Lesson 5: *Fat Facts Feature*, in which students investigate the fat content of various foods, and set goals to reduce the fat content of their diets, may improve the fat and saturated fat content of lunches selected and consumed by the students. In addition, presenting all activities within each lesson, such as taking the students on a tour of the kitchen and discussing what the students learned about nutrition on a daily basis, may reinforce the eating behaviors learned during the nutrition education class and result in improved eating behaviors in the cafeteria. Additional studies should be conducted with larger populations and with well-trained classroom teachers who can integrate activities with other subjects. In addition, more information is needed on the contribution that FPCM lunches make on the child's total eating behaviors to identify appropriate target levels for number of fruit, vegetable, and grain servings, as well as amounts of energy, fat, and saturated fat.

Summary and Conclusion

This study shows that including a school-based nutrition education program can improve the nutritional quality of the school lunch selected and consumed by third graders participating in the FPCM system. More than half of the intervention students increased the number of different fruits and vegetables selected from FPCM after the nutrition education intervention. In addition, about half of the intervention students increased the

number of grains selected after the nutrition education. The intervention students also selected significantly more kcals from fruit and consumed significantly more vitamin A and fiber after the intervention.

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APPENDICES

Appendix A
Informed Consent Forms

Parent's Informed Consent for Child's Participation in Research Study

January 30, 1997

I understand that the Department of Nutrition and Food Management at Oregon State University is conducting a study for the Oregon Department of Education, Child Nutrition Division, about the foods third graders eat for lunch. The purpose of this study is to help schools serve lunches which are healthy and well liked by children. My child's class is participating during the weeks of February 10-14 and April 14-18, 1997. In addition, my child's class is participating in classroom nutrition education and activities during February and March.

I understand that my child's participation in the study will involve choosing his/her lunch in the cafeteria each day as usual and giving the tray to a researcher who will take it away for about two minutes to record information. Children in the study will sit at a table together and, after lunch, the children will leave their trays on the table instead of throwing away leftovers themselves. I agree not to send lunches from home with my child during the study weeks.

I understand that my child's participation in the study is voluntary and that she/he may choose not to participate or drop out at any time without penalty. I understand that my child's status with regard to free, reduced, or full priced meals may be disclosed to the researcher. I understand that information will only be reported about the class as a whole rather than for individuals and that data about individual children will be kept strictly confidential with trays identified by number, not by name.

I understand the nature of this research study and agree to let my child participate. I believe my child understands the commitment being made and is participating willingly. My questions have been answered satisfactorily and I know how to contact the researcher should other questions arise.

Please sign and return this letter whether you check Yes or No. Thank you.

____ Yes, I agree to let my child participate

____ No, I do not want my child to participate

Parent's Signature

Date

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DEPARTMENT OF NUTRITION AND FOOD MANAGEMENT



OREGON STATE UNIVERSITY

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Telephone 541-737-3561 Fax 541-737-6914

Child's Informed Consent for Participation in Research Study

January 30, 1997

Child's Name _____

I agree to have the foods I choose for school lunches recorded for two weeks.

I will follow instructions given in class for sitting with my class at lunch and leaving my tray on the table after lunch.

I agree to eat school lunches during the week scheduled, not bring my lunch from home.

I understand that information about what I eat will be kept private. I know that research results will be given only for my whole class and my name will not be used. I understand that I am a volunteer and that I can stop being in the study at any time with no penalty.

I understand that my class will be participating in classroom nutrition education and activities during February and March.

I understand what I am being asked to do.

Please sign and return this letter whether you check Yes or No. Thank you.

_____ Yes, I agree to participate

_____ No, I do not want to participate

Child's Signature_____
Date

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Appendix B

**Mean Daily Energy and Nutrient Content of One Week's Lunches as Offered
to Third Graders at Troutdale Elementary and Glenfair Elementary Schools**

Mean Daily Energy and Nutrient Content of One Week's Lunches as Offered to Third Graders at Troutdale Elementary and Glenfair Elementary Schools.¹

	² NSLP Standard or Accepted ³ Recommendation	⁴ Lunches as Offered
Energy (kcal)	> 664	695
Carbohydrate (g)		94
% Kcal CHO	> 55 % Kcal	54 %
Protein (g)	> 10	28
% Kcal Protein		16
Total fat (g)		26
% Kcal Total fat	< 30 % Kcal	33 %
Saturated fat (g)		10
% Kcal Saturated fat	< 10 % Kcal	13 %
Cholesterol (mg) ⁵	100 ³	42
Fiber (g) ⁵	³	5.7
Vitamin A (RE)	> 224	434
Vitamin C (mg)	> 15	41
Calcium (mg)	> 286	465
Iron (mg)	> 3.5	3.7
Sodium (mg) ⁵	800 ³	1162

1. Table adapted from Georgiou et al. (1998).

2. School Meals Initiative for Healthy Children guidelines taken from applicable recommendations from the Dietary Guidelines for Americans (USDA/DHHS 1995) and Recommended Dietary Allowances (NRC 1989).

3. An increase in fiber intake and a decrease in cholesterol and sodium intake is recommended by SMI (USDA/CNP 1995). No specific level is specified. The SNDAS recommended a target lunch intake for cholesterol of less than 100 mg and sodium intake less than 800 mg. Standard for fiber intake (Williams, 1995).

4. Nutrient content of lunches as offered during one week at Troutdale Elementary and Glenfair Elementary Schools was analyzed Nutrikids software.

5. NSLP has not established standards for these nutrients but has requested that they be monitored in school lunches.

Appendix C

Menu for the Weeks of February 10-14, 1997 and April 14-18, 1997

Menu for the weeks of February 10-14, 1997 and April 14-18, 1997
Reynolds School District

Monday	Tuesday	Wednesday	Thursday	Friday
Tamales	Spaghetti	Nachos	Turkey/Gravy	Ravioli
Pizza	Pizza	Pizza	Pizza	Pizza
Cheeseburger	Cheeseburger	Cheeseburger	Cheeseburger	Cheeseburger
Burrito	Burrito	Burrito	Burrito	Burrito
Peanut butter & Jelly Sandwich	Turkey Sandwich	Turkey Sandwich	Ham & Cheese Sandwich	Tuna Sandwich
1% Milk	1% Milk	1% Milk	1% Milk	1% Milk
2% Milk	2% Milk	2% Milk	2% Milk	2% Milk
Carrots	Carrots	Carrots	Carrots	Carrots
Broccoli	Broccoli	Broccoli	Broccoli	Broccoli
Celery	Celery	Celery	Celery	Celery
Cauliflower	Cauliflower	Cauliflower	Cauliflower	Cauliflower
Apples	Apples	Apples	Apples	Apples
Oranges	Oranges	Oranges	Oranges	Oranges
Pears	Salad	Grapes	Fruit Salad	Banana
Beets	Sunflower Seeds	Banana	Banana	Salad
Corn	Mixed Vegetables	Apricots	Cranberry Sauce	Pineapple
Saltines	Applesauce	Beets	Green Beans	Mixed Vegetables
Graham Crackers	Garlic Bread	Hot Broccoli	Hot Roll	Hot Roll
White Bread	Saltines	Graham Crackers	White Bread	Saltines
Salsa	Wheat Bread	Saltines	Graham Crackers	Graham Crackers
Catsup	Salsa	Wheat Bread	Salsa	Salsa
Mustard	Catsup	Salsa	Catsup	Catsup
Butter	Mustard	Catsup	Mustard	Mustard
Ranch Dressing	Butter	Mustard	Butter	Butter
	Ranch Dressing	Butter	Ranch Dressing	Cupcake
		Ranch Dressing		Ranch Dressing

Appendix D

Forms for Recording and Computing Pre-portioned Samples

[illegible]

ITEM	quantity	trial 1(g)	trial 2	trial 3	trial 4	trial 5	AVE
grapes	5 ea						
	10 ea						
	15 ea						
apples	each						
Oranges	each						
pears	each						
	T						
	1/4 cup						
Banana	each						
Fruit Salad	tsp						
	Tbs						
	1/4 cup						
Cranberries	tsp						
	Tbs						
	1/4 c						
Pineapple	tsp						
	Tbs						
	1/4 c						
Cupcake	each						
Sunflower sd	tsp						
	Tbs						
	1/4 c						
Ranch	tsp						
	Tbs						
	1/4 c						
Butter	each						
	tsp						
	T						
Ketchup	tsp						
	Tbs						
	1/4 c						
Mustard	tsp						
	Tbs						
	1/4 c						
Salsa	tsp						
	Tbs						
	1/4 c						

ITEM	quantity	trial 1(g)	trial 2	trial 3	trial 4	trial 5	AVE
carrot sticks	each						
celery sticks	each						
broccoli	each						
cauliflower	each						
beets	each						
	tsp						
	Tbs						
	1/4 c						
corn	tsp						
	Tbs						
	1/4 c						
salad greens	tsp						
	Tbs						
	1/4 c						
	1/2 c						
mixed veggies	tsp						
	Tbs						
	1/4 c						
green beans	tsp						
	Tbs						
	1/4 c						

Appendix E
Collection Form for Selected Data

SELECTED

REYNOLDS S.D.

M	T	W	H	F	NAME	#	F/R	P								
ENTREES	EA	MILK	EA		FRUIT	EA	1 tsp	1 T	1/2 c	VEG	EA	1 ts	1 T	1/2 c	1/2 c	?
Tamales		1 %			Grapes					Carrots						
PI & Jelly		2 %			Apples					Celery						
Spaghetti		Nonfat Choc			Oranges					Broccoli						
Turkey Sand					Pears					Cauliflower						
Sub Sand		BREAD	EA		Banana					Beets						
Nachos		Garlic			Fruit Salad					Corn						
Turkey Gravy		White Bread			Cranberries					Salad Greens						
Ham & Cheese		Wheat Bread			Pineapple					Mixed Veggies						
Ravioli		Saltines								Green Beans						
Tuna Sand		Graham														
Burrito		Rolls			OTHER	EA	1 tsp	1 T	1/2 c	CONDIMENT	EA	1 ts	1 T	1/2 c	1/2 c	
Cheeseburger					Sunflower sds.					Ranch						
Pepperoni					Cupcake					Salsa						
										Ketchup						
										Mustard						
										Butter						

Appendix E.

Appendix F
Collection Form for Wasted Data

WASTED

A = Ave S = Selected W = Wasted E = Eaten ? = Other Measurement

TROUTDALE

Appendix F.

M	T	W	H	F	NAME							#	F/R		P
ENTR	A _s	W _s	E _s	MILK	A _s	W _s	E _s	FRUIT	A _s	W _s	E _s	VEG	S _s	W _s	E
Tamale				1 %				Grapes				Carrots			
PI & Jelly				2 %				Apples				Celery			
Spaghetti				NF Choc				Oranges				Broccoli			
Turkey Sand								Pears				Cauliflower			
Sub Sand				BREAD	A _s	W _s	E _s	Banana				Beets			
Nachos				Garlic				Fruit Salad				Corn			
Turkey Gravy				White Bread				Cranberries				Salad Greens			
Ham & Cheese				Wheat Bread				Pineapple				Mixed Veggies			
Ravioli				Saltine								Green Bean			
Tuna Sand				Graham											
Burrito				Rolls				OTHER	A _s	W _s	E _s	CONDIMENT	S _s	W _s	E
Cheese burger								Sunflower sds.				Ranch			
Pepponi Pizza								Cupcake				Salsa			
												Ketchup			
												Mustard			
												Butter			

Appendix G

Team Nutrition: *Food Works* Nutrition Education Lesson Plans

LESSON 1: FOOD GROWS

Objectives: Students will discover where food comes from and explore the role plants and animals play in the bigger picture of life on earth.

Materials:

1. "Food Works" video.
2. "Food Works" magazine.
3. "My Lab Notes" handout.
4. Plants for each group.
5. Glow light.

Procedure:

A. Introduction

1. State objectives.
2. Show the video.
3. Distribute "Food Works" magazine. Let students read the magazine at their leisure. Remind them to take care of it, as they will need it throughout the unit.

B. Getting Started

1. Ask students to discuss what they ate for lunch. List the items on the flip chart.
2. Have the class trace the "history" of one of the foods listed. They follow the food's journey backwards from the plate to the kitchen, to the store, to the factory, to the farm, to the plant. (Even meat and dairy products can be traced back to plants when students think about what animals and fish eat.)
3. Challenge students to think of anything they have eaten in the last 24 hours that did not, at some point in its existence, depend on plant life.

C. Activity 1. "What do living things need to grow?"

Hand out "My Lab Notes".

Students have seen that we depend on plants and animal products for our nutrition. Ask them to brainstorm the conditions under which plants and animals grow strong and healthy. (Write their answers on flip chart) Tell them that in order to examine the connection between healthy conditions and healthy growth, they can investigate what happens when a plant is grown under different conditions. Divide students into four teams of scientists. Give each team a plant. Each team will observe seedlings growing under one set of conditions:

- * with soil, regular watering, and plenty of sunlight
- * with sunlight and water, but no soil
- * with soil and sunlight, but no water

LESSON 1: cont.

C. Activity 1. (Cont.):

- * with soil and water but no sunlight.

Encourage students to come up with other variables they can test, such as growing one plant inside, and another outside, and so on. Students should clearly record what they deny the plant - water, light, soil, etc.

Over the next two weeks, students keep record of what they observe.

D. Activity 2. Kitchen Tour.

1. Arrange for students to tour the kitchen and introduce themselves to food service staff. Before students visit the kitchen, they should prepare questions to ask the staff. Write their questions on the handout "Kitchen Tour":

- *Where does the food come from?
- *Where is it stored?
- *Who cooks the food?
- *Who plans the menu?

Students will write a paragraph about their tour of the kitchen. They can draw a picture about food or something they liked on their tour.

E. Activity 3. Homework.

1. Send "Dear Parent" handout home. Encourage students to continue learning about where foods come from by going to the grocery store with their parents.
Ask your parents to discuss which foods are examples of roots, stems, leaves, fruits, flowers, and seeds. Encourage students to try one of each.

E. Evaluation

1. Activity 1. At the end of the two weeks, students compare results. Each team names a spokesperson to tell the class about their experiment. After the results of the experiments have been shared and discussed, students list the things plants must have in order to survive. Then list the conditions that resulted in the healthiest plants.
2. Activity 2. Students will turn in their paragraph on Friday of that week.
3. Activity 3. Students will report to class what foods they saw at the grocery store and if they tried eating a new food this week.

KITCHEN TOUR

Questions:

Report:

REPRODUCIBLE

2

Name _____

My Lab Notes

Scientists always keep detailed records of their observations. As you do your plant experiment, you can record your observations below.

Type of plant _____

What I am giving the plant to grow:

☐

soil

☐

water

☐

light

☐

other



My Observations Draw your plant and describe your observations below.

Day 1. Date _____	Day ____ Date _____

Day ____ Date _____	Day ____ Date _____

Dear Parents,

Welcome to Food Works, a nutrition education program brought to you by Scholastic Inc., the United States Department of Agriculture's Team Nutrition, and your child's school. The goal of Food Works is simple — to improve the health of children by empowering them to:

- Choose a variety of foods
- Eat more grains, vegetables, and fruits
- Construct a diet lower in fat

You are your child's most important role model, and your help is needed for this program to succeed. Therefore, we have created parent pages, full of fun and informative activities you and your child can do together. After each of the first six Food Works lessons, your child will bring home one of these pages to share with you.

WHAT IS A HEALTHY DIET?

The following Dietary Guidelines for Americans, developed by the USDA and the US Department of Health and Human Services, contain the best, most up-to-date advice from nutrition scientists.

- **Eat a variety of foods** to get the energy, protein, vitamins, minerals, and fiber you need for good health.
- **Balance the food you eat with physical activity; maintain or improve your weight** to reduce your chances of having high blood pressure, heart disease, a stroke, certain cancers, and the most common kind of diabetes.
- **Choose a diet with plenty of grain products, vegetables, and fruits**, which are important sources of fiber, complex carbohydrates, and other food components that can help reduce your risk of some chronic diseases.
- **Choose a diet low in fat, saturated fat, and cholesterol** to reduce your risk of heart disease and certain cancers, and to help you maintain a healthy weight.
- **Choose a diet moderate in sugars.** A diet with lots of sugars has too many calories and too few nutrients for most people and can contribute to tooth decay and overweight.
- **Choose a diet moderate in salt and sodium**, which may help reduce the risk of high blood pressure in some people.
- **If you drink alcoholic beverages, do so in moderation**, because alcoholic beverages supply calories but little or no nutrients, and in excess are related to liver disease and some forms of cancer.

Unfortunately, most children do not consume a diet that meets the Dietary Guidelines outlined above. Less than one in five children eats the recommended amount of servings of fruit and vegetables daily. Team Nutrition needs you to join in and help kids make food choices for a healthy diet.

Thanks for joining Team Nutrition.

0-590-93416-3

SCHOLASTIC



This is the first of eight parent pages your child's teacher will photocopy and ask your child to bring home to you. Each page deals with a different aspect of nutrition, and is related to what your child learned in school.

What Are Children Eating Today?

- 35% of elementary school-age children eat no fruit, and 20% eat no vegetables on a given day.
- 27% of children 6-11 years old are considered obese.
- 12% of school-age children reported skipping breakfast.



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LESSON 2: BODIES GROW

Objectives: Students learn how the Food Guide Pyramid can help them construct a healthy diet.

Materials:

1. "Food Guide Pyramid" and "What Counts As a Serving?" handout.
2. Food Works video.
3. Dry and liquid measuring cups and spoons.
4. Ounce weighing scale.
5. Blender.
6. Food Samples: crackers, bread, cereal, assorted vegetables, strawberries, milk.
7. School lunch menu.

Procedure:

A. Getting Started

1. Review the conditions under which plants grow best and the benefits the plants get from the correct balance of soil, light, and water.
2. Now ask students to review the comparisons they were challenged to make between the needs of people and plants in Lesson 1. What benefits would they expect people to get from the correct balance of food, water, and exercise?
3. Challenge students to think up one change they could make in their daily lives that would improve their health.

B. Activity 1. "What Is A Healthy Diet?"

- *Hand out the Food Guide Pyramid handout. Allow students time to read it and discuss it. Have them keep it to refer to in upcoming lessons.
- *Explain that the Food Guide Pyramid represents a balanced diet to help people make healthy eating choices. Students may need some help deciphering the pyramid.
- *Review the food chain discussed in the previous lesson. Challenge students to determine which of the major food groups include foods from plants, which from animals.

C. Activity 2. "How Much Is A Serving?"

- *Review the "Munching at the Mall" segment of the Food Works video where the Food Guide Pyramid is discussed and Zelda and Noah interview people about the number of servings they've had from different food groups that day.
- *Have students look at the foods brought into class and estimate how many servings they eat at a sitting. For example, if they eat cereal with milk for breakfast, they might estimate that they eat one serving from the grain group and one serving from the milk group.
- *Divide students into teams and give each team some of the foods brought into class. Students take turns using measuring spoons, cups, and scale to measure out serving sizes.
- *Have students wash their hands. Let students measure milk and strawberries into blender, according to recipe. Blend. Taste test untouched foods and drink.

D. Activity 3. Homework.

- *Send Parent Reproducible 3, Building Healthy Meals and Snacks, the Food Guide Pyramid is presented. Ask students to explain the pyramid to their parents.

D. Activity 3. (Cont.)

***Send Parent Reproducible 7. Pyramid Snacks.** Encourage students to try the snack suggestions, along with their parents.

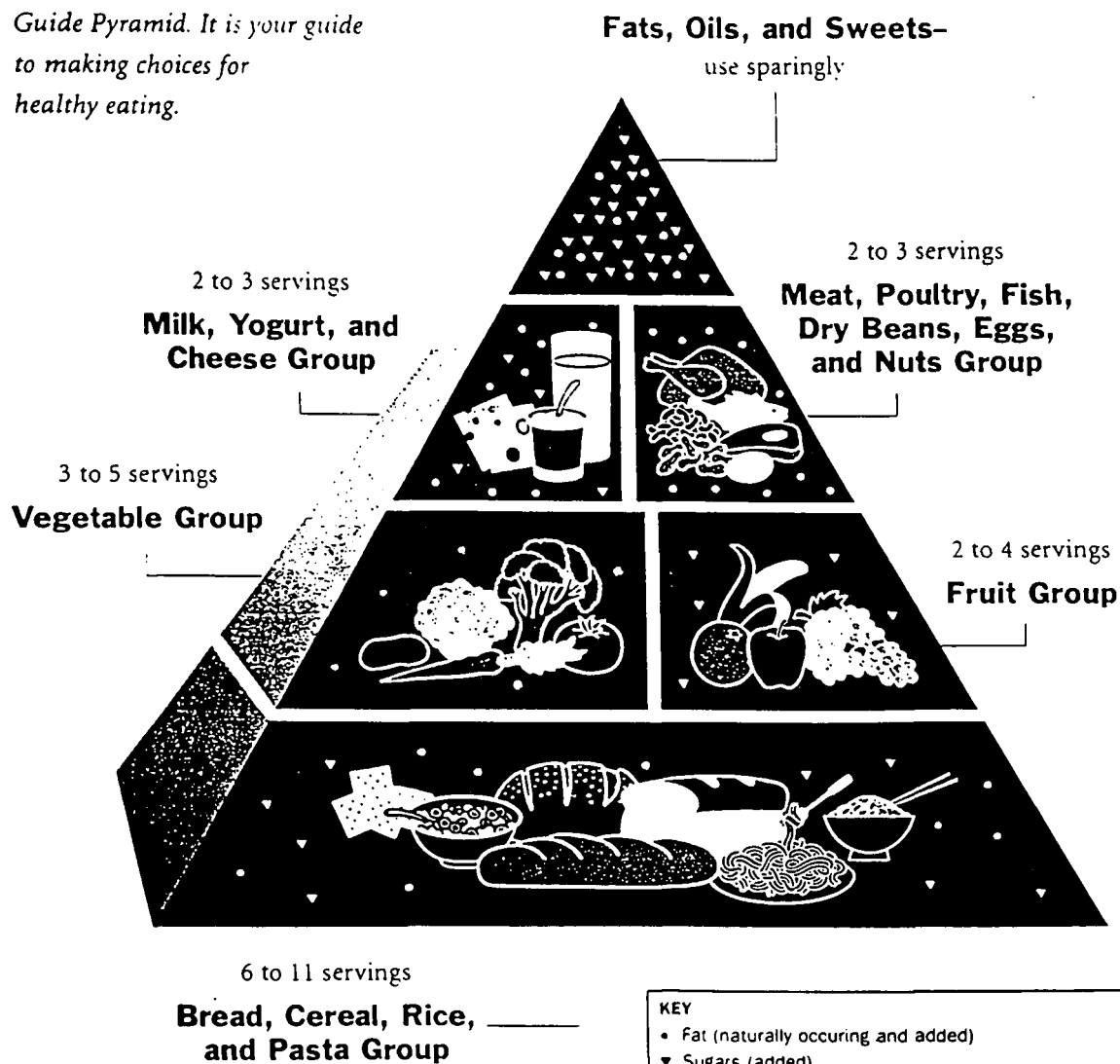
E. Evaluation

1. Activity 1. Students will report to the class what their favorite food is and from what food group it comes from.
2. Activity 2. Students will accurately measure ingredients in the drink recipe and will be able to identify what a serving size for grains, vegetables, fruit and milk.

Name _____

The Food Guide Pyramid

This is your copy of the Food Guide Pyramid. It is your guide to making choices for healthy eating.



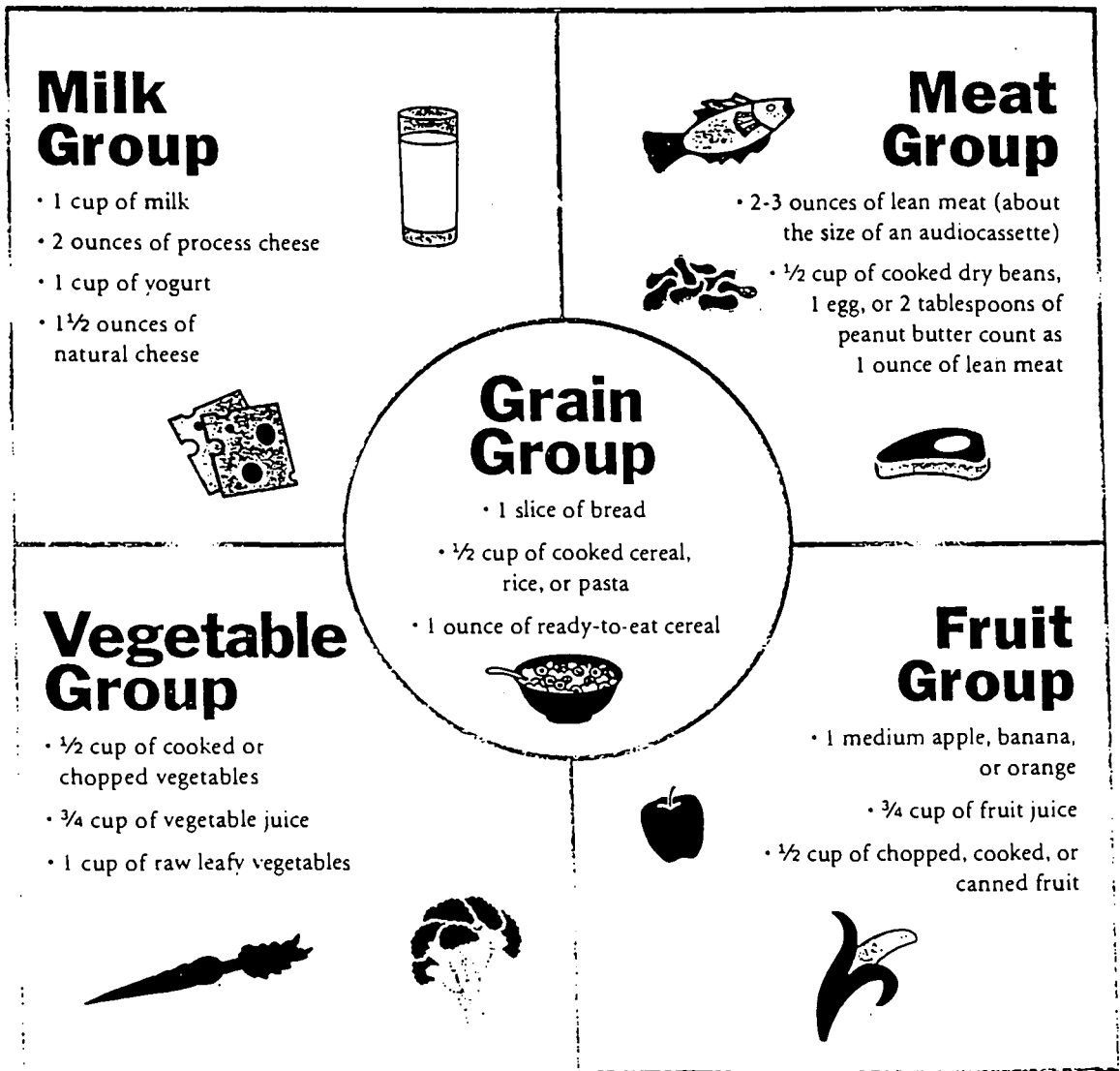
REPRODUCIBLE

5

Name _____

What Counts As A Serving?

Here are some examples of what counts as a serving in each food group. Use measuring cups and spoons to see how big each serving is.

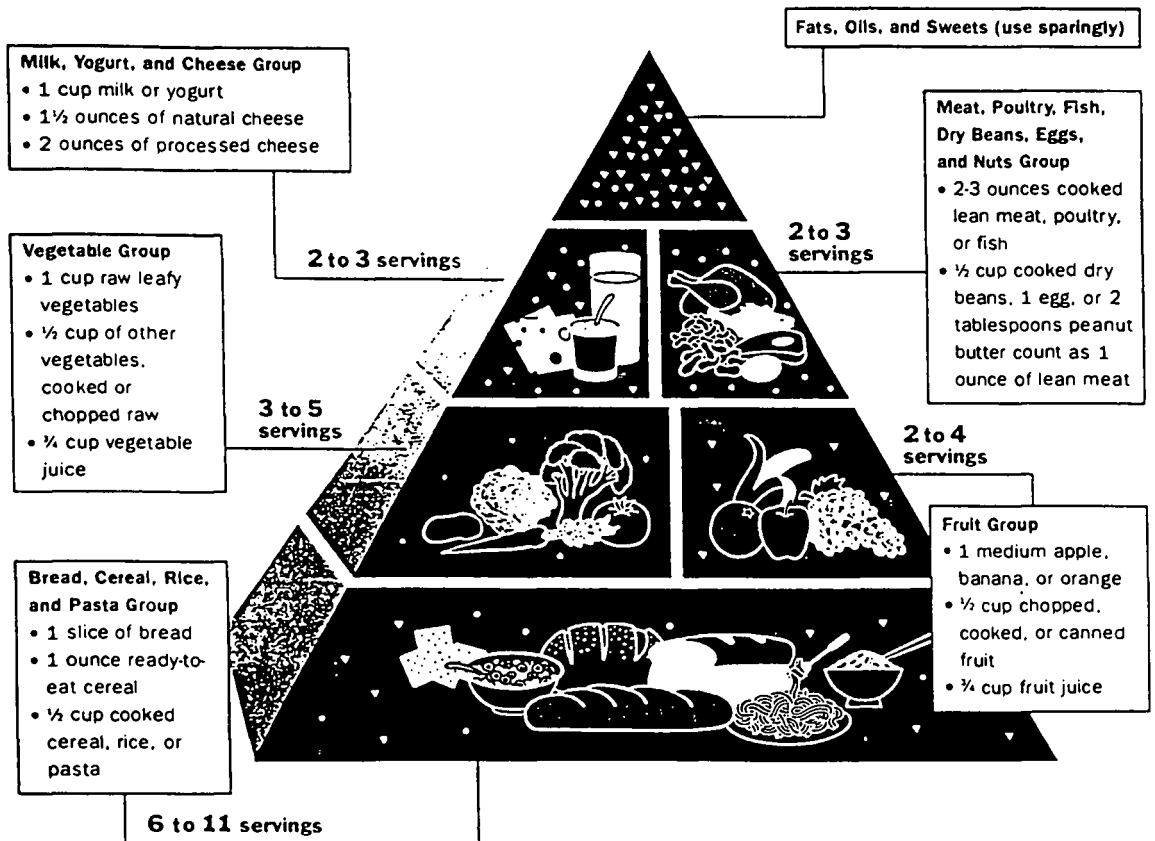


Building Healthy Meals & Snacks



The US Department of Agriculture's Food Guide Pyramid, which appears below, is a guide you and your family can use to assess your eating habits. It presents guidelines for choosing foods that provide the right balance of vitamins, minerals, and other nutrients and examples of typical serving sizes. With your child, you can create tasty menus that meet the goals you set based on the pyramid.

FOOD GUIDE PYRAMID: A Guide to Daily Food Choices



■ **Remember!** The calorie needs of elementary school children vary. Each day, your child should be eating the lower-to-middle number of servings suggested on the Food Guide Pyramid for each of the five major food groups.

KEY

- Fat (naturally occurring and added)
 - Sugars (added)
- These symbols show fat and added sugars in foods.

Pyramid Snacks



Children often cannot consume the amount of food in regular meals that will meet all their dietary needs, so snacks are an important part of their diet. Just as when you plan meals, when you select snack foods, you need to keep an eye on your main goal—a balanced diet. Here are some ideas for healthy snacks that you and your child can try out together:

SNACK MIX

Are you always on the go? Do you participate in active sports like hiking or cross-country skiing? If so, then this mix is an ideal snack for you. It has only half the fat of a one-fourth cup serving of salted peanuts and 144 milligrams less sodium.

- Pretzels, unsalted 1 cup
- Roasted peanuts, unsalted 1 cup
- Raisins 1 cup
- Sunflower seeds, unsalted $\frac{1}{2}$ cup

12 SERVINGS,
about $\frac{1}{4}$ cup each

Per serving:
Calories 150
Total fat 9 grams

1. Break pretzels into bite-size pieces.
2. Mix ingredients together.
3. Store in airtight container.

SALSA

A fat-free, low-sodium vegetable dip that provides vitamin C and vitamin A too.

- 8-ounce can "no-salt-added" tomato sauce
- 1 tablespoon chili peppers, canned, drained, finely chopped
- $\frac{1}{4}$ cup green pepper, finely chopped
- 2 tablespoons onion, finely chopped
- 1 clove garlic, minced
- $\frac{1}{4}$ teaspoon oregano leaves, crushed
- $\frac{1}{4}$ teaspoon ground cumin

SERVINGS, about 1 cup

Per tablespoon:
Calories 5
Total fat Trace

1. Mix all ingredients thoroughly.
2. Chill before serving to blend flavors.
3. Serve with toasted pita bread, breadsticks, or raw vegetable pieces.

CURRY VEGETABLE DIP

Dress up vegetables in a low-fat way.

- 8-ounce carton plain, low-fat yogurt
- $\frac{1}{4}$ cup carrots, shredded
- 2 teaspoons green onions, minced
- 1 tablespoon mayonnaise-type salad dressing
- 1 teaspoon sugar
- $\frac{1}{4}$ teaspoon curry powder
- dash pepper

SERVINGS, about 1 cup

Per tablespoon:
Calories 15
Total fat 1 gram

1. Mix ingredients in a bowl.
2. Chill.
3. Serve with crisp raw vegetable pieces, such as celery, carrot, or summer squash sticks.



OTHER SNACK IDEAS

When your child wants something:

- **Juicy:** fruits
- **Crispy:** pumpkin seeds, carrot sticks, cucumber strips, toast, cereal mixed with nuts
- **For warmth:** soups, cider, or herbal tea
- **For thirst:** vegetable juices, or fruit and yogurt shakes

LESSON 3: READ ALL ABOUT IT !

Objectives: Students analyze their diets, and set goals to bring their diets in line with the recommendations in the Food Guide Pyramid.

Materials:

1. Reproducible 6 and 7.
2. Food Works magazine.
3. School Lunch Menu.
4. Food Diary rating form.

Procedure:

A. Before you begin: Ask students if they've done any of the activities with their parents. Remind students of what they saw in the Food Works video. Point out that Noah and Zelda are investigative reporters who get the "inside story" on food. Tell students that in this lesson they will get the inside story on their own diets.

B. Getting Started

1. Working in small groups, students skim the articles in the Food Works magazine, talk about the main ideas of different articles. They should note that the main idea of the story is often contained in the first paragraph. The rest of the story backs up the main point with details and further explanations.
2. Students should also note that stories include menu facts, and reporters often answer the following questions in their story: Who, What, When, Where, Why and How? Ask students to look back at an article and see if they can find the answers to these questions.

C. Activity 1. Keep A Food Diary.

- *Ask students to use a piece of paper and to keep a food diary for a 24-hour period. Each student should decide which day they are going to use and tell me. They should record everything they eat and drink during the time.
- *Have students fill in the blanks of the Food Diary rating form.
- *They also should estimate serving size each time they make an entry because it may be more difficult to remember the size of their portions later on.
- *Have students write a newspaper article about their diets and how they stack up next to the Food Guide Pyramid. Remind students that reporters use facts.
- *First have student fill in the blanks of the Food Diary rating form. Ask students to categorize the foods in their diaries according to food group. Remind them that many food (such as pizza) have a combination of ingredients and therefore, include foods from several of the food groups. Once they have organized the foods by group, ask student reporters to count and record the number of servings they ate from each group. What are the number of recommended daily servings for each of the groups according to the Food Guide Pyramid? What food groups did they eat enough servings from? Too many servings from? Too few servings from? On pages 6 and 7 of their Food Works magazine they will see how two students' diets stacked up against the Food Guide Pyramid.
- *Based on their article, students determine how they can make healthier eating choices. Have students write one dietary goal for themselves based on the evaluation presented in their article.

D. Activity 2. Homework.

***Send Parent Reproducible 5, Get Energized, home. Discuss the importance of physical exercise for healthy bodies. Explain to students that the handout includes several ideas for exercise they can do at home with their parents.**

E. Evaluation.

- 1. Activity 1. Have students write and turn in their reports on Friday.**
- 2. Activity 2. Ask students which exercises they enjoy the most and what they might try with their parents this week.**

REPRODUCIBLE

6

Name _____

Reporter's Notebook

Reporters ask questions and take notes before they write a story. These questions will help you organize your food story.



Who is the story about? Say something about yourself. _____

Which foods from each food group did you eat? _____

When and where did you eat these foods? _____

Why did you choose these foods? _____

Did anyone say anything about the food you ate? Write down some quotes from other people. _____

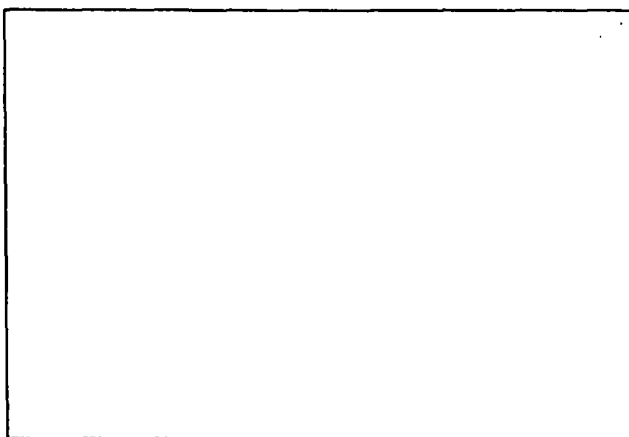
What is the main message in your story? _____

The Daily Digest

The Big Story

REPORTED BY

Write your story and draw
a picture of what happened.



Fats, oils, and sweets
Use sparingly

1. _____
2. _____

Milk Group

1. _____
2. _____
3. _____

Meat Group

1. _____
2. _____

Vegetable Group

1. _____
2. _____
3. _____

Fruit Group

4. _____
5. _____
6. _____

Bread Group

7. _____
8. _____

3. _____
4. _____

3. _____
4. _____

4. _____
5. _____

3. _____
4. _____

Get Energized!



Recent studies report that many children are not physically active on a regular basis. Encourage your child to become involved in sports activities available at school or in the community. At home, you can try some of the activities suggested below to help your child be more active, and to reinforce the link between diet, exercise, and good health.

GRAINS—THE FUEL FOOD

Grains (bread, pasta, or cereal, for example) are filled with complex carbohydrates, a great source of sustained daily energy. The Food Guide Pyramid recommends that children eat at least six servings of grains a day. Encourage your child to set a goal to meet this recommendation. Help your child meet this goal by trying new grain-based snacks together and keeping a log of the grains your family eats at home.

OUTDOOR FITNESS FUN

Children love to be outside, and doing an activity with you makes the experience even more special.

Try these fun fitness ideas together:

■ **Go on All-Season Scavenger Hunts** Challenge your child to walk more by joining him/her on a scavenger hunt. Before you set out, write up a list of items that you can both look for. See who can locate these items the fastest. For example, try to find:

- Items with different colors—red, orange, yellow, green, blue, or purple
- Objects with a variety of textures—smooth, fuzzy, hard, soft, wet

You can take scavenger hunt walks together during every season. Winter, spring, summer, or fall, there's always something interesting that you and your child can discover. You can adapt your checklist of items appropriately:

For example:

- Look for human and animal tracks in the snow
- Search for signs of spring in new flowers and buds on trees
- Find interesting shadows on a sunny summer day
- Gather colorful leaves and acorns on a crisp autumn afternoon



INDOOR EXERCISE ACTIVITIES

Physical activity doesn't have to mean running, biking, or swimming. If the weather keeps you inside you can still keep fit.

■ **Have a Dance Party** Dancing is a fun way to exercise and something fun that you and your child can do every day. Encourage your child to invent a dance to go along with a favorite song. Give your child the opportunity to be the teacher and instruct you in their new dance. Later, you can introduce your child to the dances you enjoy most, along with your own favorite songs.

■ **Household Exercise Olympics** Many household jobs help to build strong bodies. Create your own Household Exercise Olympics. Together, you and your child can try the following "events":

- Raking leaves
- Shoveling snow
- Weeding the garden
- Dusting all furniture or washing all windows in a designated room

Try doing these activities in tandem. Afterwards, tally up the "medal" winners in each event and announce the top Olympian in your family at dinner that night.

RELATED READING

After exercising, you and your child might want to settle down and read a book together—try *Bread, Bread, Bread*, by Anna Morris (1989, Scholastic). Filled with lots of photos, it tells the story of the variety of high-energy grain-based breads found all over the world.

LESSON 4.: THE GREAT NUTRITION ADVENTURE

Objectives: Students revisit all they have learned about healthy eating, and share this information with family and friends.

Materials:

1. Invitation to Parents.
2. Food samples.

Procedure:

A. Preparation.

1. Students decorate and display their art and writing assignments from all they've learned.
2. Welcome parents.
3. Introduce the Guest Chef. Tom Ohling.

B. Activity 1. Guest Chef

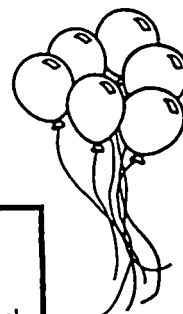
1. Chef will bring together all that the students have learned in an exciting, multi-media presentation.
2. Food grows, food helps our bodies grow, all foods can be apart of a healthy diet, and FOOD IS FUN!
3. Students garnish an orange bird.

E. Evaluation

1. Activity 1. Students and parents will discuss the art and writing projects around the room.
2. Students and parents will discuss the physical activities that they've participated in.
3. Students and parents will have a good time.

Name _____

An Invitation to Our Food Fair



Dear _____,

Our class is organizing a food fair, and we would like to invite you to come!

We will have games, skits, posters, and food to entertain you. You see, we just completed a course all about food and nutrition, and we would like to share some of the exciting things we discovered with you.

Our fair will be held on _____
at _____. Please fill in the reply below and return it to us.

Reply Form

Check the boxes that apply to you.

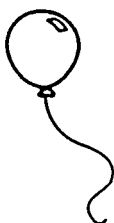
I would be delighted to come to your food fair. ☐

I am sorry, I cannot come to your fair. ☐

I would like to help the class prepare the food for the fair. ☐

I am sorry, I cannot help prepare the food for the food fair. ☐

Signature



Appendix H
Parent's Questionnaire

DEPARTMENT OF NUTRITION AND FOOD MANAGEMENT



OREGON STATE UNIVERSITY

108 Milam Hall • Corvallis, Oregon 97331-5103

Telephone 541-737-3361 Fax 541-737-6914

Parent's Questionnaire

March 17, 1997

The Department of Nutrition and Food Management at Oregon State University has been conducting a study for the Oregon Department of Education, Child Nutrition Division, in your child's class at Glenfair Elementary School over the past month. The purpose of the study is to help schools serve lunches which are healthy and well liked by children.

In addition to the study at school we are interested to know what you have observed at home about your child's attitude and behavior in regard to fruits and vegetables.

Your participation in filling out this questionnaire is voluntary. All information from the study is completely confidential. All data will only be reported about the class as a whole and not for individual children.

Please sign and return this letter and questionnaire to your child's teacher by Friday, March 21, 1997, whether you check Yes or No. Thank you.

☐ Yes, I agree to complete the questionnaire

☐ No, I do not want to complete the questionnaire

Parent's Signature

Date

Connie Georgiou, Ph.D., L.D., Associate Professor
Department of Nutrition and Food Management
Milam Hall 108
Oregon State University
Corvallis, OR 97331-5103 (541) 737-0965 Georgiou@ccmail.orst.edu

Please circle the best answer

1. Has your child talked about nutrition over the past month?

- 1 YES
- 2 NO
- 3 NOT SURE

2. Has your child talked about the Food Guide Pyramid in the past month?

- 1 YES
- 2 NO
- 3 NOT SURE

3. Has your child talked about eating more fruit in the past month?

- 1 YES
- 2 NO
- 3 NOT SURE

3.a. IF YES, what? _____

4. Is your child willing to eat most fruits?

- 1 YES
- 2 NO
- 3 NOT SURE

5. Have you noticed a change in your child's willingness to eat fruit over the past month?

- 1 YES
- 2 NO
- 3 NOT SURE

5.a. IF YES, how? _____

6. Has your child changed his/her consumption of fruit over the past month?

- 1 YES
- 2 NO
- 3 NOT SURE

7. Has your child asked you to buy any specific fruit over the past month?

- 1 YES
- 2 NO
- 3 NOT SURE

7.a. IF YES, what? _____

OVER

8. Has your child talked about eating more vegetables over the past month?

1 YES

2 NO

3 NOT SURE

8.a. IF YES, what? _____

9. Is your child willing to eat most vegetables ?

1 YES

2 NO

3 NOT SURE

10. Have you noticed a change in your child's willingness to eat vegetables over the past month?

1 YES

2 NO

3 NOT SURE

10.a. IF YES, how? _____

11. Has your child changed his/her consumption of vegetables over the past month?

1 YES

2 NO

3 NOT SURE

12. Has your child asked you to buy any specific vegetable over the past month?

1 YES

2 NO

3 NOT SURE

4 IF YES, what? _____