

DISSERTATION

INCREASING FRUIT AND VEGETABLE CONSUMPTION IN
GRADE-SCHOOL CHILDREN

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION
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ABSTRACT OF DISSERTATION

INCREASING FRUIT AND VEGETABLE CONSUMPTION IN GRADE-SCHOOL CHILDREN

Diets rich in fruits and vegetables have many health benefits. Nutrients in fruits and vegetables such as vitamins, minerals, and fiber help protect individuals from certain cancers and cardiovascular disease. Children in our nation are not meeting the national health objectives or recommendations to eat plenty of fruits and vegetables. This research assessed whether the provision of classroom nutrition education on the benefits of eating fruits and vegetables and providing more fresh fruits and fresh vegetables in the school lunch program increased consumption by grade-school children. This research was completed in three parts.

The purpose of part one (The Nutrition Education Intervention Study) was to determine if providing nutrition education to grade-school children and the community increased fruit and vegetable consumption. In this study a nutrition education program was given to the grade-school children and community of Holyoke (experimental group). The effects of the nutrition education intervention were compared to the control group (i.e., the grade-school children and community of Haxtun), which received no intervention. A nutrition education program was developed and designed as a hands-on education program for the children and for the community. The intervention included nutrition education materials, demonstrations, and activities on increasing the consumption of fruits and vegetables and good nutrition. Fruit and vegetable consumption was measured by a 24-hour food recall (children only) and a pre- and post-questionnaire for the

children and community. The results showed mean fruit and vegetable consumption increased by 1.37 servings per day (from 2.45 to 3.82) among the grade-school children using the 24-hour food recall assessment method and 0.93 (3.93 to 4.86) using a pre/post self-reported questionnaire (both at $p \leq 0.05$). The community's mean fruit and vegetable intake increased by 0.66 servings per day (3.28 to 3.94) from the pre to post questionnaire ($p \leq 0.05$).

The purpose of part two (The Fresh Fruit and Vegetable Intervention Study) was to determine if providing quality fresh fruits and fresh vegetables increased consumption by grade-school children. In this study the Department of Defense (DOD) provided fresh fruits and vegetables to schools within Colorado. The schools receiving the fresh fruits and vegetables (experimental group) were compared to schools not receiving fresh produce (control group). The children in the experimental group were offered a variety of high quality of fresh fruits and vegetables in the school cafeteria with their school lunches. Fruit and vegetable consumption was measured by subtracting plate waste from the beginning weight for each fruit and vegetable served. The results were as follows: 1. The experimental group took on an average 2.70 ounces combined fruits and vegetables per child, the control group took 3.14 ounces per child ($p \geq 0.05$). 2. The children in the experimental group consumed a greater percentage (73%) of fruits and vegetables than the control group (61%) ($p \leq 0.05$). 3. The children in both groups consumed more fruits than vegetables.

In part three, the results of the two studies were completed. The results showed that there was no difference in the two approaches, both interventions increased consumption of fruits and vegetables in the grade-school children.

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CHAPTER I

INTRODUCTION

Eating habits and attitudes toward food are formed early in life (Birch and Fisher, 1995; Birch and Marlin, 1982). Healthy eating by children is important since chronic disease can be linked to diet (NAS, 1989). Children consume less than one serving of fruits and vegetables a day (Bellinger, Rabinovitz, and Obester, 1993; Krebs-Smith, 1993). Diets rich in fruits and vegetables have many health benefits (National Academy of Sciences, 1989). One benefit is the higher the intake of fruits and vegetables the lower the risk of cancer (Steinmetz and Potter, 1991a). Nutrients in fruits and vegetables such as vitamins, minerals, and fiber help protect individuals from certain cancers and cardiovascular disease. After examining an abundance of research on diet and its link to cancer, the Healthy People 2000 report in 1990 included a national objective for eating five or more servings of fruits and vegetables per day (USDHHS, 1990). In 1989 the National Cancer Institute (NCI) and the Produce for Better Health Foundation developed the national 5 A Day campaign (Havas et al., 1995; "5 A Day is Under Way!", 1991). The 5 A Day campaign is designed to encourage people to eat five or more servings of fruits and vegetables per day to improve their health. In 1995 the most recent "Dietary Guidelines for Americans" was issued by the USDA and the U.S. Department of Health and Human Services (USDA, USDHHS, 1995). These guidelines again call for moderation, variation, and proportionality in the diet.

The latest recommendations are as follows:

- ◆ Eat a variety of foods.
- ◆ Balance the food you eat with physical activity. Maintain or improve your weight.
- ◆ Choose a diet with plenty of grain products, vegetables and fruits.
- ◆ Choose a diet low in fat, saturated fat and cholesterol.
- ◆ Choose a diet moderate in sugar.
- ◆ Choose a diet moderate in salt and sodium.
- ◆ If you drink alcoholic beverages, do so in moderation.

The 1995 Dietary Guidelines now position fruits and vegetables as the third guideline, thus increasing its importance. The National School Lunch Program is working to improve and maintain the health of the nation's children by adhering to these guidelines (White, Sneed, and Martin, 1992). Schools are beginning to use more fresh fruits and fresh vegetables in their menus. Children in our nation are not meeting the National Healthy People 2000 objective or recommendations by various agencies to eat plenty of fruits and vegetables (Bellinger et al., 1993). This dissertation addresses the need to assess whether the provision of nutrition education and fresh fruits and fresh vegetables in the school lunch program increased consumption, and if providing nutrition education and more fruits and vegetables helps children make healthful choices and encourages them to eat more fruits and vegetables.

Major goals of this research were to answer the following questions:

1. Can providing nutrition education increase the consumption of fruits and vegetables in grade-school children?
2. Can providing additional quality fresh fruits and vegetables increase consumption of fruits and vegetables by grade-school children?

3. Which of the above is more efficacious in increasing consumption of fruits and vegetables by grade-school children?

Purpose of the Nutrition Education Intervention Study and Fresh Fruit and Vegetable Intervention Study

The overall purpose of these studies was to measure fruit and vegetable consumption by grade-school children in Colorado attributable to interventions. This dissertation includes two studies that have the following purposes:

The purpose of the Nutrition Education Intervention Study was to determine if providing nutrition education effected fruit and vegetable consumption in grade-school children. The increase in fruits and vegetables was measured by a pre- and post-24-hour food recall and a pre- and post-questionnaire.

The purpose of the Fresh Fruit and Vegetable Study was to determine if providing additional quality fresh fruits and fresh vegetables effected percent consumption in grade-school children. The fruit and vegetable consumption was measured by weighing the plate waste from children's school lunches and subtracting the waste amount from the beginning weight.

Research Objectives

Nutrition Education Intervention Study

The impact of nutrition education on consumption had the following objectives:

1. To develop nutrition education materials that can be used in a nutrition education program designed to increase the consumption of fruits and vegetables.

2. To develop a nutrition education intervention program to improve nutrition by increasing the consumption of fruits and vegetables in grade-school children and residents living in a rural northeast county of Colorado.

3. To determine the amount of fruits and vegetables consumed by grade-school children and residents in the county in order to compare the experimental school, which received intervention through nutrition education, to the control school.

Fresh Fruit and Vegetable Intervention Study

Impact of providing fresh fruits and vegetables on consumption had the following objectives:

1. To develop a monitoring system, using trained monitors, to collect the necessary data in order to measure the amount of fruits and vegetables available to and consumed by grade-school children in Colorado.

2. To determine the amount of fruits and vegetables consumed during school lunch by first-grade through sixth-grade children. The experimental schools that have been provided additional fresh fruits and fresh vegetables will be compared to the control group schools.

3. To measure which fruits and vegetable are favored by the grade-school children in the study.

4. To evaluate the school lunch menus from the 1993-94 school year and compare those menus to the 1994-95 school year in order to evaluate if fresh fruits and fresh vegetables were added or substituted in the school lunch menu from the previous year.

Intervention Program

In the Nutrition Education Intervention Study a nutrition education program was designed as a hands-on education program and included nutrition education materials on increasing the consumption of fruits and vegetables and good nutrition.

In the Fresh Fruit and Vegetable Intervention Study the availability of additional quality fresh fruits and fresh vegetables was increased during school lunch. The children were offered better variety and higher quality fresh fruits and vegetables with their school lunches.

The results of these studies will be beneficial since National School Lunch Program (NSLP) provides the majority of nutrients for many children in the U.S. (Bellinger et al., 1993). Today NSLP feeds over 26 million children a balanced meal daily (Price and Kuhn, 1996). Because so many children eat school lunches, the lunchroom is a highly effective environment for providing fresh fruits and fresh vegetables and for evaluating the consumption of fresh fruits and vegetables.

CHAPTER II

LITERATURE REVIEW

Diet and Cancer

Strong and consistent research findings have indicated that diets high in fruits, vegetables, and fiber are protective against a wide range of human cancers. Anticancer effects have been related to low fat, high fiber diets, cruciferous vegetables, and antioxidants, such as beta carotene, vitamin C (Steinmetz and Potter, 1991a; Block, Patterson, and Subar, 1992; Ziegler, 1991), vitamin E, selenium, copper, zinc, and manganese (Diplock, 1991). Antioxidants combine with free radicals in the body and render the free radicals harmless which inhibits tumor promotion (Higginson and Sheridan, 1991). Four main theories have been proposed as to the mechanisms by which fruits, vegetables, fiber, and fat affect cancer: the Fat Theory, the Fiber Theory, the Antioxidant Theory, and the Cruciferous Vegetable Theory.

The mechanism behind the Fat Theory is that a high intake of fat causes excretion of bile acids that help to digest fat. Either the bile acids or the breakdown products of the bile acids are thought to promote tumor growth (Gershoff and Whitney, 1990).

The Fiber Theory states that increased intake of fiber increases the bulk of the stool. The increase in the stool bulk speeds the passage of fat through the G.I. tract, thus lessening the time carcinogens are present.

Fiber may also bind to carcinogens, preventing their harmful effect (Pilch, 1987).

The Antioxidant Theory involves free oxygen radicals. The body's oxygen is constantly being shifted from cell to cell. When oxygen is not bound to hydrogen, it is an unstable, electrically charged, highly reactive atom called a "free radical." Free radicals cause chemical chain reactions to occur within the cell. These chain reactions produce more free radicals that eventually can cause damage to the cell's genetic material and result in cancerous growth. Antioxidants (i.e., vitamin C, beta carotene, vitamin E, selenium, copper, zinc, and manganese) bind or trap the free oxygen radical, thus preventing the chain reaction that may have a positive or negative effect on DNA processing (Higginson and Sheridan, 1991).

The Cruciferous Vegetable theory states that cruciferous vegetables contain chemicals called "indoles" that inhibit cancer cell proliferation. Indoles are found in brussels spouts, broccoli, cabbage, cauliflower, kale, and bok choy (Wattenburg, 1992).

Many studies have predicted that reducing the risk of some types of cancer may be possible with diet. To date, many studies have examined the relationship between fruit and vegetable intake and cancer.

Fruits and Vegetables

Eating high amounts of fruits and vegetables can reduce the risk of cancer. La Vecchia, Negri, D'Avanzo, Boyle, and Franceschi (1991) studied 105 patients with cancer and 1,169 hospital patients without cancer. Of the cancers diagnosed in one year, those individuals with food histories low in fruit consumption had the greatest incidence of cancer.

Shibata, Paganini-Hill, Ross, and Henderson (1992) conducted a prospective cohort study from 1981 to 1989 of 11,580 community residents. During the eight years, 1,335 cancer cases were diagnosed. Those adult individuals without cancer (10,245) had food frequencies which included high intakes of fruits, vegetables, vitamin C, and vitamin A. Shibata et al. (1992) concluded that this type of diet was instrumental in reducing their risk of cancer.

Several researchers examined the literature for fruit and vegetable consumption and their link with cancer prevention (Steinmetz and Potter, 1991a; Block, Patterson, and Subar, 1992; Bal and Foerster, 1993). Steinmetz and Potter concluded from 137 studies that consuming fruits and vegetables were consistently associated with a reduced risk of cancer. The mechanism they proposed was due to antioxidants, indoles, and fiber (Steinmetz and Potter, 1991b). Block, Patterson, and Subar (1992) looked at 200 studies. The individuals with low fruit and vegetable intake had about twice the risk of cancer compared to those with high intake even after controlling for confounding factors. The work of these individuals formed the basis of the 5 A Day recommendations. The 5 A Day recommendation is to eat five servings of fruits and vegetables daily for better health. Block, Patterson, and Subar (1992) concluded that fruits and vegetables are a protective factor against cancer and that a dose response relationship exists (more is better).

From the work of these researchers, the 5 A Day recommendations

were made. Bal and Foerster (1993) have used these recommendations and translated them into Dietary Strategies for Cancer Prevention. They proposed models for behavior change to increase the number of fruits and vegetables eaten daily.

5 A Day For Better Health Program

Researchers (Block et al., 1992; Steinmetz and Potter, 1991a; and Ziegler, 1991) have recommended that Americans eat more fruits and vegetables daily to reduce their risk of cancer. From this recommendation, the 5 A Day for better health program was born. The program strives to reduce the cancer mortality rate in Americans.

The history of the 5 A Day For Better Health Program began in 1982 when the National Academy of Science (NAS) concluded that major cancer sites are related to diet. In 1989 NAS concluded that diet recommendations should be food specific. As the relationship between diet and cancer became clearer, strategies for nutrition recommendations were formed. In 1990 "Healthy People 2000" (USDHH, 1990) objectives were developed. The "Healthy People 2000" national health objectives specify health promotion and disease prevention for the nation, including the recommendation to eat five or more servings of fruits and vegetables a day. Research by Block et al. (1992), Steinmetz and Potter (1991a), and Zeigler (1991) showed a strong negative association between cancer rate and patterns of higher fruit and vegetable consumption. From this, the NCI and Produce for Better Health Association developed the 5 A Day For Better Health Program, which was launched in October 1991. This program has one simple dietary message: "Eat 5 or more fruits and vegetables every day for better health" (Havas et al., 1994; Havas et al., 1995; "5 A Day News is Under Way!", 1991).

In 1991, The American Cancer Society (ACS) established the following guidelines on diet, nutrition, and cancer:

- ◆ maintain a desirable body weight,
- ◆ eat a varied diet,
- ◆ include a variety of fruits and vegetables in the daily diet,
- ◆ eat more high fiber foods (e.g., whole grain cereal, legumes, vegetables, and fruits),
- ◆ cut down on total fat intake,
- ◆ limit consumption of alcoholic beverages, and
- ◆ limit salt cured, smoked, and nitrate preserved foods

(ACS, 1991).

Were Americans meeting the 5 A Day dietary recommendations? Bal and Foerster (1991) reviewed recommendations from 12 health authorities all suggesting a need to increase fruits, vegetables, and fiber in most people's diets.

From the National Health and Nutrition Examination Survey II (USHHS, NHANES II, 1986) the actual fruit and vegetable intake was estimated to be 2.5 servings per day (Patterson, Block, Rosenberger, Pee, and Kahle, 1990; Patterson and Block, 1991). In a baseline telephone survey conducted by NCI, it was reported that only 23% of Americans were eating five or more servings of fruits and vegetables daily and only 8% of Americans were aware that they should eat five or more servings of fruits and vegetables each day. (Subar, Heimendinger, Patterson, Krebs-Smith, Pivonka, and Kessler, 1992; 1995). Also, 60% of these people who thought they should eat five or more servings per day actually did so, indicating a strong relationship between awareness, knowledge, and behavior. In

demographic breakdowns, women scored a little higher than average in their fruit and vegetable consumption, at nearly four daily servings. Men reported below average at three servings per day. Also older Americans ate more fruits and vegetables than other age groups.

In 1993, another telephone survey of 1,003 people was conducted by NCI. NCI found the percentage of people who believed they should eat at least 5 servings of fruits and vegetables per day had increased from the 8% in 1991 to 22% in 1992 to 29% in 1993 (Havas et al., 1994; 1995; Subar et al., 1995; "More Americans think 5 !", 1993). These results showed that the awareness of the importance of fruit and vegetable consumption had risen in the past two years; however, people were still not acting on this knowledge. As a result only one in eight adults were eating five or more servings a day (Havas et al., 1994; 1995; "More Americans think 5 !", 1993).

Two separate analyses of the Continuing Survey of Food Intake by Individuals concluded that children were not eating the recommended amounts of fruits and vegetables (NCI, 1989; USDA,HNIS, 1989). In fact, Krebs-Smith (Bellinger, Rabinovitz, and Obester, 1993) examined the data and found a disturbing absence of fruits and vegetables in children's diets based on a three-day period. In Bellinger's report children were consuming less than one serving per day of fruits and vegetables, which is far short of the recommendation of five servings a day.

The 5 A Day project goal is to increase per capita fruit and vegetable consumption to five or more servings daily by:

- ◆ increasing awareness of the importance of eating at least five servings of fruit and vegetables every day for better health, and
- ◆ providing consumers with specific information about how to incorporate more servings of fruits and vegetables into a daily diet.

Children's Eating

The health and wellness of a child is of utmost importance. Nutrition plays a vital role in the health, growth, and development of a child. There is much evidence that eating habits and food preferences are established in childhood and can continue through life into adulthood (Birch, Johnson, and Fisher, 1995; Birch and Marlin, 1982). A child's introduction to new foods, repeated exposure, and tasting new foods enhances acceptance of foods (Sullivan and Birch, 1990).

Offering a new food with repeated exposure can be a slow but effective means of expanding the variety of foods the children accept. From the many studies performed on children and food exposure, researchers (Birch and Marlin, 1982; Sullivan and Birch, 1990) concluded that repeated exposures to foods can help to increase a child's acceptance and consumption. It should be noted, however, that the child must actually taste the offered food in order to increase the child's acceptance of that food (Birch, McPhee, Shoba, Pirok, and Steinberg, 1987). These changes in food acceptance occur after an average of ten exposures to the food (Sullivan and Birch, 1990). This learned food preference is a result of associative learning (Birch, Johnson, and Fisher, 1995).

Eating is a social event for young children because they cannot prepare their own food and often they eat lunch in a school setting. These social interactions in the home and in school present opportunities for children to associatively learn food acceptance patterns. Peers influence a child's food preference. For example, exposure to peers who like a food considered unpalatable by a certain child increases the likelihood that the child will accept the disliked food (Birch, Zimmerman, and Hind, 1980). There is a strong positive correlation between children and parents' food

intakes (Laskarewski, 1980). Parents' diets' strongly influence these foods to which the child will be consistently exposed.

During the early years of life, food intake is shared between parent and child (Birch and Fisher, 1995). It is necessary for parents, school lunch personnel, and caregivers to provide a child with a variety of healthful foods (like fresh fruits and fresh vegetables) from which to add to their diets. This repeated variety helps to shape a child's food acceptance.

Mealtime provides social interactions. Birch et al. (1995) investigated the impact of the use of foods in social contexts and a child's food preference. When foods are given to a child in positive social contexts (as a reward or paired with positive social interactions with an adult) the child's preference for those foods are enhanced. Conversely, negative associations with foods reduce the chance that a child will like it (Birch, Marlin, and Rotter, 1984). For example, a child who is pressured to eat vegetables so that the child may have a sweet dessert learns that the vegetable is undesirable, while the dessert becomes a reward and very desirable. Positive associative learning can lead to healthy food acceptance patterns and good nutrition.

Meals are important for family and school interactions. Providing nutritious foods with repeated exposure to fruits and vegetables in combination with tasting the fruits and vegetables at home and during school lunch can positively influence a child's food acceptance and consumption of fruits and vegetables. One responsibility of parents and schools is to try to ensure a child's health. Providing healthy choices at home and during school lunch can be a part of providing this optimal environment for growth and health.

National School Lunch Program

The National School Lunch Program (NSLP) provides the majority of nutrients for many children in the U.S. (Bellinger, et al., 1993). Today NSLP feeds more than 25 million children a balanced meal daily (USLC, 1993). In Colorado in 1995 over 280,797 children ate school lunches (McMillan and Herminia, 1996). NSLP is especially valuable to children who rely on school meals for much of their daily food and nutrient intake. The extensive outreach of NSLP to numerous children provides the perfect opportunity to make a public health impact on the nutrition and health of children.

Significant shifts in participation in NSLP occurred in 1992 compared to previous years. Heimstra (1992) states that the reason for these shifts was the struggling economy. Daily participation from 1982 to 1992 increased by 2.4 million children per day.

Data on the nutrient intake of children in the Bogalusa Heart Study were examined to determine the contribution of school lunch to the total day's intake of nutrients. Food intake was obtained by 24-hour recall from six groups of 10-year-olds (n=1295) over a 15 year period (1973-1988). This study found that school lunch provided 30% of the calories, 1/3 of the protein, 1/3 of the carbohydrates, and 1/3 of the fat consumed by children ages 10 to 17 years in the study (Farris, Nicklas, Webber, and Berenson, 1992). The school lunch program for Colorado schools follows the federally required meal pattern. The school lunch meal pattern has four components which include:

1. meat or meat alternative,
2. vegetable and/or fruit,
3. bread or bread alternative, and
4. milk.

Minimum portion size for lunch kindergarten through third grade is: 1 1/2 ounces of meat/meat alternative, 1/2-cup total of two or more fruits and/or vegetables, 5 breads per week and 1/2 pint of milk per day. For the fourth through sixth grades, the portion size for lunch is: 2 ounces of meat/meat alternative, 3/4-cup total of two or more fruits and/or vegetables, 8 breads or bread alternatives per week, and 1/2 pint of milk per day (USDA, 1983).

The food pattern and the quality of the foods eaten by elementary school children in New York were examined (Wolfe and Campbell, 1993). Forty percent did not eat vegetables and 20% did not eat fruit; however, children who ate a school lunch ate more fruits and vegetables than the children who ate lunches they brought from home.

With the school lunch providing one-third of the nutrients for most children, the need to increase the number of fruit and vegetable servings is evident. Incorporating more high quality fresh fruits and fresh vegetables and better nutrition education into the NSLP may lead to an increase in fruit and vegetable consumption among children, thereby improving their health and reducing their risk of cancer.

Since eating habits and attitudes toward food are formed early in life, the NSLP can serve as a model for encouraging healthy food choices by helping school children establish good dietary habits early in their lives. Good habit formation is important since chronic disease can be linked to diet (NAS, 1989). Children should start to learn about nutrition at an early age (USDA, 1989). Working with children in the lunchroom setting can be effective because the resources in the Nutrition Education Intervention Study are quality fresh fruits and vegetables served during school lunch. This approach provides an opportunity for the children to consume fresh fruits and fresh vegetables and improve their eating behavior.

Nutrition knowledge is relatively easy to change; however, nutrition behavior and attitude are difficult to change through traditional classroom instruction (Garrett and Vaden, 1978). A nutrition education study in the classroom and in the lunchroom was performed by Garrett and Vaden (1978). They found that when the School Food Service Personnel, the teachers, and the school lunch program coordinated the nutrition education intervention there was a positive influence on students' attitudes and eating behaviors.

Nutrition Assessment

Nutrition assessment has become an essential component for obtaining dietary information. The information from nutrition assessment studies is often used to determine the health status of individuals or groups. There are a variety of methods used to assess dietary intakes (Gordon, 1990). Commonly used methods to assess food consumption of individuals are: 24-hour recalls, estimated food records, weighed food records, dietary histories, food frequency questionnaires, and plate waste methods. Any of these methods can be used to assess dietary intakes; however establishing validity and reliability of any method is very important (Block, 1982). A comparison of the various methods used in dietary assessment was carried out on two groups of women aged 50-64 years (Bingham et al., 1994). Seventy-nine women in group one were compared to eighty-one women in group two. Bingham et al. compared the weighed records, 24-hour recalls, food frequency questionnaires, and estimated diet records for the two groups. Bingham et al. assessed the accuracy of these methods and compared them with 16-day weighed records. The 24-hour recall method was most closely associated to the 16-day weighed records followed by the food frequency questionnaire and estimated diet records.

The 24-hour Food Recall

The 24-hour recall method involves interviewing individuals and asking them to recall all food/beverages and quantities of food/beverages ingested in the past 24 hours. Quantities are estimated in household measures using cups, bowls, etc. to assist in portion sizes (Block, 1982; Gordon, 1990). The data can then be analyzed for the nutrient content. Researchers have found that 24-hour recalls are inexpensive and easy to conduct. Recollecting food and beverage intake for the past 24 hours may be more precise and accurate than remember over longer periods of time (Block, 1982). Even young children can provide accurate information on what they consumed over the past 24 hours. Emmons and Hayes (1973) conducted a study testing the accuracy of 24-hour food recalls in young children. They tested children ages six to twelve that were in grades one through four. They found that these children provided accurate recalls—more accurate information on their 24-hour food intake than their mothers. Other researchers found that since diets vary daily, a single day's intake may not be representative of an individual's diet (Ferguson, Gibson, and Opare-Obisaw, 1994). Woteki (1992) reports that 24-hour recalls provide accurate estimates of dietary intakes for population groups and taking multiple-day recalls are necessary to estimate individual intakes. Using the 24-hour recall to assess dietary intake has many limitations; however, it is widely used for estimating dietary intakes.

Plate Waste Measurement

Plate waste data are commonly used to assess dietary information in individuals. Plate waste is the portion of the selected meal that is not consumed. The plate waste method was used in the Fresh Fruit and Vegetable Intervention Study to measure the fruits and vegetables consumed by grade-school children during school lunch. The researcher weighed fruits and vegetables **before** and **after** (the waste) lunch.

The 1992 FNS study (Bellinger, et al., 1993,) found the plate waste for elementary school children to be 23% of their selected menus. Plate waste data are used for evaluation of food consumed, food acceptability (Harper, Jansen, Shigetomi, and Fallis, 1977; Jansen and Harper, 1978; Sandoval, Lockner, and Adkins, 1986), and effectiveness of nutrition education programs (Kirk and Wolff, 1985).

There are two methods to obtain plate waste data: (a) actual weighing (Cormstock, Pierre, and Mackiernan, 1981; Cormstock and Symington, 1982) and (b) visual estimation (Graves and Shannon, 1983). Kirk and Wolff in 1985 and Dubois in 1990 compared these two methods finding little difference between them. Both methods were effective in quantifying food consumed. Dubois (1990) tested the accuracy of the visual method using the six-point estimation scale to the actual weighting of food method. This researcher found that there was a small amount of inaccuracy in this method of measurement. When Kirk and Wolff (1985) compared the two methods and they concluded that the visual estimation method appeared to be an adequate substitution for the weighting method since they found the weighting method to be more-expensive, more-time consuming and not appropriate for large sample sizes. However, the weighing method was more advantageous for obtaining accurate nutrient determinations.

Training of Monitors for the Fresh Fruit and Vegetable Intervention Study

The design and the delivery of training for the monitors must be effective and successful. Adults learn faster when the new knowledge has been integrated with prior knowledge and experience, and when the expected results from learning have been stated (Knowles, 1975). The participants' life experiences are invaluable and should be considered during the teaching or learning process. Training should consider individual, interpersonal, and school community factors. Strategies for training should include models of learning. In this study the following models were used: Consumer Information Processing (CIP), and Self Directed Learning Theory (SDLT).

Consumer Information Processing Theory was incorporated in the training of the monitors. The central premise of CIP Theory is that individuals can process only a limited amount of information at one time (Bettman, 1979; Rudd and Glanz, 1990). Employing various sources for relating information can improve nutrition educators' abilities to provide useful information.

The art and science of helping adults learn—*andragogy*—is well illustrated by Knowles (1984). Knowles provides information and principals of *andragogy* (adult learning) in different settings. Knowles emphasizes the management of education or what he terms—the *gaining access phase*. Knowles' self-directed learning model is primarily dealing with adults' life experiences, tasks, and participation in decision making (Knowles, 1975). The elements of self-directed learning are: self-concepts and competencies. Self-concept is simply being a self-directed person. In order for learners to improve they should have certain competencies. These competencies are relationships with others, self-assessment, translating learning needs into objectives, selecting effective strategies, and collecting and evaluating

evidence of accomplishment.

Nutrition Education Programs

Nutrition education is any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviors conducive to health and well-being (Green and Kreuter, 1991; Bedworth and Bedworth, 1992). Behavior change is the ultimate criterion for effectiveness of nutrition education. Nutrition education focuses on providing nutrition information to communities, groups, or individuals (Glanz, 1985). Nutrition education can be an intervention (usually for changing behavior in large groups and communities) or counseling (usually for individuals) (Glanz, 1985). According to Sloan (1987) Americans generally understand the basics of nutrition but need more specifics on how to incorporate nutrition into their lives. Other researchers have suggested that nutrition education emphasizes total diet verses individual foods (Guthrie, 1987). For ongoing compliance Glanz (1985) recommends that nutrition education include small step-wise changes with frequent evaluations and maintenance meetings.

For nutrition education to be effective, nutrition educators and researchers need both an understanding of relevant theories of individual behavior and dietary behavior change. A combination of behavioral and educational theories has the potential for more success (Glanz and Rudd, 1993; Contento et al., 1995). In order for nutrition education to be effective, behavior change must be set as the goal with comprehensive theory-based nutrition education, interventions, and prior research (Contento et al., 1995). Elements that contribute to effective change are: behavior intent, expectancies, health values, self-efficacy, behavioral capabilities, skills, knowledge, affective state, and environmental support.

Numerous nutrition education programs have involved school-aged children. These studies were conducted primarily in the school setting and involved a variety of programming techniques with either knowledge-based nutrition education or behavior-focused nutrition education. According to Contento et al. (1995) those nutrition education programs that were solely knowledge-based often resulted in knowledge gains and a few behavior changes. The behavior-focused nutrition education programs were successful in behavior changes. The behavior-focused nutrition education programs used three domains of learning. These domains are: cognitive, affective, and behavioral learning. Cognitive understanding focused on how to change behavior. The affective component encompassed beliefs, attitudes, values, and emotional status of behavior change. The behavior component focused on cognitive, affective, and behavior skill for a change. In addition, the studies that used a behavior-focused nutrition education program used social learning theory and social cognitive theory. Contento determined from her in depth analysis that behavior focused nutrition education programs were successful in bringing about a behavior change whereas the knowledge-based nutrition education programs were not as effective in bringing about changes in behavior.

Forty-three studies on nutrition education and school-age children have been reported on in the literature since 1980 (Contento et al., 1995). Four of these studies have investigated nutrition education and changes in fruit and vegetable consumption.

St. Pierre, Cook, and Straw (1981) conducted a nutrition education program for 2,351 children in grades one through six. Nutrition education was conducted in the classroom and a pre-post test was given. Knowledge gains were seen in all the grades, and an increase in preference for vegetables only was seen in the post test.

In 1985 Perry, Mullis, and Maile implemented the "Slice of Life" nutrition education program to ninth and tenth graders. In this study 270 children participated in the classroom intervention. After 10 weeks the post-test reported these children were eating more dark green vegetables and fruits than at the start of the program when the pretest was administered.

Hearn et al. (1992) evaluated the "Hearty Heart" and "Home Team" nutrition education program. They presented both of these programs to third graders. In conjunction to the third grade program they presented the "Stowaway to Planet Strongheart" nutrition program to fourth graders. Eight schools tested the "Healthy Heart", "Home Team", and "Stowaway to Planet Strongheart" nutrition programs. These researchers concluded that these children had a significant change in behavior in the pre test/post-test. A behavior change found in this study was that there was an increase in the consumption of fresh fruits and whole milk. Also found was that there was a decrease in the consumption of sugary snacks and fried foods. Although this behavior change was seen in the consumption of fresh fruits, whole milk, sugary snacks, and fried foods, no behavior changes were seen in the consumption of fresh vegetables and skim milk.

Domel et al. in 1993 presented "Gimme 5" to 301 fourth and fifth graders. Based on an evaluation, the pre-post test showed significant gains in the knowledge of fruits and vegetables. Also they saw an increased preference for fruits and fruit and vegetable snacks in the fourth and fifth graders evaluated. However, Domel and associates found no significant difference in the consumption of fruits and vegetables.

Other researchers have investigated the effectiveness of formal and informal approaches to nutrition education in schools. Bahl, Fetter, and Reed (1990) compared formal and informal nutrition education approaches in Texas schools. In their study they investigated the effectiveness of a nutrition education program in the school lunchroom (they termed this an informal approach to education) versus the classroom (which they called a formal approach to education). The results showed school lunch to be an effective site for carrying out nutrition education.

Mead and Wilford (1992) and the Dairy Council of Wisconsin conducted a seven-day nutrition education program in the lunchroom of 90 schools in Wisconsin, Northern Illinois, and Northwest Indiana. They turned their lunchroom into a learning center on the benefits of milk in the diet. This nutrition program included nutrition posters, activities for the children, educational materials the children could take home, and demonstrations involving milk. Mead and Wilford and the Dairy Council of Wisconsin were successful in increasing school lunch participation, milk consumption, and nutrition awareness.

School lunch is an area in which increasing the quantity and quality of fruits and vegetables for children can begin. Based on previous information (Bellinger, et al., 1993), children consume less than one serving of fruits and vegetables a day. These numbers may be increased with the help of food service personnel and a change in school lunch. This change may include an increase in the number and a variety of quality fresh fruits and vegetables served. Gordon (1992) feels that training and education of food service personnel are keys to preparing children for the challenge of changing diets. According to White, Sneed, and Martin (1992),

school food service in the year 2000 will be instrumental in meeting the National Food Service Management Institute (NFSMI) objectives for better health and education for children. The objectives are that, by the year 2000, every child will have the opportunity to enjoy the benefits of effective child nutrition programs, with healthy food choices, provided in pleasant surroundings, and served by compassionate people (White et al., 1992).

Nutrition education can provide individuals with the skills to choose a nutritious diet throughout life. Nutrition education and research have sought to improve and assess the effectiveness of a broad range of strategies for promoting healthful eating (Achterberg, Novak, and Gillespie, 1985; Sims, 1987). When developing a nutrition education program for grade-school children, a review of literature is needed to evaluate, compare, and contrast existing and previous programs. The program should include informal and formal approaches to nutrition education theories and knowledge of behavior change. The behavior change must be set as the goal with a comprehensive, theory-based nutrition education program, intervention, and use of prior research.

CHAPTER III

NUTRITION EDUCATION INTERVENTION STUDY

Introduction

This study was conducted in two rural communities in northeast Colorado in 1993 and 1994 to evaluate fruit and vegetable consumption in the populations. A nutrition education program was provided to the community and grade-school children in one of these two communities. Holyoke (population 1,500) served as the experimental town; the other town, Haxtun (population 1,000) located 20 miles away, served as the control community. The two towns are remote and rural with dairy and agriculture as their main industries. Because the towns are remote, access to nutrition information is minimal thus the information provided by this program was helpful. See Figure 1 for the location of Holyoke and Haxtun in Colorado.

The nutrition education study began when concerned citizens of northeast Phillips County contacted the Colorado State University Cooperative Extension agent. Residents expressed concern about the high rate of cancer in their community. Further investigation revealed an increased cancer incidence (14% above the state norm) in their county (American Cancer Society, 1993). Representatives from the community were interested in a community-wide program to improve nutrition and thereby reduce the risk of cancer. The Colorado State University doctoral student developed materials and a nutrition education program to be implemented in the schools and community of Holyoke and Haxtun.

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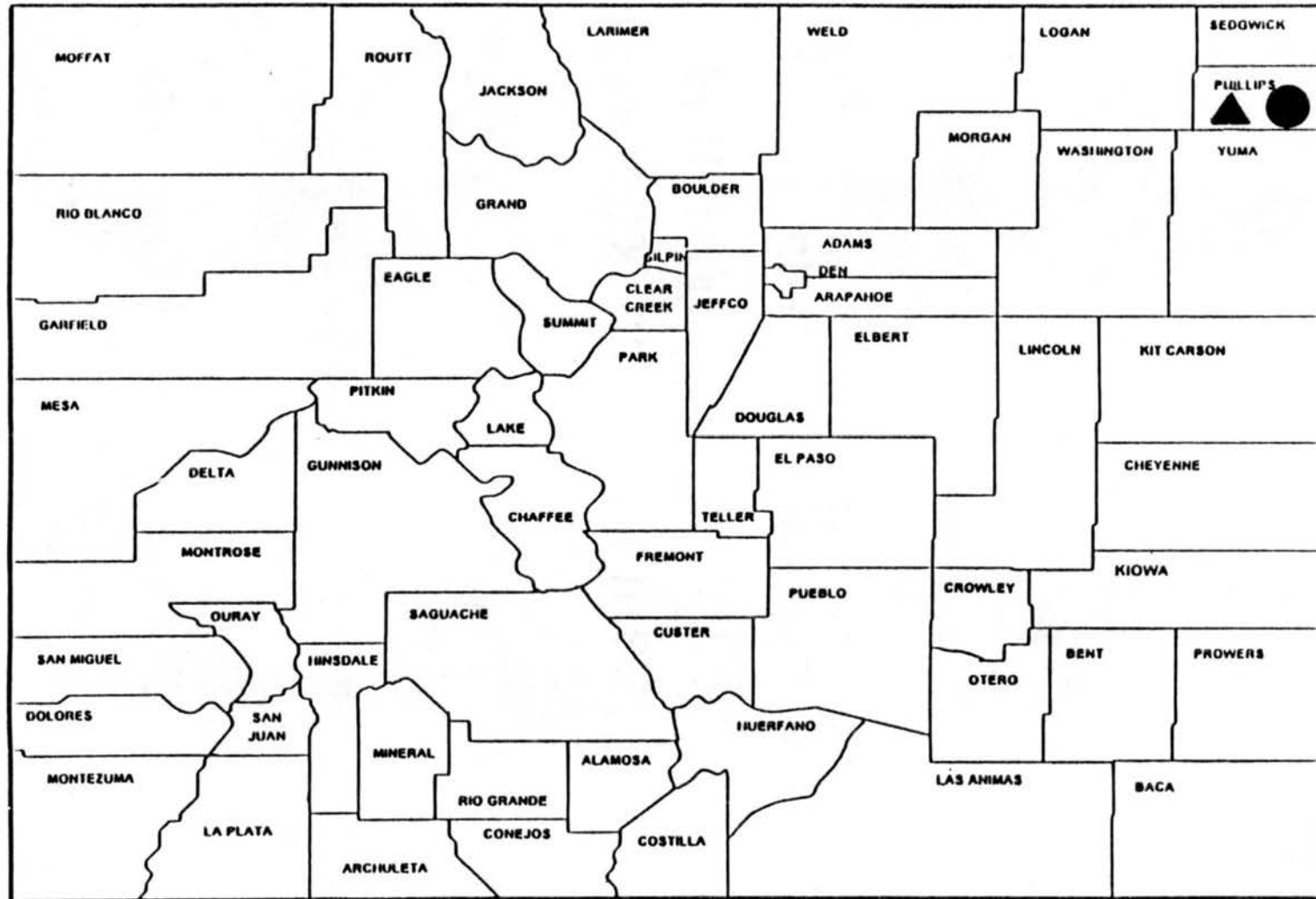


Figure 1. Location of Holyoke and Haxtun in Colorado (Circle Holyoke, Triangle Haxtun).

A Colorado State University Cooperative Extension initiative grant provided part of the funds for implementation and evaluation of this program. After the study was completed, the control school and town of Haxtun received the nutrition education program. See Figure 2 for a schematic diagram of this study's design.

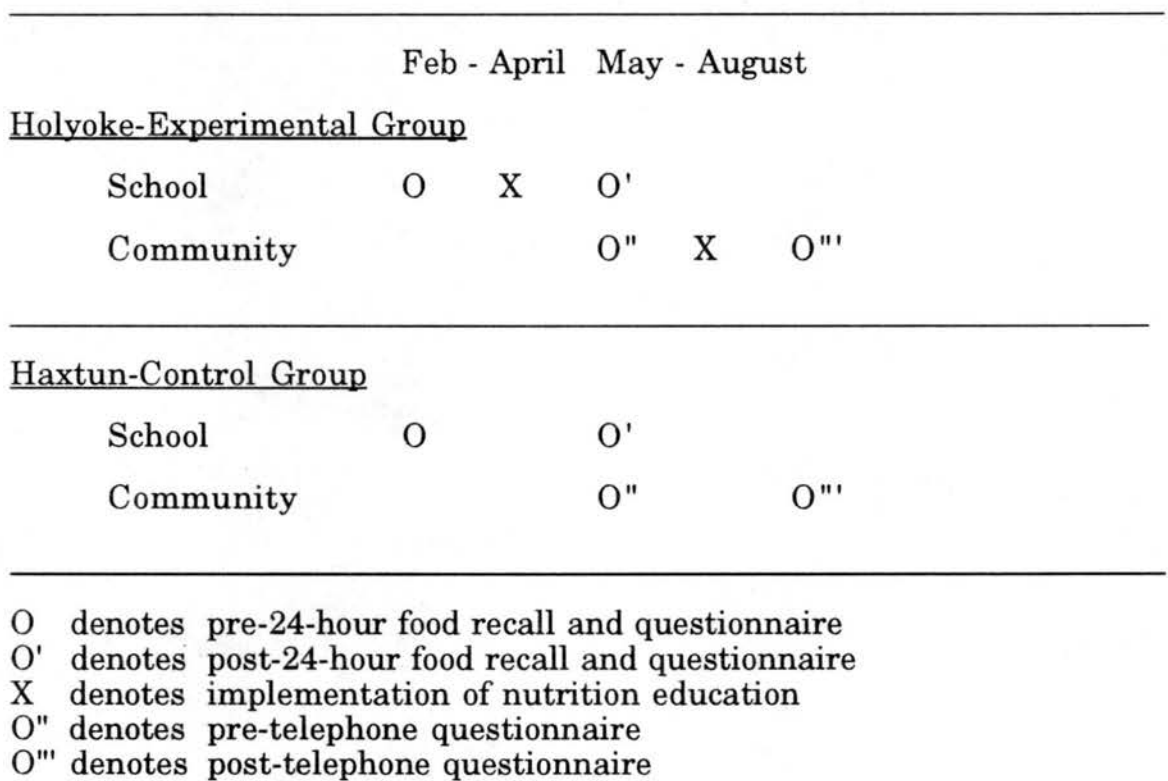


Figure 2. Schematic Diagram of Nutrition Education Intervention Study.

Objectives and Hypotheses

The objectives of the Nutrition Education Intervention Study were as follows:

1. To develop nutrition education materials that can be used in a nutrition education program designed to increase the consumption of fruits and vegetables.
2. To develop a nutrition education intervention program to increase the consumption of fruits and vegetables by grade-school children and residents living in a rural northeast county of Colorado.
3. To determine the amount of fruits and vegetables consumed by grade-school children and residents in the county.

With these objectives in mind, the following hypotheses were tested in the Nutrition Education Intervention Study:

1. There will be an increase in fruit and vegetable consumption by grade-school children following nutrition education in the experimental group compared to the control group.
2. There will be an increase in fruit and vegetable consumption by the heads-of-household following nutrition education in the experimental group compared to the control group.

If these hypotheses prove to be true, then providing nutrition education for the children in the schools and the adults in the community helps to improve their fruits and vegetables daily intake and hence enhance their diet to meet dietary recommendations.

Methods

In April 1992, a community-wide meeting was held in the town of Holyoke. Fifteen concerned residents attended. A set of open-ended questions was used to guide the meeting. The consensus of the residents and researchers was that nutrition education should be delivered first in the schools targeting the grade-school children. Community information would later be disseminated through local newspapers, grocery stores, and health fairs.

Permission for the Nutrition Education Intervention Study was granted by the elementary school principals of Holyoke and Haxtun and by the Colorado State University Human Subject Research Committee. A copy of the project approval by the Human Subject Research Committee is included in Appendix A.

School Program

A teacher's workshop was conducted by the Colorado State University doctoral student, the Colorado State University Cooperative Extension Specialist, and the Colorado State University Cooperative Extension Agent. At this workshop, University Continuing Education credit was available for teacher recertification. The workshop took place in February 1993. During this workshop, the teachers were educated on the 5 A Day nutrition education program and details were presented on the role of nutrition in cancer prevention. Specific nutrition education materials were developed by the Colorado State University doctoral student for use in the classroom. The materials used in this study are listed in Table 1. These materials, activities, and intervention plans were presented at the day-long workshop. For children in the experimental town of Holyoke, the nutrition education intervention included skill sheets, experimentation, games, and activities.

Table 1

Materials Used in the Nutrition Education Intervention Study,
Food Activities, Activity Sheets, and Skill Sheets

Kindergarten

Food Activity

Stone Soup Story and Activity with Fruits and Vegetables.
Activity modified by L. Ryan, Story book by M. Brown and
Retold by J. Warren.

Activity Sheets

Percy's Balancing Game.
Developed by M. Catherwood.

Skill Sheets

Cross Match Foods with Fruits and Vegetables.
Modified by L. Ryan.

1st Grade

Food Activity

Stone Soup Story and Activity with Fruits and Vegetables.
Activity modified by L. Ryan, Story book by M. Brown and
Retold by J. Warren.

Activity Sheets

Percy's Balancing Game.
Developed by M. Catherwood.

Skill Sheets

Cross Match Foods with Fruits and Vegetables.
Modified by L. Ryan.

2nd Grade

Food Activity

Make Fun Fruit and Vegetable Foods Pt. 1.
Developed by L. Ryan.

Activity Sheets

Making Fruit and Vegetable Puppets.
Developed by L. Ryan.

Skill Sheets

Super 5 A Day Snacks.
Developed by L. Ryan.

3rd Grade

Food Activity

Make Fun Fruit and Vegetable Foods Pt. 2.
Developed by L. Ryan.

Activity Sheets

Testing for Vitamin C in Fruits and Vegetables.
Modified by L. Ryan.

Skill Sheets

My Favorite Fruits with Vitamin C and Vitamin A.
Developed by L. Ryan.

Table 1 cont.

Materials Used in the Nutrition Education Intervention Study,
Food Activities, Activity Sheets, and Skill Sheets

4th Grade

Food Activity

Make Fun Fruit and Vegetable Foods Pt. 3.
Developed by L. Ryan.

Activity Sheets

Food Groups Do Count and Fill in the Blanks.
Modified by L. Ryan & B. Sherman.

Skill Sheets

My Favorite 5 A Day Snacks.
Developed by L. Ryan.

Serving Size Activity.
Developed by L. Ryan.

Serving Size Activity with the Food Guide Pyramid.
Modified by L. Ryan.

5th Grade

Activity Sheets

Vegetables of All Kinds, Identify Vegetable Parts.
Developed by L. Ryan.

Fruit Flair and Unscramble.
Modified by L. Ryan & B. Sherman.

Vegetable Crossword.
Modified by L. Ryan & B. Sherman.

Skill Sheets

My Favorite Fruits with Fiber.
Developed by L. Ryan.

6th Grade

Activity Sheets

Nutrients In Fruits and Vegetables Crossword.
Modified by L. Ryan & B. Sherman.

Fruit and Vegetable Hidden Word Puzzle.
Modified by L. Ryan & B. Sherman.

Foods with Vitamin A and Vitamin C.
Modified by L. Ryan & B. Sherman.

Experiment Sheets

Test for Vitamin C in a Variety of Foods.
Modified by L. Ryan.

All materials are available upon request from Colorado State University, Cooperative Extension Department of Food Science and Human Nutrition, Fort Collins, CO 80523.

The intervention also included unique demonstrations of fruits and vegetables, activities, discussions, and taste testing. Allowing the children to taste fresh fruits and fresh vegetables gives them the opportunity to try produce they may not have had before. For grades K through third, a fruit and vegetable puppet show explaining 5 A Day and the importance of fruits and vegetables was presented.

Permission slips for children to participate in the program were obtained from parents. A copy of the consent form is found in Appendix B. Pre- and post-questionnaires to assess fruit and vegetable consumption were developed, evaluated for appropriateness by three nutrition professionals, CSU faculty and staff, and five grade-school children. These individuals read and discussed the questionnaire with the researcher for readability and applicability to the study.

All children in fourth and fifth grades in both the experimental and the control towns completed a pre- and post- 24-hour food recall (Appendix C) with portion size assessments and a pre- and post-food habit questionnaire (Appendix D) to assess the amounts and types of fruits and vegetables typically consumed. The 24-hour food recall was conducted by the researcher with each student individually. Assessment aids such as cups, glasses, plates bowls, and spoons were used to assist the students recall the food portions. The researcher converted what the children reported into serving sizes and rounded the serving size to the nearest 1/4-cup measurement. All food items were recorded on a 24-hour food recall sheet (Appendix C). Although a 24-hour food recall was done, only information on fruits and vegetables were evaluated. Fresh, canned, and frozen fruits and vegetables were assessed. Mixed dishes that included fruits and vegetables were not used in this study, for example: pizzas and tacos with vegetables were not counted.

For the purpose of this study a serving size of fruits and vegetables was defined as:

- (a) 1/2-cup of cooked or raw fruits or vegetables
- (b) 1 cup raw leafy vegetables
- (c) 3/4-cup of fruit or vegetable juice

The data collected for the Nutrition Education Intervention Study, 24-hour food recall are listed in Appendix E. The reported servings for the Nutrition Education Intervention Study, questionnaire for the grade-school children are listed in Appendix F.

During the intervention period, a Parent Teacher Association (PTA) meeting was held in the experimental town of Holyoke to present a workshop for parents on nutrition and cancer. Also presented were highlights of their children's involvement in the school program. At the end of the school year and after completion of the nutrition education program, a meeting was held with the teachers to gather their opinions, judge the students' posters and class projects, and plan for the next school year. Following completion of the evaluation of the nutrition education program, the children in the control town of Haxtun were presented the nutrition education materials in the following school year.

Community Program

Before the community program was implemented, a randomized community telephone survey was conducted in both rural towns by the Colorado State University Cooperative Extension agent and staff (Appendix G). The combined telephone directory for the towns of Holyoke and Haxtun was used. Every fifth head-of-household who lived in the towns was contacted by the Extension office staff under the direction of the agent and Colorado State University doctoral student. Some of the people listed in the

directory lived outside of the town and others did not respond, resulting in a survey of 5% of the population (i.e., Holyoke, n=78; Haxtun, n=46). The survey measured fruit and vegetable consumption of the heads-of-household (the heads-of household was the adult answering the telephone). After this pre-survey, materials on 5 A Day nutrition and health were distributed in the town of Holyoke through the newspaper, mail, grocery store, and local health fair. Four months after the intervention, at the end of the summer prior to the new school year, a post-telephone survey to the same heads-of-household was completed. The data collected on the reported servings of fruits and vegetables for the Nutrition Education Intervention Study, and the telephone survey results for the experimental and control groups are shown in Appendix H.

A follow-up town meeting was held in the community to solicit their opinions. After all the pre- and post-surveys were completed in both towns, the control town of Haxtun was offered the nutrition education materials.

Analysis

The study data were analyzed statistically using descriptive and inferential statistics via the Statistical Analysis Systems (SAS) computer program (SAS Institute Inc.,1989). Unpaired two-tailed t-tests were used to test for the differences between the experimental group and the control group. The level of significance was set at $p \leq 0.05$.

The results of this study were used to evaluate the effectiveness of the nutrition education program in terms of consumption of fruits and vegetables by the grade-school children and heads-of-household of the rural towns of Holyoke and Haxtun. In addition, the results were submitted in a written report to Colorado State University, the institution that issued the grant, and an article was accepted for publication in the Journal of Extension. A copy of the publication is presented in Appendix I.

Results

Grade-School Intervention

Results from the children's 24-hour food recall and pre- and post-questionnaires (Table 2 and 3) were gathered and unpaired two-tailed t-tests for association were performed. A total of 48 children participated (n=29 pre and post Holyoke intervention, experimental group and n=19 pre and post for Haxtun children, control group).

Analysis of the 24-hour food recall for the Holyoke children (n=29) showed that, based on the pre-24-hour, 2.45 mean servings of fruits and vegetables were consumed per day. Post assessment showed 3.82 mean servings per day, a significant ($p \leq 0.05$) increase of 1.37 mean servings of fruits and vegetables per day (Table 2). For the control school's (n=19) 24-hour food recall, 2.26 mean servings of fruits and vegetables were reported for the pre intervention and 1.63 mean servings of fruits and vegetables were reported for the post intervention. This is a decrease of 0.63 mean serving per day, which was not significantly different ($p \geq 0.05$). The experimental group pre intervention 24-hour food recall showed the mean servings were 2.45 where as the control group pre 24-hour food recall was 2.26. No significant difference was shown ($p \geq 0.05$). The experimental group post 24-hour food recall mean servings (3.82) were significantly different ($p \leq 0.05$) than the control group post 24-hour food recall mean servings (1.63).

The analysis of the Holyoke children's pre-questionnaire (Table 3) determined consumption to be 3.93 mean servings of fruits and vegetables per day and 4.86 mean servings per day post-questionnaire. This is a significant ($p \leq 0.05$) increase of 0.93 mean serving of fruits and vegetables per day after intervention. In the control group the pre-questionnaire showed 2.84 mean servings and post-questionnaire showed

Table 2

Fruit and Vegetable Consumption by Fourth and Fifth Grade-School Children Based on 24-Hour Food Recalls

Variable	<u>Mean Servings+ (Standard Deviation)</u>	
	Experimental Group n=29*	Control Group n=19*
<u>24-Hour Food recall</u>		
Pre	2.45 (1.45) ^{am}	2.26 (1.33) ^{am}
Post	3.82 (1.97) ^{aw}	1.63 (1.21) ^{bm}

+ Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, or 3/4-cup fruit or vegetable juice.

* The number of children pre and post for experimental group n = 29 and control group n = 19.

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$).

m,w Means followed by different letters in a column are significantly different ($p \leq 0.05$).

Unpaired two-tailed t-tests were performed to analyze data.

Table 3

Fruit and Vegetable Consumption by Fourth and Fifth Grade-School Children Based on Reported Number of Servings Per Day

Variable	<u>Mean Servings+ (Standard Deviation)</u>	
	Experimental Group n=29*	Control Group n=19*
<u>Questionnaire</u>		
Pre	3.93 (2.12)am	2.84 (1.34)bm
Post	4.86 (1.94)aw	2.47 (1.02)bm

+ Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, or 3/4-cup fruit or vegetable juice.

* The number of children pre and post for experimental group n = 29 and control group n = 19.

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$).

m,w Means followed by different letters in a column are significantly different ($p \leq 0.05$).

Unpaired two-tailed t-tests were performed to analyze data.

2.47. This was not significantly different ($p \geq 0.05$) with a decrease of -0.37 mean serving of fruits or vegetables. Also from the data the pre-questionnaire for the experimental group mean servings (3.93) was not different ($p \geq 0.05$) the control group pre-questionnaire (2.84). The experimental group post-questionnaire mean servings (4.86) were significantly higher ($p \leq 0.05$) than the control group post questionnaire mean servings (2.47).

Telephone survey analysis

Total respondents were 124 heads-of-household: $n=78$ from Holyoke and $n=46$ from Haxtun. Respondents were not identified by gender. Results of the telephone survey are listed in Table 4. The telephone survey showed the average number of fruits and vegetables eaten by heads-of-households in Holyoke prior to the intervention was 3.28 mean servings a day. Post-intervention showed 3.94 mean servings, a significant ($p \leq 0.05$) increase of 0.62 mean serving of fruits and vegetables per day. For Haxtun, the control town, the average number of fruits and vegetables pre-study was 4.13 and post-study was 4.15, an increase of 0.02 mean serving per day indicating no significant difference at $p \geq 0.05$.

The mean servings for the experimental group pre intervention (3.28) was different ($p \leq 0.05$) than the control group pre intervention (4.13). The experimental group mean servings post intervention (3.94) was different than the control group (4.15) post intervention ($p \leq 0.05$).

Table 4

Fruit and Vegetable Consumption of Community Members Based on Reported Number of Servings Per Day

Variable	<u>Mean Servings+ (Standard Deviation)</u>	
	Experimental Group n= 78*	Control Group n= 46*
<u>Telephone Survey</u>		
Pre	3.28 (1.41) ^{am}	4.13 (1.48) ^{bm}
Post	3.94 (1.65) ^{aw}	4.15 (1.35) ^{bm}

+ Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, or 3/4-cup fruit or vegetable juice.

* The number of community members pre and post for experimental group n = 78 and control group n = 46.

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$).

m,w Means followed by different letters in a column are significantly different ($p \leq 0.05$).

Unpaired two-tailed t-tests were performed to analyze data.

Discussion and Recommendations

Discussion

Based on the unpaired two-tailed t-tests, the intervention (nutrition education) was shown to have a significant effect ($p \leq 0.05$) on fruit and vegetable consumption in the grade-school children of the experimental group for both the 24-hour food recall and for the self-reported pre- and post-questionnaire (Table 2 and 3). No significant change was shown in fruit and vegetable consumption for either method of data collection for the grade-school children in the control group. The telephone survey showed the average number of fruits and vegetables eaten by heads-of-households in the experimental group increased significantly, whereas the control group had no significant change in fruit and vegetable consumption (Table 4). This means the intervention caused a significant increase in fruit and vegetable consumption among the children and the community.

The results of the Nutrition Education Intervention Study are supported by findings from Domel and associates' "Gimme 5" program (1993). Domel et al. implemented a six-week nutrition education program to 301 fourth and fifth graders from two schools and collected pre/post food diaries and pre/post questionnaires. The "Gimme 5" nutrition education program provided significant gains in fruit and vegetable knowledge and an increased preference for fruits and fruit and vegetable snacks. In another study, Perry and associates (1985) implemented the "Hearty Heart and Friends" nutrition education program to 371 third and fourth graders in two schools for 10 weeks. This nutrition education program was implemented in the classroom with a 24-hour food recall pre/post assessment. The results of this program were similar to the Nutrition Education Intervention Study. After the "Hearty Heart and Friends"

nutrition education program, the children were eating more fruits and dark green vegetables.

Kedler, Perry, Lytle, and Klepp (1995) combined nutrition education in the classroom and in the community. Kelder et al. conducted a five year longitudinal cohort study of students and followed them from the sixth grade through the twelve grade. Classroom and community interventions were conducted and a survey implemented every year. A significant effect was found on nutrition knowledge and behavior after nutrition education. This is in agreement with the results in the Nutrition Education Intervention Study which showed that nutrition education in the classroom and in the community lead to a significant increase in fruit and vegetable consumption in the children and in the community.

Limitations of the Nutrition Education Intervention Study were recognized. Limitations of this study included the following:

1. The student sample size in the schools for the experimental group (n=29) and control group (n= 19) was small. The experimental and control groups in this study were from small rural communities and may not be representative of all communities. Inferring the results of this study may be a limitation for urban schools and communities.

2. Educational materials and training were developed and provided to seven teachers for their nutrition educational classroom activities. This study did not measure the time or method each teacher spent presenting the information to the students.

3. The school lunch program was not involved in this nutrition education program. Nutrition education materials and activities were not distributed in the lunch room and had no influence over the school lunch

menu. In fact, the school principal did not want the school food service personnel involved or the menu changed.

4. One serving size was defined as 1/2-cup of cooked or raw fruits or vegetables, one cup raw leafy vegetables, and 3/4-cup of fruit or vegetable juice. This serving size was used for both children and adults in the 24-hour food recall and for the questionnaire. This may not have been an ideal serving size for the children. During school lunch the maximum number of fruits or vegetables a child was allowed to take was two, totaling 3/4-cup. This put a ceiling on the number of servings a child took during school lunch.

5. Time was a limitation in this study. This study did not include multiple evaluation. The schools and the community were evaluated once (pre and post) within the one month intervention. Also the length of time the change was sustained was not evaluated.

6. Self-reported questionnaires and 24-hour food recalls have weaknesses. Individuals may not accurately report food intake when using self-reported evaluations. The ability of individuals to remember and estimate food intake also was a limitation. Another limitation of the 24-hour food recall was that this was a one day evaluation and may not be representative of an individual's diet.

7. The data from the 24-hour food recall were not analyzed for nutrient content (calories, vitamins, minerals etc.); thus, the nutritive content of the child's diet was not available for evaluation. This was a limitation because the researcher was unable to determine if eating more fruits and vegetables affected the child's nutrient intake.

Recommendations

Based on this study the following recommendations are made:

1. Use 5 A Day educational materials and the Dietary Guidelines in the classroom to educate the children on eating healthier. Numerous materials are available for teachers to assist them in explaining the 5 A Day message and the Dietary Guideline recommendations. Colorado State University Cooperative Extension office can assist in providing the materials.

2. Provide fresh fruit and fresh vegetable tasting demonstrations in the classroom. The tastings allow the children a chance to taste fresh fruits and fresh vegetables that may not be available at home. Encourage teachers to become acquainted with the produce department in the local grocery stores to assist in fresh produce availability and selection when doing the demonstrations.

3. Work with the school principals and school lunch personnel on ways to increase service of more fresh fruits and fresh vegetables during the school lunch.

4. Expand the 5 A Day message and the Dietary Guidelines to work within the classroom and the community, with school food service personnel and parents. It is important to involve all these individuals when changing a child's behavior and to accomplish lasting effects.

These recommendations are part of a nationwide program currently being implemented. This program, called "Team Nutrition" was developed by the USDA (Price and Kuhn, 1996) to help improve school meals and children's nutrition. "Team Nutrition" is a multifaceted, national effort to provide nutrition education through schools, families, the community, and the media. Training and technical assistance for school food service personnel is also provided in this program.

Conclusions

Nutrition education materials and program were developed. The nutrition education program was implemented and the results of the nutrition education intervention were compared. Based on statistical analysis, fruit and vegetable consumption increased 1.37 mean servings per day by the grade-school children for the 24-hour food recall and 0.93 for the self-reported questionnaire ($p \leq 0.05$). The telephone survey results showed an increase of 0.62 mean servings in fruits and vegetables consumed in the intervention town of Holyoke. This increase is within the national norm of an increased 0.5 serving following a nutrition education intervention (USDHHS Public Health Service, 1994).

From these conclusions, the following hypotheses were accepted:

1. There will be an increase in fruit and vegetable consumption by grade-school children following nutrition education in the experimental school compared to the control school.

2. There will be an increase in fruit and vegetable consumption by the heads-of-household following nutrition education in the experimental town compared to the control town.

In addition, after the intervention, the teacher and community members expressed that the nutrition education program was well received and, in their view, effective. Teachers indicated that the students enjoyed the classroom material, activities, and demonstrations. Teachers also indicated that they would like to continue using the 5 A Day nutrition material in their classrooms. Teachers and parents felt that the children had an increased awareness of fruits and vegetables in their diet. The residents of Holyoke stated that they liked the newspaper articles, the

pamphlet, and demonstrations and would like the 5 A Day nutrition and cancer prevention information to continue. As a result, they wanted the nutrition intervention in the school to continue and additional nutrition information to be provided for the families.

An increase in the amount of fruits and vegetables consumed was found in the Nutrition Education Intervention Study. In addition, this nutrition education program provided an unique opportunity for Cooperative Extension agents to become involved in education with national nutrition campaigns. The response to this effort, especially from rural areas, is encouraging. As a result of the Nutrition Education Intervention Study additional nutrition education was requested for the school food service personnel. This provides continuing opportunities for researchers to become more involved with the schools and education of students, teachers, and food service personnel.

CHAPTER IV

Fresh Fruit and Vegetable Intervention Study

Introduction

The United States Department of Agriculture (USDA) and the United States Department of Defense (DOD) initiated the Fresh Fruit and Vegetable Pilot Project in 15 Colorado school districts in the 1994-95 school year. The USDA formed a partnership with the DOD in 1994 to deliver nutritious, high-quality fresh produce to the children participating in the National School Lunch Program (NSLP). The history on how these two agencies teamed up began in 1993 when Ellen Haas (Under Secretary for the Food, Nutrition, Consumer Services USDA) announced an initiative to improve the NSLP. One area of emphasis in this initiative was to increase fresh fruits and vegetables in the school lunch program. The USDA looked for a way to fulfill this emphasis. Though the request sounds simple, in most states it is difficult to fulfill with existing distribution systems that are designed to handle the frozen and semi-perishable products that are normally distributed to the schools. States are not equipped to handle the more perishable fruit and vegetable items, such as pears, peaches, kiwi, and strawberries. The USDA was introduced to the DOD and their unique fresh fruit and vegetable buying system. This agency can buy fresh high-quality fruits and vegetables in individual cases instead of by the truck load. The DOD receives quality fresh fruits and vegetables at a low cost due to competitive bidding and volume buying. The DOD price is 43% to 55% less

than grocery store prices. The DOD buys produce from local vendors and transports the produce to area military institutions and commissaries. This buying system could assist the USDA in providing fresh fruits and fresh vegetables to the schools. The USDA national office met with the DOD in Philadelphia. It was proposed that the USDA (Food and Consumer Service) team up with DOD to buy fresh fruits and vegetables for the school lunch program. The proposal was accepted by both agencies and an agreement was signed. In 1994-1995, eight states in the United States participated in this partnership. The eight states that participated in the USDA's Fresh Fruit and Vegetable Pilot Project were: Maryland, New Hampshire, Florida, South Carolina, Texas, Wyoming, South Dakota, and Colorado. In 1995-1996, 30 states participated. The program continues and in the 1996-1997 year, 32 states have contracted with the USDA to participate in this initiative.

In the Mountain Plains Region, three states participated in 1994-95. These states were: Colorado, South Dakota, and Wyoming. To start the fresh fruit and fresh vegetable program, the USDA regional office in Colorado contacted all the school districts throughout the three states. The fresh fruit and vegetable program was introduced, and requests were solicited to determine which school districts would like to participate. Those districts that responded became part of the Fresh Fruit and Vegetable Pilot Project in which fresh produce was provided to the schools one to five times a week. Fifteen school districts in Colorado responded and received fresh high-quality fruits and vegetables. The school districts ordered quality, U.S. grown produce from the DOD. Using entitlement funds, the schools districts purchased fresh fruits and vegetables at a lower cost but were assessed a 6.1% surcharge. The DOD purchased the produce from local

vendors and delivered it to the individual schools, the central kitchens, or the school district warehouse. Fifty to 75 different premium fresh U.S. fruits and vegetables were made available to the schools.

This project initiative was evaluated in terms of process and attitudes of the school lunch personnel by the USDA Food and Consumer Service and is not reported here. This study was conducted to evaluate the actual consumption of fruits and vegetables in first through sixth-grade school children. The consumption pattern in the experimental group (schools participating in the Fresh Fruit and Fresh Vegetable Pilot Project) was compared to that in the control group (schools not participating in the Fresh Fruit and Fresh Vegetable Pilot Project). Results were analyzed for differences in the amounts of fruits and vegetables consumed by the children in these two groups.

Objectives and Hypotheses

Objectives of the Fresh Fruit and Vegetable Intervention Study were as follows:

1. To develop a monitoring system to collect necessary data to measure the amount of fruits and vegetables available and consumed by grade-school children.
2. To determine the amount of fruits and vegetables consumed during school lunch by first through sixth-grade children.
3. To measure which fruits and vegetables are favored by the grade-school children in the study.
4. To evaluate the school lunch menus from the 1993-94 school year and compare to the 1994-95 and 1995-96 school year in order to evaluate if fresh fruits and fresh vegetables were added or substituted in the school lunch menu from the previous year.

With these objectives in mind, the following hypothesis was tested in the Fresh Fruit and Vegetable Intervention Study:

There will be a significant difference in percent consumption of fresh fruit and fresh vegetable by grade-school children given additional premium quality fresh fruits and fresh vegetables when compared to the control group.

If this hypothesis is true, then increasing the quantity of fresh fruits and fresh vegetables during school lunch helps children to meet the 1995 Dietary Guidelines of eating more fresh fruits and vegetables a day, for good habit formation and for the promotion of improved health.

Methods

In this study, the lunchroom became the vehicle for helping to change student behavior and attitude about fresh fruits and fresh vegetables. The lunchroom can be a highly effective environment for providing fresh fruits and fresh vegetables. This study provided a mechanism for applying the 5 A Day message by providing the students more fresh fruits and vegetables in the school lunchroom. The fruit and vegetable consumption was evaluated by measuring the plate waste of fruits and vegetables only.

All fruits and vegetables (fresh, frozen, and canned) available for the school lunch program were monitored. To determine the amounts of fruit and vegetable consumed, trained monitors weighed the fruits and vegetables on ounce scales calibrated each day at the start of data collection. Total weights of the fruits and vegetables served were measured before and after school lunch. The amount consumed was computed by subtracting ounces actually served minus ounces discarded.

Weights were collected from three different styles of school lunch service. The three types are listed below and explained in detail on page 62.

Type 1 lunch: The fruits and vegetables were served to the children by the food service personnel.

Type 2 lunch: The fruits and vegetables were offered to the children in small preportioned bowls. The children were able to choose the fruits and vegetables they wanted.

Type 3 lunch: The fruits and vegetables were presented on a self-serve bar, and the children were able to choose the items they wanted and the amount to put on their plate or tray.

Experimental vs. Control Schools

In order to evaluate actual changes in consumption a quasi-experimental design with the use of a control group was instituted. This study contained two groups. The experimental group consisted of 29 schools in the fruit and vegetable intervention program (Appendix J). The control group contained 37 schools not participating in the program.

The students in this study were male and female grade-school children in grades one through six, 5-to 11-years old from nine school districts along the Front Range of Colorado. Student enrollment by grade was collected for the experimental and control groups and are listed in Appendix K. The experimental group was comprised of seven school districts and from these, 30% of the schools from each district were randomly selected to participate. The following districts were in the experimental group:

Arapahoe 6	Denver	Pueblo
Adams 12	Douglas	
Adams 14	Poudre R-1	

School districts not participating in the Fresh Fruit and Fresh Vegetable USDA program were identified and asked to participate as control sites. These school districts were:

Boulder Valley
Thompson

The location of these districts in Colorado is displayed in Figure 3.

The Fresh Fruit and Vegetable Intervention Study was approved by the Colorado State Human Research Committee (Appendix L). School food service directors of each district and school principals of the selected

COLORADO

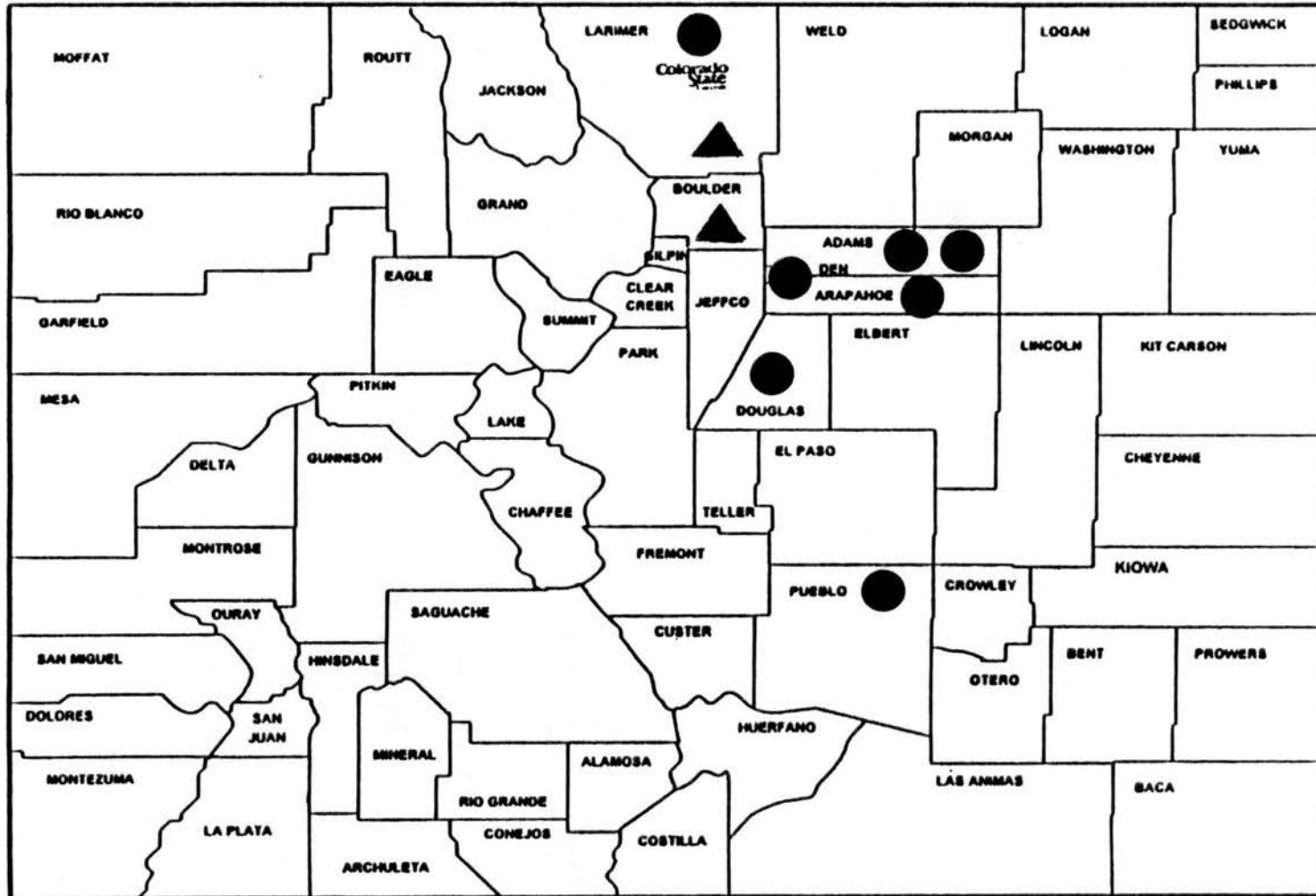


Figure 3. Location of School Districts in Colorado Containing Schools in the Experimental Group (Circle) and the Control Group (Triangle).

schools were contacted, and permission was acquired to monitor the school lunch. The investigator pilot-tested all training techniques and monitoring systems prior to the start of the study.

School Selection

The USDA Food Distribution regional staff and the Colorado Department of Education were consulted, and demographic data were collected for all schools in the participating districts. Selection of schools for this study was based on demographic information, available money for continuation in the pilot project, and school interest. From the schools meeting these selection criteria, sample of schools within each district were selected for participation in the study forming the experimental group. Initially the researcher attempted to identify schools in which 40% to 60% of the students participating in the program met the income criteria for free or reduced-price school lunches. The researcher selected this criteria to reflect children from a range of socio-economic group. Unfortunately, few schools met this criteria in some districts; so the criteria was dropped as a school selection standard.

Schools participating in the Fresh Fruit and Vegetable Project received funds to purchase fruits and vegetables. If the entitlement funds to purchase fresh fruits and vegetables were depleted prior to completion of the study, the school was not visited again for this study.

Training of Monitors

Monitors were recruited to collect the data during the school lunch. The monitors in this study had experience in nutrition and had worked in food service operations. Eight monitors were trained on March 14, 1995. A copy of the agenda is provided in Appendix M.

The monitors were trained using classroom instruction and demonstrations. A visit to a nearby school provided an opportunity to observe the school lunch process and practice the data-gathering technique. Fruit and vegetable plate waste was collected and weighed. The training for the monitors was active rather than passive and the learning process built on their backgrounds and interests. This training considered individual, interpersonal, and school community factors. For training of the monitors, strategies from two theoretical models were used: Consumer Information Processing (CIP) which uses multi-sources for delivery of information (Bettman, 1979, Rudd and Glanz, 1990); and the Self Directed Learning Theory (SDLT) which uses life experiences, tasks, and participation in decision making (Knowles, 1975).

Monitors in this research participated in this one-day training program to enhance their observational learning and build self-efficacy in their ability to organize and conduct school site collections. Training in the school lunch environment with self-guided forms were also important in providing the monitors the knowledge and skill to perform data collection.

In order to enhance the monitors' learning, many sources were used during the training. The training was clear and simple; several training sources were used during the training. Lecture and printed materials were provided to the monitors. In addition, pictures, food models, and actual on-site visitations to the schools were used to teach and reinforce the

monitoring techniques used to measure fruit and vegetable consumption in the schools.

During the monitors' training, a work book was given to the monitors to direct them in the monitoring process. Also, on the individual level, visits by the primary researcher and telephone conversations daily provided guidance and enhanced accuracy in monitoring the school lunch. All the monitors had the above competencies, and were able to use past experiences to assist them while monitoring the school lunch.

Monitoring System

A monitoring system was developed to collect the data on the fruit and vegetable weights. Large pound and ounce scales were used to weigh the fruits and vegetables. They were set to zero and calibrated before each use. These scales were borrowed from local schools.

The fruits and vegetables, minus the container weight, were weighed before lunch was served. The weight of the container was noted and the total weights for the fruits and vegetables were recorded. Lunch was served and a tally of those children who took any fruits or vegetables was recorded. During lunch, the waste from each child was collected. The different food waste items were separated and put into different containers.

After lunch, the leftover fruits and vegetables not served to the children were weighed. These weights, minus the container weight, yielded the net weight of fruits and vegetables served.

The waste fruits and vegetables, that is, the amounts left on the students' plates, were then weighed. The entire part (e.g., rind and edible part) of the fruit or vegetable was weighed. The weight was recorded without the container weight. Those fruits and vegetables with rind or skin

were separated from the edible part. The rind was weighed and recorded. The edible part was also weighed and recorded. All weights were compiled and recorded into a data base for further calculations and statistical analysis.

Data Collection Procedures

Principals and the school food service personnel in the selected schools were informed of the purpose, objectives, and procedures of this study. To ensure that a consistent message was relayed, the primary researcher, Linda Ryan, was the only person to contact the principals and food service personnel. The school food service personnel were contacted to identify high-participation days in order to include the greatest possible number of students who ate school lunch. An attempt was made to visit each school twice during the collection period.

Data collection began in April 1995. The procedure check list for assisting the monitors during the evaluation is shown in Appendix N. On the day of evaluation, the monitors followed the procedure listed below:

1. Obtained the menu, recorded the number of students who ate fruits and vegetables from the school lunch.
2. Recorded the total weight of fruits and vegetables available to the students **during** the school lunch period.
3. Recorded the total weight of fruits and vegetables **remaining after** the school lunch period ended.
4. Recorded the total weight of fruits and vegetables **discarded** (waste) by the students.
5. Recorded only the **edible** portion of the fruits and vegetables discarded.

The procedure for calculating the edible portions of discarded fresh fruit and vegetable was as follows:

1. Weighed all the fresh fruit or vegetable minus the container weight.
2. Separated the rind or skin from the edible portion of the fresh fruit or vegetable.
3. Weighed all the rind of the fresh fruit or vegetable.
4. Weighed all the edible portions of the fresh fruit or vegetable.
5. Recorded the edible portion of fruit or vegetable on the form.

The forms for recording the weights for fruits and vegetables are included in Appendix O. The data collected for each school were compiled. A sample of the data collected is shown in Figure 4.

Analysis

The experimental data were analyzed using descriptive and inferential statistics via the Statistical Analysis Systems (SAS) computer program (SAS Institute Inc., 1989). Initially a nested ANOVA was used to compare the data from the schools. The variability between schools was not significantly different ($p \geq 0.25$) than the variability of multiple day visits within the same school; therefore, multiple day visits in the same school were treated as if they were independent. Thus unpaired two-tailed t-tests and analysis of variance (ANOVA) were used to test for the differences between the experimental group and the control group. The level of significance was set at $p \leq 0.05$.

District
 Monitor
 Today's Date
 School Evaluating
 School Full address with zip code
 Street
 City
 School Phone Number
 Food Service Manager's Name

Today's Menu:
 EntreeChicken Sand/Hamburger
 GrainWhole Wheat Bun
 MilkWhite/Chocolate

Number of School Lunches Served 440
 # of children who did not take fruits/vegetables 8
 School Code DOD=1, Control=0 1
 Nutrition Education Material Present No=0, Yes=1 1

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	Type Frozen=2 Fresh=1 Canned=0	Choices Choice=1 Served=0	How Served Self-Serve/bar=2 Small bowls=1 Spoon=0	Proper Preparation Yes=1 No=0	Beginning Weight	Leftover Weight	Taken Weight	Waste Wt. Edible Net	Consumed
Fruit									
Pineapple	1	1	2	1	379	0	379	56	323
Apple Slices	1	1	2	1	312	41	271	88	183
Vegetable									
Cucumber	1	1	2	1	40	1	39	4	35
Celery Sticks	1	1	2	1	16	1	15	2	13
Carrot Sticks	1	1	2	1	71	2	69	22	47
Broccoli	1	1	2	1	20	2	18	3.5	14.5
Cauliflower	1	1	2	1	20	1	19	1.25	17.75
Lettuce Salad	1	1	2	1	46	4	42	3	39

Figure 4. Sample Data From Schools.

Results

Demographics

Of the 29 schools participating in the experimental group 8 schools were visited twice (n=37 visits for the experimental group). In the control group 37 schools participated and there were 37 school visits (n=37 visits for the control group). The demographic data collected on individual school visits for the experimental and control groups are listed in Appendix P. The fruit and vegetable consumption data by school districts for the experimental and control groups are shown in Appendix Q.

The schools were visited during the month of April 1995. For each school district in this study the researcher collected the school lunch menus for April 1994, 1995, and 1996. The data collected for the fruit and vegetable items listed on the school district lunch menu for April 1994, 1995, and 1996 for the experimental and control groups are shown in Appendix R. Demographic information about the schools and children participating in this study were obtained and summarized as follows:

Student Profile

The students participating in this study were both male and female, ages 5 through 11 years and in grades one through six. The students were from diverse cultural and ethnic backgrounds. The student enrollment by grade is summarized in Table 5. The majority of the children were in grades one through five, with the exception of two school districts consisting of seven schools total that had children in grades one through six. The mean number of students enrolled in schools for the experimental group (mean=404) was not significantly different ($p \geq 0.05$) than the control group (mean=339). The mean number (mean=76) of students enrolled in each grade per school for the experimental group was not significantly

Table 5

Student Enrollment by Grade

Total Students Enrolled Grades 1-6	Grades						
	1	2	3	4	5	6	
Experimental Group n=29							
Total	11799	2217	2124	2115	2340	2226	777
Mean (SD)*	404 (94) ^m	76 (33) ^a	73 (35) ^a	73 (33) ^a	81 (41) ^a	77 (37) ^a	27 (55) ^b
Control Group n=37							
Total	12540	2391	2426	2511	2640	2572	0
Mean (SD)*	339 (110) ^m	65 (24) ^a	66 (26) ^a	68(25) ^a	71(25) ^a	69 (25) ^a	0

* Mean in the mean number of students per school and SD is Standard Deviation.

Unpaired two-tailed t-tests were performed to analyze data.

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$).

m,w Means followed by different letters in a column are significantly different ($p \leq 0.05$).

different ($p \geq 0.05$) from the control group's mean number (mean=62) of students enrolled in grades one through five per school. With the exception of the sixth grade, the number of students per grade was evenly distributed in grades one through five. The sixth grade enrollment was significantly different from grades one through five due to the fact that only 777 sixth-grade students from two school districts (Douglas and Poudre R-I) participated in this study.

School Lunch Service Style

Fruits and vegetables were served using three serving styles:

1. Served to the children by school food service personnel,
2. Self-serve bar style (i.e., children selected fruits and vegetables from the self-serve bar), and
3. Small bowls style (i.e., children selected bowls containing premeasured amounts of fruits and vegetables).

Table 6 shows the fresh and canned fruits and vegetables service styles. The schools that served fruit or vegetable on line had two categories: choice or no choice. Choice means the child had a choice of taking or not taking either or both of the two different fruit/vegetable offered on the service line. No choice means the child was required to take both of the two fruits/vegetables offered on the service line. Of the schools that served fruits and vegetables on the plates of the children (i.e., the control group), 17 schools did not give the children a choice of fruits/vegetables; however, 20 did give them a choice.

Offered a variety means the child had a choice of taking or not taking from a variety of two or more fruits/vegetables offered. The child was allowed a maximum of two servings of fruits/vegetables or they could choose not to take any fruit or vegetable. The schools that offered a variety of

Table 6

Fresh and Canned Fruits and Vegetables Service Styles

	Experimental Group n=37*	Control Group n=37*
Served Fruit or Vegetable On Line		
Choice ^a	0	20
No Choice	0	17
Offered Variety of Fruit or Vegetable ^b		
Self-serve Bar Style	22	0
Small Bowls Style	15	0

* The n denotes number of school visits.

a Choice means the child had a choice of taking or not taking either or both of two different fruits/vegetables offered on the service line. No choice means the child was required to take both of the two fruits/vegetables offered on the service line.

b Offered a variety of fruit or vegetable means there was more than one fruit and more than one vegetable available to choose from the self-serve bar or from small bowls. These children could take a maximum of two servings of fruits/vegetable offered or they could choose not to take any fruit or vegetable.

fruit or vegetable had two service styles: self-serve bar or small bowls. The children that selected from the self-serve bar were limited to two servings; however, this was difficult for food service personnel to measure and enforce. The children selecting fruits/vegetables from the small bowl style were allowed two servings (i.e., two bowls). Twenty-two schools in the experimental group and zero schools from the control group served fruits and vegetables using the self-serve bar service style. Fifteen schools in the experimental group and zero schools from the control group served fruits and vegetables to the children in premeasured bowls.

Profile of Children Taking School Lunch

Demographic data about the children were collected and are summarized in Table 7. The mean number of children per school was not significantly different ($p \geq 0.05$) between the experimental and control groups. From the demographic data collected, the mean number of children who took school lunch was determined to be significantly different between the experimental and control groups ($p \leq 0.05$). The experimental group had a mean number of children taking school lunch (259) that was significantly greater than that for the control group (198). This difference could possibly be a reflection of the lack of choice or the different methods of serving lunch in the control group. On the day of observation, the mean number of children per school who took fruits and vegetables was not significantly different between the experimental (194) and control (187) groups ($p \geq 0.05$). The mean number of children per school receiving free and reduced lunches was not significantly different between the two groups ($p \geq 0.05$). Except for the number of children who took school lunch, the data demonstrate that the children in the experimental group shared similar characteristics with children in the control group.

Table 7

Demographic Data on Grade-School Children Taking School Lunch and Taking Fruits and Vegetables

	Total No. of Children Enrolled	No. Children took school lunch	No.# Children took fruit & veg	%* Free & Reduced
Experimental Group n=37				
Total Children	15,048	9,566	7,195	
Children/school Standard Deviation	407 ^a 95.5	259 ^a 81.2	194 ^a 86.1	42 ^a 24.8
Control Group n=37				
Total	12,540	7,319	6,921	
Children/school Standard Deviation	339 ^a 111.6	198 ^b 63.5	187 ^a 68.4	33 ^a 19.2

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$). Unpaired two-tailed t-tests were performed to analyze data.

* Percentage of free and reduced lunch is the number of free and reduced lunches divided by the number of children who took school lunch.

Number of children eating school lunch and took fruits and vegetables.

Fruit and Vegetable Consumption Data

Total Fresh and Canned Fruits and Vegetables

Data on total weight and average weight per child of fresh and canned fruits and vegetables consumed were compiled (Appendix S) and are summarized in Table 8. The data have been subdivided into six categories:

1. Initial weight in ounces,
2. Waste weight and waste weight in ounces per child,
3. Percentage of waste,
4. Consumed weight in ounces and ounces per child,
5. Percentage consumed, and
6. Number of students who took fruits and vegetables.

By compiling the data using these categories, comparisons were made between the experimental and control groups, as well as between the fresh and canned fruits and vegetables.

In the experimental group, the mean percent consumed was 76.1 for fresh fruit and 70.8 for the canned fruit. Having both fresh and canned fruits and vegetables in the experimental group was a significant factor in our analysis and interpretation. In the experimental group fresh vegetable mean initial weight in ounces per child (0.74) is less than the control group canned vegetables (1.46). Fresh vegetables weigh less and have less weight per unit volume than canned vegetables. For fresh vegetables in the experimental group, the mean percentage of waste (22.1) is lower than the control group canned vegetable mean percentage of waste (46.5). However, the mean percentage of waste (61.2) is higher for the control group fresh vegetable than the experimental group fresh vegetable. The reason for this

Table 8

Total Weight and Average Weight Per Child of Fresh and Canned Fruits and Vegetables Consumed by Grade-School Children*

	Experimental Group	Control Group	Total
Fresh Fruit			
Initial weight oz (oz/child)	8,147 (1.21)	398 (.58)	8,545 (1.15)
Waste weight oz (oz/child)	1,944 (.29)	101 (.15)	2,045 (.27)
% Waste	23.9	25.4	
Consumed wt oz (oz/child)	6,203 (.92)	297 (.43)	6,500 (.87)
% Consumed	76.1	74.6	
# Students Took F & V	6,764	689	7,453
Canned Fruit			
Initial weight oz (oz/child)	5,300 (1.05)	12,064 (1.98)	17,364 (1.56)
Waste weight oz (oz/child)	1,549 (.31)	3,928 (.65)	5,477 (.49)
% Waste	29.2	32.6	
Consumed wt oz (oz/child)	3,751 (.75)	8,136 (1.34)	11,887 (1.1)
% Consumed	70.8	67.4	
# Students Took F & V	5,022	6,089	11,111
Fresh Vegetable			
Initial weight oz (oz/child)	4,671 (.74)	1,676 (.87)	6,347 (.77)
Waste weight oz (oz/child)	1,034 (.16)	1,025 (.53)	2,059 (.25)
% Waste	22.1	61.2	
Consumed wt oz (oz/child)	3,636 (.57)	651 (.33)	4,287 (.52)
% Consumed	77.8	39.2	
# Students Took F & V	6,332	1,931	8,263
Canned Vegetable			
Initial weight oz (oz/child)	1,120 (.79)	7,296 (1.46)	8,416 (1.31)
Waste weight oz (oz/child)	504 (.36)	3,394 (.68)	3,898 (.61)
% Waste	45.0	46.5	
Consumed wt oz (oz/child)	616 (.44)	3,901 (.78)	4,517 (.70)
% Consumed	55.0	53.5	
# Students Took F & V	1,415	5,002	6,417

* Weight per child per school from those who ate school lunch and took fruits and vegetables. Both experimental and control groups consisted of 37 school visits with 29 schools in the experimental group and 37 schools in the control group.

large mean percentage of waste in the control group fresh vegetable was that the primary fresh vegetable served in the control group schools was salad, which was often wilted and unappealing.

The Total Weight and Average Weight Per Child of Fruits and Vegetables

The total weight and average weight per child of fresh and canned fruits have been combined as have the fresh and canned vegetables (Table 9). Using these totals and averages, comparisons of the experimental and control groups can be made. The children in the experimental group had a mean initial weight per child of 1.87 ounces of fruits on the day school lunch was observed and the control group had 2.0 ounces. The consumed weight for the mean ounces of fruit per child was 1.38 for the experimental group and 1.38 for the control group children. In the experimental group, the children consumed an average of 74.0% of their fruits while children in the control group consumed 67.7%. The children in the experimental group wasted 0.49 mean ounces per child of fruit while the children in the control wasted 0.66 mean ounces per child.

There was a large difference for vegetable consumption in the experimental and control groups. The children in the experimental group wasted 0.24 ounces of vegetables per child whereas the children in the control group discarded an average of 0.71 mean ounces of vegetables. Children in the control group discarded 49.2% of their vegetables while children in the experimental group wasted 26.6%. These numbers indicated that the children in the control group wasted more fruits and vegetables than the experimental group.

Table 9

Total Weight and Average Weight Per Child of Fruits and Vegetables Consumed by Grade-School Children*

	Experimental Group	Control Group	Total
Fruit			
Initial weight oz (oz/child)	13,447 (1.87)	12,462 (2.0)	25,909 (1.9)
Waste weight oz (oz/child)	3,493 (.49)	4,029 (.66)	7,522 (.57)
% Waste	25.9	32.3	
Consumed wt oz (oz/child)	9,954 (1.38)	8,433 (1.38)	18,387 (1.38)
% Consumed	74.0	67.7	
# Students Took F & V	7,195	6,089	13,284
Vegetable			
Initial weight oz (oz/child)	5,791 (.90)	8,972 (1.4)	14,763 (1.16)
Waste weight oz (oz/child)	1,538 (.24)	4,419 (.71)	5,957 (.47)
% Waste	26.6	49.2	
Consumed wt oz (oz/child)	4,252 (.66)	4,552 (.72)	8,804 (.69)
% Consumed	73.4	50.7	
# Students Took F & V	6,460	6,236	12,696

* Weight per child per school from those who ate school lunch and took fruits and vegetables. Both experimental and control groups consisted of 37 school visits with 29 schools in the experimental group and 37 schools in the control group.

The fruit consumed weight in ounces per child for the experimental group was 1.38. This is larger than the ounces of vegetable consumed per child which was 0.66 in the experimental group. Also the consumed weight in ounces per child for the control group was 1.38. This is larger than the vegetable consumed in ounces per child 0.72 for the control group. These numbers indicated that the children in both groups consumed more weight for fruits than vegetables.

The Total Weight and Average Per Child of Combined Fruits and Vegetables

The total weight and average per child of fruits and vegetables combined are shown in Table 10. In the experimental group the ounces per child were 2.67 whereas the ounces per child in the control group were 3.09. This could be due to the fact that fresh fruits and vegetables weigh less per unit volume than canned fruits and vegetables. The experimental group wasted 0.70 mean ounces per child whereas the control discarded 1.22 ounces per child. The control group discarded 39.4% of the fruits and vegetable served and the experimental group discarded 26.1%. On average, the children in the experimental group consumed slightly more ounces per child than the control group (i.e., 1.97 and 1.88 mean ounces respectively). The mean percent consumed for the experimental group was 73.4 and 60.6 for the control group. The mean percent consumed values indicate the children's discarded more canned vegetables.

Mean Weight and Standard Deviation Per Child of Fresh and Canned Fruits and Vegetables

The mean weight and standard deviation per child of fresh and canned fruits and vegetables for percentage of waste, and percent

Table 10

Total Weight and Average Weight Per Child of Combined Fruits and Vegetables Consumed by Grade-School Children*

	Experimental Group	Control Group	Total
Fruit & Vegetable			
Initial weight oz (oz/child)	19,238 (2.67)	21,434 (3.09)	40,672 (2.9)
Waste weight oz (oz/child)	5,031 (.70)	8,447 (1.22)	13,478 (.96)
% Waste	26.1	39.4	
Consumed wt oz (oz/child)	14,206 (1.97)	12,985 (1.88)	27,191 (1.9)
% Consumed	73.8	60.6	
# Students Took F & V	7,195	6,921	14,116

* Weight per child per school from those who ate school lunch and took fruits and vegetables. Both experimental and control groups consisted of 37 school visits with 29 schools in the experimental group and 37 schools in the control group.

consumed are shown in Table 11. The means and standard deviations were calculated on a school basis and the values used for statistical analysis. Comparisons were made using unpaired two-tailed t-tests. The fresh fruit experimental group mean percent consumed (75) was not significantly different ($p \geq 0.05$) than the fresh fruit control group mean percent consumed (61). The fresh fruit experimental group mean percent consumed (75) was significantly different ($p \leq 0.05$) than the canned fruit control group mean percent consumed (68). The canned fruit experimental group mean percent consumed (72) was not significantly different ($p \geq 0.05$) than the canned fruit control group mean percent consumed (68).

The fresh vegetable experimental group mean percent consumed (75) was significantly different ($p \leq 0.05$) than the fresh vegetable control group mean percent consumed (51). The fresh vegetable experimental group mean percent consumed (75) was significantly different ($p \leq 0.05$) than the canned vegetable control group mean percent consumed (56). The canned vegetable experimental group mean mean percent consumed (58) was not significantly different ($p \geq 0.05$) than the canned vegetable control group mean percent consumed (56).

Mean Weight and Standard Deviation Per Child Fruits and Vegetables

The fresh fruit and canned fruit data were combined as were the fresh vegetable and canned vegetable data (Table 12). The means for the experimental and control groups were compared. In the experimental and control group greater amounts of fresh fruits were taken by the children than fresh vegetables ($p \leq 0.05$). A significant difference ($p \leq 0.05$) was also found for the experimental group fruit mean percent consumption (74) and

Table 11

Mean Weight (Standard Deviation) Per Child of Fresh and Canned Fruits and Vegetables: In Ounces Per Child, Percentage of Waste, and Percent Consumed*

	Experimental Group	Control Group	Total
Fresh Fruit			
Initial weight oz/child	1.24(.89)amx	.52 (.33)bm	
% Waste	25 (16)amx	39 (32)am	
% Consumed	75 (16)amx	61 (32)am	
# School Visits	34	4	38
Canned Fruit			
Initial weight oz/child	1.07(.45)aw	2.0 (.64)bwy	
% Waste	28 (16)am	32 (15)amy	
% Consumed	72 (16)am	68 (15)amy	
# School Visits	24	31	55
Fresh Vegetable			
Initial weight oz/child	.78 (.43)amx	.78 (.45)am	
% Waste	25 (18)amx	49 (22)bm	
% Consumed	75 (18)amx	51 (22)bm	
# School Visits	32	9	41
Canned Vegetable			
Initial weight oz/child	.83 (.46)am	1.5 (.79)bwy	
% Waste	42 (25)aw	44 (22)amy	
% Consumed	58 (25)aw	56 (22)amy	
# School Visits	7	29	36

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$).

m,w Means followed by different letters in a column are significantly different ($p \leq 0.05$).

x,y Means followed by different letters for the comparison of fresh fruit experimental group vs. canned fruit control group and fresh vegetable experimental group vs. canned vegetable control group are significantly different ($p \leq 0.05$). Unpaired two-tailed t-tests were performed to analyze data.

* Mean values per child were calculated for each school so that the data could be statistically analyzed. Values are for those children who ate school lunch and took fruits and vegetables. Both experimental and control groups consisted of 37 school visits with 29 schools in the experimental group and 37 schools in the control group.

Table 12

Mean Weight (Standard Deviation) Per Child of Fruits and Vegetables: In Ounces Per Child, Percentage of Waste, and Percent Consumed*

	Experimental Group	Control Group	Total
Fruit			
Initial weight oz/child	1.86(.97) ^{am}	2.08(.58) ^{am}	
% Waste	26 (16) ^{am}	33 (17) ^{bm}	
% Consumed	74 (16) ^{am}	67 (17) ^{bm}	
# School Visits*	37	31	68
Vegetable			
Initial weight oz/child	.93(.50) ^{aw}	1.51(.75) ^{bw}	
% Waste	28 (20) ^{am}	45 (22) ^{bw}	
% Consumed	72 (20) ^{am}	55 (22) ^{bw}	
# School Visits*	33	34	67

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$).

m,w Means followed by different letters in a column are significantly different ($p \leq 0.05$).

Unpaired two-tailed t-tests were performed to analyze data.

* The number of schools that served fruits fresh and canned are counted only once. The number of schools that served vegetables fresh and canned are counted only once.

* Mean values per child were calculated for each school so that the data could be statistically analyzed. Values are for those children who ate school lunch and took fruits and vegetables. Both experimental and control groups consisted of 37 school visits with 29 schools in the experimental group and 37 schools in the control group.

the control group fruit mean percent consumption (67). The experimental group fruit mean percent consumed (74) was not significantly different ($p \geq 0.05$) than the experimental group vegetable mean percent consumed (72). The control group fruit mean percent consumed (67) was significantly different ($p \leq 0.05$) than the control group vegetable mean percent consumed (55).

Mean Weight and Standard Deviation Per Child of Combined Fruits and Vegetables

The mean and standard deviation of the fruit and vegetable mean initial weight in ounces per child, mean percentage of waste, and mean percent consumed are listed in Table 13. The mean initial weight (ounces per child) was 2.70 oz of fruit and vegetable for the experimental group and 3.14 oz for the control group ($p \geq 0.05$). The mean waste was 27% for the experimental group and 39% for the control group which was significantly different ($p \leq 0.05$). The experimental group consumed a mean of 73% of all the fruits and vegetables served whereas the control group consumed 61% ($p \leq 0.05$). This indicated that the grade-school children in the experimental group consumed a greater percentage and wasted a smaller percentage of the fruits and vegetables taken on the cafeteria line than did the control group.

When comparing the mean initial weight in ounces per child for the experimental and control groups in Table 10 and Table 13 no difference was found. The initial weight was 2.67 and 2.70 oz per child respectively for the experimental group and 3.09 and 3.14 oz per child for the control group.

Table 13

Mean Weight (Standard Deviation) Per Child of Combined Fruits and Vegetables: In Ounces Per Child, Percentage of Waste and Percent Consumed*

	Experimental Group	Control Group	Total
Fruit & Vegetable			
Initial weight oz/child	2.70(1.12) ^a	3.14(1.11) ^a	
% Waste	27 (18) ^a	39 (21) ^b	
% Consumed	73 (18) ^a	61 (21) ^b	
# School Visits*	37	37	74

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$).

Unpaired two-tailed t-tests were performed to analyze data.

* The number of schools that served fruits and vegetables, fresh and canned are counted only once.

* Mean values per child were calculated for each school so that the data could be statistically analyzed. Values are for those children who ate school lunch and took fruits and vegetables. Both experimental and control groups consisted of 37 school visits with 29 schools in the experimental group and 37 schools in the control group.

Fruit and Vegetable Preference

To determine which fruits and vegetables the children in the experimental group preferred, data on the weight in ounces of six fresh fruits and five fresh vegetables were compiled and are summarized in Table 14 and Table 15. The number of ounces consumed per child per school, percent waste, and percent consumption for fruits and vegetables was calculated in order to determine which items were most often consumed.

To compare the percentage of consumption of the fresh fruits, an ANOVA was performed on the six fruits and was significant at $p \leq 0.05$. Unpaired two-tailed t-tests were then used to evaluate individual comparisons. The unpaired two-tailed t-tests showed no significant difference among fresh grapes, fresh strawberries, fresh kiwi, and fresh pineapple; however, the percent consumption of fresh oranges and fresh apples was significantly different than fresh grapes, fresh strawberries, fresh kiwi, and fresh pineapple ($p \leq 0.05$). The percent consumption by the grade-school children was 88% for fresh grapes, 87% for fresh strawberries, 85% for fresh kiwi, 85% for fresh pineapple, 73% for fresh oranges, and 64% for fresh apples. It is possible that the children may have been tired of oranges and apples or may have found these fresh fruits difficult to consume because they were not appropriately served (i.e., cut into small, bite size pieces and unedible skins removed).

For the fresh vegetables an ANOVA was used to test the difference in percentage of consumption among the five vegetables. There was no significant difference ($p \geq 0.05$) in percent consumption among salad, carrots, celery, broccoli, and cauliflower. Children consumed approximately 75% of the salad served. This suggests that, if served, children will eat any of these five preferred vegetables.

Table 14

Fresh Fruits Mean (Standard Deviation) Weight In Ounces Consumed by Grade-School Children, Experimental Group*

Fresh Fruit	# Schools	# Took Fruits & Vegetables	Ounces Child/School Consume	% Waste	% Consume
Grapes	n=7	185.1(69.5)	.82(.59)	11(11)	88(11) ^a
Strawberries	n=7	235.6(81.7)	.62(.18)	13(14)	87(13) ^a
Kiwi	n=9	195(82.5)	.45(.33)	15(13)	85(13) ^a
Pineapple	n=13	188.6(95.4)	1.14(1.68)	15(9)	85(9) ^a
Oranges	n=14	213(101.9)	.64(1.08)	27(17)	73(17) ^b
Apples	n=10	231.5(77.3)	.49(.32)	36(14)	64(14) ^b

a,b Means followed by different letters in a column are significantly different ($p \leq 0.05$) using ANOVA and unpaired two-tailed t-tests.

Table 15

Fresh Vegetables Mean (Standard Deviation) Weight In Ounces Consumed by Grade-School Children, Experimental Group*

Fresh Vegetable	# Schools	# Took Fruits & Vegetables	Ounces Child/School Consume	% Waste	% Consume
Salad	n=24	217.7 (94.0)	.45(.74)	25(18)	75(18) ^a
Carrots	n=23	204(97.24)	.37(.53)	23(16)	77(16) ^a
Celery	n=14	196.57(95.3)	.27(.31)	25(18)	75(18) ^a
Broccoli	n=8	189.6(103.4)	.23(.33)	26(32)	74(32) ^a
Cauliflower	n= 9	196.33(80.7)	.13(.07)	13(19)	87(19) ^a

a,b Means followed by different letters in a column are significantly different ($p \leq 0.05$) using ANOVA.

A list of all the fruits and vegetables that were offered during this study are shown in Appendix T. Schools were allowed to choose from 50 to 75 premium fresh U.S. fruits and vegetables from the DOD fresh fruit and vegetable list. The actual number of fruits and vegetables fluctuated monthly and seasonally based on availability. Bananas were not included on the DOD list because they were not grown in the United States. Potatoes are counted as a vegetable under the school lunch program; however, potatoes and potato products were not served on the days of observation and were not included in this study even though red, white, and sweet potatoes were available from the DOD.

School Lunch Menus

The school lunch menus for April 1994 were compared to the April 1995 and 1996 menus. The menus were analyzed by school district. All schools in the experimental group served fresh fruits and fresh vegetables on the days observed. The menus indicated that many of the experimental schools did add fresh fruits and fresh vegetables to the menu thus replacing canned fruits and canned vegetables. The number of fruit and vegetable items listed in the school district menu for the experimental group are shown in Table 16 and for the control group are shown in Table 17. In 1994 the schools in the experimental group that participated in the Fresh Fruit and Fresh Vegetable program, preintervention, showed 14.7 mean number of fresh fruits and vegetables listed on the school district menu. During the intervention in 1995, the mean number of fresh fruits and vegetables listed increased to 22.8. Based on unpaired two-tailed t-tests, there was a significant difference in the number of fresh fruits and fresh vegetables listed preintervention, intervention, and post intervention. There was a significant difference between the 1994 ($p \leq 0.05$) preintervention school

Table 16

Fruit and Vegetable Items Listed Per School District Lunch Menus for April 1994, 1995, and 1996, for the Experimental Group*

	Listings 1994 21 days Pre-intervention	Listings 1995 20 days Intervention	Listings 1996 21 days Post-intervention
Experimental School Districts n = 7			
Fresh Fruits & Vegetables			
Mean (SD) ⁺	14.9 (12.1) ^{am}	22.8 (10.9) ^{bm}	20.7 (11.1) ^{am}
Canned Fruits & Vegetables			
Mean (SD) ⁺	14.8 (7.8) ^{am}	8.8 (8.7) ^{bw}	10.3 (12.1) ^{aw}
Total Fruits & Vegetables			
Mean (SD) ⁺	29.7 (6.1) ^a	31.7 (8.9) ^a	31.0 (8.4) ^a

+ SD is Standard Deviation.

Unpaired two-tailed t-tests were performed to analyze data.

* Menus evaluated for seven school districts during the entire month of April 1994, 1995, 1996.

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$) 1994 vs. 1995 or 1995 vs. 1996.

m,w Means followed by different letters in a column are significantly different ($p \leq 0.05$).

Table 17

Fruit and Vegetable Items Listed Per School District Lunch Menus for April 1994, 1995, and 1996, for the Control Group*

	Listings 1994 21 days Pre-intervention	Listings 1995 20 days Intervention	Listings 1996 21 days Post-intervention
Control School Districts n = 2			
Fresh Fruits & Vegetables Mean	9	8	10
Canned Fruits & Vegetables Mean	12	16	23
Total Mean	42 21	48 24	64 32

* Menus evaluated for two school districts for the entire month of April 1994, 1995, 1996.

district menu and the 1995 district menu during intervention. This suggests that more fresh fruits and fresh vegetables were available and served in 1995 than in 1994. In 1996, after intervention, the number of fresh fruits and fresh vegetables on the menu was 20.7. While 20.7 represents more fresh fruits and fresh vegetables than were listed in 1994, the difference is not statistically significant ($p \geq 0.05$). The total fruit and vegetable listings in 1995 for the experimental group did not significantly increase in 1996. This could be due to the fact the schools were not receiving funds for fruits and vegetables from the DOD. Data for the control group were not statistically analyzed because there were only two school districts; however, there was an increase in the mean number of canned fruits and vegetables listed on the menu for 1994 through 1996.

Discussion and Recommendations

Discussion

Grade-school children are not eating the daily recommended servings of fruits and vegetables. They are consuming less than one serving (1/2-cup of cooked or raw fruit and vegetable, 1 cup raw leafy vegetable, or 3/4-cup fruit or vegetable juice) of fruits and vegetables a day (Bellinger et al., 1993). Providing fresh fruits and fresh vegetables during school lunch could help children meet these recommendations for disease prevention (i.e., reducing the risk of cancer) and good health. Attaining good eating patterns early in life, specifically by including more fruits and vegetables, is likely to continue throughout life (Birch et al., 1995). In this study, fresh fruits and vegetables were available to the children in the experimental group. The results showed the children in the experimental group took or received 2.70 ounces per child of fruits and vegetables and the control group took or received 3.14 ounces; however, the experimental group had a higher mean percent consumption and conversely a reduced amount of fruit and vegetable waste ($p \leq 0.05$). The data support the supposition that fresh fruit and vegetables in the school lunch program will increase percent consumption thus helping them to meet the national recommendations of eating at least five servings of fruits and vegetables daily (Havas et al., 1995).

In the Fresh Fruit and Vegetable Intervention Study the children in both the experimental and control groups took more fruits than vegetables ($p \leq 0.05$) (Table 12). These results are similar to the findings of Domel et al. (1995) in their evaluation of the "Gimme 5" program. They compared knowledge and preference of fruits and vegetables among children after a nutrition education intervention. The pre/post test showed that, after intervention, 301 fourth and fifth graders showed significant gains in

knowledge and in preference for fruits but not for vegetables. The preference for fruits over vegetables in the Fresh Fruit and Vegetable Intervention Study was consistent with Domel's results.

In the Fresh Fruit and Vegetable Intervention Study the total fruit and vegetable consumed by the children in the experimental group during school lunch was 2.70 oz. Bellinger et al. (1993) reported and Domel et al. (1995) found children consumed, on an average, less than one serving of fruit and vegetable for the entire day. Children who consume less than one serving per day fall short of the USDA recommendations to eat five or more servings of fruits and vegetables (USDAHHS, 1990) and the Food Guide Pyramid (USDA, 1992) recommendation of two to four daily servings of fruits and three to five daily servings of vegetables. Currently, these recommendations are set for adults and do not address servings of fruits and vegetables for children. There are no standard fruit and vegetable serving sizes for children.

The researcher from the Fresh Fruit and Fresh Vegetable Project observed that children were more likely to eat more fresh fruits and fresh vegetables if the fresh fruits and fresh vegetables were served appropriately. "Served appropriately" means that fruits and vegetables such as oranges, apples, pears, kiwi, pineapple, carrots, and celery are cut into small bite size pieces such as wedges or slices with the skin removed if appropriate. An observation made in this study was that children had difficulty eating whole apples, whole oranges, whole kiwi, and whole green pears. The children ate more apples, oranges, kiwi, and pears when these fresh fruits were cut up into small pieces and served when they were ripe. In the USDA Food Buying Guide for Child Nutrition Programs (USDA, 1990), no reference is made to the appropriate size or piece to offer a child.

Of the fresh fruits and fresh vegetables they took, the grade-school

children in the experimental group had a higher ($p \leq 0.05$) mean percent consumption than the control group did of the canned fruits and canned vegetables (Table 18).

As shown in Table 10, the children in the experimental group in the Fresh Fruit and Vegetable Intervention Study consumed a greater percentage of fruits and vegetables than the children in the control group. The children in the experimental group had a choice of whether to take or not take fruits/vegetables during the school lunch. They also had an option to select from a variety of fresh fruits and vegetables served from small, premeasured bowls or from a self-serve bar, and they could take up to 3/4-cup of fruits/vegetables. The children in the control group did not have a variety of fresh fruits and vegetables from which to choose; they were served predominately canned fruit or vegetable. The control group did not have the opportunity to select from small, premeasured bowls or from a self-serve bar. The percentage of waste for canned vegetables was greater than for fresh vegetables, except for fresh vegetables in the control group. In this group wilted lettuce was served and 49% of the lettuce was thrown away. These findings are similar to the results by Dillon and Lane (1989). Dillon and Lane evaluated the offer versus served option within a self-serve school lunch menu for grade-school children. For one week two schools' lunches were monitored and visual estimates of the foods taken and consumed were estimated visually. They reported that the "offered" service style was more effective than "served" service style. Lind et al. (1986) compared "family style" (self-serve) vs. "cafeteria style service" (served) school lunch in fourth-, fifth-, and sixth-grade students. The researchers compared students' attitudes, food waste, and food intake in two elementary schools: one with "family style service" and one with "cafeteria style" food service. They used questionnaires and plate waste to evaluate the school lunch

Table 18

Mean (Standard Deviation) Per Child Per School of Fresh Fruits vs. Canned Fruits and Fresh Vegetables vs. Canned Vegetables: In Ounces Per Child, % Waste, and % Consumed (Summarized From Table 11)

	Experimental Group	Control Group
	<u>Fresh Fruit</u>	<u>Canned Fruit</u>
% Waste	25 ^a	32 ^b
% Consumed	75 ^a	68 ^b
	<u>Fresh Vegetable</u>	<u>Canned Vegetable</u>
% Waste	25 ^a	44 ^b
% Consumed	75 ^a	56 ^b

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$).

Unpaired two-tailed t-tests were performed to analyze data.

service styles and found that "family style" service had lower waste and higher intake of food than the "cafeteria style." These results are similar to those observed in the Fresh Fruit and Vegetable Intervention Study.

Providing a choice, providing fresh fruits and vegetables, and providing the fruit and vegetable in a small bowl or a self-serve bar may all be factors that affected the children's consumption and should be addressed in detail through further research.

Recommendations

It was observed that children are more likely to consume a greater percentage of fresh fruits and fresh vegetables than canned fruits and canned vegetables, if the fresh fruits and fresh vegetables are available and served appropriately. This means fresh fruits and fresh vegetables that are served during school lunch should be ripe, peeled, and cut into small, manageable portions in order for the grade-school children to easily eat them. Providing appropriately prepared fresh fruits and vegetables could reduce fruit and vegetable waste and possibly increase the fruit and vegetable consumption by the grade-school children. Appropriately prepared fresh fruits and vegetables have many benefits:

1. The fruits and vegetables are more appealing to the children and may result in more children eating school lunch.

2. The school lunch period is usually short, about twenty minutes long. Serving smaller pieces of fruits and vegetables instead of whole fruits and vegetables makes it quicker for the grade-school children to eat, thus they could eat more.

3. Many of the grade-school children have missing teeth and have a difficult time eating large whole items. Cutting the fresh fruits and fresh

vegetables into smaller pieces makes them easier for the children to eat.

The following recommendations have been compiled for serving fresh fruits and vegetables:

1. Fresh fruits and fresh vegetables should be offered rather than served to the children and allow them the opportunity to choose from a variety of produce. Serve fresh fruits and vegetables in small bowls or from self-serve bars.

2. The use of fresh fruits and vegetables should be monitored. Fresh fruits and fresh vegetables should be washed, ripened, peeled (if necessary), and cut into small manageable portions (wedges or slices).

3. Educate school food service personnel about fresh fruit and vegetable handling (e.g., maturing of fruits and vegetables and food safety issues).

4. Orders for fresh fruits should be placed in time to allow adequate ripening (but not spoilage) to occur.

5. Provide adequate time for children to eat. It takes a long time for children to consume fresh fruits and vegetables. This requires policy changes in schools. One alternative to consider is having recess before lunch, thus minimizing added stress to eat quickly so the students can play.

6. Food service directors must plan time for staff training to include discussion of the appropriate service of fresh fruits and fresh vegetables.

7. When serving fresh fruits and fresh vegetables it is important that training is provided for the school food service personnel and time scheduled for staff to attend. Money should be made available for such training and the training should include ordering and handling of fresh fruits and vegetables.

8. Allow schools the opportunity to purchase prepared and packaged

fresh lettuce, fruits, and vegetables and to participate in the USDA Department of Defense Fresh Fruit and Fresh Vegetable Program.

Limitations for the Fresh Fruit and Vegetable Intervention Study were noted. Limitations for this study included the following:

1. The schools in the experimental group served both fresh and canned fruits and vegetables during school lunch. The control served predominately canned fruits and vegetables. The preferred experimental design would have been to serve only fresh fruits and vegetables in the experimental group and only canned items in the control group.

2. The availability of the variety of fruits and vegetables could have been affected by seasons. The variety of fresh fruit and vegetable was not the same for the beginning of the study as it was at the end of the study. This could be important because of the different densities between varieties of fruits and vegetables that effect their weight.

3. Students appeared to select servings based on volume (selecting from premeasured 1/4-cups or from the self-serve bar) and this may have affected the amount selected and wasted. The servings consumed by the children were measured by weight. Servings of fresh fruits are heavier per unit volume than many fresh vegetables. Servings of canned fruits and canned vegetables weigh more than their fresh counter parts. Canned items also have added water and other ingredients (e.g., 1/4-cup of fresh carrots weighs 1.0 oz whereas 1/4-cup of canned corn weighs 3.0 oz).

4. Service style was a limitation in this study. The experimental and control groups did not have the same style of service during school lunch. The children in the control group were served fruit or vegetable on the line. Some schools gave the child a choice of taking or not taking the fruit/vegetable offered on the service line. In other schools in the control

group the children had no choice and were given the fruit/vegetable. In all the schools in the experimental group, children were offered a variety and given a choice of whether they wanted to take fruit/vegetable. The children in the experimental group were served fruits and vegetables from premeasured small bowls or from the self-serve bar. Because of the different serving styles for the experimental and control group, the amount of fruit and vegetable taken or received by students may have been effected. Of the children who took school lunch 94% in the control group took fruits and vegetables compared to 74% in the experimental group.

5. Seven school districts were evaluated in the experimental group and two school districts were evaluated in the control group. The number of times the schools were evaluated differed between the two groups. Of the 29 schools participating in the experimental group, eight schools were visited twice (n=37 visits for the experimental group). In the control group 37 schools participated and there were 37 school visits (n=37 visits for the control group). Another limitation of this study was that no pre/post evaluation was performed. It would have been ideal to do a pre-evaluation of the school lunch plate waste, have the fresh fruit and vegetable intervention, and again evaluate the plate waste in order to compare eating patterns of the grade-school children.

6. During school lunch the maximum number of fruits or vegetables a child was allowed to take was two (totaling 1/2-cup for the 1-3 grades) or three (totaling 3/4-cup for the 4-6 grades) for both the experimental group (small bowl style) and control group (served style). This put a ceiling on the number of servings a child took during school lunch in these two service styles. Monitoring the amount taken for the self-serve bar style was more difficult for the food service personnel, and the ceiling of 3/4-cup may have fluctuated from student to student.

7. Only those children who were given (i.e., the control group) or who selected (i.e., the experimental group) fruits and vegetables were evaluated in this study. Those children who had a choice (i.e., the experimental group) but did not take any fruit or vegetable were not included in the sample. The researcher could not evaluate if there was more waste in the control group because the children were served fruits or vegetables whether or not they wanted it or because the children were served canned fruits or vegetables as mentioned in the first limitation.

Conclusions

A method was developed for measuring fruit and vegetable consumption during school lunch. Results from the Fresh Fruit and Vegetable Intervention Study have led to the following conclusions:

1. The grade-school children in the experimental group had a higher ($p \leq 0.05$) mean percent consumption of fresh fruits and fresh vegetables taken than the control group did of canned fruits and canned vegetables taken.

2. The grade-school children in the control group took and consumed more fruits than vegetables ($p \leq 0.05$). The control group wasted less fruit than vegetable ($p \leq 0.05$) whereas the percentages of waste for fruits and for vegetables were the same in the experimental group ($p \geq 0.05$).

3. The mean initial weight in ounces of total fruit and vegetable per child was 2.70 for the experimental group and 3.14 for the control group. The grade-school children in the experimental group had a smaller percentage of waste and consumed a greater percent of total fruits and vegetables than the children in the control group ($p \leq 0.05$).

4. The grade-school children consumed a greater percentage ($p \leq 0.05$) of grapes, strawberries, kiwi, and pineapple (88%, 87%, 85%, and 85%

respectively) than oranges (73%) and apples (64%). Ounces consumed per child for fresh fruit ranged from 1.14 for pineapple to 0.45 for kiwi.

5. The grade-school children consumed between 74% and 87% of all fresh vegetables available to them in this study (i.e., fresh salad, carrots, celery, broccoli, and cauliflower). The consumption per child was highest for salad and lowest for cauliflower (0.45 and 0.13 ounces respectively).

6. There was a significant increase ($p \leq 0.05$) in the listings of fresh fruits and vegetables on the school district menu during the intervention for the experimental group.

From these conclusions, the following hypothesis was accepted:

There will be a significant difference in percent consumption of fresh fruit and fresh vegetable by grade-school children given additional premium quality fresh fruits and fresh vegetables versus the control schools.

CHAPTER V

COMPARISON OF THE EFFECTIVENESS OF NUTRITION EDUCATION AND INCREASED AVAILABILITY OF FRESH FRUITS AND VEGETABLES

Introduction

To date, no studies have compared the effectiveness of nutrition education with the effectiveness of the increased availability of fresh fruits and vegetables during school lunch. In order to compare the effectiveness of the two methods, serving sizes from the two studies were converted into 1/4-cup measurements and compared. In the Nutrition Education Intervention Study, nutrition education on the benefits of eating more fruits and vegetables was provided to an elementary school and to the community. The effect was evaluated by measuring the self-reported consumption of fruits and vegetables before and after the nutrition education was given. A 24-hour food recall was used to measure the effectiveness of the nutrition education. Only those fruits and vegetables consumed during school lunch were used in this part of the research. In the Fresh Fruit and Vegetable Intervention Study, the availability of fresh fruits and fresh vegetables that was served to the children during the school lunch was increased. The effectiveness of providing more fresh fruits and fresh vegetables was measured by weighing the plate waste from the children's lunches and subtracting the waste from the beginning weight. The weight of the fruits and vegetables consumed was converted into 1/4-cup servings.

Research Questions

Looking at the results of the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study raises the question as to which intervention is most effective in increasing fruit and vegetable consumption; nutrition education in the classroom or providing fresh fruits and fresh vegetables during school lunch?

Objectives and Hypotheses

The objective of comparing the results of the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study was as follows:

To determine whether or not the increased consumption of fruits and vegetables is greater due to nutrition education or because of availability of additional, quality fresh fruits and fresh vegetables.

With this objective in mind, and the lack of a clear expectation of which one is better, the following null hypothesis was tested for the comparison of the results of the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study:

There will be no difference in the increase in consumption of fruits and vegetables in grade-school children following nutrition education compared to that following the availability of fresh fruits and vegetables.

If the hypothesis is rejected, then one approach is better than the other. Because both approaches will be better than the respective controls, either approach will be beneficial for the schools to help children improve their diets and eat more fruits and vegetables. The information from this comparison will be helpful to the schools because some schools are unable to provide nutrition education and others are unable to provide additional quality fresh fruits and fresh vegetables to their children.

Methods

Nutrition Education Intervention

In the Nutrition Education Intervention Study, data from the amounts of fruits and vegetables consumed during school lunch from the 24-hour food recall were collected. The fruits and vegetables consumed during the school lunch were converted into 1/4-cup servings. All fresh, frozen, and canned fruits and vegetables were recorded as 1/4-cup servings. Data collected on the 1/4-cup servings from the Nutrition Education Intervention Study, 24-hour lunch recall for the grade-school children, experimental and control groups are listed in Appendix U.

In the Nutrition Education Intervention Study, the procedure for determining the fruits and vegetables consumed during school lunch was as follows:

1. A pre- and post- 24-hour food recall was taken from both the experimental and control groups in this study.
2. In the experimental group a 24-hour food recall was taken from the grade-school children before and after a nutrition education program was implemented.
3. In the control group two 24-hour food recalls were taken from the grade-school children who did not receive nutrition education.
4. Only the fruits and vegetables consumed by the grade-school children during the school lunch were recorded for this part of the study.
5. A one-way ANOVA was conducted on the Nutrition Education Intervention Study data. One-way ANOVA was used to compare the observed differences between means of the servings per child from the pre-and-post lunch recall. The mean and standard deviation for the 1/4-cup servings per child were calculated for the experimental-post group intervention and control-post group. The difference in means (D_1) between

these groups and the standard error of that difference (SeD₁) were then determined.

Fresh Fruit and Vegetable Intervention

In the Fresh Fruit and Vegetable Intervention Study, the weights of the consumed fruits and vegetables from the school lunch were calculated. All the fruits and vegetables used during the school lunch were recorded as weight in ounces and in 1/4-cup servings. All fruits and vegetables were placed into 1/4-cup measuring bowls which were then weighed on ounce scales to achieve weight of 1/4-cup serving in ounces. The data collected for comparison of grade-school children in the Fresh Fruit and Vegetable Intervention Study, 1/4-cup servings are listed in Appendix V. Unpaired two-tailed t-tests were used to compare consumption in 1/4-cup servings per child of fruits and vegetables in the experimental and control groups. The mean 1/4-cup serving consumed per child by the experimental group (1.13) was significantly different than the control (0.819) at $p \leq 0.05$ (Table 19). The procedure for determining fruits and vegetables consumed was as follows:

1. Data in weight, in ounces and 1/4-cup servings, of the consumed fruits and vegetables were collected in both the experimental and control groups. Each fresh fruit and vegetable was converted from ounces to 1/4-cup servings. The conversions were as follows:

1/4-cup grapes	= 2.25 ounces	1/4-cup salad	= 1.00 ounce
1/4-cup strawberries	= 2.25 ounces	1/4-cup carrots	= 1.00 ounce
1/4-cup kiwi	= 1.25 ounce	1/4-cup celery	= 1.00 ounce
1/4-cup pineapple	= 2.50 ounces	1/4-cup broccoli	= 1.25 ounce
1/4-cup oranges	= 3.50 ounces	1/4-cup cauliflower	= 1.25 ounce
1/4-cup apples	= 3.50 ounces		

2. The number of children who took the fruits and vegetables in both groups during the school lunch was recorded.

3. The schools in the experimental group served more quality fresh

Table 19

Combined Fresh and Canned Fruit and Vegetable Consumption Based on a 1/4-Cup Per Child[#]

	Experimental ⁺ Group 1/4-cup/child	Control ⁺ Group 1/4-cup/child
Mean (Standard Deviation)	1.13 (.49) ^a	0.819 (.36) ^b

a,b Means followed by different letters in a row are significantly different ($p \leq 0.05$). Unpaired two-tailed t-tests were performed to analyze data.

+ Both experimental and control groups consisted of 37 visits.

Consumption of fruits and vegetables per child based on number of children who ate school lunch and took fruits and vegetables from the cafeteria line.

fruits and fresh vegetables from the DOD during the school lunch.

4. In the Fresh Fruit and Vegetable Intervention Study, a nested ANOVA was initially used to compare the data from the schools. The variability between schools was not significantly different ($p \geq 0.25$) than the variability of multiple day visits within the same school; therefore, multiple day visits in the same school were treated as if they were independent. Thus one-way analysis of variance (ANOVA) was used to test for the differences between the experimental group and the control group. The level of significance was set at $p \leq 0.05$. In the Fresh Fruit and Vegetable Intervention Study the mean differences among servings per child per school were determined. The mean and standard deviation for 1/4-cup servings per child per school were determined. The difference in means (D_2) between the experimental and control groups and the standard error of that difference (SeD_2) were also calculated.

Comparison of the Effectiveness of Nutrition Education and Increased Availability of Fresh Fruits and Vegetables

The combined amounts of fruits and vegetables from lunch only were collected for both studies. The 1/4-cup servings were calculated for the Nutrition Education Intervention Study from the control-post group and the experimental-post group following the nutrition education intervention. From the Fresh Fruit and Vegetable Intervention Study, the 1/4-cup servings were calculated from the control and experimental group subsequent to the intervention (i.e., providing fresh fruits and vegetables in the experimental group school lunches). In order to compare the results of the effectiveness of nutrition education and the increased availability of fresh fruits and vegetables, the respective difference in means ($D_1 - D_2$) and the standard error of that difference were compared via a Z statistic.

Analysis

The data from the Nutrition Education Intervention Study and The Fresh Fruit and Vegetable Intervention Study were analyzed using independent sample one-way ANOVA . The experimental data for the comparison of the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study were analyzed by a test of the difference in effects based on independent studies. This test compared 1/4-cup servings per child on the difference between experimental and control samples for the Nutrition Education Intervention Study with similar comparisons of data for the Fresh Fruit and Vegetable Intervention Study.

In order to compare the results of the effectiveness of nutrition education and the increased availability of fresh fruits and vegetables, the respective difference in means ($D_1 - D_2$) and the standard error of that difference ($Se(D_1 - D_2)$) were compared via a Z statistic using the following formula:

$$Z = \frac{D_1 - D_2}{\sqrt{(Se D_1)^2 + (Se D_2)^2}}$$

Where D_1 is the difference in means between the experimental-post and control-post group for the Nutrition Education Intervention Study and SeD_1 is the standard error of that difference, and D_2 is the difference in means in the experimental and control group for the Fresh Fruit and Vegetable Intervention Study and SeD_2 is the standard error of that difference.

Results

Results from the comparison of the effectiveness of nutrition education and the effectiveness of increased availability of fresh fruits and vegetables showed no difference between the two interventions. The results indicate that providing fresh fruits and fresh vegetables during school lunch had no difference in mean consumption than providing only nutrition education in the classroom.

First, a one-way ANOVA for the Nutrition Education Intervention Study and for the Fresh Fruit and Vegetable Intervention Study were used to compare the experimental and control groups in the two studies. The mean difference for the Nutrition Education Intervention Study (D_1) was 0.150 and the standard error of that difference (SeD_1) was 0.227. For the Fresh Fruit and Vegetable Intervention Study the mean difference (D_2) was 0.311 and the standard error of that difference (SeD_2) was 0.10117 (Figure 5).

Second, the data from the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study were compared. The results showed no significant difference in fruit and vegetable consumption in grade-school children when providing nutrition education to the grade-school children was compared to providing fresh fruits and fresh vegetables to the grade-school children during school lunch. The Z statistic had a value of -0.647 with a p-value for a two-tailed test of 0.5189, which is not significant ($p \geq 0.05$).

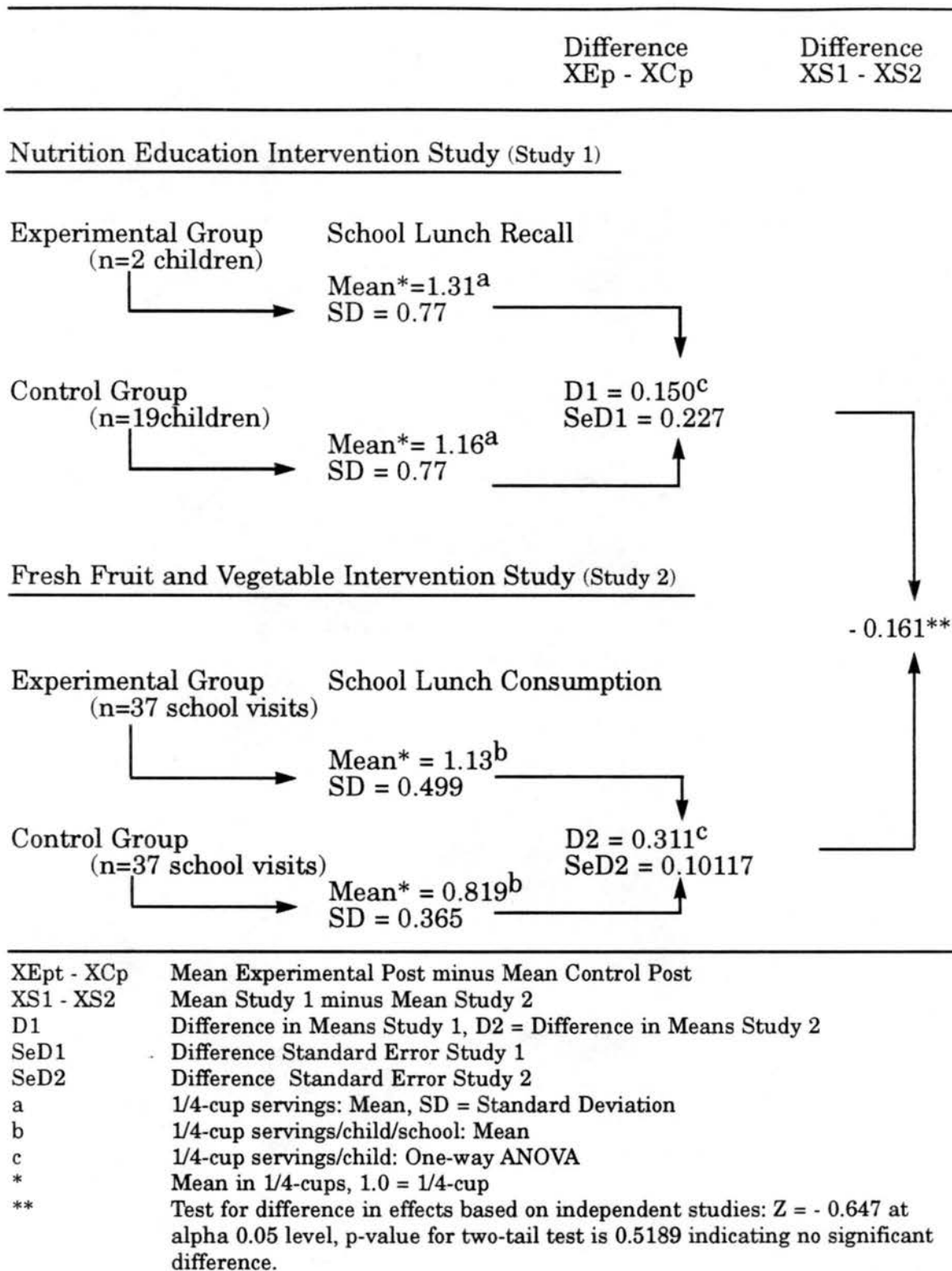


Figure 5. Results of Comparing the Effectiveness of Nutrition Education Intervention and Increased Availability of Fresh Fruits and Vegetables.

Limitations and Recommendations

Limitations of the Comparison of the Effectiveness of Nutrition Education and Increased Availability of Fresh Fruit and Vegetables were noted. The limitations included the following:

1. The groups evaluated in the Nutrition Education Intervention Study were different than those in the Fresh Fruit and Vegetable Intervention Study. The Nutrition Education Intervention Study evaluated individual children grades fourth and fifth whereas the Fresh Fruit and Vegetable Intervention Study evaluated groups (schools and the number of children in the schools) grades first through sixth. Comparing the individuals of the Nutrition Education Intervention Study to the groups of the Fresh Fruit and Vegetable Intervention Study is a limitation of the experimental design as the number of participants was not the same in the two studies.

2. The data in the Nutrition Education Intervention Study came from 1/4-cup serving estimates self-reported by the children during the school lunch period within the the 24-hour food recall whereas the serving data in the Fresh Fruit and Vegetable Intervention Study came from weight measurements (ounces) that were then converted into 1/4-cup servings.

3. Using 1/4-cup as a unit of measure presents a volume issue because fruits and vegetables do not have the same mass. Fresh fruits are heavier per unit volume than many fresh vegetables. Canned fruits and canned vegetables usually weigh more than their fresh counter parts. Canned items also have added water and other ingredients.

4. In both studies, the schools did not serve the same fruit and vegetable during school lunch; thus like comparisons could not be made. The type of fruits and vegetable served varied daily making comparisons complicated. For example, in the experimental group one school served

fresh strawberries, and on the same day another school served fresh apples; thus the researcher could not conclude if the children ate more strawberries because they liked strawberries or because they were tired of apples or because strawberries were easier to eat (i.e., bite size). Choice and no choice of receiving fruits and vegetables was a limitations when making like comparisons.

5. The number of participants in the Nutrition Education Intervention Study was 29 whereas the participants for the Fresh Fruit and Vegetable Intervention Study was 14,195. Given the difference in sample size in the Nutrition Education Intervention Study versus the Fresh Fruit and Vegetable Intervention Study and the above limitations, the comparison of these two studies can only be used as a model to demonstrate how one might compare differences if the samples were comparable.

Recommendations

From the results of comparing the effectiveness of nutrition education and the effectiveness of increased availability of fresh fruits and vegetables, the researcher recommends including either or both interventions to increase the consumption of fruits and vegetables in grade-school children. In this study both proved to increase consumption of fruits and vegetables in grade-school children. It is also recommended that additional research be conducted in this area of nutrition for children by combining the two interventions. Would there be a synergistic increase in consumption of fruits and vegetables by the grade-school children using the combined interventions? Would the combined interventions help grade-school children meet the 5 A Day goal and the Dietary Guidelines recommendations?

Conclusions

A model was developed to compare the results from the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study. Based on the huge differences in the sample size of these two studies, the results have limitations. When comparing the effectiveness of nutrition education and the effectiveness of increased availability of fresh fruits and vegetables, there was no significant difference in consumption of fruits and vegetables in the grade-school children. Both interventions increased consumption of fruits and vegetables during school lunch in the children tested. In the Nutrition Education Intervention Study, the mean increase was 0.15 for 1/4-cup servings of fruits and vegetables consumed by the experimental group during school lunch compared to the control group. In the Fresh Fruit and Vegetable Intervention Study, the mean increase was 0.311 for 1/4-cup servings of fruits and vegetables in the experimental group compared to the control group. Both interventions increased fruit and vegetable consumption of grade-school children, thus helping them to meet the 5 A Day goal and the Dietary Guidelines that recommend eating more fruits and vegetables for disease prevention.

From these conclusions, the following hypothesis was accepted:

There will be no difference in the increase in consumption of fruits and vegetables in grade-school children following nutrition education compared to following the availability of additional fresh fruits and vegetables.

CHAPTER VI

GENERAL DISCUSSION

Summary

Children in our nation are not meeting the National Health objective or recommendations to eat plenty of fruits and vegetables (Bellinger et al., 1993). This research assessed whether or not providing classroom nutrition education on the benefits of eating fruits and vegetables and providing more fresh fruits and fresh vegetables in the school lunch program increased consumption in grade-school children. From the results of the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study, both nutrition education and serving more fresh fruits and fresh vegetables during school lunch were shown to help children make healthful choices and to encourage them to eat more fruits and vegetables.

In the Nutrition Education Intervention Study, nutrition education was added to the grade-school curriculum, for the students, the teachers, and the parents. The researcher found that after providing nutrition education on fruits and vegetables for the students, parents, and teachers, consumption of fruits and vegetables did increase in the grade-school children (Ryan, Anderson, and Sherman, 1995). The nutrition education program was designed as a hands-on education program and included nutrition education materials on increasing the consumption of fruits and vegetables and good nutrition. For children in the experimental group the

nutrition education intervention included skill sheets, experiments, games, and activities. The intervention also included unique fruit and vegetable demonstrations, activities, discussions, and taste testing. For grades K through third, a fruit and vegetable puppet show explaining 5 A Day and the importance of fruits and vegetables was presented.

In the Fresh Fruit and Vegetable Intervention Study, the availability of additional quality fresh fruits and fresh vegetables was increased during school lunch. The children were offered a better variety and higher quality of fresh fruits and vegetables with their school lunches. NSLP feeds over 26 million children a balanced meal daily (Price and Kuhn, 1996). Because so many children eat school lunches, the lunchroom is a highly effective environment for providing fresh fruits and fresh vegetables and for evaluating the consumption of fresh fruits and vegetables. This study demonstrated that if fresh fruits and fresh vegetables are offered during school lunch periods, children wasted less of these items. The results showed that the grade-school children consumed a greater percentage and wasted a smaller percentage of fresh fruits and vegetables during school lunch when a wide variety of fresh fruits and vegetables were available.

When comparing the effectiveness of nutrition education and the effectiveness of increased availability of fresh fruits and vegetables, the consumption of fruits and vegetables in the grade-school children was not different. Both interventions increased consumption of 1/4-cup servings of fruits and vegetables in the grade-school children.

Discussion

Ideal Nutrition Program:

From the knowledge gained from conducting the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study, the following suggestions are listed to help develop an ideal nutrition education program. This ideal nutrition education program would have three components:

1. Intervention with the children in the classroom.
2. Intervention in the school lunchroom.
3. Intervention with the parents, teachers, school staff, and school food service personnel.

Classroom intervention

Several nutrition education programs have involved the teacher in the classroom (Contento, Manning, and Shannon, 1992); however, the researcher proposes that a trained teacher/nutrition educator visit the schools and classrooms to provide the nutrition education to the children. In particular, the classroom intervention would begin with a qualified, trained nutrition educator who would visit the schools and teach for one month in each school. This nutrition educator would present the nutrition education program to the children in the classroom. The program would include those activities used in the Nutrition Education Intervention Study. The nutrition education intervention would include skill sheets, experiments, games, and activities. The intervention would also include unique fruit and vegetable demonstrations, activities, discussions, taste testing, and for grades K through third, a fruit and vegetable puppet show explaining 5 A Day and the importance of fruits and vegetables. This

trained nutrition educator will have the proper knowledge, skills, time, and training to enthusiastically present this nutrition education program to the children. This relieves the regular classroom teacher from any pressure to learn the material and schedule this nutrition program into their curriculum. Also children are often enthusiastic and more willing to participate with guest speakers in the classroom. The nutrition education program ideally would be presented to the children before lunch.

Presenting the nutrition education activities before lunch provides the children information on good nutrition and the benefits of eating fresh fruits and fresh vegetables that they can then put into action immediately by eating the fruits and vegetables provided to them during school lunch. The nutrition education program can be continued after lunch. An after-lunch discussion can reinforce good nutrition, highlight what was eaten at lunch and the advantage of eating the fruits and vegetables served during lunch.

School Lunch Intervention

Another component for this ideal nutrition program is to involve school food service. In this program school lunch will serve more, quality fresh fruits and fresh vegetables to the children during school lunch. Before serving the fresh produce during school lunch, the food service educator will provide training to the food service personnel in the schools. This training will emphasize the following:

1. Ordering and handling of fresh fruits and vegetables.
2. Ripening and washing fresh fruits and fresh vegetables.
3. Cutting the fresh fruits and vegetables into small, manageable pieces or slices.
4. Serving fresh fruits and fresh vegetables in small bowls or from self-serve bars.

5. Serving a variety of fresh fruits and fresh vegetables.

6. Allowing the children to choose the fresh fruits and fresh vegetables.

Schools can offset the cost of serving more fresh fruits and fresh vegetables by working with the DOD in purchasing produce. Providing a nutrition education component before serving the fresh fruits and fresh vegetables during school lunch will reinforce the education component by helping the children put into practice this educational piece to eat more fresh fruits and fresh vegetables. Eating more fresh produce can help develop this healthful practice in the children, which can continue throughout their life.

Parent and School Staff Intervention

Many school-based programs include some parent involvement (Contento et al., 1992), because the family plays an important role in shaping children's eating habits. This nutrition education program for the grade-school children will include a parent component. Involving the parents can enhance the desired behavior change of eating more fruits and vegetables daily. This nutrition education program will inform the parents and school staff about the school intervention and provide nutrition education materials for them. These materials will emphasize 5 A Day and the Dietary Guidelines recommendation to include more fruits and vegetables. The information will be presented to the parents at a Parent Teacher Association Meetings (PTA) and in mailings to the parents (to include those who did not attend PTA meetings). The materials will include newsletters, handouts, recipes, and activities to be used at home.

Recommendations

From the results of the nutrition education intervention, the increased availability of fresh fruit and vegetable intervention, and the comparison of the effectiveness of the interventions, the researcher recommends including both nutrition education in the classroom for students and serving fresh fruits and fresh vegetables during school lunch. Information for parents, teachers, and food service personnel should also be provided, emphasizing the health benefits of fruit and vegetable consumption. Possibly, the ideal situation would be to combine a nutrition education component in the classroom with serving quality fresh fruits and fresh vegetables during the school lunch.

The researcher's goal as a nutrition educator is to help improve the eating habits and the health of grade-school children. This can be achieved by providing nutrition education to grade-school children in the classroom, by serving fresh fruits and fresh vegetables during the school lunch, and by involving the parents and school staff. For effective behavior changes the researcher recommends that nutrition educators need to be more than just teachers. Nutrition educators need to be:

1. A resource for the teachers, parents, children, and food service personnel by suggesting materials and resources to them.
2. Accessible for the teachers, parents, children, and food service personnel for questions, training, and teaching.
3. A liaison with the schools, community, and government.
4. Enthusiastic, creative, and professional.
5. Involved with the community and serve on committees.
6. Currently informed in nutrition.

Future Research

The link has been well recognized between diet and chronic disease (U.S. Senate Select Committee, 1977; USDHHS, 1988). Nutrition education is defined as any set of learning experiences designed to facilitate the voluntary adaption of eating and other nutrition-related behaviors conducive to health and well-being (Bedworth and Bedworth, 1992). Little is known about the educational effect of school meals on students. In other words, are students exposed to health-promoting meals and environments and selecting nutritious foods over than those students who are not? (American Dietetic Association, 1995). Nutrition education and a person's nutrition environment are important components in health promotion and disease prevention. Since nutrition education practices have been successful in improving dietary practices (Contento et al., 1995) and changing behavior, the researcher is of the opinion that combining nutrition education with serving fresh fruits and fresh vegetables to grade-school children (environment) helps to improve their dietary habits.

This research examined nutrition education intervention and school lunch intervention separately and then compared the results of the interventions. From these results several factors arose and should be addressed in other research. Future research should:

1. Develop nutrition education programs that are multifaceted and ongoing. Effective nutrition education programs take time to see change and progress. Though observation of the methods and results of the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study the researcher concluded that programs be ongoing to achieve measurable results.

2. Incorporate several components in the nutrition education program. These components should be theory based, contain active and motivational educational strategies, include creative communication techniques, incorporate behavior change strategies, and engage environmental, individual, and community interventions. Based on the Nutrition Education Intervention Study and the Fresh Fruit and Vegetable Intervention Study some activities were effective with some children while other children were effected by other activities. For example, some students were influenced by taste testing the fresh fruits and vegetables while other children learned more from the skill sheets. By having multi components researchers can ensure that they reach many individuals.

3. Incorporate comprehensive nutrition education for specific groups. One-time education programs are ineffective in changing long term behaviors. Extensive nutrition education is needed for prenatal women, infants and mothers, young children, families, teachers, school food service personnel, physicians, other health care professionals, and paraprofessionals, just to mention a few groups. From the Nutrition Education Intervention Study and the researcher found that by focusing on grade-school children materials could be developed specifically for their specific needs and developmental stage.

4. Develop comprehensive nutrition education for communities, including present and new forms of the media. Nutrition education needs to skillfully and creatively use new forms of advanced technology to maintain its effectiveness. As seen in the Nutrition Education Intervention Study using various forms of communication (i.e., newspapers, health fairs, mailings etc.) ensures that researchers reach more individuals. For example, not all people in the Nutrition Education Intervention Study read

the newspaper or attended the health fair. Future nutrition education programs can incorporate new forms of the media (such as the Internet) to reach a different segment of the population.

Dietary habits can effectively be improved through nutrition education combined with environmental factors such as the presence of fresh fruits and vegetables. Comprehensive review of existing literature and future research can lead to new insights on how nutrition educators can continue to improve dietary habits.

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APPENDIX I

Nutrition Education Intervention Study

APPENDIX II

Fresh Fruit and Vegetable Intervention Study

APPENDIX III

**Comparison of the Effectiveness of Nutrition Education and Increased
Availability of Fresh Fruits and Vegetables**

APPENDIX I

Nutrition Education Intervention Study

APPENDIX I: A
Human Subject Approval

JAN 29 1993

Regulatory Committees
Office of Vice President for Research
Fort Collins, CO 80523
(303) 491-6355
FAX (303) 491-6147

MEMORANDUM

TO: Jennifer Anderson
Department of Food Science & Human Nutrition

FROM: LaVina Matzdorff, Administrator *L. Matzdorff*
Human Research Committee

SUBJECT: Protocol No. 92-176H - Improving Nutrition, Diet and
Health: Reducing Cancer Risk Using the 5-A-Day Message

DATE: January 27, 1993

Enclosed is the approval for the above-referenced project.

The Committee did not require that the heads of household be mailed the draft letter. You must, of course, give them that information on the phone, but I am sure you were planning to do that.

xc: Linda Ryan

APPENDIX I: B
Parent Consent Form

Attachment 3

COLORADO STATE UNIVERSITY
INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

TITLE OF PROJECT:

NAME OF PRINCIPAL INVESTIGATOR: Improving Nutrition, Diet and Health: Reducing Cancer Risk Using The 5-A-Day Message.

Name Of Principal Investigator: Dr. Jennifer Anderson

Name OF CO-INVESTIGATOR: Linda Ryan MS RD

CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEMS:
Bonnie Sherman (303) 854-3616

SPONSOR OF PROJECT: Funding Agency or company: Colorado State University

PURPOSE OF THE RESEARCH: State that the study involves research, an explanation of the purposes of the research, the expected duration of the subjects' participation and identification of any procedures which are experimental.

*To promote and demonstrate good nutrition habits which will serve as prevention and protective factor against cancer, thus providing good health.

PROCEDURES/METHODS TO BE USED: Describe the techniques and procedures to be used. If subjects will receive remuneration for participation or will be videotaped or audiotaped, that information must be disclosed. Disposition of the tapes at the end of the study must be divulged. This description must be presented in LAY LANGUAGE so subjects clearly understand how the study is going to be conducted and what will be expected of them.

1. Pre/Post questionnaires in person and by telephone will be administered.
2. 24-Hour diet recall will be administered to children.
3. Educational materials will be distributed to children and adults.

RISKS INHERENT IN THE PROCEDURES: Include a description of any reasonably foreseeable risks or discomforts to the subject.

*No perceived risks.

(Include this statement.) I understand that it is not possible to identify all potential risks in an experimental procedure, but I believe that reasonable safeguards have been taken to minimize both the known and the potential, but unknown, risks.

BENEFITS: Describe any benefits to the subject or to others which may reasonably be expected from the research.

- * Promote good nutrition habits as a protective approach to disease prevention and good health.
- * Reduce health care costs through improved health status.
- * Attain good eating patterns specifically more fruit and vegetable consumption which will be continued through life.

CONFIDENTIALITY: Include a statement describing the extent to which confidentiality of records identifying the subject will be maintained. If the study involves an investigational new drug or an investigational new device, the subject should be advised of the possibility that the Food and Drug Administration may inspect the records.

*Participating adults and children will not be identified individually or published individually.

FINANCIAL OBLIGATION: (This statement must be included on the form.)

Colorado State University is a publicly funded institution of higher education and, because it is a state institution, recourse for injuries sustained during the course of this research may be limited under a Colorado law known as the Colorado Governmental Immunity Act (Colorado Revised Statutes, Section 24-10-101, et seq.). If injuries should occur which the subject believes are the responsibility of Colorado State University or its employees, the University advises the individual to seek independent legal counsel.

Page ___ of ___ Subject initials _____ Date _____

(Page number, space for subject initials and date must appear on each page.)

In addition, under Colorado law, any claim against the University must be filed with the Risk Management Liaison Office at Colorado State University, within 180 days from the date of the injury. In light of these laws, participants are encouraged to evaluate their own health and disability insurance to determine whether coverage exists for any injuries sustained during the course of research as it may be necessary to rely on individual coverage for any such injuries.

PARTICIPATION: (Include these paragraphs with minimal modification.)

I understand that my participation in this research is voluntary. If I decide to participate in the study, I may withdraw my consent and stop participating at any time without penalty or loss of benefits to which I am otherwise entitled.

I have read and understand the information stated and willingly sign this consent form. My signature also acknowledges that I have received, on the date signed, a copy of this document containing _____ pages.

Subject name (printed)

Subject signature

Date

Investigator or co-investigator
signature

Date

PARENTAL SIGNATURE FOR MINOR SUBJECT

I authorize _____ (print name) to become a subject for the described research. The nature and general purpose of the project has been satisfactorily explained to me by _____ and I am satisfied that proper precautions are to be observed.

Minor's date of birth

Parent/Guardian name (printed)

Parent/Guardian signature

Date

APPENDIX I: C

24-Hour Recall Form

APPENDIX I: D

Food Habit Questionnaire

APPENDIX I: E

Calculated Servings for the Nutrition Education Intervention Study,
24-Hour Food Recall, Grade-School Children

Appendix E

Calculated servings* for the Nutrition Education Intervention Study,
24-hour Food Recall Grade-School Children, Experimental Group, n=29

Student	Pre 24-hour	Post 24-hour	Difference
1	1	1	0
2	4	5	1
3	2	2	0
4	3	4	1
5	2	3	1
6	2	4	2
7	2	2	0
8	2	2	0
9	2	5	3
10	2	3	1
11	5	6	1
12	2	4	2
13	0	1	1
14	3	5	2
15	4	6	2
16	2	6	4
17	0	2	2
18	3	4	1
19	3	4	1
20	3	6	3
21	7	10	3
22	2	3	1
23	1	2	1
24	0	1	1
25	2	3	1
26	3	5	2
27	3	5	2
28	3	3	0
29	3	4	1

* Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, and 3/4-cup fruit or vegetable juice.
See page 32 for rounding technique.

Appendix E

Calculated servings* for the Nutrition Education Intervention Study,
24-hour Food Recall Grade-School Children, Control Group, n=19

Students	Pre 24-hour	Post 24-hour	Difference
1	3	3	0
2	3	2	-1
3	1	1	0
4	2	2	0
5	1	1	0
6	2	3	1
7	2	1	-1
8	6	2	-4
9	2	1	-1
10	2	0	-2
11	3	0	-3
12	2	2	0
13	3	2	-1
14	4	5	1
15	2	2	0
16	3	2	-1
17	1	1	0
18	1	0	-1
19	0	1	1

* Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, and 3/4-cup fruit or vegetable juice.
See page 32 for rounding technique.

APPENDIX I: F

Reported Servings for the Nutrition Education Intervention Study,
Questionnaire, Grade-School Children

Appendix F

Reported servings* for the Nutrition Education Intervention Study,
Questionnaire Grade-School Children, Experimental Group, n=29

Students	Pre Questionnaire	Post Questionnaire	Difference
1	5	3	-2
2	4	5	1
3	3	5	2
4	2	5	3
5	4	5	1
6	2	2	0
7	6	3	-3
8	4	6	2
9	5	3	-2
10	5	4	-1
11	7	9	2
12	3	5	2
13	2	2	0
14	3	5	2
15	4	6	2
16	5	6	1
17	2	4	2
18	2	7	5
19	3	4	1
20	3	4	1
21	8	8	0
22	2	3	1
23	1	2	1
24	2	4	2
25	1	3	2
26	3	5	2
27	8	8	0
28	8	8	0
29	7	7	0

* Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, and 3/4-cup fruit or vegetable juice.
See page 32 for rounding technique.

Appendix F

Reported servings* for the Nutrition Education Intervention Study,
Questionnaire Grade-School Children, Control Group, n=19

Students	Pre Questionnaire	Post Questionnaire	Difference
1	3	3	0
2	7	3	-4
3	4	3	-1
4	3	4	1
5	3	2	-1
6	2	2	0
7	1	1	0
8	5	3	-2
9	2	1	-1
10	3	2	-1
11	3	3	0
12	2	1	-1
13	2	2	0
14	2	4	2
15	3	4	1
16	3	3	0
17	2	1	-1
18	2	3	1
19	2	2	0

* Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, and 3/4-cup fruit or vegetable juice.
See page 32 for rounding technique.

APPENDIX I: G

Telephone Survey

Phone number _____

Town _____

Date _____

Questionnaire For: Nutrition Education Project

1) Do you eat fruits, vegetables or juice at each meal? Yes No

2) Do you eat fruits, vegetables, or juice between meals? Yes No

3) How many servings of fruit do you eat during a day? Fruit

4) How many servings of vegetable do you eat in a day? Vegetable

5) What fruits you eat. (you can mention more than one)

Apple _____

Orange _____

Banana _____

Grapefruit _____

Peach _____

Tomato _____

Pear _____

Applesauce _____

Other _____

6) What vegetables you eat. (you can mention more than one)

Corn _____

Green beans _____

Beets _____

Peas _____

Carrots _____

Broccoli _____

Cauliflower _____

Potatoes _____

Other _____

7) What juice you drink. (you can mention more than one)

Orange juice _____

Apple juice _____

Grape juice _____

Tomato juice _____

V- juice _____

Other _____

APPENDIX I: H

Reported Servings for the Nutrition Education Intervention Study,
Telephone Survey

Appendix H

Reported servings* for the Nutrition Education Intervention Study,
Telephone Survey, Experimental Group, n=78

Community Member	Pre Questionnaire	Post Questionnaire	Difference
1	3	3	0
2	0	1	1
3	5	3	-2
4	4	3	-1
5	1	1	0
6	4	5	1
7	4	3	-1
8	3	4	1
9	2	4	2
10	3	5	2
11	4	6	2
12	7	6	-1
13	3	3	0
14	4	4	0
15	2	2	0
16	2	4	2
17	2	3	1
18	5	10	5
19	4	4	0
20	2	4	2
21	4	6	2
22	6	4	-2
23	4	6	2
24	4	3	-1
25	3	5	2
26	4	4	0
27	4	5	1
28	4	5	1
29	4	2	-2
30	3	3	0
31	1	3	2
32	3	4	1
33	4	3	-1
34	4	5	1
35	5	4	-1
36	7	8	1
37	5	6	1
38	1	2	-1
39	5	5	0
40	3	2	-1

Appendix H cont.

Reported servings* for the Nutrition Education Intervention Study,
Telephone Survey, Experimental Group, n=78

Community Member	Pre Questionnaire	Post Questionnaire	Difference
41	2	5	3
42	3	2	-1
43	6	3	-3
44	3	3	0
45	2	8	6
46	3	4	1
47	1	2	1
48	4	4	0
49	2	2	0
50	1	1	0
51	3	4	1
52	2	2	0
53	5	2	-3
54	5	4	-1
55	3	4	1
56	3	4	1
57	2	2	0
58	4	3	-1
59	1	3	2
60	2	8	6
61	5	3	-2
62	3	4	1
63	2	4	2
64	4	5	1
65	4	4	0
66	2	3	1
67	2	4	2
68	2	5	3
69	5	5	0
70	3	3	0
71	3	2	-1
72	2	6	4
73	2	5	3
74	3	4	1
75	5	3	-2
76	4	5	1
77	3	5	2
78	3	4	1

* Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, and 3/4-cup fruit or vegetable juice. See page 32 for rounding technique.

Appendix H

Reported servings* for the Nutrition Education Intervention Study,
Telephone Survey Control Group, n=46

Community Member	Pre Questionnaire	Post Questionnaire	Difference
1	3	2	-1
2	3	4	1
3	4	4	0
4	4	8	4
5	5	5	0
6	5	4	-1
7	5	4	-1
8	3	5	2
9	8	8	0
10	4	4	0
11	3	3	0
12	4	4	0
13	7	6	-1
14	4	4	0
15	3	4	1
16	2	5	3
17	3	4	1
18	6	6	0
19	5	4	-1
20	5	6	1
21	2	2	0
22	8	4	-4
23	2	2	0
24	4	4	0
25	5	4	-1
26	4	4	0
27	3	3	0
28	5	5	0
29	6	5	-1
30	4	4	0
31	4	4	0
32	5	4	-1
33	3	2	-1
34	5	4	-1
35	5	5	0
36	3	2	-1
37	4	2	-1
38	3	4	1
39	2	3	1
40	3	4	1

Appendix H cont.

Reported servings* for the Nutrition Education Intervention Study,
Telephone Survey Control Group, n=46

Community Member	Pre Questionnaire	Post Questionnaire	Difference
41	4	4	0
42	5	6	1
43	2	5	3
44	5	4	-1
45	2	3	1
46	5	4	-1

* Serving size is 1/2-cup of cooked or raw fruits and vegetables, 1 cup raw leafy vegetables, and 3/4-cup fruit or vegetable juice.
See page 32 for rounding technique.

APPENDIX I: I

Journal Article

The Effect of Nutrition Education on Improving Fruit and Vegetable
Consumption of Youth

Linda Ryan, M.S., R.D.
Ph.D. Candidate

Jennifer Anderson, Ph.D., R.D.
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Food and Nutrition Extension Specialist
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Department of Food Science and Human Nutrition
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Bonnie M. Sherman, M.A.
Consumer and Family Education/4-H Youth Agent
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Holyoke, Colorado

The high rate of cancer deaths in two rural towns in northeast Colorado prompted community action and Extension intervention. Further investigation confirmed that these Colorado communities did have an increased incidence of cancer above the state norm. Further investigation revealed an increased cancer incidence (14% above the state norm) in their county (American Cancer Society, 1993). Citizens, aware that nutrition and eating practices could lower cancer risk, contacted their Colorado State University Cooperative Extension agent for program possibilities. A team was formed to work in these remote small towns to improve nutrition, diet, and health using the 5 A Day message. The 5 A Day campaign was developed by NCI (National Cancer Institute) and PBHF (Produce for Better Health Foundation) in 1991 ("5 A Day is Underway!", 1991). The 5 A Day program is designed to increase consumption of fruits and vegetables to at least five servings a day to improve the health of Americans. A small initiative grant from Colorado Cooperative Extension was awarded for this

nutrition education intervention program. The nutrition study focused in grade schools, targeting children aged 5-11. The program was designed to be a hands-on education program and included: nutrition education materials in 5 A Day, skill sheets, fruit and vegetable demonstrations, related activities, experiments, puppet shows, and behavior simulation on good nutrition.

Also included was nutrition education for the residents of the community. Nutrition information was provided through local newspaper, grocery stores, and county fairs. Of the two towns in the county, Holyoke received the education program and Haxtun served as the control town. The 40-mile separation between towns isolated the control and intervention group.

This article outlines the nutrition education program implemented by a team of Colorado State University Cooperative Extension faculty and students. An evaluation was conducted to test the effectiveness of the intervention.

Methods

In April 1992, a community-wide meeting was held in the town of Holyoke. Fifteen concerned residents attended. A set of open-ended questions was used to guide the discussion. The consensus of the residents and researchers was that nutrition education should be delivered first in the schools targeting the grade-school children. Community information would later be disseminated through local newspapers, the grocery stores, and health fairs.

School Program

A teacher's workshop was held with University Continuing Education credit available for teacher re-certification. The workshop took place in February 1993. At this workshop, the teachers were educated on the 5 A Day nutrition education program and details were presented on the role of nutrition in cancer prevention. Specific nutrition education materials were developed by Colorado State University doctoral student for use in the classroom. These materials, activities, and intervention plans were presented at the day-long workshop. For children in the experimental town of Holyoke, the nutrition intervention included skill sheets, experimentation, games, and activities. The intervention also included unique fruit and vegetable demonstrations, activities, discussions, and taste testing. For grade K-3, a fruit and vegetable puppet show explaining 5 A Day and the importance of fruits and vegetables was presented.

Permission slips for children participating in the program were obtained from parents. Pre- and post-questionnaires to assess fruit and vegetable consumption were developed and evaluated for appropriateness. All children in fourth and fifth grades in both the experimental and control towns completed a 24-hour food recall and a pre- and post- food habit questionnaire to assess the amounts and types of fruits and vegetables typically consumed.

During the intervention period, a Parent Teacher Association (PTA) meeting was held in the experimental town of Holyoke to present a workshop for parents on nutrition and cancer. Also presented were highlights of their children's involvement in the school program. At the end of the school year and after completion of the nutrition education program, a meeting was held with the teachers to gather opinions, judge the students' posters and class projects, and plan for the next school year.

Community Program

Before the community program was implemented, a randomized community telephone survey was conducted in both rural towns by the Colorado State University Cooperative Extension agent and staff. A telephone directory for the towns of Holyoke and Haxtun was used. Every fifth heads-of-household was contacted by the Extension office staff under the direction of the agent and Colorado State doctoral student. The result was 5% of the population was surveyed. The survey measured fruit and vegetable consumption of the heads-of-household. After this pre- survey, materials on 5 A Day were distributed in the town of Holyoke through the newspaper, the mail, the grocery store, and local health fair. Four months after the intervention, at the end of the summer and before school started, a post-telephone survey to the same heads-of-household was completed. A follow-up town meeting was held in the community to solicit their opinions.

Results of the Study

School Program

Results from the children's 24-hour food recall and pre- and post-questionnaires were gathered and two-tailed t-tests for association was performed. A total of 48 children participated (n=29 pre and post Holyoke intervention, experimental group and n=19 pre and post for Haxtun children, control group).

Analysis of the 24-hour food recall for the Holyoke children (n=29) showed that, based on the pre-24-hour food recall, 2.45 mean servings of fruits and vegetables were consumed per day. Post assessment showed 3.82 mean servings per day for an increase of 1.37 mean servings of fruits and vegetables per day. The analysis of the Holyoke children's questionnaires determined consumption to be 3.93 mean servings of fruits and vegetables per day pre-questionnaire and 4.86 mean servings per day post-questionnaire for an increase of 0.93 mean serving of fruits and vegetables per day after intervention.

For the control school's (n=19) 24-hour food recall, 2.26 mean servings of fruits and vegetables were reported for the pre-24-hour food recall and 1.63 mean servings of fruits and vegetables were reported for the post-24-hour food recall. An increase of 0.63 mean serving per day. In the control school the pre-questionnaire showed 2.84 mean servings and post-questionnaire showed 2.47, a decrease of -0.37 mean serving of fruits or vegetables.

Based on the two-tailed t-test, the intervention was shown to have a significant effect on fruit and vegetable consumption in the grade-school children for the 24-hour food recall and for the pre- and post-questionnaire at $p \geq 0.05$. No significant difference was shown in the grade-school children, control group. This means the intervention caused a significant increase in fruit and vegetable consumption among the grade-school children

Telephone survey analysis

Total respondents were 124 heads-of-household: n=78 from Holyoke and n=46 from Haxtun. The telephone survey showed the average number of fruits and vegetables eaten by heads-of-households in Holyoke prior to the intervention was 3.28 mean servings a day. Post-intervention showed 3.94 mean servings, a significant ($p \leq 0.05$) increase of 0.62 mean serving of fruits and vegetables per day. For Haxtun, the control town, the average number of fruits and vegetables pre-study was 4.13 and post-study was 4.15, an increase of 0.02 mean serving per day. Haxtun showed no significant difference at $p \geq 0.05$.

Conclusions and Discussion

Nutrition education materials and program were developed. The nutrition education program was implemented and the results of the nutrition education intervention were compared. Based on statistical analysis, fruit and vegetable consumption increased 1.37 mean servings per day by the grade-school children for the 24-hour food recall and 0.93 for the self-reported questionnaire ($p \leq 0.05$). The telephone survey results showed an increase of 0.62 mean servings in fruits and vegetables consumed in the intervention town of Holyoke. This increase is within the national norm of an increased 0.5 serving following a nutrition education intervention (USDHHS Public Health Service, 1994).

Teachers indicated that the students enjoyed the classroom materials, activities, and demonstrations. Teachers also indicated they would like to continue using the 5 A Day nutrition education material in their classrooms. Teachers and parents felt that the children had an increased awareness of fruits and vegetables in their diet. The residents of Holyoke stated they liked the newspaper articles, pamphlets, and demonstrations and would like the 5 A Day nutrition and cancer prevention program to continue. As a result, they wanted the nutrition intervention in the school to continue and additional information provided for the families.

The study did determine an increase in the amount of fruits and vegetables consumed. In addition, this program provided a unique opportunity of Cooperative Extension agents to become involved in national nutrition education campaigns. The response to this effort, especially in rural areas is encouraging. As a result of this study, there was a request for additional nutrition education for school food service personnel. This provides continuing opportunity for Cooperative Extension to become more involved with the schools and the education of students, teachers, and food service personnel.

References

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5 A Day is underway: President Bush's principal advisor on consumer affairs helps launch 5 A Day. NCI commits \$27 million to mobilize public health community. (1991, December). The 5 A Day News. 1,1-4.

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APPENDIX II

Fresh Fruit and Vegetable Intervention Study

APPENDIX II: J
Schools Participating

Experimental Group

Adams 12 School District: Broomfield, Denver, Northglenn, Thornton and Westminster, Colorado

Schools

Centennial Elementary
Coronado Elementary
McElwain Elementary
Northmor Elementary
Northstar Elementary
Riverdale Elementary
Thornton Elementary

Adams 14 School District: Commerce City, Colorado

Schools

Alsup Elementary
Kemper Elementary
Rosehill Elementary

Arapahoe School district: Littleton, Colorado

Schools

Centennial Elementary
East Elementary
Eugene Elementary
Peabody Elementary
Whitman Elementary

Denver School District: Denver, Colorado

Schools

Johnson Elementary
Knight Academy Elementary
Marama Elementary
Palmer Elementary

Douglas School District: Parker, Colorado

Schools

Northeast Elementary
Pine Lane Primary Elementary
Pine Lane Intermediate Elementary

Poudre School District: Fort Collins, Colorado

Schools

Lopez Elementary
McGraw Elementary
Olander Elementary
Riffenburgh Elementary
Werner Elementary

Pueblo School District: Pueblo, Colorado

Schools

Goodnight Elementary
Hellbeck Elementary

Control Group

Boulder School District: Broomfield, Boulder, Lafayette, Louisville and Nederland, Colorado

Schools

Birch Elementary
Coal Creek Elementary
Columbine Elementary
Crestview Elementary
Douglas Elementary
Emerald Elementary
Fireside Elementary
Foothill Elementary
Heatherwood Elementary
Kohl Elementary
Lafayette Elementary
Louisville Elementary
Majestic Height Elementary
Mapleton Elementary
Martin Park Elementary
Mesa Elementary
Pioneer Elementary
Ryan Elementary
Uni Hill Elementary
Washington Elementary
Whittier Elementary

Thompson School District: Loveland and Berthoud, Colorado

Schools

Berthoud Elementary
B.F. Kitchen Elementary
Big Thompson Elementary
Carrie Martin Elementary
Centennial Elementary
Cottonwood Plains Elementary
Garfield Elementary
Laurene Edmondson Elementary
Lincoln Elementary
Mary Blair Elementary
Namaqua Elementary
Sahah Milner Elementary
Stansberry Elementary
Truscot Elementary
Van Buren Elementary
Winone Elementary

APPENDIX II: K
Student Enrollment

Appendix K

Student Enrollment by Grade, Experimental Schools n=29

School	Total No. Students Enrolled	Grades					
		1	2	3	4	5	6
1	480	100	100	100	90	90	—
2	274	54	50	50	72	48	—
3	400	100	75	60	90	75	—
4	397	88	88	80	69	72	—
5	404	86	74	92	78	74	—
6	564	112	115	101	115	121	—
7	319	71	69	68	55	56	—
8	380	76	76	76	76	76	—
9	330	60	66	60	73	71	—
10	364	75	67	73	82	67	—
11	451	83	109	100	84	75	—
12	430	89	88	77	90	86	—
13	383	72	64	95	71	81	—
14	338	75	66	63	74	60	—
15	310	75	66	55	62	52	—
16	279	51	40	65	69	54	—
17	462	96	96	90	90	90	—
18	376	88	81	61	68	78	—
19	254	68	50	50	41	45	—
20	608	—	—	—	226	192	190
21	571	188	192	191	—	—	—
22	570	—	—	—	190	190	190
23	444	69	69	80	82	67	77
24	429	66	75	72	66	75	75
25	476	86	69	81	77	83	80
26	381	57	66	69	54	66	69
27	511	100	100	85	65	65	96
28	288	57	45	65	70	51	—
29	326	75	68	56	61	66	—

Appendix K

Student Enrollment by Grade, Control Schools n=37

School	Total No. Students Enrolled	Grades					
		1	2	3	4	5	6
1	446	87	81	93	87	98	—
2	544	113	119	120	105	87	—
3	362	82	77	62	75	66	—
4	455	74	105	78	103	95	—
5	321	69	64	58	67	63	—
6	480	95	91	90	90	114	—
7	497	106	93	111	95	92	—
8	453	83	97	105	90	78	—
9	436	84	85	88	89	90	—
10	583	106	110	120	123	124	—
11	379	90	78	70	70	71	—
12	450	80	94	86	109	81	—
13	135	30	25	26	19	35	—
14	135	30	31	23	23	28	—
15	392	92	68	84	72	76	—
16	336	65	70	62	75	64	—
17	346	—	—	110	109	127	—
18	424	77	82	87	91	87	—
19	292	59	66	54	54	59	—
20	235	50	49	54	56	26	—
21	245	52	46	50	54	43	—
22	415	71	74	80	92	98	—
23	255	44	53	44	54	60	—
24	272	52	54	50	58	58	—
25	262	49	45	65	52	51	—
26	246	47	40	55	52	52	—
27	267	63	64	43	49	48	—
28	255	53	45	51	44	62	—
29	229	50	45	41	51	42	—
30	268	50	56	48	51	63	—
31	425	77	102	72	108	66	—
32	420	68	78	83	85	106	—
33	351	71	54	72	79	75	—
34	261	63	48	47	53	50	—
35	193	31	38	31	54	39	—
36	264	38	62	48	59	57	—
37	211	40	37	50	43	41	—

APPENDIX II: L
Human Subject Approval

MAR 07 1995

**Colorado
State
University**

Office of Regulatory Compliance
Office of Vice President for Research
Fort Collins, CO 80523
(303) 491-1563
FAX (303) 491-1958

MEMORANDUM

TO: Jennifer Anderson
Food Science and Human Nutrition

FROM: Celia S. Walker, Director
Office of Regulatory Compliance *Celia S. Walker*
Human Research Committee

SUBJECT: PROJECT APPROVAL
Title: Evaluating the Fresh Fruit and Vegetable Pilot Project in
Colorado
Protocol No.: 95-042H
Funding Agency: USDA
Funding Agency Deadline: N/A

DATE: March 2, 1995

The above-referenced project was approved by the Human Research Committee on March 1, 1995 for the period March 1, 1995 through March 1, 1996. Because of the nature of this research, it will not be necessary to obtain a signed consent form.

A status report of this project will be required within a 12-month period from the date of approval. The necessary form (H-101) will be mailed to you prior to that date.

It is the responsibility of the investigator to immediately inform the Committee of any serious complications, unexpected risks or injuries resulting from this research.

It is also the investigator's responsibility to notify the Committee of any changes in experimental design or consent procedures (file Form H-101).

Any questions about the Committee's action on this project should be directed to me.

xc: Linda Ryan

APPENDIX II: M

Training Agenda

MARCH 14, 1995

School Lunch Training Day

- 9:00 - 11:00 Introductions and Procedures
- 11:15 - 12:00 School Lunch Observation at Centennial Elementary
(3306 W. Berry Avenue)
- 12:00 - 12:30 Lunch at Centennial Elementary School
- 1:00 - 2:00 Demonstrations, Practice, Questions and Wrap-up.

APPENDIX II: N

School Lunch Procedure Check List

SCHOOL LUNCH CHECK LIST

Prior to school lunch :

- Arrive at least 30 minutes prior to school lunch.
- Enter through the school front door.
- Stop by the school office and introduce yourself.
- Locate the food service manager.
- Introduce yourself to the school food service manager/staff.
- Arrange tables for waste fruits and vegetables.
- Gather 4 to 6 bowls for waste fruits and vegetables.
- Gather scales: (1) ounce scale.
- (2) pound scale.

Lunch Type A - Served fruit & vegetable

Weigh the containers of fruits and vegetables.

- I. Empty weight of:
 - a. metal/plastic steam table pans.
 - b. plastic bowls.
- II. Full weight of:
 - a. metal/plastic pans with fruits.
 - b. metal/plastic pans with vegetables.
 - c. plastic bowls with fruits.
 - d. plastic bowls with vegetables.
 - e. serving size in weight used for fruits/vegs.

Lunch Type B - Preportion fruit & vegetable

Weigh the containers of fruits and vegetables.

- I. Empty weight of:
 - a. small plastic/foam bowls.
- II. Full weight of:
 - a. 5 small plastic/foam bowls with fruit & no juice.
 - b. 5 small plastic/foam bowls with veg. no juice.

Count the number of preportioned

- a. fruit bowls.
- b. vegetable bowls.

Lunch C - Fruit & vegetable self-serve bar

Weigh the containers of fruits and vegetables.

- I. Empty weight of:
 - a. metal/plastic pans in fruit/veg. self-serve bar.
- II. Full weight of:
 - a. metal/plastic pans with fruits.
 - b. metal/plastic pans with vegetables.
- III. Count pieces of large fruit & vegetables.

Lunch D

I. Any combination of lunch A, B, C.

During School lunch:

Observe the children in the lunch room; is the day:
normal.

are they rushed.

was lunch cut short/cancelled.

Any posters on fruits and vegetables in lunch room.

Gather the trays from the children as they discard lunch.

Collect all the fruits, vegetables and salads in bowls.

Separate the fruits from the vegetables.

After School lunch:

Lunch A

Weigh the fruits and vegetables left in steam pans.

Lunch B

Count the number of fruits or vegetables bowls left.

Lunch C

Weigh the fruits and vegetables left on the self-serve bar.

Lunch A, B, C, D-Procedure for Weight Waste

Weigh all the like fruits together.

Weigh all the edible fruit portions together.

Weigh all the fruit rinds & seeds together.

Wash off any salad dressing on lettuce and vegetables.

Weigh all the like vegetables together.

Weigh all the salad together.

Write out the menu served that day

a. main entree

b. grain

c. milk

d. vegetable (canned, fresh, frozen)

e. fruit (canned, fresh, frozen)

Number of school lunches served that day.

Clean up, Thank you and Good-byes.

APPENDIX II: O

School Lunch Project Weight Forms

School Lunch Project

Monitor name _____

Today's date _____

School evaluating _____

School full address with zip code _____

School phone number _____

Food service manager name _____

Today's menu

entree _____ serving size _____

grain _____ serving size _____

milk _____ serving size _____

fruit

1 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

2 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

3 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

4 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

5 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

vegetable

1 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

2 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

3 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

4 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

5 _____ serving size weight _____ pieces _____ fresh _____ can _____ froz _____

Number of School Lunches served _____

Number of free & reduced lunches served _____

Number of children who **did not** take any fruits or vegetables _____

Lunch A - Served

Weights prior to lunch:

Pan or bowl 1 name _____ weight _____
Pan or bowl 2 name _____ weight _____
Pan or bowl 3 name _____ weight _____
Pan or bowl 4 name _____ weight _____
Pan or bowl 5 name _____ weight _____
Pan or bowl 6 name _____ weight _____
Pan or bowl 7 name _____ weight _____
Pan or bowl 8 name _____ weight _____
Pan or bowl 9 name _____ weight _____

Weights after lunch:

Pan or bowl 1 name _____ weight _____
Pan or bowl 2 name _____ weight _____
Pan or bowl 3 name _____ weight _____
Pan or bowl 4 name _____ weight _____
Pan or bowl 5 name _____ weight _____
Pan or bowl 6 name _____ weight _____
Pan or bowl 7 name _____ weight _____
Pan or bowl 8 name _____ weight _____
Pan or bowl 9 name _____ weight _____

Lunch B - Preportion

Number of small bowls prior to school lunch:

Fruit 1 name _____ total number of bowls _____

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Fruit 2 name _____ total number of bowls _____

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Fruit 3 name _____ total number of bowls _____

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Fruit 4 name _____ total number of bowls _____

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Fruit 5 name _____ total number of bowls _____

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Number of small bowls prior to school lunch:

Vegetable 1 name _____ total number of bowls__

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Vegetable 2 name _____ total number of bowls__

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Vegetable 3 name _____ total number of bowls__

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Vegetable 4 name _____ total number of bowls__

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Vegetable 5 name _____ total number of bowls__

weight 1 _____ # pieces _____

weight 2 _____ # pieces _____

weight 3 _____ # pieces _____

weight 4 _____ # pieces _____

weight 5 _____ # pieces _____

Average weight _____

Number of small bowls after school lunch:

Fruit 1 name _____ number of bowls _____
Fruit 2 name _____ number of bowls _____
Fruit 3 name _____ number of bowls _____
Fruit 4 name _____ number of bowls _____
Fruit 5 name _____ number of bowls _____
Fruit 6 name _____ number of bowls _____

Vegetable 1 name _____ number of bowls _____
Vegetable 2 name _____ number of bowls _____
Vegetable 3 name _____ number of bowls _____
Vegetable 4 name _____ number of bowls _____
Vegetable 5 name _____ number of bowls _____
Vegetable 6 name _____ number of bowls _____

Lunch C - Fruit & vegetable self-serve bar

Weights prior to lunch:

Pan 1 name_____ weight_____ number of pieces____
Pan 2 name_____ weight_____ number of pieces____
Pan 3 name_____ weight_____ number of pieces____
Pan 4 name_____ weight_____ number of pieces____
Pan 5 name_____ weight_____ number of pieces____
Pan 6 name_____ weight_____ number of pieces____
Pan 7 name_____ weight_____ number of pieces____
Pan 8 name_____ weight_____ number of pieces____
Pan 9 name_____ weight_____ number of pieces____

Weights after school lunch:

Pan 1 name_____ weight_____ number of pieces____
Pan 2 name_____ weight_____ number of pieces____
Pan 3 name_____ weight_____ number of pieces____
Pan 4 name_____ weight_____ number of pieces____
Pan 5 name_____ weight_____ number of pieces____
Pan 6 name_____ weight_____ number of pieces____
Pan 7 name_____ weight_____ number of pieces____
Pan 8 name_____ weight_____ number of pieces____
Pan 9 name_____ weight_____ number of pieces____

Waste weights

Name of fruit (all)Weight

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

Name of fruit (edible part)Weight

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

Name of fruit (skin only)Weight

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

Waste weights

Name of vegetable (all) Weight

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

Name of vegetable (edible part) Weight

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

Name of vegetable (skin only) Weight

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

Salad Weight

1	_____
2	_____

APPENDIX II: P

Demographic Data on Individual School Visits

Appendix P

Demographic Data On Individual School Visits, Experimental Group n=37

Visit	Total No. enrolled	No.Children took school lunch	% took sch lunch	No. Children took f & v	%Free & Reduced
1	480	351	73	130	36
2	274	197	72	54	48
3	274	227	83	165	48
4	400	268	67	165	48
5	400	271	68	136	48
6	397	250	63	125	11
7	397	232	58	128	11
8	404	226	56	182	15
9	564	440	78	322	39
10	319	318	99	307	39
11	380	378	99	230	82
12	330	193	58	148	54
13	364	363	99	351	79
14	451	351	78	302	18
15	451	360	80	261	18
16	430	429	99	402	71
17	383	382	99	279	68
18	383	268	70	123	79
19	310	265	85	265	77
20	279	243	87	231	62
21	462	274	59	266	37
22	376	234	62	173	18
23	254	183	72	118	78
24	254	183	72	174	78
25	608	250	41	148	6
26	571	229	40	118	7
27	570	225	39	98	10
28	570	162	28	86	10
29	444	225	51	210	12
30	429	177	41	149	36
31	476	240	50	240	26
32	476	223	47	216	26
33	381	132	35	122	41
34	381	152	40	145	41
35	511	126	25	101	29
36	288	276	96	266	68
37	327	263	80	259	63

Appendix P

Demographic Data On Individual School Visits, Control Group n=37

Visit	Total No. enrolled	No. Children took school lunch	% took sch lunch	No. Children took f & v	%Free & Reduced
1	446	238	53	238	16
2	544	332	61	332	5
3	362	251	69	251	56
4	455	139	30	24	24
5	321	117	36	117	11
6	480	275	57	275	38
7	497	263	53	215	4
8	453	110	24	107	6
9	436	316	73	316	15
10	583	284	49	284	13
11	379	201	53	189	50
12	450	248	55	176	20
13	135	101	75	101	21
14	135	62	46	57	40
15	392	263	67	263	32
16	336	198	59	195	5
17	346	221	64	221	66
18	424	239	56	239	34
19	292	114	39	114	32
20	235	169	72	139	79
21	245	190	77	190	69
22	415	289	70	283	25
23	255	179	70	174	45
24	272	152	56	152	30
25	262	179	68	163	41
26	246	146	59	128	17
27	267	196	73	195	42
28	255	206	81	198	44
29	229	171	75	165	43
30	268	162	60	162	44
31	425	234	55	224	32
32	420	215	51	215	16
33	351	242	69	225	40
34	261	152	58	150	29
35	193	163	84	159	60
36	264	125	47	122	30
37	211	177	84	163	63

APPENDIX II: Q

Fruit and Vegetable Consumption by School Districts

Appendix Q

Fruit and Vegetable Consumption by School District: Experimental Group

School District	Ounces consumed	# Schools	# Visits	# Took F & V
Adams #12	Ounces	n = 7	n = 8	2323
Fresh Fruit Weight	2376			
Canned Fruit Weight	1027			
Fresh Vegetable Weight	1141			
Canned Vegetable Weight	146			
Total	4690			
Adams #14	Ounces	n = 3	n = 3	667
Fresh Fruit Weight	710			
Canned Fruit Weight	566			
Fresh Vegetable Weight	269			
Canned Vegetable Weight	0			
Total	1545			
Arapahoe #6	Ounces	n = 5	n = 8	1085
Fresh Fruit Weight	730			
Canned Fruit Weight	229			
Fresh Vegetable Weight	389			
Canned Vegetable Weight	135			
Total	1483			
Denver	Ounces	n = 4	n = 5	962
Fresh Fruit Weight	478			
Canned Fruit Weight	308			
Fresh Vegetable Weight	300			
Canned Vegetable Weight	63			
Total	1149			
Douglas	Ounces	n = 3	n = 4	450
Fresh Fruit Weight	563			
Canned Fruit Weight	184			
Fresh Vegetable Weight	400			
Canned Vegetable Weight	0			
Total	1147			
Poudre	Ounces	n = 5	n = 7	1183
Fresh Fruit Weight	1181			
Canned Fruit Weight	806			
Fresh Vegetable Weight	823			
Canned Vegetable Weight	141			
Total	2951			
Pueblo	Ounces	n = 2	n = 2	525
Fresh Fruit Weight	188			
Canned Fruit Weight	319			
Fresh Vegetable Weight	303			
Canned Vegetable Weight	0			
Total	810			
TOTAL	13775	29	37	7195

Appendix Q

Fruit and Vegetable Consumption by School District: Control Group

School District	Ounces consumed	#Schools	# Visits	#Took F & V
Boulder	Ounces	n = 21	n = 21	4039
Fresh Fruit Weight	10			
Canned Fruit Weight	3750			
Fresh Vegetable Weight	505			
Canned Vegetable Weight	1496			
Total	5761			
Thompson	Ounces	n = 16	n = 16	2878
Fresh Fruit Weight	134			
Canned Fruit Weight	3718			
Fresh Vegetable Weight	166			
Canned Vegetable Weight	1726			
Total	5744			
TOTAL	11505	37	37	6917

APPENDIX II: R

Fruit and Vegetable Items Listed on School District Lunch Menus For
April 1994, 1995, and 1996

Appendix R

Fruit and Vegetable Items Listed on School District Lunch Menus for April 1994, 1995, and 1996, for the Experimental Group*

		No. Listings 1994 21 days Pre-intervention	No. Listings 1995 20 days Intervention	No. Listings 1996 21 days Post-intervention
School District				
1	Fresh F & V	10	18	21
	Canned F & V	15	0	0
2	Fresh F & V	9	21	23
	Canned F & V	20	6	8
3	Fresh F & V	12	25	19
	Canned F & V	14	7	8
4	Fresh F & V	14	15	13
	Canned F & V	12	14	10
5	Fresh F & V	42	46	42
	Canned F & V	0	0	0
6	Fresh F & V	8	21	21
	Canned F & V	25	10	10
7	Fresh F & V	9	14	6
	Canned F & V	18	25	36

* Each experimental unit represents one school district. Menus evaluated seven school districts during the entire month of April 1994, 1995, 1996.

Appendix R

Fruit and Vegetable Items Listed on School District Lunch Menus for April 1994, 1995, and 1996, for the Control Group*

		No. Listings 1994 21 days Pre-intervention	No. Listings 1995 20 days Intervention	No. Listings 1996 21 days Post-intervention
School District				
1	Fresh F & V	15	15	17
	Canned F & V	12	18	16
2	Fresh F & V	3	1	2
	Canned F & V	12	14	29

* Each control unit represents one school district. Menus evaluated two school districts during the entire month of April 1994, 1995, 1996.

APPENDIX II: S

Comparison of Grade-School Children in the Fresh Fruit and Vegetable
Intervention Study, Ounces

Appendix S

Comparison of Grade-School Children in The Fresh Fruit and Vegetable Intervention Study, Ounces

Experimental Group n=37 visits for 29 schools

School Visit	# Children took school lunch	# Children took fruit & vegetable	Total ounces servings consumed	Ounces/child consumed
1	351	130	114.15	0.878
2	197	54	139.5	2.58
3	227	165	141.25	0.856
4	268	165	128.25	0.777
5	271	136	156.6	1.153
6	250	125	229.25	1.83
7	232	128	256	2.00
8	226	182	257.25	1.41
9	440	322	672.25	2.09
10	334	307	614.52	2.00
11	378	230	765.6	3.33
12	193	148	472.5	3.19
13	366	351	409.9	1.17
14	351	302	601.7	1.99
15	360	261	803.8	3.07
16	439	402	897.5	2.23
17	386	279	774	2.77
18	268	123	190	1.55
19	265	265	581.25	2.19
20	243	231	173.5	0.75
21	274	266	683	2.57
22	234	173	159.8	0.92
23	183	118	106	0.89
24	183	174	114.8	0.66
25	250	148	556.6	3.76
26	229	118	127	1.08
27	225	98	279	2.85
28	162	86	256.5	2.98
29	225	210	510	2.43
30	177	149	346	2.32
31	240	240	861.8	3.59
32	223	216	671	3.11
33	132	122	249	2.04
34	152	145	355.5	2.45
35	126	101	308	3.05
36	276	266	357.9	1.35
37	263	259	452.9	1.75

Appendix S

Comparison of Grade- School Children in The Fresh Fruit and Vegetable Intervention Study, Ounces

Control Group n=37 schools

School Visit	# Children took school lunch	# Children took fruit & vegetable	Total ounces servings consumed	Ounces/child consumed
1	238	238	386	1.62
2	332	332	216	0.65
3	251	251	472	1.88
4	139	24	49	2.04
5	117	117	146.8	1.25
6	275	275	368	1.39
7	263	215	385.5	1.79
8	110	107	320	2.99
9	316	316	866	2.75
10	284	284	436	1.54
11	201	189	102	0.54
12	248	172	76	0.44
13	101	101	237	2.35
14	62	57	124	2.18
15	263	263	328	1.25
16	198	195	188	0.96
17	221	221	503	2.28
18	239	239	480	2.01
19	114	114	53	0.46
20	169	139	192	1.38
21	190	190	76	0.40
22	289	283	940	3.30
23	179	174	284	1.60
24	152	152	468	3.07
25	179	163	423	2.59
26	146	128	327	2.55
27	196	195	726	3.72
28	206	198	540	2.73
29	171	165	491.8	2.98
30	162	162	316	1.95
31	234	224	383	1.71
32	215	215	588	2.73
33	242	225	106	0.47
34	152	150	400	2.67
35	163	159	240	1.51
36	125	122	308	2.52
37	177	163	287	1.76

APPENDIX II: T
Fruits and Vegetables Observed

Fruits and Vegetables Observed

Fruits

Fresh

Apples

Bananas

Blueberries

Grapefruits

Grapes

Kiwi

Nectarines

Oranges

Pears

Pineapple

Plums

Strawberries

Tangerines

Frozen

Cherries

Peaches

Canned

Apricots

Apples

Applesauce

Cherries

Fruit Cocktail

Peaches

Pears

Pineapple

Vegetables

Fresh

Alfalfa Sprouts
Bean Sprouts
Broccoli
Cabbage
Carrots
Cauliflower
Celery
Coleslaw
Cucumbers
Green Pepper
Lettuce Salad
Mushrooms
Radishes
Spinach
Tomatoes

Frozen

Peas

Canned

Carrots
Corn
Green Beans
Peas

APPENDIX III

Comparison of the Effectiveness of Nutrition Education and Increased Availability of Fresh Fruits and Vegetables

APPENDIX III: U

1/4-cup Servings from the Nutrition Education Intervention Study
24-Hour Lunch Food Recall, For Grade-School Children

Appendix U

1/4-Cup* Servings from the Nutrition Education Intervention Study 24-Hour Lunch Recall, Grade-School Children, Experimental Group.n=29 children

Student	Pre 24-hour lunch recall	Post 24-hour lunch recall	Difference
1	0.00	1.0	1.0
2	1.0	1.0	0.0
3	1.5	0.5	-1.0
4	2.0	2.0	0.0
5	1.0	2.0	1.0
6	1.0	2.0	1.0
7	1.0	1.0	0.0
8	2.0	1.0	-1.0
9	0.5	1.0	0.5
10	0.5	1.5	1.0
11	1.0	2.0	1.0
12	1.5	2.0	0.5
13	0.5	1.0	0.5
14	0.0	1.0	1.0
15	1.5	1.0	-0.5
16	1.0	1.0	0.0
17	1.0	1.0	0.0
18	0.0	0.0	0.0
19	1.0	1.0	0.0
20	1.0	1.0	0.0
21	1.0	2.0	1.0
22	2.5	4.0	1.5
23	1.0	0.0	-1.0
24	0.0	1.0	1.0
25	1.0	1.0	0.0
26	1.0	1.0	0.0
27	1.0	2.0	1.0
28	1.5	1.0	-0.5
29	1.0	2.0	1.0

* 1.0 = 1/4-cup, 2.0 = 1/2-cup, 3.0 = 3/4-cup, 4.0 = 1 cup.

Appendix U

1/4-Cup* Servings from the Nutrition Education Intervention Study 24-Hour Lunch Recall, Grade-School Children, Control Group n=19 children

Student	Pre 24-hour lunch recall	Post 24-hour lunch recall	Difference
1	1.0	1.0	0.0
2	1.0	1.0	0.0
3	1.0	2.0	1.0
4	1.0	2.0	1.0
5	1.0	1.0	0.0
6	2.0	2.0	0.0
7	0.0	1.0	1.0
8	1.0	2.0	1.0
9	1.0	1.0	0.0
10	1.0	0.0	-1.0
11	1.0	0.0	-1.0
12	1.0	1.0	0.0
13	1.0	1.0	0.0
14	2.0	2.0	0.0
15	1.0	2.0	1.0
16	1.0	2.0	1.0
17	1.0	1.0	0.0
18	1.0	0.0	-1.0
19	0.0	0.0	0.0

* 1.0 = 1/4-cup, 2.0 = 1/2-cup, 3.0 = 3/4-cup, 4.0 = 1 cup.

APPENDIX III: V

Comparison of Grade-School Children in the Fresh Fruit and
Vegetable Intervention Study, 1/4-cup Servings

Appendix V

Comparison of Grade-School Children in The Fresh Fruit and Vegetable Intervention Study, 1/4-cup Servings

Experimental Group n=37 visits for 29 schools

School Visit	# Children took school lunch	# Children took fruit & vegetable	Total # 1/4-cup servings consumed	#1/4 cp/child consumed
1	351	130	76.02	0.59
2	197	54	70.93	1.32
3	227	165	56.5	0.34
4	268	165	99.36	0.60
5	271	136	112.69	0.83
6	250	125	157.35	1.26
7	232	128	143.5	1.12
8	226	182	115.5	0.64
9	440	322	341.29	1.06
10	334	307	420.65	1.37
11	378	230	341.83	1.49
12	193	148	252.25	1.70
13	366	351	196.74	0.56
14	351	302	297.13	0.98
15	360	261	448.71	1.72
16	439	402	470.2	1.17
17	386	279	330.22	1.18
18	268	123	147.86	1.20
19	265	265	360.06	1.36
20	243	231	94.7	0.41
21	274	266	431.92	1.62
22	234	173	61.25	0.35
23	183	118	47.11	0.40
24	183	174	13.4	0.34
25	250	148	355.4	2.40
26	229	118	95.84	0.81
27	225	98	108.24	1.11
28	162	86	156.48	1.82
29	225	210	271.22	1.29
30	177	149	216.55	1.45
31	240	240	401.51	1.67
32	223	216	354.71	1.64
33	132	122	145.84	1.19
34	152	145	228.99	1.58
35	126	101	166.59	1.65
36	276	266	161.62	0.61
37	263	259	283.65	1.09

Appendix V

Comparison of Grade- School Children in The Fresh Fruit and Vegetable Intervention Study, 1/4-cup Servings

Control Group n=37 schools

School Visit	# Children took school lunch	# Children took fruit & vegetable	Total # 1/4-cup servings consumed	#1/4cp/child consumed
1	238	238	205.4	0.86
2	332	332	144	0.43
3	251	251	188.8	0.75
4	139	24	19.6	0.82
5	117	117	79.45	0.68
6	275	275	147.2	0.54
7	263	215	154.6	0.72
8	110	107	144	1.35
9	316	316	346.4	1.10
10	284	284	174.4	0.61
11	201	189	40.8	0.22
12	248	172	30.4	0.18
13	101	101	94.8	0.94
14	62	57	61.6	1.10
15	263	263	196	0.75
16	198	195	75.2	0.39
17	221	221	222	1.00
18	239	239	192	0.80
19	114	114	26.5	0.23
20	169	139	92	0.69
21	190	190	30.4	0.16
22	289	283	382.62	1.35
23	179	174	114.4	0.66
24	152	152	185.85	1.22
25	179	163	169.19	1.04
26	146	128	130.8	1.02
27	196	195	300.86	1.54
28	206	198	242.84	1.23
29	171	165	208.74	1.27
30	162	162	158	0.98
31	234	224	158.25	0.71
32	215	215	268.8	1.25
33	242	225	42.4	0.19
34	152	150	160	1.07
35	163	159	96	0.60
36	125	122	137.6	1.13
37	177	163	120.06	0.74