The effect of nutrition education on preschool childrens food choices
by Michelle Kay Baker

A thesis submitted in partial fulfillment of the requirements of the degree of Master of Science in Home Economics
Montana State University

Abstract:
The purpose of this study was twofold. The first was to determine if preschool children could become knowledgeable about nutritious foods. The second was, if preschoolers were knowledgeable, would they consume more nutritious foods than children who were not knowledgeable. A nutrition education program was developed using a systems approach to educational design. Children were to achieve a mastery level of the material presented. Pre and post testing of the control and treatment groups included a direct measure of eating behavior, a behavioral eating test, and a self-report measure, a food preference test. The results of this study showed that children can be knowledgeable about nutritious food to the extent that they can repeat the information presented. However, this repetition of information did not imply understanding of the material. There was no significant change in the eating behavior of the treatment group when compared to the control group. It was concluded that this nutrition education did not change eating behaviors of preschool children. From a behavioral systems analysis of the nutrition education system, it appeared that a method other than nutrition education is needed to change eating behavior of preschoolers.

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Michelle Kay Baker

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ABSTRACT

The purpose of this study was twofold. The first was to determine if preschool children could become knowledgeable about nutritious foods. The second was, if preschoolers were knowledgeable, would they consume more nutritious foods than children who were not knowledgeable. A nutrition education program was developed using a systems approach to educational design. Children were to achieve a mastery level of the material presented. Pre and post testing of the control and treatment groups included a direct measure of eating behavior, a behavioral eating test, and a self-report measure, a food preference test. The results of this study showed that children can be knowledgeable about nutritious food to the extent that they can repeat the information presented. However, this repetition of information did not imply understanding of the material. There was no significant change in the eating behavior of the treatment group when compared to the control group. It was concluded that this nutrition education did not change eating behaviors of preschool children. From a behavioral systems analysis of the nutrition education system, it appeared that a method other than nutrition education is needed to change eating behavior of preschoolers.

CHAPTER 1

INTRODUCTION

In recent years, research into factors which influence children's eating behavior has increased. This research has focused on factors which influence food preferences such as peers, social context of food presentation, television advertising, and nutrition education.

Birch (1980a) studied peers' influence on preschoolers' vegetable preferences. Seating at lunchtime was assigned so that a child who disliked a particular vegetable was seated with four children who liked that vegetable. After four days there was a significant shift from choosing their originally preferred vegetable to their nonpreferred vegetable. The change in preference was retained when a follow up test was given one to eight weeks later. Children 3 years old had preferences that were more malleable than children 4 years old.

There has been relatively little systematic study of the effects of environmental setting or presentation context on the formation of food preferences. Birch, Zimmerman, and Hind (1980) studied the effects of four different social-affective contexts on children's food preferences. The four contexts were: (a) as a reward contingent upon good

behavior; (b) noncontingently, paired with friendly adult attention; (c) in a nonsocial context (snack placed in child's cubby); (d) at snack time. They found that the social-affective context clearly influenced the formation of food preference. Food presented as a reward enhanced the child's preference for that food. This effect was still present 6 weeks after the conclusion of the reward presentations. Preferences were also enhanced when presented noncontingently during a social interaction with an adult. The effect was not as great as the reward situation, but produced a similar effect. The enhanced preferences were noted for sweet and nonsweet foods. The authors were concerned since sweet foods are frequently used for rewards and special occasions, thereby increasing the children's preference for these foods.

Preference for sweetness was evident in babies several days old (Desor, Maller, & Turner, 1972). These data have led many child development experts to believe that the preference for sweetness is innate (Worthington-Roberts, 1981). Birch (1979a, 1979b) has observed a developmental shift in food preference structure between the ages of 3 and 4. The salient dimension which determined food preferences was familiarity for 3 year olds, and sweetness for the 4 year olds.

Preschoolers watch, on the average, 26 hours of television a week (National Science Foundation, 1977).

In typical children's programming, 68 percent of the commercials are for food products: 25 percent for cereals (presweetened cereals outnumber the unsweetened ones more than three to one), 25 percent for candy and other sweets, 10 percent for fast food establishments, 4.8 percent for snacks and packaged foods, and 3.2 percent for fruit, breads, and dairy products (Barcus & Wolkin, 1977). Barcus and Wolkin concluded that the nutritional message in these commercials, if any, was "vitamin fortified". Advertisements for nutritious foods such as dairy products or fruits and vegetables were felt to be of inferior quality, as compared to traditional advertising aimed at children (Lemnitzer, Jeffrey, Hess, & Stroud, Note 1).

Levin, Petros, and Petrella (1982) found that preschoolers were able to correctly identify television segments as either program or commercial, and that this ability improved with age. Their study did not ask children to explain the purpose of a commercial. The authors felt that such studies as their own are limited by preschoolers' verbal ability. Lambo (1981) studied children's ability to evaluate the cariogenic potential of sugared products advertised on television. The youngest children tested were first graders, who had the greatest difficulty in determining the cariogenicity of food products, especially

the presweetened cereals. Older children did better, but were unable to describe the role of sugar in caries formation.

Dental caries are the most common dental health and health problem found in children (Miller & Rosenstein, 1982). Caries have a 57 percent prevalence in children ages 36 to 39 months and an average of 3.7 and 5.1 carious teeth for children 5 and 6 years old respectively. Decay is caused by acid products from bacteria in plaque when refined sugars, especially sucrose, act as substrates.

Controlled studies on institutionalized children and adults in Vipeholm, Sweden have provided evidence that carbohydrate is a key factor in the development of dental caries (Newbrun, 1979). It was found that caries increased significantly when sucrose was eaten between meals as opposed to at meal times. The food consistency was as important as frequency since sticky or adhesive forms can maintain a high sugar level in the mouth.

Carbohydrate consumption in the United States has changed significantly in the past 100 years. Sugars contributed about one-third of the total carbohydrate consumption during the early part of this century. Sugars and starches became about equal by the late 1950's. Presently approximately 54 percent of the carbohydrate consumption is from sugars (Worthington-Roberts, 1981). The introduction of corn sweeteners has significantly

contributed to this increase. Of the sucrose and corn sweeteners consumed, 72 percent is from prepared or processed foods (National Academy of Sciences, 1975).

Presweetened cereals frequently eaten as snack foods automatically classifies them as potential dental hazards (Shelton & Ferretti, 1982). Studies are inconclusive as to the relationship between the cereals and cariogenic activity. This may be due to increased salivation during mealtime removing the dissolved sugar or the possibility that milk consumed with cereals is capable of nullifying any cariogenic potential due to the buffering capacity of milk proteins.

In view of the quantity of sucrose found in the American food supply, television advertisements for food aimed at children, and the impact of television on developing children's eating habits, it appears that early childhood is the time to intiate nutrition education. Children between the ages of 3 and 4 have food preferences that have been shown to be changed by such factors as peer influence and the social context of food presentation. Therefore they appear to be a good population to educate nutritionally. This education should focus on the selection of foods and snacks with a low sucrose content for the prevention of dental caries. The knowledge enabling healthy food selections should be gained by a majority of children at a high accuracy level in order for a nutrition education

program to be considered effective. Furthermore, to be of health value, nutrition education should ultimately change food choices and food preferences.

Purpose

The purpose of this study was to investigate the effect of a nutrition education program on preschoolers' food choices and preferences. The first question to be answered was: can preschoolers (3 to 5 year olds) become knowedgeable at a 90 percent level about nutritious foods? In a pilot study conducted by the investigator this appeared feasible. The second question to be answered was: if children were knowledgeable about nutritious foods, would they consume more nutritious foods than children who were not knowledgeable?

CHAPTER 2

REVIEW OF LITERATURE

The American Dietetic Association position paper on nutrition education (1978) states that nutrition education should bring about an understanding of foods and practices which promote good health. The American Dietetic Association recommends that since food preferences are formed early in life, nutrition education should start as early as possible, should be part of the curriculum for preschoolers, and continue throughout one's entire life.

In the past, preschoolers' food preferences were assessed indirectly. Byran and Lowenberg (1958) reported on how fathers' preferences influenced preschool children's food preferences. To determine that relationship, the researchers asked the mothers to report their child's food preferences since reports by children of this age were considered unreliable. The mothers' report was then compared to the fathers' preferences. The only food group that had a significant correlation was the vegetable group. The researchers felt that the fathers' preferences were not responsible for their child's preferences. The authors concluded that the father's main influence was due to the limitation of variety offered by the mother planning the

menus around the father's preferences. Burt and Hertzler (1978) used a family questionnaire to determine the parents' influence on kindergarten children's food preferences. They found that the mother and father equally influence children's food preferences. Eppright, Fox, Fryer, Lamkin, and Vivian (1969) also used a family survey to assess food likes and dislikes. Parents reported that their children had already developed food dislikes by the age of three and that most of these were of vegetables. Again parents were reporting for their children. This indirect approach was used because it was felt that young children were an unreliable source of information regarding their own food preferences.

Birch (1979a) reported on a successful method of directly assessing children's food preferences. In a study of 37 preschoolers, Birch asked each child to taste a series of fruits. Then the child was asked to point to the one he/she liked the best. The procedure was repeated three times, with intervals ranging from 4 to 51 days. The 4 year olds' preferences were slightly more stable than the 3 year olds. The author concluded that preschool children can provide reliable information about their food preferences and that future studies on food preferences should use a direct assessment technique.

Food preferences should successfully predict consumption of those foods if they were made available. Birch

(1979b) assessed the validity of preference data as a predictor of consumption patterns. Seventeen preschoolers aged 3 to 4 years old individually ranked eight different sandwiches. The ranks were then compared to the quantity of sandwiches eaten at snack time over a four day period. The child's preference predicted the relative consumption of food in this study. The correlation between these two measures was higher than the relationship reported in studies using adult subjects. The results indicated that directly obtained preference information can be a very effective tool to predict a child's consumption pattern.

Parents are considered the primary socializers of their children. Parental food preferences may limit the available food in the home. A study by Birch (1980b) investigated the relationship of children's food preferences with those of their parents. Previous studies were contradictory which Birch felt was due to methodological problems of data collection, namely indirect assessment of the child's preferences. The 128 preschoolers in this study included 2 to 5 year olds and their parents. Preference data were collected for mother-child and father-child pairs. There was a high percentage of positive correlations for both mother-child and father-child pairs. However, the number of statistically significant correlations were few. It was thought that there may be a subcultural group preference which might explain the consistent low positive

correlations. The author suggested that preference studies focus on individual foods instead of food groups.

Lamb (1969) found that exposure to a wide variety of foods in early life greatly increases food acceptance. A study of preschoolers' vegetable preferences (Phillips & Kolasa, 1980) found preschoolers preferred the vegetables served most frequently at home and at the day care center. In this study, 36 children rated 12 vegetables using the facial hedonic scale. When the ratings given by the child were compared to the ratings the mothers reported for their child, only four vegetables had significant correlations. The authors concluded that mothers may not be relaiable sources for reporting preschoolers' food preferences when children attend day care centers that serve lunch.

Birch (1979a) studied the effect of exposure or familiarity on increasing food preferences. An unfamiliar food was presented at lunch for seven consecutive days. The day following the last exposure, preference testing was initiated and was completed within two days. Familiarity increased for the foods studied, but the slight increase in preference was not statistically significant.

Goldberg, Gorn, and Gibson (1978) assessed food preferences of kindergarteners. Their self-report instrument utilized pictures of food from which children rated the foods using the facial hedonic scale. The children in this study were able to accurately report whether a food

made them healthy or not, but this did not appear to influence the child's stated food preference.

Nutrition curricula for preschoolers are becoming more available. Nutrition education has been an integral part of the Head Start program since its inception in 1965 (U.S. H.E.W., 1977). However, there has not been a nation-wide curriculum developed for use in the Head Start program. Nutrition education takes place in the Head Start classroom by indirect methods. For example, nutritious lunches and snacks expose the children to a wide variety of food and the children are encouraged to taste everything.

The White House Conference on Food, Nutrition, and Health developed seven key concepts on which to base nutrition education. They are:

(a) nutrition: its effect on energy, growth, and health;
(b) nutrients: their relationship to health;
(c) food handling: its effect on health and food quality;
(d) the life cycle: its effect on nutritional needs;
(e) social/psychological needs: the influence on food choice;
(f) food technology: its impact on the food supply;
(g) nutrition and society: an interdependence (National Dairy Council, 1979).

The Society for Nutrition Education (1982) has combined these concepts with the "Nutrition Concepts for a Comprehensive Curriculum" from a Pennsylvania State University study on curriculum into a single conceptual framework. This framework includes: nutrition, food and its handling, nutrients and dietary components, nutrition

and physical activity, food selection, and national and international food policy. These concepts are meant to be used as a starting point for writing objectives in the curriculum development process.

The National Dairy Council's curriculum for preschoolers, "Food...Early Choices" is based upon the White House concepts. It comes with 22 learning activities, a puppet named Chef ComboNation, food picture cards, and a series of letters to the parents about child nutrition. Each learning activity states the objective of the lesson, gives a script for use with the puppet, and suggests additional activities for the teacher to carry out. The puppet is well received by preschoolers which makes this curriculum exciting for the children.

Nutrition in a Changing World: A Curriculum for Preschool (Marbach, Plass, & O'Connell, 1979) was developed at Pennyslvania State University. Each lesson has an objective, rationale and pre and post tests. The lessons are designed around the basic four food groups with the intent of making children informed consumers. A recent study by Shannon, Bell, Marbach, O'Connell, Graves, and Nicely (1981) found Nutrition in a Changing World effective for grades kindergarten through six. This conclusion was based on the results of pre and post testing of the children's nutritional knowledge.

Randell and Olson of Cornell University have developed the Early Childhood Nutrition Program (1979) for use with children aged 3 to 5. This curriculum package includes: (a) parent handouts which gives parents nutrition information and activities to do with their preschooler, (b) an educator's nutrition handbook, and (c) food and nutrition activities for the teacher to carry out in the classroom. Each of the four units of the food and nutrition activities includes: a key concept, precipitating event, and learning center activities in the areas of: art, music, language, and dramatic play. Three of the four units focus on critical issues in early nutrition education: "Food for a Healthy You", "Sweets Can Turn You Sour", and "TV Tells It Like It Isn't". The fourth unit is "Delicious Discoveries". The end of each unit has an evaluation section but the evaluations are not always measurable behaviors.

Contento (1981) intensively interviewed children who were at different cognitive stages of development to investigate how they thought about food. Preschoolers, who were at Piaget's preoperational stage, considered all edible items as food and were unable to distinguish between the categories of foods and snacks. They believed that vitamins were pills that made people strong or healthy and that food goes into the stomach and stays there unchanged. The author concluded that curricula should emphasize appropriate food choices both as foods and snacks.

Nutrition curricula could be more efficiently and effectively designed if a system were utilized. Johnson and Morasky (1980) advocate instructional design for all subjects and all grade levels based on the following sequential steps: (a) definition of task to be learned, (b) analysis of task, (c) development of criteria measures, (d) writing instructional objectives, (e) lesson design, and (f) implementation and revision. The results of outcome research indicate that this method has not been utilized by nutrition educators.

The methods used to measure the effectiveness of nutrition education programs have primarily been plate waste studies and written tests of nutrition knowledge. A plate waste study measures the amount of food not eaten from lunch with a before and after design. It has been thought that the more nutrition knowledge a child has, the more food he/she should eat, resulting in less food waste since he/she knows that the foods served for lunch are good for him/her.

A study by Blakeway and Knickrehm (1978) used food service personnel in conjunction with the nutrition coordinator to give 10 short talks and 5 tasting parties to first through third graders. It was concluded that there was a successful decrease in plate waste but this did not result in sufficient consumption. The waste reduction was greater for the first and second grades than for the third

grade. Harrill, Smith, and Gangever (1972) were able to increase the consumption of vegetables by preschoolers following a nutrition education program. The post-education plate waste data was collected the same day as the lesson was given on that vegetable. The authors concluded that vegetables remained the least liked food on the lunch menu.

It has been suggested that the method of cooking vegetables influenced vegetable acceptance. However, Ireton and Guthrie (1972) found that the use of positive reinforcement for eating vegetables was more effective than altering the method of preparation in reducing plate waste. In contrast, Shovic and Jennings (1979) did not find a significant decrease in vegetable plate waste by fourth graders following a five week nutrition education program. In this study, a nutrition knowledge posttest did show a significant increase over the pretest. The authors cited shortness of the lessons, peer influences, institutional cooking techniques and portion size as possible reasons for the results. Age of the children in this study may have also played a role; it may be easier to change eating habits of younger children.

The plate waste studies and written tests have measured successes in nutrition education programs. But knowledge about nutrition does not imply that changes will be made in eating habits. School lunch plate waste studies can only measure eating habits when the choices have been made for

the participants. The American food supply provides a wide variety of high sucrose containing foods as well as nutritious foods as possible food selections. Nutrition education studies have not used a behavioral measure that allows the participants to select the foods to be eaten.

The behavioral eating test, developed at the University of Montana (Jeffrey, Lemnitzer, Hickey, Hess, McLellarn, & Stroud, 1980), measures children's actual eating behavior. Children are allowed to eat as much of the foods presented as desired within an 8 minute period. Equal numbers of high sucrose foods and low sucrose foods are presented. Children's responses on self-report measures of food preferences were found to be highly disparate from actual behavioral measures (Jeffrey, McLellarn, Fox, Lemnitzer, & Hickey, Note 2). It was suggested that two methods of assessment be used to measure children's eating behavior, such as the behavioral eating test, and the second method a self-report measure, such as the food preference test.

CHAPTER 3

RESEARCH DESIGN

The design was a quasi-experimental design using measures of direct behavior and self-reported food preferences. A pretest and posttest was used for control and treatment groups. The statistical model was an analysis of two independent samples which compares differences in scores.

Subjects

Subjects were 33 preschoolers between the ages of 3 and 6 years old and were enrolled in the University of Montana Home Economics' Preschool and the Associated Students of the University of Montana Day Care. The assignment to the treatment and control group was by school at random. Written permission was obtained from the Human Subjects Research Committee at Montana State University and from the parents of each child participating in the study. Parents were informed of the nature of the study in the parent permission letter (see Appendix B) and informed of the results as soon as they became available in a group parent meeting. Each child was allowed to terminate participation at any time during the study.

Three children did not complete the study due to absences during the posttesting.

Procedure

Each child was given the behavioral eating test and food preference test before and after treatment or control period. Children were tested at least one hour after their last meal and at the same time of day to control for hunger. A familiarization day preceded the initial testing to acquaint the child with the testing procedure and the investigator.

Familiarization

The investigator took small groups of three to five children at a time to the test area. The children were told about what would happen when they came individually the next time. To illustrate the procedure, a tray of food was placed before the group of children and they were given the same instructions that accompanied the behavioral eating test and the food preference test. The children were returned to their classroom and told that they would be able to return again and have a chance to sample some foods. This procedure was repeated until all the children had participated once.

Behavioral Eating Test

The behavioral eating test which was developed by Jeffrey, Lemnitzer, Hickey, Hess, and Stroud (1980) and refined by Bridgwater (Note 3) was used as a dependent variable. It has a test-retest reliability coefficient of .72. This test consists of serving six foods to each subject individually and allowing an eight minute period to sample the foods as desired. The foods were weighed on a gram scale before and after the subject had tasted the foods. The foods were served in clear plastic cups and randomly arranged on a serving tray. The foods presented were equally divided into high sucrose and low sucrose containing foods. The foods selected were suitable for a child's snack and were somewhat similar in color, texture, and density. The foods were apple, saltine crackers, peanuts, sugar cookie, frosted donut, and Frosted Flakes.

Each child was escorted to the testing area by the investigator and instructed as follows:

> I am trying to find out what kids think of different foods. In front of you are six small cups of foods. In a minute I am going to ask you to taste the different foods. Can you tell me the name of each food on this tray?

The child was encouraged to name the foods in any order he/she chose. If any food was unfamiliar to the child, the investigator named it for him/her.

> That's good, you knew a lot of the foods on the tray. Now I have to go into the other room for a few minutes. While I'm gone you can eat as much of anything you

> wish. There is a glass of water if you get thirsty. Do you have any questions? (Answer any questions.) Go ahead. You can eat as much as you like.

The investigator leaves for an eight minute period timed by a stop watch. At the conclusion of that period, the investigator returns and says:

> Well, it looks like you've tasted a few of these foods.

Food Preference Test

The food preference test, which was developed by Birch (1979a), was the second dependent variable. It has a food preference order test-retest correlation of .58 and preference order-consumption correlation of -.80. The latter correlation is negative since the most preferred food is scored as "1" and compared to the quantity of food eaten. This test consists of a self-report measure in which a child's food preferences are rank ordered in a free choice situation. Each child was given a tray with six clear plastic cups of foods. The foods were divided into high sucrose and low sucrose containing foods. The child was told to taste the contents of each of the cups. Then the child was asked which one he/she liked the very best. The selection was removed from the tray and the process was repeated until all six cups had been removed from the tray and rank ordered in this fashion. The process was repeated with another set of foods. The foods from the behavioral eating test were ranked before that tray was removed for

weighing. The other sets of foods were: set (a): cola, Hershey Chocolate Bar, M & M's, milk, Cheerios, and orange; and set (b): Lifesavers, Trix, chocolate cupcake, carrot, yogurt, and Rice Krispies. The investigator scores the child's first choice as "1" and each choice thereafter in ascending order. This was repeated with the second set of choices.

Treatment

Johnson and Morasky (1980) delineated a comprehensive plan for developing curricula to ensure that students are capable of meeting the desired goals upon completion of the curricula. The Johnson and Morasky systems approach was used in the development of the lessons for this experiment. First the task was defined and analyzed. The task was identifying the sugar content of 18 food pictures as either "too much" or "good for you". It was assumed that the child had an understanding of the concept of "too much". The task was broken down into smaller tasks: (a) identifying the food with too much sugar from a pair of foods, (b) identifying the food that is good for you from a pair of foods, and (c) identifying foods that are good for you from a set of six foods.

The next step was the development of criterion measures. A criterion measure indicates whether or not the child has succeeded in the instructional goal. In

the lessons for example this was asking the child "which of these two foods has too much sugar?" The third step was the preparation of objectives. A behavioral objective must be: measurable, stated in terms of student behavior, and include the conditions. In this case, the objective was for each child to correctly name and identify the snack pictures that were low in sugar when shown a group of six snack picture cards.

The next step was the preparation of the instructional sequences. Only those activities that related directly to the final task were included. The task analysis was used to help identify the activities needed. For example, field trips and tasting parties were not directly related to the task of identification and not included in the lessons. Finally the lessons were implemented in a pilot study at the Montana State University Child Development Center and evaluated using the criterion measures. Revisions were made as needed. The criterion measures were met and the only changes made were in the cereals used. Wheaties and Golden Grahams were replaced with Rice Krispies and Frosted Flakes. The Wheaties box did not picture the cereal which caused some confusion and Golden Grahams was not a familiar cereal to the children.

In the current study, one class received the two week unit of nutrition education taught by their teacher (see Appendix A). The teacher was trained by the investigator in

the use of the curriculum. The children were individually tested on criterion measures following lessons three and five by the investigator. Ninety percent of the children must score at least eight out of nine correct before proceding to the behavioral posttesting. The teacher was observed to assure that the lessons were conducted as planned.

Parents were sent handout materials on child nutrition from the Cornell University curriculum (see Appendix B). These handouts were sent home with the child on the days of lessons one, three, and four. The handouts were intended to give parents some background information on how children's eating habits develop and to promote interaction between parents and children (Randell & Olson, 1979).

Analysis of Data

The results of the behavioral eating test were analyzed using the Mann-Whitney test from the SPSS computer package (Hull & Nie, 1979). The Mann-Whitney test is for two independent samples when the samples are of unequal size or when the distribution of the measured variable is unknown. The observations from the two samples were ranked from the least to the highest and totaled for the two groups. The expected sum of the ranks is similar if there is no difference between the groups. The variable analyzed was

the difference in grams of each food served for the behavioral eating test from the pre and post tests.

The food preference test data was also analyzed using the Mann-Whitney test. Each food had a possible rank of 1 to 6. The difference between the ranks from the pre and post tests were analyzed. There is no difference between the groups if the treatment has no effect.

CHAPTER 4

RESULTS

Nutrition Knowledge

Following the nutrition lessons, 13 of the 15 children (86 percent) in the treatment group identified 16 out 18 foods (88 percent) correctly for its sugar content. The two children who did not attain the 88 percent level were 3 year olds. This experiment did not consider age as a factor, but perhaps the lessons and final task were too difficult for these two 3 year olds.

Of the 18 foods tested, the two most frequently missed foods were Rice Krispies and Frosted Flakes. The four cereals were presented pictorially by their box fronts. Rice Krispies and Frosted Flakes both have blue boxes and may have caused some of the children to incorrectly identify the cereals. Of the other two cereals, Cheerios and Trix, Cheerios is currently advertised on television as being low in sugar and there was little confusion regarding its name or sugar content.

In this investigation 86 percent of the treatment group were able to be educated to meet the criterion at an 88 percent level. This finding was consistent with the

pilot study conducted by the investigator. This finding is similar to the findings in a study by Shortridge (1976) who also used a mastery model of education. In that study, Shortridege developed a curricula for the California Dairy Council for grades K-6. It focused on the learner meeting nutritional objectives. This resulted in 80 percent of the children mastering the objectives at the A or B level. Shortridge attributed the success of the curricula to three principles: (a) give the learner facts and information, (b) provide the learner chances to practice the new skills, and (c) give the learner immediate feedback. The principles used by Shortridge are the same as those contained within the subsystem of educational sequences of the systems approach to educational design advocated by Johnson and Morasky (1980) and utilized for the development of the curriculum for this study.

Other studies have shown increases in children's nutritional knowledge following nutrition education units. Feshbach, Jordan, Dillman, and Choate (1978) used robot-like figures to teach children ages 4 to 10 about the nutrient and energy values of foods. The 4 year olds were able to comprehend this complex relationship but were less accurate in reproducing the information than the older children in this study. Feshbach et al. concluded that children as young as 4 years old who were taught to use this tool could evaluate the nutritional values of foods

advertised on television. This seems to be a very broad generalization. Contento (1980) found that children ages 4 to 6 thought of vitamins as being pills and not something found within foods. Therefore it seems unlikely that 4 year olds can truly comprehend the relationship of nutrients and energy values. Also the study by Feshbach et al. did not follow any system of educational design but instead created a tool to teach a specific skill.

Food Choices

Behavioral Eating Test

The behavioral eating test was administered to children in the treatment group before and after the nutrition lessons and twice to the control group. The means and standard deviations for the six foods (apples, peanuts, crackers, cookies, donuts, and Frosted Flakes) are presented in Table 1. Children in both groups ate on the average more: donuts, apples, and peanuts; and fewer: crackers, Frosted Flakes, and cookies. Of the sweet foods, only donuts were consumed in large quantities. It was anticipated that all sweet foods would be consumed in large quantities since young children tend to prefer sweet foods. The cereal, Frosted Flakes, for this experiment was served without milk to facilitate measurement and avoid confusing the children since milk is a nutritious food. If the Frosted Flakes had been served with milk it might have been

Table 1. Means, standard deviations, and changes of the behavioral eating test.

Food	Control Group[a] $\bar{x}$ grams	S.D.	Treatment Group[a] $\bar{x}$ grams	S.D.
Apple				
Pretest	10.35	15.17	9.80	11.37
Posttest	12.65	14.36	12.47	15.99
Change	1.7		2.71	
Peanuts				
Pretest	12.09	13.10	5.04	7.00
Posttest	6.50	5.48	7.70	5.23
Change	-4.67*		2.45*	
Crackers				
Pretest	1.86	2.12	2.58	2.35
Posttest	1.43	1.51	2.31	2.68
Change	-.57		-.25	
Cookie				
Pretest	4.64	5.86	8.51	11.44
Posttest	5.19	5.17	5.37	6.53
Change	.75		-2.42	
Donut				
Pretest	14.17	9.91	13.49	10.08
Posttest	17.87	10.38	17.43	12.50
Change	2.61		3.71	
Frosted Flakes				
Pretest	2.02	2.91	1.97	3.12
Posttest	3.32	4.31	2.45	3.28
Change	1.75		.47	

[a] $n = 15$ for both groups

* significant at $p \leq .05$

more popular. A shortbread-type cookie was chosen for its uniform color and was not as popular as perhaps a chocolate chip cookie might have been.

The standard deviations for the behavioral eating test tended to be larger than the means (see Table 1). Since a standard deviation is a measurement of dispersion about the mean, the quantity of each food eaten varied widely from child to child. With such large standard deviations it is difficult to predict how much of a food a child will eat since the value "0" is included in the confidence interval. For example the confidence interval for apples on the pretest for the control group would be (-5.18, 25.52).

Three foods did not have standard deviations larger than the means (see Table 1). They were: donuts (both groups, both tests), crackers (treatment group, pretest), and peanuts (control group, posttest). Donuts and peanuts were two foods that were eaten in large quantities, while crackers were eaten in small amounts. Most of the data for these three foods clustered tightly about the mean. Children tended to be in agreement with each other about their likes and dislikes of these three foods.

The findings of large standard deviations is consistent with the findings of Bridgwater (Note 3). This is because children have varying appetites and consume differing amounts. Likes and dislikes are also different from child

to child. One should not expect a group of children to eat similar quantities of each food.

To study the change in foods eaten on the behavioral eating test, each child's pretest amount was subtracted from the posttest amount (posttest - pretest = change). From the values for change, the mean changes were calculated and presented in Table 1. The control group increased their consumption (positive changes) of: donuts, Frosted Flakes, apples, and cookies. They decreased their consumption of peanuts and crackers. This group had increases for the three sweet foods and decreases for two of the nutritious foods. The treatment group had positive changes for: donuts, apples, peanuts, and Frosted Flakes. Donuts, apples, and peanuts were noted earlier as the three most consumed foods in this test. Frosted Flakes increased but only by about half a gram on the average. The treatment group had a decreased consumption of cookies and crackers, two of the least consumed foods.

Changes in food consumption were noted. The Mann-Whitney test was used to determine statistical significance, which is similar to the Student's t statistic but does not require a normally distributed variable or a large sample size. Only the change in consumption of peanuts was significant with the probability of $p \leq .05$. A closer look at the data shows that this is due to the decreased consumption by the control group, rather than an increase by the

treatment group. It was hoped that the nutrition lessons would significantly increase the consumption of nutritious foods (apples, crackers, and peanuts) or decrease the consumption of the sweet foods (donuts, cookies, and Frosted Flakes) compared to the children in the control group. These results show that there was no statistical difference between the two groups.

Consumption--Preference Comparison

To compare the behavioral eating test to the food preference test, children were asked which of the foods from the behavioral eating test they liked the best. Their choice was scored as a "1". Subsequent choices were scored in ascending order until all six foods were ranked. Table 2 displays the Spearman rank-order correlations for the behavioral eating test compared with the food preference test. The correlations between the two tests ranged from a rho (r_s) of -.87 to -.20. The correlations were negative indicating that the most preferred foods were given a low rank and compared to the number of grams of food consumed. For example, a child may have ranked donuts as their favorite food (scored as a 1) and eaten 25 grams of donuts.

Five of the six correlations were significant at $p \leq .05$. Crackers had a significance of $p \leq .14$ and the smallest correlation of $r_s = -.20$. Children did not rank crackers as well as they did the other foods. A child may have eaten a bite of cracker and ranked it as the least

favorite (6) while another food which he/she did not even taste was ranked higher (4 or 5).

Table 2. Spearman's rho (r_s) correlation coefficients for behavioral eating test with food preference test.

Food	Correlation (r_s)	Significance (p)
Frosted Flakes	-.87	$\leq$.001
Cookie	-.59	$\leq$.001
Donut	-.57	$\leq$.001
Apple	-.44	$\leq$.01
Peanut	-.34	$\leq$.05
Cracker	-.20	$\leq$.14

Since the two tests were highly correlated, the food preference test may be used to measure the same behavior as the behavioral eating test. The food preference test was easier to administer and allowed the investigator to test a wider variety of foods in less time. This result disagrees with the finding of Jeffrey et al. (Note 2) in which they found the self-report measure to differ significantly from the behavioral measure. This difference may be due to the tasting of the foods in the self-report measure, the food preference test, used in the current investigation instead of using pictures of food. Similar to the results found by Birch (1979b), it appears that these preschool children could accurately report their food preferences which were directly proportional to the amount of food eaten.

Food Preference Test

The food preference test data was analyzed in a similar manner to the behavioral eating test. The change in rank of food preferred was calculated by subtracting the pretest rank from the posttest rank (posttest - pretest = change). A food highly preferred on the posttest but liked less in the pretest has a negative value. The mean ranks and mean changes are shown in Tables 3 and 4. In general these children rated carrot, milk, and orange as their least favorite foods; and M & M's, Hershey Bar, and cupcake as their favorite foods. Of the favorite foods, all were chocolate and in the sweet category. All of the least favorite foods were in the nutritious category. The treatment group increased their preference for Cheerios, cola, yogurt, cupcake, and carrots; and decreased their preference for Trix, Lifesavers, Rice Krispies, Hershey Bar, and milk. There was no change in preference for M & M's and oranges. If any child did change his/her ranking of these two foods, it was in effect cancelled out by another child changing so that there were the same number of children giving the same number rank on the pretest and posttest.

The control group increased their preference for milk, oranges, cola, cupcake, and Trix. They decreased their preference for Cheerios, Hershey Bar, M & M's, yogurt,

Table 3. Means and mean changes in rank[a] of nutritious foods on the food preference test.*

Food	Control Group[b]	Treatment Group[b]
Yogurt		
Pretest	3.78	3.77
Posttest	4.38	3.33
Change	.42	-.54
Rice Krispies		
Pretest	3.50	4.23
Posttest	3.50	4.46
Change	0.00	.08
Cheerios		
Pretest	3.81	4.26
Posttest	3.85	4.21
Change	.15	-.20
Orange		
Pretest	4.88	4.00
Posttest	4.35	4.00
Change	-.71	0.00
Milk		
Pretest	4.23	4.93
Posttest	3.53	5.13
Change	-.67	.20
Carrot		
Pretest	3.40	4.60
Posttest	3.50	5.20
Change	.08	-.08

[a]Rank of 1 is most preferred food.

[b]n = 15 for each group.

*None of the changes in rank were significant at $p \leq .05$

Table 4. Means and mean changes in rank[a] of sweet foods on the food preference test.

Food	Control Group[b]	Treatment Group[b]
M & M's		
Pretest	2.00	2.33
Posttest	3.20	2.33
Change	1.40	0.00*
Hershey Bar		
Pretest	2.31	2.20
Posttest	2.93	2.30
Change	.50	.13
Cupcake		
Pretest	2.93	2.50
Posttest	3.00	2.46
Change	-.15	-.07
Trix		
Pretest	3.88	2.43
Posttest	3.28	3.20
Change	-.86	.71
Cola		
Pretest	3.50	3.26
Posttest	2.64	3.13
Change	-1.15	-.13
Lifesaver		
Pretest	2.94	3.08
Posttest	3.08	3.33
Change	.62	.15

[a]Rank of 1 is most preferred food.

[b]n = 15 for each group.

*$p \leq .05$

Lifesavers, and carrots. There was no change in their preference for Rice Krispies.

The treatment group increased their preference for three nutritious foods while the control group increased their preference for only two (see Tables 3 and 4). The Mann-Whitney test found only M & M's had a significant change with a probability of $p \leq .02$. Since the treatment group had no net change in their ranks, this must be due to a change within the control group. There was no statistically significant change in the food preference between the control and treatment groups, therefore the treatment had no effect on food choices.

CHAPTER 5

DISCUSSION

The findings of the current investigation disagree with the findings of several studies that have used a behavioral measure. Harrill, Smith, and Gangever (1972) conducted a food education program emphasizing four vegetables (beets, brussel sprouts, cauliflower, and squash), for 17 preschoolers. The lessons consisted of discussion periods and dramatic play. Felt boards, hand puppets, and hero pictures aided the discussions. Immediate reinforcement was provided by serving the vegetables at the noon meal. At that noon meal the post-education food waste data were collected and compared to pre-education food waste data. The authors concluded their nutrition program increased the mean amount of vegetables consumed. The authors did not state how they developed the lessons to compare to the current investigation. One similarity between the two studies was the use of puppets. Since the plate waste study was conducted the same day as the lesson, the results are not surprising. It seems likely that the change of behavior would not be maintained.

Johnson, Smith, Bittle, and Nuckolls (1980) developed a curriculum for developmentally disabled children which is

also considered appropriate for kindergarteners. The lessons were organized around the basic four food groups with goals, objectives, and posttests. A plate waste study was conducted at lunch time to measure the effectiveness of the curriculum. The results showed a reduction of food wasted on the school lunch at the posttest. This curriculum has a behavioral organization with its goals and objectives. It still did not have all the elements of instructional sequences, namely practicing the new skills and receiving immediate feedback nor did it use a mastery model of education before testing the behavioral measure.

Investigators who found similar results to the current study were Shovic and Jennings (1979). Using fourth graders, Shovic and Jennings gave a five week unit on nutrition. The lessons used the basic four food groups as a basis with an emphasis on vegetables. The lessons were planned around objectives which emphasized important points but do not meet the three qualities of behavioral objectives. All students were given the treatment in this study. Pretests and posttests measured nutrition knowledge, food acceptance, and vegetable waste in the school lunch program. Children in this study scored higher on the nutrition knowledge test at the posttest than they did on the pretest. Vegetable acceptance increased significantly for cucumbers and cabbage, two of the vegetables that were tasted during the lessons. Of these two vegetables, only cabbage

slaw was served with lunch for the plate waste study. There was no significant change in vegetable plate waste in this study. As possible reasons for this result, the authors cited the shortness of the lessons, peer influences, institutional cooking techniques, and serving size. The authors did not use a systems approach for their educational design. The point of tasting vegetables as part of the lessons was to increase their acceptability, but then only cabbage was served for the plate waste study. Had there been a decrease in consumption of the vegetables tasted, it would have been difficult to determine whether it was the lessons per se or the tasting that caused the change. The current study did not include tasting in the lesson plan to avoid the possibility of confounding and to adhere to the principles of instructional design.

Tolin, Newell, Grieg, and Staab (1979) compared the key nutrient approach to the basic four food group approach to nutrition education for third graders. Their study used two control groups and a treatment group for each approach. A pretest and posttest were given to all four groups and a plate waste study was conducted at the beginning and end of the experiment. Nutrition knowledge did not increase for third graders instructed in the basic four food groups. There were significant increases for those children taught the five nutrients method. The authors thought that the five nutrients approach stimulated more interest than did

the basic four. Plate waste data were available for only a few students since lunch participation was optional. Therefore the study was unable to show any change in behavior. A systems approach was not used in developing the lessons for this study. It appeared to this author that the five nutrients approach had a slightly better educational design than the basic four approach. Neither approach involved having the children practice the new skills or receive any immediate feedback. Tasting foods was part of both approaches but did not contribute to the objective of the learning sequences or make any contribution to the reduction of plate waste. The results of this study were similar to the current investigation in that children's knowledge increased but there was no change in eating behavior.

Similar results to the current study were also found by St. Pierre and Rezmovic (1982). They summarized six independent studies on the effectiveness of the Nutrition Education and Training Program. The California study (Wolff, Note 4) found no change in nutrition knowledge for preschoolers and kindergarteners. The California and Georgia (St. Pierre & Glotzer, Note 5) studies showed improvements in food attitudes for first and second graders but not for older children. The Nebraska study (St. Pierre, Glotzer, Cook, & Straw, Note 6) found a positive change for reported food preferences and willingness to select

new foods. The studies which included plate waste measures had varying results depending upon grade level and food type. Improved eating behaviors were most evident in the California and West Virgina (W.V. Dept. of Ed., Note 7) studies. California had a 25 percent overall reduction in plate waste while West Virgina reported significant reductions for the seven foods studied. St. Pierre and Rezmovic concluded from their evaluations of these studies that nutrition knowledge increased regardless of the curricula used. The exception was the California preschoolers and kindergarteners. The majority of states reviewed did not have changes in eating behavior as an effect of nutrition education.

The two studies that were able to demonstrate changes in eating behavior (Harrill et al., 1972, Johnson et al., 1980) used subjects similar in age to those of the present study, preschoolers and kindergarteners. They differ from the current study in that they used only a pretest as a control. Although this is considered sufficient control for statistical purposes, it does not take into account the exposure to the foods tested. Nutrition educators have for many years considered familiarity a factor in increasing a food's acceptability. This may be especially true for preschoolers. The greater the exposure to a particular food, the more apt a child is to eat it and possibly to increase the quantity eaten. The current

investigation utilized both a control group and a pretest-posttest design. This allowed for comparing the changes that took place by the effect of the treatment without the confounding by repeated exposure.

The other studies (Shovic & Jennings, 1979, Tolin et al., 1979, and St. Pierre & Rezmovic, 1982) involved older children and found no change in eating behaviors. It appears that younger children's eating habits are easier to change. All of these studies limited the choice for the children to eating or not eating the foods served for lunch. Had the investigators offered the children the opportunity to select the foods they ate, the results may have been similar to the present investigation.

Nutrition educators have listed peer influence (Shovic & Jennings, 1979, Yperman & Vermeersch, 1979), teacher preparation (Gillis & Sabry, 1980, Shannon, Marbach, Graves, & Sims, 1981), and parent education (Yperman & Vermeersch, 1979, Kirks, Hendricks, & Wyse, 1982) as possible explanations for the failure of nutrition education to change eating behaviors. In addition child development theories of cognitive and moral development which have been overlooked in nutrition education can help explain the current findings in the literature. Behavioral systems theory may also help to explain the outcome of the current study and aid in the planning of new strategies for future behavior changes.

Young children (ages 2 to 6 or 7) are at the preoperational stage of cognitive development according to Piaget (Lindgren, 1980). Children at this stage learn by experience and by exploring with their senses. It is direct interaction with the environment that children construct the reality of their world. Children in this study were unable to experience the pain of a cavity as a direct or immediate result of eating sweet foods. Since this is also an egocentric stage, the child believes that his/her thoughts are the only thoughts possible and therefore must be correct. It is quite likely that many of the children in this study have eaten sweet foods without getting a cavitiy. The preoperational child would therefore reject the new information in the lessons in favor of his/her old beliefs and past experiences.

Preoperational children are developing language skills and learn to repeat words and sentences. They do not necessarily comprehend what they are saying due to the lack of the basic cognitive structures required for understanding. Children in this study were able to memorize the classifications of foods but did not understand the meaning of the classifications. It is not until the next stage (concrete operational) that children are able to make classifications according to some property, but even then these mental operations cannot be applied to abstract qualities (Contento, 1981). The nutrition lessons required

the children to classify the foods according to sugar content, an abstract quality.

Children at this stage are unable to use causal reasoning and their thinking is not reversible. Children cannot follow a line of reasoning back to its start. This also results in the inability to conserve matter (Owen, Blount, & Moscow, 1978). Reversibility requires children to deal with proportions as abstractions. For a child who does not yet understand conservation, he/she would reason that a tall narrow container contains more than a short broad one. Therefore to reduce the quantity of sugar in a container, one could simply pour it into a shallower dish.

Kohlberg (1975) has theorized that there are stages of moral growth. These stages tie in with Piaget's stages of cognitive development. A child's logical reasoning must be advanced enough to permit moral reasoning. A preschooler usually fits into Kohlberg's punishment-and-obedience stage of moral development. At this stage the physical consequences of an action (for example, how many things get broken) determines the action's goodness regardless of the human intention. Also at this stage, damage incurred to property is considered worse than damage to a person. Intentions are abstractions and are not yet part of the cognitive processes. Therefore telling young children that eating sweet foods is bad for them and will

cause damage to their teeth may be above their level of moral reasoning since it involves personal damage as opposed to physical damage.

Other factors which would help explain the reasons for the failure of this nutrition education program can be identified by analyzing the behavioral system. Gillespie (1981) developed a framework for studying school nutrition education programs. The major subsystems in Gillespie's framework were: home and family environment, community environment, and school environment. Formal nutrition education takes place within the school environment. How the variables within the other two environments influence eating behavior must be investigated since formal nutrition education alone does not change behavior.

The home environment contains the child's mother, father, and siblings. Individually and together these family members are the child's nutrition educators from birth. The first years of life are influenced by the parents' level of nutrition education, food attitudes, and preferences. For example, researchers have shown the mother's nutrition knowledge affects the adequacy of her child's diet (Eppright et al., 1969). Yperman and Vermeersch (1979) found in their study that parental attitudes about food condition those of their children which affects the child's willingness to try new foods at school.