Teenagers Teaching Nutrition: Effects on Their Own Dietary Habits

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TEENAGERS TEACHING NUTRITION: EFFECTS ON THEIR OWN DIETARY HABITS

BY

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A thesis submitted in partial fulfillment of the requirements for the degree Master of Science Major in Home Economics South Dakota State University

1980
TEENAGERS TEACHING NUTRITION: EFFECTS
ON THEIR OWN DIETARY HABITS

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable for meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Adviser

Date

Dean, College of
Home Economics

Date
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A ten-state nutrition survey, conducted by the U.S. Department of Health, Education and Welfare in 1968-70 (Picardi and Pariser, 1975), showed that children under seventeen, and especially teenagers, had the highest prevalence of nutrition problems of all age groups studied, which included infants through adults. A large percentage of the teenagers surveyed consumed too little iron, calcium, and vitamin A and, in many cases, made poor food choices and unwise use of money to pay for their food.

In the fall of 1975 (Brown, Bergan, and Murgoo, 1979), data collected from 278 home economics students pointed out that the deficiencies in teenage diets had not been substantially altered in the five year interim. The nutrient intake of males, with the exceptions of vitamin A and ascorbic acid, was significantly higher than that of females. The higher nutrient intake levels of males were explained by consumption of larger quantities of food. Lack of iron was considered a problem for both males and females, as was a lack of vitamin A. Females were low in calcium and in food energy, whereas males were not.
Statement of the Problem

Nutrition information, whether good or bad, is gathered from a variety of sources. A person's first information about food is usually learned in the home. The foods to which one is exposed repeatedly become familiar and are considered "good" to eat and are most likely thought of as "good" in the nutritional sense as well (Marshall, 1972). Additional information is obtained from advertisements. As observed by this researcher, a child is presented with many requests to consume a wide variety of cereals and candies while watching favorite television programs or reading favorite magazines. The child often desires the food as a result of the advertising campaign and that food may become a staple part of the diet. The actual nutritive value of the advertised product is not mentioned by the advertiser and seems to be virtually ignored by the parents (Johnson, 1965). As a child grows older and receives less of his/her daily food in the home, other persons influence the food choices made. Teachers in school, school lunch personnel, and friends all contribute to the attitudes toward food. The child either rejects these opinions or accepts them and assimilates them into his/her own eating pattern (Marshall, 1972). Thus, nutrition information and ideas are received from many sources before ever encountering nutrition instruction in a classroom.
Most nutrition courses have been taught by the traditional means of lecture, discussion and other in-class methods in concert with the use of a variety of materials that have been developed to aid the nutrition teacher. However, many of the techniques used in the classroom fail to actively involve the student in his/her own learning. The resulting tendency seems to be that the student learns nutrition concepts well enough to retain the information for testing, but fails to apply the principles to personal eating habits (Guthrie, 1978). The task of the nutrition teacher is not to be a dispenser of information, but to aid the student in learning about nutrition in such a way that the knowledge gained will be applied to his/her own diet in an attempt to correct any weaknesses in it. The student should be able to continue to learn about food and nutrition beyond formal schooling and be able to identify and deal with nutrition related problems (Barnette and Branca, 1978).

Promising techniques of teaching are those which attempt to secure increased involvement of the students in their own instruction. Students are given more responsibility in the discovery of relevant information rather than having all information provided for them with no specific effort on their part. One such method is having students provide instruction to others of their own age or younger. This method has been used as a means of teaching teenagers about the responsibilities of parenthood and to create...
awareness of the effect pre-natal care or lack of that care has on an unborn child (Noonan, 1977). The process of teens teaching others has also been used in the areas of math and reading. Studies by Csapo (1976) and Dineen, Clark and Risley (1977), further described in the literature review chapter, have shown that this type of student tutoring benefits both the teen "teacher" and the one being taught.

Objective of the Study

This researcher first felt the need for teenage nutrition education beyond the traditional in-class activities after teaching several years of home economics at the high school level. During discussions, students revealed that they daily consumed only small quantities of food in order to lose weight or remain slim. Diets leaned heavily toward meats and carbohydrate foods, and included very few fruits and minute quantities of vegetables other than potatoes. Students also showed a great reluctance to prepare or sample unfamiliar foods in the laboratory, especially vegetables and milk products. Discussions with other teachers showed these to be common problems in teenage nutrition.

The researcher observed that the use of games, lab experiments, and home projects in addition to classroom lecture and discussion seemed to have little or no effect
upon teenage students' attitudes toward improved eating habits. Therefore, this researcher felt that having students assume some responsibility for the nutrition education of others might make a more lasting impression and foster an interest in maintaining more nutritionally balanced diets.

The objective of the study was to see if the diets of teenage students would improve as a result of involving them in their own instruction through the process of teaching nutrition concepts to others.

Definition of Terms

As used in this study, the following terms are defined by the researcher:

Adolescent or teenager: a person between the ages of thirteen and eighteen.

Dietary: a record of all food eaten by a person in the course of one day.

Elementary student: a student in grades one through six.

Recommended Dietary Allowances (RDA): amounts of nutrients recommended by the Food and Nutrition Board of the National Research Council, and considered adequate for maintenance of good nutrition in healthy persons in the United States.

Secondary student: a student in grades nine through twelve.

Traditional method of teaching: nutrition courses taught primarily through lecture, discussion or other familiar in-class techniques.
CHAPTER II

REVIEW OF LITERATURE

The problem of poor teenage nutrition was tentatively identified by the researcher through informal observation in her home economics classroom. Food selections of students were low in vegetables and milk products and particularly high in carbohydrate foods and foods high in fat content. Literature surveyed confirmed that students in the adolescent years were indeed consuming less than adequate diets.

The review of literature is divided into three parts. Part one is a review of the nutritional quality of the diets of American teenagers. Part two deals with food habits, how they are developed and how they can be changed. Part three focuses on the teaching of nutrition to others as a promising means of facilitating change in dietary habits.

Diets of American Teenagers

For nearly half a century, evidence has been accumulating in nutrition laboratories throughout the world which shows that the growth of the young of all species and their ultimate size are dependent in large measure upon the nutrition at various stages throughout their life span. Also affected by nutrition are the structure of the bones
and teeth, the ability to withstand infection, the attainment of physical vigor and the length of life (Martin, 1954).

More than two decades ago, Martin (1954) noted that dietary deficiency diseases, as such, were no longer a major nutrition problem but that other nutrition problems remained.

The evidence is substantial that a large segment of our people are skating on thin ice nutritionally. While their intake of nutrients now is sufficient to prevent overt evidence of vitamin and mineral deficiency, they have little margin of safety in their tissue stores to resist nutritional stresses incident to disease or to periods of temporary unbalance or shortages in their diets. (p. 8)

Historically, dietary studies on groups of children at various ages show wide gaps between actual dietary intakes and recommended amounts. Martin (1954) found children's meals to be low in foods rich in ascorbic acid, notably citrus fruits and tomatoes and their juices, and other raw vegetables and fruits.

A study by Brown, Bergan and Murgo (1979) gave evidence that dietary improvements have not resulted despite increased emphasis on needed changes. In their study, a diet was considered low in a specific nutrient if it contained less than 67 per cent of the RDA for that nutrient. Allowances for ascorbic acid were found to be adequate but several other nutrients were deficient. None of the females
met the allowance for iron and 92 per cent had low iron intakes. Sixty-one per cent of these females had intakes below 50 per cent of the RDA. The average iron intake of the male was also less than 67 per cent of the RDA. Adequate amounts of calcium were consumed by the majority of males, but approximately 50 per cent of the females had low intakes. Over 50 per cent of the subjects in this study consumed diets low in vitamin A. Only six per cent of the females met the allowance for energy each day, while 74 per cent of the males consumed adequate amounts. With the greater variety of foods now available, one wonders why there have been no notable improvements in dietary intakes.

Davis, Gershoff, and Gamble (Henderson, 1972) reviewed surveys of nutritional adequacy done by nongovernmental agencies between 1950 and 1965 and found that the nutritional value of the diet had slipped perceptibly in that time span. In view of the greater variety of foods available, it seemed that the cause of deterioration was the increased opportunity to make selection errors.

A number of eating practices other than inadequacy of intake contribute, directly or indirectly, to insufficient diets. One of the most serious problems is that of hurry. Many teenagers spend a good deal of time away from home, thus eating many of their meals and snacks "on the run". This food is often obtained from vending machines,
soft drink machines or fast-food establishments. The outcome is serious when the nutritive quality of the diet is affected, that is, when the hasty meals routinely consist of foods which contribute little in nutrient or satiety value and the total food intake for the day is thereby rendered inadequate (Picardi and Pariser, 1975).

Eating between meals may also tend to reduce both the quantity and quality of the day's food intake. Perhaps the most common effect of constant nibbling is to cut down on the day's consumption of protective foods and thus reduce nutrient intakes (Martin, 1954).

Candy and all other concentrated sweets may contribute to malnutrition in two chief ways: 1) when just enough is eaten to spoil the appetite for regular meals and particularly for the foods which should make up the main part of a child's diet, and 2) when sufficient quantities of sweets are eaten to actually displace the more nutritious foods. Overuse of soft drinks and stimulating beverages may also affect nutrition unfavorably. The most serious consequence to children is the decrease in their milk consumption (Martin, 1954).

Teenage girls have been berated by any nutritionist who has included subjects of this age in the study of dietary habits (McWilliams, 1975). The common problem for the teenage girl is usually that of fulfilling the body's nutritional requirements without consuming an excessive
quantity of calories. Two factors complicate the achievement of good nutrition by the female adolescent: a penchant for snacks and a preoccupation with being thin. Teenagers like to get together and snacks are an important part of their parties and informal gatherings. The foods served at such times are typically high in calories and low in nutrients (McWilliams, 1975).

Another problem that may lead to poor nutrition is inadequate knowledge of nutrition and lack of appreciation of the value of good dietary habits. Studies testing the nutrition knowledge and misconceptions of elementary and high school students have consistently shown a low level of knowledge among these groups (Wodarski, Adelson, Todd and Wodarski, 1980). Teenagers frequently have little understanding of what nutrients are contained in different foods and the role of the various nutrients in their bodies (McWilliams, 1975). When a person does not understand basic nutrition principles and is unaware of the nutritional contribution of various foods, it is difficult to choose foods that supply all the body's needs, and deficiency conditions may gradually develop.

The achievement of good nutrition for all infants and children during the growing years is a goal of significance for the entire world. The ultimate goal should be to help each person achieve the information and motivation to select foods which are nutritionally adequate.
Factors Involved in Formation of Dietary Habits

Why people accept some foods while rejecting others has been studied by several authors (Cussler and DeGive, 1952; Hamburger, 1953; Johnson, 1965; Lee, 1957; Marshall, 1972; Martin, 1963; Moore, 1957). This phenomenon becomes important when it affects the nutritional well-being of the persons making the food selections, particularly those who are going through periods of rapid growth.

The basis of food habits of the individual in normal circumstances lies in part in the pleasurable and disagreeable sensations associated with specific qualities of food, such as temperature, taste, flavor, texture and appearance. If no cultural group existed these qualities would presumably be the sole conditions of food choice (Cussler and DeGive, 1952).

Texture seems to have great significance in food choice. Some factors of texture which are disliked seem to be dryness, mushiness, coarseness, toughness, stringiness, and hardness. Preferred textures seem to be moistness, softness, and crispness. A variety of textures also seem to be important. Contrast in texture seems to play a part in the foods which are usually served in pairs. Contrasts in color may also have an effect in making a meal more appetizing. It seems possible that foods whose appearance give an impression of trouble in preparation are more appetizing (Cussler and DeGive, 1952).
Influences of Parents and Society. By the time a child enters school, he/she already has a well-developed pattern of eating, based on food habits that have been forming since birth. The groundwork for these habits, good and bad has been laid in the home (Martin, 1963). Children's food habits are inseparable from family food habits, which are, in turn, deeply rooted in racial, religious, and family practices.

The way in which a parent controls the eating habits of children is of great importance. Display of personal food dislikes to children or forcing children to eat foods disliked in order to set a good example are modes of control. Enticing the family to eat foods thought to be good for them or catering to their food preferences are other methods by which eating habits are controlled. Food may be used as a system of reward and punishment (Cussler and DeGive, 1952). All of these actions play a part in the development of the child's food habits.

The more ways food is used for purposes other than hearty enjoyment, the greater the danger that children will develop undesirable eating habits (Marshall, 1972). For example, the child who is given candy as a reward for good behavior may place undue emphasis upon candy as an especially desirable food. The child who is given a sweet dessert only after cleaning his/her plate may learn that dessert is
a reward obtained for completion of a task. The child who is not allowed to eat a meal after misbehaving learns to attach great emotional meaning to food. In these ways children learn to equate food with a system of reward and punishment rather than the quality of the food itself. As a result, they may continue to use food as their personal reward system throughout life which could possibly lead to obesity, but will more likely result in the eating of those foods which are not necessarily nutritious in place of the protective foods.

Food habits have the strength of tradition behind them. Therefore it is not surprising that the types of food considered edible and methods used in food preparation are deeply embedded in each culture (Marshall, 1972). In order to change food habits successfully, something must be known about the food traditions of the given culture.

Every society has developed traditional ways of conducting the activities connected with food. Marshall (1972) notes that how food is acquired, which foods are selected for consumption, how they are prepared for eating, who eats them, with whom, when, how and in what quantity they are eaten are food behaviors developed throughout the history of a society and adapted by each succeeding generation.

Our culture influences food selection in a variety of ways. It dictates when to have an appetite for specific
foods, such as breakfast foods. It tells whether or not one shall satisfy his appetite, as in the case of dieting. In this country, the influence on speed and efficiency throughout the culture has affected dietary choice, as evidenced by the prevalence of sandwiches. The kind of food appropriate to different occasions during the year is also culturally patterned (Lee, 1957). Certain foods have been especially suitable for children as distinguished from those suitable for adults. Distinctions have been made between men's food and women's food (Cussler and DeGive, 1952).

Much of our learning about foods consists of the development of habits that conform to a society's customs and is tied to our judgement of what is good or bad, right or wrong. Each society develops a list of acceptable foods and decides which foods will be important. Traditions regarding who may properly eat particular food items, the time and frequency of eating, the number and status of the individuals who eat together, and the ceremonial use of food are all culturally approved (Marshall, 1972).

Emotional Factors. All people respond emotionally to food. The nature and strength of the response depends upon past experiences. For very young babies, food is associated with the relief of bodily discomfort and comforting bodily contact (Marshall, 1972). Since this is the
method by which babies perceive love and affection, one can see that a deep emotional attachment to food begins at a very early age. Also, since the infant is fully dependent on parents or other adults for a long period of time, he/she is at the mercy of their food habits.

Positive and negative feelings have grown up about certain food items. Taboos are relaxed only in times of disaster, particularly famine. A positive attitude is usually associated with foods that are used to mark the passage from one state of life into another, such as baptism, weddings, funerals, and other ceremonies (Cussler and DeGive, 1952).

Food and eating are looked upon as symbolizing interpersonal acceptance, friendliness, sociability and warmth. To express rapport and communion, we urge one another to eat. The association of eating and friendship is very deep. We accept food best from those we consider our friends. We most enjoy eating with people who are close and emotionally desirable to us. To some extent we distrust the food given us by strangers, especially if they are real or potential enemies (Moore, 1957).

Influences of Industry. One cultural factor in the United States that contributes to food selection is pressure from competitive advertising of the food industry. Addition of new food is often made because of nutritional claims,
real or implied. Health benefits are frequently promoted in a way which leads to ready acceptance by the population. Advertisers utilize what the consumer already knows and believes and attempts to convince consumers in these terms that the product is better than the one now being used (Johnson, 1965). Consumer acceptance of the new food often results in displacement of a food already in the diet. Consumers need to evaluate the nutritional benefits available from each food before making diet changes.

Our culture is experiencing greater monotony in food choice. There is more eating away from home and more foods coming into the home ready-prepared. This means we are eating more standardized, mass-produced items, which limits the possibility for new food experiences. We eat the same foods prepared in the same way over and over, and this tends to accentuate a natural disinclination toward unfamiliar food items. This is in opposition to the fact that the more opportunity a person has to experience a wide variety of foods provided in a wide variety of situations, the more readily any available foods are accepted (Marshall, 1972)

Perceptions of whether or not a food is pleasurable is a complex of all past experiences, both sociocultural and sensory. Reaction is expressed as a degree of liking or disliking. Food liked very much becomes the preference, and will tend to be chosen if available (Marshall, 1972).
**Difficulties in Changing Dietary Habits**

A wide variety of factors play a part in the foods selected for consumption by an individual within a society. A single factor causing any person to accept or reject a particular food item available would be impossible to isolate.

By adolescence, eating patterns are well established according to the cultural influences and personal experiences an individual has encountered. Eating what one wishes has become a symbol of increasing independence with increasing maturity. This fact has important implications for any program attempting to change food habits (Marshall, 1972).

Changes in interests and concerns brought about by increasing maturity are usually reflected in some alteration of attitudes and habits in regard to food. Teenagers are aware that they can use food to help them achieve some of the things they want, and they are receptive to concerned assistance in learning how to use foods to those ends (Marshall, 1972). For example, a wrestler may go on a weight reduction diet in order to make a certain weight class. Young people of all ages are interested in nutrition if it relates to them at their stage of development. They want to understand what is happening to their own bodies as they mature into adulthood (Marshall, 1972).
Because food habits have emotional connotations, they are particularly resistant to change. Resistance to change is normal. Human beings change their habits slowly unless immediate benefits are evident. Change slows to an almost imperceptible rate when it deals with daily patterns of living, such as eating practices, because potential future gains are so often obscured by the immediate rewards of not changing (Marshall, 1972).

When dealing with a change in food habits, one must remember that food habits are complex, deep-seated and resistant to change. However, changes can be made if the reasons for change are relevant to the life stage of the persons involved and if they are not in opposition to existing cultural food patterns. Hamburger (1958) emphasized that people who resist dietary change should not be pressured, threatened, or made to feel guilty if they cannot follow the recommendations. An attempt must also be made to expose persons to a wider variety of foods in pleasant, comfortable situations.

Facilitating Learning Through Teaching Others

Increasingly, nutrition educators are concerned about the lack of application of nutrition knowledge gained in the classroom. Poolton (1972) found this concern voiced by instructors in her study of the effectiveness of the Basic Four food groups and the conceptual approach used in
the teaching of nutrition. One teacher in the Poolton study commented: "In my observations of the teenagers' own eating habits, there still seems to be a gap between what they learn they should eat and what they actually include in their everyday diets" (p. 110). A second teacher added that "A few can recognize the difference enough to want to do something about it--but most do not actually break the habit of soft drinks, hamburgers, fried foods..." (p. 110).

Many who are well informed retain very faulty dietary habits, and misinformation seems to have more impact than accurate material in influencing food choices (Guthrie, 1978).

Information alone is often not enough to cause a person to improve eating habits and thus the nutritional state. The challenge for nutrition educators is to find ways in addition to providing information to change the behavior of those who are acting on the information they have (Guthrie, 1978). Current methods of nutrition education have not proved as effective as they need to be.

Teaching nutrition to secondary students requires great skill and a knowledge of the way adolescents think and act. Interest in nutrition is not usually shown by adolescents unless they can see how it serves their own special needs. Boys are particularly interested in physical development, strength and athletics. Girls are interested in personal appearance and grooming. At this age both are increasingly concerned with personality as it makes them
more acceptable to their own age groups and enhances their ability to obtain jobs (Martin, 1954).

Nutrition education depends on communication—by word, deed and example, soft-sell, hard sell and motivation. It also depends on facts and ideas that are sent through the communication process (Leverton, 1967). Nutrition education must be related to some action, and not to the storage of scientific information. Too often nutrition education is presented merely as a means for transmitting isolated facts (Johnson, 1965).

Education must arouse interest and stimulate thinking. Inasmuch as adolescents have a short attention span, they should have a variety of experiences to stimulate their interest (Carruth and Foree, 1971). Successful learning experiences come from involvement in an activity with meaning, and therefore purpose, for the individual. Meaning and purpose in learning will help prevent or overcome "avoidance" behavior related to disinterest (Poolton, 1972).

Students getting involved in education through the process of teaching others is one method which shows promise as a means for increased learning. In a study by Csapo (1976), students were used as reading tutors in an attempt to improve their own reading abilities. The tutors were students whose reading levels were three to five years behind the age grade expectancy level. The results indicated that both the helpers and the receivers of the help
benefitted from the experience. Both groups showed increases in the number or words read correctly per minute and the number of words read correctly on the standardized reading test used in the study. A similar study in spelling by Dineen, Clark and Risley (1977) also showed favorable results. Tutoring a peer increased the subjects' spelling accuracy nearly as much as being tutored by a peer.

Programs using students as teachers have also been adapted to the area of nutrition. The experience of applying nutrition knowledge in teaching another person has increased student interest and involvement and improved the ability of students to apply nutrition knowledge in new situations (Mills, 1972).

Shoup (1975) utilized such a technique with junior and senior high school students in Somers, Connecticut. Teens made choices as to the topics to be taught. Each team of students wrote their own set of objectives and planned related activities, with guidance from the teacher. They were encouraged to use little or no lecture but to involve their "students" in learning activities. Teens were checked regularly the week before, the morning of, and immediately following each lesson for extent of preparation. As evidenced by a food rating chart administered at the beginning and end of the project, their attitudes toward foods appear to have been influenced in an encouraging manner. Scores on tests of nutrition knowledge also improved.
student involved in a project of teaching nutrition to peers said that in recognizing some poor food habits in others she was better able to see and deal with her own poor habits (Mills, 1972). Another student involved in a program of gaining nutrition information through discovery learning stated, "I enjoyed being able to learn about nutrition without having to read or be lectured to. We were able to learn by finding out for ourselves in a way we all enjoyed" (Spitze, 1976, p. 61).

Nutrition education which is merely the transmission of facts from teacher to student with no resulting change in actual eating habits must be avoided. Nutrition needs to be made more relevant to the student. Evidence suggests that one way of doing this is by getting students actively involved in their own learning program.
CHAPTER III

METHODOLOGY

The purpose of the study was to determine whether teenage diets would improve as a result of involving the teenagers in their own instruction through the process of teaching others. Students developed their own lessons for instruction of elementary students and were also responsible for keeping records of food eaten both prior to and following the experiment. The process by which the study was developed will be covered in this chapter.

Selection of Sample

Schools participating in the study were selected from a list of South Dakota schools having secondary home economics departments teaching semester nutrition courses. The list was obtained from the South Dakota State Supervisor of Vocational Home Economics. All home economics departments offering such programs were asked to participate in the study. Two of the fourteen eligible schools contacted agreed to participate. One of these schools later had to be dropped because they did not complete the final dietary. A second appeal involving a personal contact failed to produce additional teachers willing to participate in the study. Since the number of subjects was not sufficient, the researcher decided to include her own classes in the
study. Total numbers consisted of 11 students from Canistota High School and 32 students from Freeman High School. All of the subjects were females.

Students in each of the two participating schools were randomly divided into two groups. Red and black checkers were drawn in order to produce random assignment of groups. Each group consisted on one-half of the usual class section. Both groups were involved in the instruction of elementary students. The experimental group taught nutrition to elementary students while the control group taught another health related concept. A coin was flipped to randomly determine which group taught the nutrition concept.

**Instrumentation**

Students involved in the study were enrolled in nutrition courses one semester in length. As part of the course content, the students were involved in teaching two lessons of approximately thirty minutes each to elementary students. Teachers of the high school students enrolled in nutrition classes were instructed that students should be familiar with the Basic Four food groups and the various nutrients found in foods in order to knowledgeably present information to younger subjects.

Students in both the experimental and the control groups were required to complete three consecutive 24-hour
recalls of food consumption prior to planning the lessons their group would be teaching. Following the elementary school presentations, all pupils submitted a second set of three 24-hour recalls to ascertain if there were differences in eating habits after participating in the teaching experience. The time lapse between the collecting of the first dietary and the second was approximately one month.

Data was extracted from the dietaries using food record forms (see Appendix A). The food records were coded for analysis through the use of a system designed by the Consumer and Food Economics Institute (Nutritive Value of Foods, 1971). Figure 1 illustrates the information used for coding. Serving sizes had been indicated by the students using common household measurements as references. When coding, the number assigned to a food in the bulletin was recorded, as well as the decimal fraction of the size portion as indicated in the bulletin. For example, one-half cup of whole milk consumed would be coded as 001 (the number assigned to the food) and .05 (the decimal fraction of the serving size listed in the chart). For foods that were not included in the bulletin a similar food or the ingredients were used. Thus, a milk drink made by blending one cup of milk with a banana would be coded as 001 for the milk and 1.0 for the serving size of milk as well as the food identification number and serving size for one banana.
<table>
<thead>
<tr>
<th>Food, approximate measure, and weight (in grams)</th>
<th>Food Water</th>
<th>Protein Fat</th>
<th>Fatty acids Saturated (total)</th>
<th>Unsaturated Oleic Linoleic</th>
<th>Carbohydrate</th>
<th>Calcium</th>
<th>Iron</th>
<th>Vitamin A value</th>
<th>Thiamin</th>
<th>Riboflavin</th>
<th>Niacin</th>
<th>Ascorbic acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>MILK, CHEESE, CREAM, IMITATION CREAM: RELATED PRODUCTS</td>
<td>Grams</td>
<td>Percent</td>
<td>Calories</td>
<td>Grams</td>
<td>Grams</td>
<td>Grams</td>
<td>Grams</td>
<td>Grams</td>
<td>Milligrams</td>
<td>Milligrams</td>
<td>International units</td>
<td>Milligrams</td>
</tr>
<tr>
<td>Milk fluid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole, 3.5% fat</td>
<td>1 cup</td>
<td>244</td>
<td>87</td>
<td>160</td>
<td>9</td>
<td>9</td>
<td>8.5</td>
<td>Trace</td>
<td>12</td>
<td>238</td>
<td>0.1</td>
<td>1</td>
</tr>
<tr>
<td>Nonfat (skim)</td>
<td>1 cup</td>
<td>245</td>
<td>99</td>
<td>99</td>
<td>9</td>
<td>Trace</td>
<td>12</td>
<td>236</td>
<td>.1</td>
<td>10</td>
<td>0.9</td>
<td>0.44</td>
</tr>
<tr>
<td>Partly skimmed, 2%</td>
<td>1 cup</td>
<td>245</td>
<td>87</td>
<td>145</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>Trace</td>
<td>15</td>
<td>352</td>
<td>.1</td>
</tr>
<tr>
<td>Canned, concentrated, undiluted:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporated, unsweetened</td>
<td>1 cup</td>
<td>252</td>
<td>74</td>
<td>345</td>
<td>18</td>
<td>20</td>
<td>11</td>
<td>7</td>
<td>1</td>
<td>24</td>
<td>635</td>
<td>.3</td>
</tr>
<tr>
<td>Condensed, sweetened</td>
<td>1 cup</td>
<td>308</td>
<td>27</td>
<td>980</td>
<td>25</td>
<td>27</td>
<td>15</td>
<td>9</td>
<td>1</td>
<td>166</td>
<td>802</td>
<td>.3</td>
</tr>
<tr>
<td>Dry, nonfat instant:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-density (1/2)</td>
<td>1 cup</td>
<td>68</td>
<td>4</td>
<td>245</td>
<td>21</td>
<td>Trace</td>
<td>35</td>
<td>879</td>
<td>.4</td>
<td>120</td>
<td>.24</td>
<td>1.21</td>
</tr>
<tr>
<td>High-density (1/2 cup)</td>
<td>104</td>
<td>4</td>
<td>375</td>
<td>37</td>
<td>1</td>
<td></td>
<td>54</td>
<td>1,345</td>
<td>.6</td>
<td>130</td>
<td>.36</td>
<td>1.85</td>
</tr>
</tbody>
</table>

Figure 1

Chart of Nutritive Values used for Coding the Dietaries (Consumer and Food Economics Institute, 1971)
The nutrients contained in each food item had been previously recorded on computer tapes and did not require coding.

Design

An attempt was made to approximate the true experimental design. However, all variables could not be controlled, resulting in a study of quasi-experimental design. The selection of schools involved in the study was on a voluntary basis rather than random selection. Possibly, those instructors cooperating in the study already had positive attitudes toward the teaching of nutrition in the classroom. This attitude might influence teaching style and have an effect on students acceptance of classroom material. Instructors' individual teaching styles were not taken into account, which could have an effect on the lessons the students prepared for teaching and previous nutrition knowledge accumulated.

As first conceived, the intention of the researcher was to develop teaching aids which would be an alternative to the lecture-discussion methods commonly used in the teaching of nutrition classes. Upon further investigation, it was discovered that a wide variety of excellent material was currently available for use by nutrition instructors. The researcher felt that the existing materials could be used to involve students more fully in the classroom instruction. One general learning principle is that the
greater the involvement in learning, the more likely the learning is to endure. The researcher felt that students' preparation and teaching of nutrition lessons would enable them to become more interested in and concerned about their own nutritional practices. Thus, the study was designed to have secondary students teach elementary students.

Prior to the experiment, a pilot study was performed using the researcher's home economics classes not involved in the final study. Students planned one lesson and presented it to elementary students. As a result of information gained from the pilot study, two major changes were made in the study design. In order to facilitate accuracy in the recording of dietaries, a display of household containers was made available to students to aid in estimating size of servings. Students were given additional help in planning lessons for the elementary age level, as the lesson taught in the pilot study was quite advanced for the elementary students.

Structure of Lessons. Randomly selected groups of students were given responsibility for planning and preparing two lessons to be taught at the elementary level. The classroom teacher offered suggestions for possible topics to both groups and provided information on sources of teaching materials.
The students used some classroom time in preparing the lessons, with the remaining preparation being done as homework. Students worked as a group in selecting the teaching topic and preparing the lessons, assigning individuals within the group responsibility for a segment of the presentation. The classroom teacher worked individually with each student to check for appropriateness of the subject matter for the age level of the elementary students and for accuracy of content.

Student groups chose teaching topics from several areas. The most commonly used topics of the experimental groups were "Dairy Foods in the Diet", "Choosing Good Snacks", "Selecting Foods from the Basic Four Food Groups" and "Eating Breakfast". Control groups chose topics of "Tooth Care", "The Importance of Cleanliness" and "Physical Fitness".

Students were encouraged to use a variety of teaching techniques in their presentations. Very little of the lesson was presented by lecture. Methods used were puppet shows, songs and rhymes, short plays, flannel boards, filmstrips and demonstrations. The elementary children were involved in the lessons through scavenger hunts, question and answer periods, food preparation, game playing and voluntary participation as demonstration models. Students developed their own lesson materials and prepared food samples or obtained sample items, such as toothbrushes, from
local sources. The student lessons were checked several times prior to their presentation to make certain the information being presented was accurate and that the lessons were prepared well enough to progress smoothly.

Each lesson was approximately thirty to forty minutes long with the majority of the time being student presentations of one form or another. The remainder of the time involved elementary student participation. Each group of students presented two separate lessons one week apart to the elementary children. In order to present a lesson, students had to obtain accurate information about the topic they chose to teach. They were acquiring nutrition information through their own initiative which would normally have been teacher presented.

Hypothesis. The following null hypothesis was formulated: There is no significant difference in teenagers eating habits as a result of involving them in their own nutrition studies through the process of teaching nutrition concepts to others.

Data Analysis. With all of the data collected, the dietaries were coded and the data was punched on tabulating cards. All data was coded by the researcher and an analysis of variance was computed on mean changes between pre- and post-test scores.
CHAPTER IV

FINDINGS AND DISCUSSION OF FINDINGS

The goal of the experiment was for subjects to obtain an increase in food and nutrient intake as a result of teaching nutrition lessons to younger students. The nutrients of primary concern were those found to be commonly low in teenage diets by previous studies, that is, iron, calcium and vitamin A. All major nutrients were included in the study to ascertain whether nutrients other than iron, calcium and vitamin A were deficient in the diets of teenagers involved in the study.

Recommended Dietary Allowances (RDA) (Nutritive Value of Foods, 1976) were used as the standard by which to judge the nutritional adequacy of the diets prior to and following the teaching experiment. The RDA's used as shown in Figure 2, were for girls age 14 to 16, as all the subjects involved in this study were females in this age group.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>2100</td>
</tr>
<tr>
<td>Protein</td>
<td>48 g</td>
</tr>
<tr>
<td>Calcium</td>
<td>1200 mg</td>
</tr>
<tr>
<td>Iron</td>
<td>18 mg</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>4000 IU</td>
</tr>
<tr>
<td>Thiamin</td>
<td>1.1 mg</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>1.4 mg</td>
</tr>
<tr>
<td>Niacin</td>
<td>14 mg</td>
</tr>
<tr>
<td>Ascorbic Acid</td>
<td>45 mg</td>
</tr>
</tbody>
</table>

Figure 2

RDA's of Girls, Ages 14 to 16
Mean scores on the pre-test dietary analysis revealed that the subjects were most deficient in iron, followed by calcium, thiamin and vitamin A. These deficiencies varied from 9.10 milligrams (fifty per cent) for iron in the experimental group to 3085.10 International Units (seventy-seven per cent) for vitamin A in the control group. Post-test scores showed iron to be the most deficient at 8.87 milligrams for the experimental group and 8.87 milligrams for the control group (forty-nine per cent). Vitamin A consumption increased to 3276.76 International Units (eighty-one per cent) for the experimental group but declined to 731.30 International Units (sixty-three per cent) for the control group. Calcium consumption decreased for both groups, while thiamin consumption increased for both groups. Subjects in both groups consumed well above the minimum RDA for the nutrients riboflavin, protein and ascorbic acid. This data supports findings from previous studies for nutrients most commonly found deficient in teenage diets. Actual nutrient consumption by the experimental and control groups is found in Tables 1 and 2.
Table 1. Pre- and Post-test Scores for Individual Nutrients, Experimental Group (Group 1)

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>RDA</th>
<th>Pre-test</th>
<th></th>
<th></th>
<th>Post-test</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Minimum</td>
<td>Maximum</td>
<td>Mean</td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>Calories</td>
<td>2100</td>
<td>1859.35</td>
<td>965</td>
<td>2820</td>
<td>1853.35</td>
<td>917</td>
<td>2888</td>
</tr>
<tr>
<td>Protein</td>
<td>48 g</td>
<td>69.78</td>
<td>29</td>
<td>101</td>
<td>68</td>
<td>33</td>
<td>104</td>
</tr>
<tr>
<td>Calcium</td>
<td>1200 mg</td>
<td>868.61</td>
<td>243</td>
<td>1502</td>
<td>773.22</td>
<td>216</td>
<td>1367</td>
</tr>
<tr>
<td>Iron</td>
<td>18 mg</td>
<td>9.04</td>
<td>4</td>
<td>14</td>
<td>8.87</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>4000 IU</td>
<td>3395.40</td>
<td>1171</td>
<td>7816</td>
<td>3276.70</td>
<td>675</td>
<td>12737</td>
</tr>
<tr>
<td>Thiamin</td>
<td>1.1 mg</td>
<td>.87</td>
<td>0</td>
<td>1</td>
<td>1.04</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>1.4 mg</td>
<td>1.57</td>
<td>1</td>
<td>2</td>
<td>1.57</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Niacin</td>
<td>14 mg</td>
<td>12.22</td>
<td>5</td>
<td>23</td>
<td>13.48</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>45 mg</td>
<td>68.96</td>
<td>22</td>
<td>127</td>
<td>73.57</td>
<td>11</td>
<td>257</td>
</tr>
</tbody>
</table>

N = 23
Table 2. Pre- and Post-test Scores for Individual Nutrients, Control Group (Group 2)

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>RDA</th>
<th>Pre-test</th>
<th></th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>Calories</td>
<td>2100</td>
<td>1959.50</td>
<td>736</td>
<td>2857</td>
</tr>
<tr>
<td>Protein</td>
<td>48 g</td>
<td>75.20</td>
<td>27</td>
<td>113</td>
</tr>
<tr>
<td>Calcium</td>
<td>1200 mg</td>
<td>969.40</td>
<td>193</td>
<td>1893</td>
</tr>
<tr>
<td>Iron</td>
<td>18 mg</td>
<td>9.75</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>4000 IU</td>
<td>3085.10</td>
<td>800</td>
<td>6749</td>
</tr>
<tr>
<td>Thiamin</td>
<td>1.1 mg</td>
<td>.85</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>1.4 mg</td>
<td>1.75</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Niacin</td>
<td>14 mg</td>
<td>12.95</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>45 mg</td>
<td>77.80</td>
<td>16</td>
<td>171</td>
</tr>
</tbody>
</table>

N = 20
A comparison of the pre-test scores showed the control group having higher mean scores than the experimental group for all nutrients except vitamin A and thiamin. The post-test mean scores for the control group were higher in calories, protein, iron, and niacin, while the experimental group consumed larger amounts of calcium, vitamin A, thiamin, riboflavin and ascorbic acid.

Table 3 shows mean differences between pre- and post-test scores for each of the nutrients analyzed plus total calories. Most nutrients showed decreases in consumption when comparing pre- and post-test mean scores. Students in school A consumed less total calories after the teaching experiences, especially notable in the control group. The control group in this school also showed large decreases in protein and ascorbic acid. School B students decreased in consumption of vitamin A, especially in the control group. Ascorbic acid and calcium consumption was also lower in the control group of school B after teaching the health related lessons. Although none of these decreases were significant, it is important to be made aware of them. In comparing experimental and control groups for the above mentioned nutrients, it can be noted that in all cases the control group decreases were larger than those of the experimental group.
### Table 3

Mean Change in Per cent RDA Between Pre- and Post-test Scores for Individual Nutrients

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Total Sample</th>
<th>School A</th>
<th>School B</th>
<th>Schools A and B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Group 1</td>
<td>Group 2 Total</td>
</tr>
<tr>
<td>Calories</td>
<td>- 0.37</td>
<td>- 8.49</td>
<td>- 1.13</td>
<td>- 17.33</td>
</tr>
<tr>
<td>Iron</td>
<td>- 2.42</td>
<td>- 2.85</td>
<td>5.95</td>
<td>-13.41</td>
</tr>
<tr>
<td>Thiamin</td>
<td>12.00</td>
<td>9.06</td>
<td>18.38</td>
<td>- 2.12</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>- 5.33</td>
<td>- 0.77</td>
<td>6.37</td>
<td>- 9.35</td>
</tr>
<tr>
<td>Niacin</td>
<td>15.55</td>
<td>- 9.78</td>
<td>1.46</td>
<td>-23.27</td>
</tr>
<tr>
<td>Ascorbic Acid</td>
<td>- 6.47</td>
<td>-33.06</td>
<td>-24.17</td>
<td>-43.72</td>
</tr>
</tbody>
</table>

N = 43  
Group 1 (Experimental) N = 23  
Group 2 (Control) N = 20
Possible reasons for the increases in consumption in thiamin and niacin can be postulated. Both thiamin and niacin are B vitamins and are found in small quantities in a wide range of foods, such as bread, cereals, meats and dairy products. Therefore, by consuming a larger variety of foods, the student could easily increase consumption of these two nutrients. Nutrients which are confined to one main type of food would be less likely to show changes. For example, calcium is obtained almost entirely through consumption of milk products. If the student failed to consume additional milk, cheese or other dairy products, there would likely be no change in the record.

In part, individual nutrient decreases could be related to the decrease in calorie consumption. Calorie reduction is evidence of a decrease in total food consumption. When food intake declines, individual nutrients must also decline.

The null hypothesis was that "there is no significant difference in teenager's eating habits as a result of involving them in their own nutrition studies through the process of teaching nutrition concepts to others". The procedure used to test the hypothesis was analysis of variance. Changes in mean per cent of nutrient intake between the pre- and post-test were analyzed. No significant differences were found between the experimental group
and the control group. Therefore the null hypothesis was not rejected.

Analysis of variance did show a significant change in schools and a significant interaction between school and group for niacin intake (see Table 4). A closer look at the mean changes for niacin (Table 3) reveals that though there was an overall increase, it was largely attributable to a change in the control group (23.15 per cent) rather than the experimental group (8.94 per cent).

Table 4
Analysis of Variance Summary for the Dependent Variable, Change Niacin Intake

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>1</td>
<td>9372.941*</td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>2050.391</td>
</tr>
<tr>
<td>School X Group</td>
<td>1</td>
<td>5447.844*</td>
</tr>
<tr>
<td>Residual</td>
<td>39</td>
<td>1319.961</td>
</tr>
</tbody>
</table>

*significant at the .05 level

One must ask why such sporadic changes occurred. The great difficulty in changing food habits formed over a lifetime must be taken into account. Marshall (1972) states that food habits are particularly resistant to change because of the emotional connotations involved.
Students may have learned about nutrition well enough to teach it, but not well enough to change their attitudes toward food consumption. Secondly, these students are at a very healthy, energetic stage of their life. They may not be able to comprehend the long-term effect of poor nutrition due to the fact that their eating habits seem to have no ill effect on their health at the present time. Also, peer pressure has a great influence on students in the teen years. A young person in a group of peers might find it difficult to reject potato chips and soda pop in favor of a piece of fruit and a glass of milk.

Since students were involved in the project for only about one month, they may not have had enough time to fully assimilate nutrition knowledge to the point that eating habits were affected. Although they were given basic nutrition information prior to teaching their lessons and found more information about nutrition on their own in preparing the lessons, the information may have been presented over too short a time period to leave a lasting impression.

The tool used in the collection of data may not be totally accurate. A number of studies have been performed to determine the accuracy of the 24-hour recall. Dietary studies are used to determine the sources and amounts of nutrients consumed. According to Christakis (1973) there are several reasons why short term dietary studies have their limitations. These include the skill of the history
taker, the degree of cooperation and memory of the subject, and the inadequacy of short-term studies which may not reflect total nutrient intake over longer periods.

Most individuals cannot accurately recall food intakes beyond twenty-four hours. Week-end or holiday meals differ from other days. Seasonal variations in consumption may be present. Subjects may have difficulty in estimating serving size. If the subject is forewarned, taking a food record may cause her/him to change eating habits (Christakis, 1973). All of these factors may affect the accuracy of the food record.

A study by Young, Hagan, Tucker and Foster (1952) showed that the 24-hour recall did not give the same estimate of intake for the individual as the diet history, however, the 24-hour recall could be used interchangeably with the seven day record. Thus, keeping dietaries for longer periods of time on random days may have given a more accurate picture of nutrient intake.
CHAPTER V

SUMMARY AND RECOMMENDATIONS FOR FURTHER STUDY

The objective of the study was to improve the eating habits of teenage students through the process of teaching nutrition lessons to others. The underlying theory was that the need for eating a nutritionally sound diet would become more relevant to students if they were involved in their own nutrition education.

The entire experiment consisted of a three day dietary collected prior to the lessons, the planning and presentation of student lessons to younger students, and a three day dietary collected following the lessons. The time lapse of the entire experiment was approximately one month from the collecting of the first dietary to the collecting of the last dietary. Lessons were planned and presented by the students with guidance from their nutrition instructors. Forty-three female students, twenty-three in the experimental group and twenty in the control group, from Canistota and Freeman High Schools in South Dakota participated in the study.

Significant improvement in nutrient intake was not found for any nutrient. While thiamin, riboflavin, niacin and ascorbic acid increased for the experimental group as a whole and iron, protein and vitamin A showed increases in
the experimental group of one of the schools, no changes were shown to a significant degree.

The following suggestions or revisions are recommended for improvement of the study:

1. Involve a larger number of students in the study.

2. Have students teach more than two lessons to younger students.

3. Collect an additional series of 24-hour recalls a period of time after completion of the study in order to ascertain whether changes are short or long term.

4. Use a form of dietary record collection other than the 24-hour recall.

5. Participate in classroom follow-up activities for reinforcement of nutrition education.

6. Involve students in teaching activities for a longer period of time.

The following areas of research are recommended for further study:

1. Develop a similar program, with students teaching others only a couple of years younger than themselves, rather than five to seven years younger. The students would thus be presenting materials closer to their own level of comprehension. The more difficult information may have more dietary relevance.
2. Compare the method of involving students in their own nutrition instruction through the instruction of others with another method of self-instructed nutrition education.
References


Csapo, M. "If you Don't Know It, Teach It!". The Clearing House, April 1976, 49, 365-367.


Noonan, D. "Healthy Babies: Chance or Choice". March of Dimes presentation at South Dakota Future Homemakers of America state meeting, Huron, October 1, 1977.


Food Consumption Record

Name ___________________________  Sex M F  Date ________________

School ___________________________  Class 9 10 11 12

Remember to write down EVERYTHING YOU ATE AND DRANK from the time you got up yesterday morning, until the time you got up this morning. You do not need to write down the amount of water you drank during the day, but do remember such things as:

- Milk or sugar on your cereal
- Butter or jelly on your bread or toast
- Frosting on your cake
- Soda pop, Kool-aid, Fizzies, etc.
- Vitamin pills (if you take them)

<table>
<thead>
<tr>
<th>Kind of Food &amp; Drink</th>
<th>Amount Eaten or Drunk</th>
<th>DO NOT WRITE HERE</th>
</tr>
</thead>
<tbody>
<tr>
<td>After I got up yesterday morning and before breakfast, I ate and drank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For breakfast yesterday morning, I ate and drank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between breakfast and my noon meal yesterday, I ate and drank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For my noon meal yesterday, I ate and drank</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Between my noon meal and my evening meal yesterday, I ate and drank

For my evening meal yesterday, I ate and drank

Between my evening meal and the time I went to bed last night, I ate and drank

After I went to bed and before I got up this morning, I ate and drank
APPENDIX B
**APPENDIX B**

### Table 5. Analysis of Variance Summary for Changes in Nutrient Intake

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>School df</th>
<th>$\chi^2$</th>
<th>Group df</th>
<th>$\chi^2$</th>
<th>School x Group df</th>
<th>$\chi^2$</th>
<th>Residual df</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>1</td>
<td>975.688</td>
<td>1</td>
<td>1.013</td>
<td>1</td>
<td>925.294</td>
<td>39</td>
<td>715.163</td>
</tr>
<tr>
<td>Protein</td>
<td>1</td>
<td>340.658</td>
<td>1</td>
<td>393.075</td>
<td>1</td>
<td>3818.299</td>
<td>39</td>
<td>1992.147</td>
</tr>
<tr>
<td>Calcium</td>
<td>1</td>
<td>698.390</td>
<td>1</td>
<td>1411.142</td>
<td>1</td>
<td>61.745</td>
<td>39</td>
<td>1032.659</td>
</tr>
<tr>
<td>Iron</td>
<td>1</td>
<td>3.304</td>
<td>1</td>
<td>169.551</td>
<td>1</td>
<td>865.173</td>
<td>39</td>
<td>216.492</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>1</td>
<td>10140.887</td>
<td>1</td>
<td>4539.563</td>
<td>1</td>
<td>158.203</td>
<td>39</td>
<td>3789.926</td>
</tr>
<tr>
<td>Thiamin</td>
<td>1</td>
<td>134.608</td>
<td>1</td>
<td>613.942</td>
<td>1</td>
<td>611.411</td>
<td>39</td>
<td>704.224</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>1</td>
<td>286.460</td>
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<td>2177.204</td>
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$df =$ degrees of freedom  
$\chi^2 =$ mean square