

THE UNIVERSITY OF MANITOBA

AN EVALUATION OF THE NUTRIENT INTAKE
BY DIETARY RECALL OF GRADE V SCHOOL CHILDREN
IN A LOW INCOME AREA OF WINNIPEG

AN ASSESSMENT OF THE NEED
FOR A SCHOOL LUNCH PROGRAM

BY

Carol Ann Smirl

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE

WINNIPEG, MANITOBA

OCTOBER 1973



ABSTRACT

AN EVALUATION OF THE NUTRIENT INTAKE BY DIETARY RECALL OF GRADE V SCHOOL CHILDREN IN A LOW INCOME AREA OF WINNIPEG

AN ASSESSMENT OF THE NEED FOR A SCHOOL LUNCH PROGRAM

A sample population of grade V elementary school children living in a low income area of central Winnipeg were surveyed, in order to determine their daily nutrient intakes as well as their nutrient intakes and food habits at lunch with a view to demonstrating the need for a school lunch program. It was hypothesized that the daily nutrient intakes of the children would be below the Canadian Dietary Standard and that their nutrient intakes at lunch would be less than one-third of the Standard. Therefore, a school lunch program would likely benefit these children with regard to improving their nutrient intakes.

Twenty-four hour recall records were used to obtain the food intake data and questionnaires were used to gather information about the food habits at lunch. Nutrient intakes for each child and mean intakes for each of the eight schools surveyed were obtained by computer analysis. Daily nutrient intakes were divided into three meals and three snacks in order to determine the adequacy of the noon lunch particularly. Anthropometric measurements for weight, height, and triceps skinfold were obtained for each child and were compared to Canadian average values.

Analysis of the 24-hour recall data showed that the nutrients most frequently below the Canadian Dietary Standard were calcium, iron, and ascorbic acid as well as kilocalories. The same nutrients were found to be present in less than one-third of the recommended allowances for lunch. It was also observed that more children omitted the morning meal than omitted the noon meals. Analysis of the lunch questionnaires showed that the majority of the children went home for the noon meal. Although there appeared to be a trend for the twelve-year-old girls to have the poorest nutrient intakes as compared to the ten- and eleven-year-old children, statistical significance could not be shown.

It is recommended that food supplements directed at increasing the specific nutrient deficiencies of calcium, iron, and ascorbic acid, as well as kilocalories, would be more beneficial to this group of children than a complete school lunch. As a major part of the food supplement program, nutrition education should be an important component in order to teach the children good food habits.

ACKNOWLEDGEMENTS

The author would like to thank her advisors, Miss Donna M. Baxter, formerly of the Department of Foods and Nutrition, for guidance in planning and implementing the project, and Dr. Vivian M. Bruce, who assisted in the preparation of this thesis. A special thanks to Dr. B. Johnston, Department of Statistics, for advice and direction throughout the entire study.

Appreciation is also expressed to Miss Sharon Parker, Home Economics graduate, who assisted in collecting the data, and Mr. Murray Smith, Assistant Superintendant of School Division No. I, the principals, teachers, and grade V children who co-operated and made this study possible.

Also thank-you to my family for all their support and encouragement during the period of the project.

TABLE OF CONTENTS

	Page
INTRODUCTION	1
REVIEW OF LITERATURE	4
Income and Nutrient Intake	4
The Effect of School Feeding Programs on Nutrient Intakes	10
Nutrition Education for Elementary School Children	16
RESEARCH DESIGN	22
Objectives of the Study	22
Hypothesis	22
Selection of the Sample	26
Preliminary Approval of the Research Study	26
Selection of the Schools ; Preliminary Work	26
Selection of the Students	27
Interview Schedule	28
The Data	29
RESULTS AND DISCUSSION OF DATA	33
Daily Nutrient Intakes	33
Height, Weight, and Skinfold Measurements	40
Data from Lunch Questionnaire	50
Nutrient Intakes for Lunch	50

Home Lunches as Compared to Type "A" Lunch	50
Implications of the Study	65
Limitations of the Study	69
CONCLUSION	71
BIBLIOGRAPHY	72
APPENDICES	
A: Map of Area Surveyed	80
B: Letter to Parents of Grade V Children	81
C: Twenty-four Hour Food Intake Record Sheet	82
D: Lunch Questionnaire	84
E: Type "A" Lunch Requirements	85
F: Mean Daily Nutrient Intake for 189 Grade V Children by Sex	86
G: Mean Daily Nutrient Intake for 189 Grade V Children by Schools	87
H: Mean Nutrient Intake for Lunches for 189 Grade V Children by Schools	88
I: Mean Nutrient Intake for Lunches of 189 Grade V Children by Sex	89
J: Number of Children Meeting Requirements of Type "A" Lunch	90

TABLES

I	Distribution of 189 Grade V Children by Age and Sex in Each School	34
II	Number and Percentage of 189 Grade V Children Whose Diets Met the Cana- dian Dietary Standard for Kilocalories and the Eight Nutrients	36
III	Mean Total Daily Intake of Kilocalories and Eight Nutrients of 189 Grade V Children, As Compared with Canadian Dietary Standard	37
IV	Number and Percentage of 187 Grade V Children Falling into Various Weight Categories as Compared to Canadian Averages	41
V	Number and Percentage of 187 Grade V Children Falling into Various Height Categories as Compared to Canadian Averages	43
VI	Number and Percentage of 186 Grade V Children Falling into Various Cate- gories for Skinfold Measurement as Compared to Canadian Averages	44
VII	Number and Percentage of 189 Grade V Children Who Ate a Noon Meal Which Met One-Third of the Canadian Dietary Standard for Kilocalories and the Eight Nutrients	51
VIII	Mean Intake at Lunch of Kilocalories and Eight Nutrients for 189 Grade V Children, As Compared with One-Third Canadian Dietary Standard	53

IX	Number and Percentage of 189 Grade V Children and the Quantities of Milk and Milk Products Consumed	54
X	Number and Percentage of 189 Grade V Children Consuming Various Amounts of Fruits and Vegetables	57
XI	Number and Percentage of 189 Grade V Children Meeting Type "A" Lunch	60

INTRODUCTION

A frequent misconception in an affluent society is that everyone is well-fed. Lack of current information about food intake of individuals and groups, as well as the absence of acute malnutrition, may conceal the fact that various segments of our population are not adequately nourished. Prior to the completion of the Canadian National Nutrition Survey 1970-73, Beaton (1) summarized the nutritional status of Canadians as follows:

"If the Canadian literature is searched, one is impressed by the paucity of information about nutrient intakes in Canada. There are some reports on food intakes as judged against patterns of food use such as "Canada's Food Guide" but until the advent of the computer, few investigators had the patience or time to calculate nutrient intakes. What data are available strongly suggest that a significant proportion of our population is at risk with regard to malnutrition; that they do not achieve the recommended nutrient intakes. By itself, this of course, does not establish the prevalence of malnutrition in Canada: these data only suggest that current public health programs have failed to meet the objectives set down in the Canadian Dietary Standard."

It is hoped that when the results of the National Nutrition Survey are released, many gaps in knowledge about the nutritional status of Canadians as a whole will be made known.

The nutritional status of the elementary school population is of particular interest because growth and development, are related to the child's diet.

Studies carried out largely in the United States suggest that elementary school children, particularly those living in low-income areas, comprise one segment of the population in which there is a high frequency of diets which are below recommended allowances (2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13). Intakes below recommended allowances of citrus fruits, green and yellow vegetables, milk, meat, and whole grain cereals occurred among children from all economic levels but were more common among those from low income families (3, 5, 6, 9, 11, 12, 14, 15). Since income appears to be related to nutritional status, supplementation of the family income should improve the nutritional status of the children. School feeding programs in which meals are provided free or at a low cost have been shown to improve the immediate nutrient intake (16, 17). However, since food habits and attitudes are probably formed early in life, a school meal alone may not always be an effective means of improving the total food intake (8, 14, 18, 19).

Food habits and meal patterns have been shown to deteriorate as children approach adolescence (6, 7, 8, 11, 16, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34). The omission of meals, inadequate meals and the consumption of low nutrient value snacks occurred more frequently among older children as compared to younger children. The omission of a meal, particularly, lunch or breakfast, or an inadequate lunch (less than one-third of the

Recommended Dietary Allowances) or breakfast (less than one-quarter of the Recommended Dietary Allowances) made it difficult for children to meet the recommended allowances and interfered with their academic progress (7). Adolescent girls particularly, tended to have inadequate food intake which was related to their dietary practices (6, 8, 21, 22, 23, 28, 29, 30, 31, 34, 35, 36). Furthermore, children from low income families often drop out of school prematurely and thus establishing good food habits in the early years of education would seem to be important (37).

The studies cited here indicate that there is a need for more current descriptive information about the Canadian elementary school child's nutritional status, food habits and socio-economic background so that effective nutrition education programs may be introduced into the school curriculum. One means of teaching good nutrition and establishing good food habits as well as supplementing specific nutritional needs might be accomplished through an organized school feeding program.

REVIEW OF LITERATURE

Income and Nutrient Intake

The concept of low and high income categories can only be defined in relative terms because of the rapidly changing economic conditions which affect income, cost of living, taxation, and pension plans. Data collected from 1961 Canadian expenditure surveys (38) showed that families, on the average, allocated approximately one-half of their annual income to expenditures on food, shelter and clothing. Families who allocated 70% or more of their income for these items were considered to be in the low-income categories. For subsequent years the low-income cut-off values were adjusted for increases in the Consumer Price Index. In 1961 the low income cut-off for a family of five was \$4,000 as compared to \$5,368 in 1971.

In order to conduct nutrition surveys to study socio-economic groups, investigators have used various methods of income classification; percentage of income spent for food (15, 39, 40, 41); arbitrary annual income (3, 4, 9, 12, 13); low versus high income with income not defined (6, 10, 11); low versus high income with income compared on weekly and monthly basis (8, 14); and welfare versus non-welfare families (2, 5, 7). Canadian families have been arbitrarily classified into four categories based on annual income: the poverty level was considered to be below \$3000, low

income from \$3000 to \$5,999, medium income from \$6000 to \$9,999 and high income was considered to be over \$10,000 (42).

A relationship between income and nutrient intake has been reported by several investigators (2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 39, 40, 41). Proportionate food expenditure has been shown to correlate negatively with income (30, 40, 41). In spite of the higher proportion of total income spent by the low-income family, the absolute amount spent for food was less (30, 40, 41). Children from low-income families have been shown to consume diets which fall below dietary allowances or food guides* more frequently than children from high income families (2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15). Calcium, ascorbic acid, iron, vitamin A, thiamin, riboflavin, and niacin, were below recommended allowances most frequently and in greater deficit for children from the low income families (7, 8, 9, 10, 11, 12, 14, 15). Milk and dairy products, fresh fruit, vegetables and meat which are among the most expensive food items on the market contribute a large proportion of the nutrients found to be lacking. Because less money is available, the low income family is restricted when shopping for more expensive food items.

In order to estimate the adequacy of the American diet several extensive surveys have been carried out (9, 15, 39, 40). An early survey (15) which examined trends in family food consumption between 1942 and 1948 showed that as income rose, families purchased more

* Canada's Food Guide; Basic Four Food Groups; Basic Seven Food Groups

milk and dairy products, meat and poultry, and fruits and vegetables. This increased purchasing power was reflected in the larger percentage of families who met the Recommended Dietary Allowances for calcium, ascorbic acid, thiamin, riboflavin, and niacin.

The United States National Nutrition Survey in 1965 (40) showed that nearly 40% of the households with incomes below \$3000, had diets which contained less than two-thirds of the Recommended Dietary Allowances for at least one nutrient, as compared to 9% of the families in the \$10,000 and over income bracket. Calcium, ascorbic acid, and vitamin A were the nutrients most often below the Recommended Allowances. The trends indicated by this household survey stimulated more investigators to study the diets of children, who are a high risk group nutritionally. Therefore, the Ten State Nutrition Survey (9) conducted between 1968 and 1970 included a large sample of children sixteen years and under. The adolescent group between the ages of ten and sixteen years were reported to have the highest prevalence of diets which failed to meet the Recommended Allowances. Although calcium, iron, and vitamin A were all significantly below the Recommended Allowances, only calcium intake was reported to be related to income; as income increased, calcium intake increased.

In a study (5) in which children from different socio-economic groups were compared, it was reported that 92% of the children from relief families as compared to 41% from economically independent

families had diets which were considered to be inadequate. The child's diet was considered inadequate if the weekly consumption of food was less than 5½ quarts of milk, 24 servings of fruits and vegetables, and 7 servings of meat, fish, poultry, and eggs. Another dimension included in this study showed that there was an improvement in the children's diets following an increase in the income in the form of Food Stamps. The frequency of good diets among the relief group increased from 3% to 20% six months after the Food Stamp program was introduced. Besides this increase in the number of children consuming good diets in the relief group, a marked improvement in physical status and weight gain was reported after the introduction of the Food Stamp program. Similarly other investigators (3, 6, 10, 11, 12) have reported that children from high income families appeared to have better physical status than children from low income families.

Because children from low-income families appear to have more frequent and severe nutrient deficits than children from high income families, studies have been carried out in low income areas alone to investigate the dietary patterns and the extent of malnutrition (2, 7, 14).

An early Canadian study (14) sponsored by the Red Cross Society in a relatively low income area of Toronto showed that families who had an income of less than \$5/person/week had food intakes which were below the Recommended Dietary Allowance for calcium,

thiamin, riboflavin, and ascorbic acid more frequently than families who had a minimum income of \$10/person/week. Furthermore, it was shown that as the cost of food rose and the number of dependents increased, the percentage of diets below the Recommended Allowances increased.

More recent studies in low income areas in Boston (7) and in New York City (2) showed that a significant number of children consumed diets which were below the Recommended Allowances. Results of the study in New York (2) showed that approximately 75% of the children from both welfare and non-welfare families consumed diets which contained less than one-half of the Recommended Allowances. When Baker (43) investigated the vitamin levels in the diets of these same children, low intakes of riboflavin, pyridoxine, cobalamine, niacin, and ascorbic acid were common; food patterns indicative of inadequate intakes of milk, meat, citrus fruits, and green and yellow vegetables. Since no income categories were defined, comparisons of food intake for a welfare family and for a low income family cannot be made. Results of the Boston study (7) were similar, and indicated that there was a need for interest in the nutrient intakes of economically deprived children living in urban situations characterized by social disorganization, limited educational climate and apathy.

The criteria of family income and family size which has been used frequently to determine children's eligibility for free school

lunches in the United States has been questioned (13). It has been assumed in formulating criteria that children with the greatest need for school feeding come from low income families. A study (13) of 845 children, 6 to 12 years, showed that all economically needy children were not nutritionally needy, and vice versa; i.e., economic need was not necessarily synonymous with nutritional need. On the basis of the biochemical and anthropometric measurements and dietary intakes, the children were classified as "nutritionally adequate" or "nutritionally needy". A diet was considered adequate if it contained 70% or more of the Recommended Dietary Allowances for all nine nutrients and was judged as inadequate if three or more nutrients were below 70% of the Recommended Dietary Allowances. Results of the study showed that in the "eligible group" one-fifth were classified as "nutritionally adequate", and one-third as "nutritionally needy". Within the "ineligible group", one-quarter were considered to be "nutritionally adequate" and one-quarter as "nutritionally needy". Calories, calcium, iron, vitamin A, and thiamin were most often below 70% of the Recommended Allowances.

Conflicting reports in the literature make it difficult to prove or disprove the theory that a poor diet and poor food habits are the result of a low income. However, because of the relative severity and prevalence of inadequate nutrient intakes among low income groups, it appears that some direct relationship does exist between family income and the nutritional status of the children.

The Effect of School Feeding Programs on Nutrient Intake

Since income has been shown to be a major determinant of nutritional status, supplementing a low income with free or reduced cost school lunches for the children should improve their nutrient intakes.

Because few studies have been conducted to determine the effects of school feeding on low income children only, the following review includes studies in which researchers have used a cross section sample of children; thus all economic categories are represented.

The effects of school feeding programs on the nutritional status of children has been investigated by several researchers (4, 8, 11, 14, 15, 16, 17, 18, 19, 44, 45, 46, 47, 48, 49). Many types of school feeding programs, e.g., school lunch, breakfast, brunch, specific supplements and snacks, are possible and each may be used to improve the nutritional status of groups of children. The United States National School Lunch Program*, in which Type "A" lunches are obligatory, is the most widely known, and therefore, most of the studies included here refer to this program.

A survey to study the effects of supplementing the children's diets with ascorbic acid, vitamins A and D, plus milk, was carried out over a three-year period in Ohio (16). The first period (Period A) was an observation period in which the standard Type "A" lunch was served. Seventy-five percent of the children who ate the school lunch as compared to 35% of the non-school lunch group, had

* The National School Lunch Program requires that Type "A" lunches provide a third of the Recommended Daily Allowances for a 12-year-old boy for calories and 8 nutrients.

nutrient intakes which met two-thirds of the Recommended Dietary Allowances. Approximately 50% of the non-school lunch group and up to 25% of the school lunch group failed to meet two-thirds of the Recommended Dietary Allowances for vitamin A, calcium, and ascorbic acid. Therefore, during the next two years (Period B and B') all of the children received 50 mg. of ascorbic acid in the form of reconstituted frozen orange juice plus 2500 I.U. of vitamin A and 360 I.U. of vitamin D combined in the form of a vitamin concentrate. During Period B, additional foods which were incorporated into the school lunch at least three times a week included two ounces of a protein rich food, a serving of fruit or vegetables, and skim milk solids. Ninety-five to 100% of the school lunch group compared to approximately 80% of the non-school lunch group met two-thirds of the Recommended Dietary Allowances for vitamin A and ascorbic acid. However, calcium intake was shown to decline after supplementation for both groups during this and the following period.

In the third period (Period B'), a special milk program was introduced so that all children could purchase milk at low cost. During this period the majority of the children who participated in the milk program ingested two-thirds of the recommended calcium allowance and improved their intake of protein. Nearly all of the children from both groups had diets which contained two-thirds of the Recommended Allowances for vitamin A and ascorbic acid but the

greatest improvements in nutrient intake were found among the non-school lunch group after supplementation. Studies reported by other investigators showed that children who ate the school lunch consumed diets which contained more ascorbic acid rich foods (8, 11, 15, 17, 46, 48), a variety of vegetables (8, 11, 15, 17, 46), whole grain cereals (11, 15) as well as milk and milk products (8, 11, 15, 46). In general, it has been shown that children who participated in the school lunch program regularly had nutrient intakes which met recommended allowances more often than children who did not participate (2, 11, 13, 15, 17, 44, 45, 46, 47, 48, 49).

A hot school lunch which supplied at least one-third of the Recommended Dietary Allowances produced a greater improvement in the food intake, physical and biochemical status of children than a supplemented school lunch (17). Comparison of the total daily food intake of the children who ate the school lunch to the same children who ate all their meals at home showed that when the school lunch was eaten, the children met the Recommended Allowances more frequently. These investigators and others (11, 15) reported that citrus fruits and green and yellow vegetables were not consumed daily at home by the children but were included in the complete school lunch. This difference could help explain the better nutrient intake for the children when they ate the complete school lunch. Other interesting findings were that children who ate the school lunch ate fewer cookies, candies, sweets and soft drinks (46) and

that girls more often than boys who ate the hot school lunch had more adequate nutrient intakes (11).

A recent report on the effectiveness of the school lunch and breakfast programs (45) in Texas showed that the children who participated regularly in these programs had better health, better blood levels of specific nutrients and better school attendance than non-school lunch and breakfast participants. Another study (50) in a low income area of Kansas City also reported that children who participated in the school feeding program showed a marked improvement in academic achievement, attendance, behaviour and alertness. These findings are in contrast to other investigators (8, 14, 18, 19) who reported that the school lunch produced little or no improvement in the nutritional status of the children.

Groups of children who participated in various types of school feeding programs in Pennsylvania were studied over a nine year period (18). Medical, dental, and biochemical tests were carried out to evaluate the effectiveness of the different types of feeding programs. Food intakes of the children and nutritive content of the school lunches were recorded. Twenty percent of one group of 144 children who participated in the school lunch became proportionally lighter in weight for their sex, age, and build. The number of children who showed no improvement, or a decrease in blood and urine values, far exceeded those who did show an improvement. The fact that persons responsible for the child's home diet were

found to pay less attention to meals because of their confidence in the adequacy of the school lunch was noted in this study (18) and by other investigators (11, 17, 48). Analysis of school lunches showed that few compensated for omissions in the children's home diets (18, 48) and few provided one-third of the Recommended Allowances (15, 18, 48, 51). The importance of the school lunch and the children's home diets complementing each other appears evident (4, 8, 13, 14, 15, 16, 17, 18, 19, 44, 48). It was concluded in the Pennsylvania study (18) that all children could profit from a school lunch program planned by a trained nutritionist but that provision of a school lunch alone did not necessarily assure improvement in the nutritional status and food habits of the children concerned. Similar findings were reported in Florida (44) and in Newfoundland (52).

The study carried out in Newfoundland (52) showed that even after milk was made available to the students, the consumption of soft drinks remained high, particularly among secondary school students. Food preferences, price and parental interest appeared to influence the children's food intake more than the ready availability of milk.

A study of school children in Toronto (14) who received a well balanced school lunch were compared to a matched group of children who followed their usual eating habits. It was reported that only slight differences existed in the physical and biochemical tests carried out on the two groups. Children who consumed 90% or more of the

lunches showed slight improvement in physical condition and growth, in the levels of serum ascorbic acid, vitamin A and carotene and in the condition of their teeth. However, these differences were not statistically significant. Factors which may have contributed to lack of improvement and in some cases regression of food intake over the two-year period were the rise in the retail cost of milk, meat, butter, vegetables, and cereals, preference for refined cereals and white bread and the amount of money spent on sweet bakery products by almost all the families.

The results of the studies reported here show that a school lunch alone may not always be an effective means of improving nutritional status. If a school lunch is to be beneficial, it must be planned and supervised by persons trained in nutrition so that deficiencies in children's home diets are compensated for in the school lunch. Children who eat school lunches that complement their home diet and thus improve their nutrient intake have been shown to improve in physical status and academic progress. It seems apparent from the studies included here that factors such as education, income, food preferences, parental influence and availability of foods are associated with nutritional status. In order to improve nutritional status all of these factors must be considered.

Nutrition Education for Elementary School Children

Because food practices as well as income and school lunches appear to affect food intake, a relevant nutrition education program should improve food habits. Numerous food habit surveys have shown that children from all socio-economic levels consume diets which lack citrus fruits, green leafy and yellow vegetables, milk and milk products (2, 5, 6, 8, 11, 15, 16, 20, 24, 25, 26, 27, 30, 46, 47, 48, 53, 54, 55, 56, 57, 58, 59, 60, 61). In place of these food groups children frequently substitute sweets, cake, cookies, other baked products, soft drinks, and candy (14, 22, 24, 25, 30, 49, 52, 53, 54, 55, 57, 58). It has also been shown that the food habits of children tend to deteriorate as they approach adolescence (6, 7, 8, 11, 16, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33) and that girls particularly have poor food habits and nutrient intakes below recommended allowances (6, 8, 21, 23, 27, 28, 29, 30, 46, 47). Implications from the food habit surveys are that children are not well informed about the nutritive value of foods and the importance of good nutrition (62). One study (12) showed that only 10% of the grade IV, V, and VI children could name the Basic Four Food Groups. The following studies, concerned with nutrition education, have used a cross section sample of children frequently, so that all income groups are represented.

The effectiveness of different nutrition education techniques for teaching both parents and children was examined (62) when the results of a previous survey (54) showed that 41% of the children were in poor or fair physical condition. The food records showed that 30% consumed less than one pint of milk daily, that 91% did not have any source of vitamin D and that the consumption of sweet foods was high. The education procedures implemented were directed at improving the intake of milk and vitamin D and discouraging the use of sweet foods. Different methods of nutrition education were used for the parents and the children. The parents were informed about their child's health status initially and were present for the final physical examination. Nutrition classes and consulting services were provided for the mothers. Nutrition pamphlets, newspapers, and radio were used to inform the parents; while techniques used to educate the children included mimeographed sheets, poster contest, animal experiments, wall posters, and films. Nutritional status of the children improved during the first year of nutrition education, but did not continue to improve during the second year. Intakes of fruit and vitamin D increased during both years, while intakes of meat and eggs increased only during the first year. The consumption of sweet foods remained high during both years. Many influences on food intake, e.g., rise in food prices, food preferences, were apparent and the educational techniques employed proved ineffective for the long term improvement of milk intake. The authors concluded that a change in food habits would

occur only when the children themselves wished to consume adequate amounts of the recommended foods and when the parents made available the proper quantities of the necessary foods. The physical examinations of the children attended by one or both parents and the home visits made by the school nurse were the most effective contacts in terms of teaching the parents about nutrition. The poster contest appeared to be an effective tool for teaching the children. The most serious problem in classroom health teaching was believed to be the teachers' lack of nutrition knowledge and the lack of use of stimulating teaching techniques. Similar findings showed that nutrition education alone had little effect on an increased consumption of milk among students (52). It was recognized that students must be motivated to improve food habits and teachers must be convinced that nutrition education is an important subject which should be introduced into other subject areas.

An improvement in nutrition knowledge after receiving nutrition education was shown in a recent study of grade II children (63). Two groups, an experimental group which received special nutrition education for four weeks, and a control group which received only health in the school curriculum, were compared. A pre-test of nutrition knowledge was given to both groups prior to the education program. The objective of the program was to help the children incorporate the Four Food Groups into their diets. This was accomplished by animal experiments, taste panels, team contests,