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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

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ABSTRACT

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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.

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TABLE OF CONTENTS

TABLES

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

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* 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 5¼ 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,

informal discussions about food, a "good nutrition" party, food games, posters, pictures, and individual food records. Two weeks after and two weeks before the program, both groups had their lunches evaluated for nutrient content and the amount of food eaten. A brief test after the education program was given to both classes to determine any changes in nutrition knowledge.

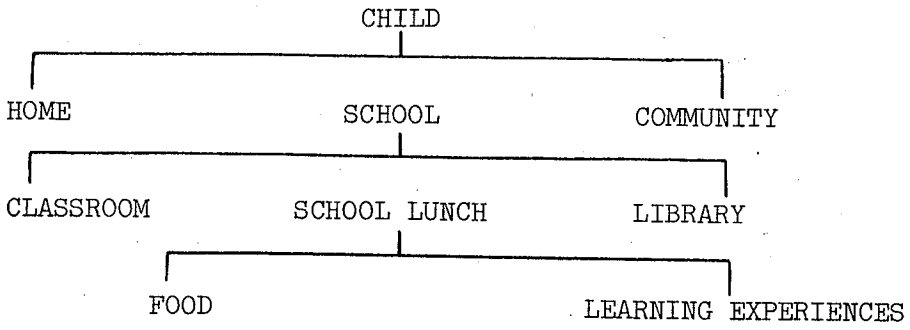
Results of the survey showed that the group which received the special education improved their nutrition knowledge 70% and that 74% of them were able to pick out a well balanced breakfast. The percentage of children consuming an adequate breakfast also increased. More children brought milk from home or bought it at school for lunch and an increased number showed more willingness to drink milk. The group which did not receive the special course improved their nutrition knowledge only 20%. Although 31% of the group were able to pick out a well balanced breakfast, the number of children having an adequate breakfast decreased. The consumption of milk did not improve and lunches brought from home still lacked fruit, milk and vegetables and yet contained cake and cookies. A questionnaire was sent to the parents of the children who had received the special course, in order to evaluate the effect of nutrition education on the children's home food habits. Fifty percent of the mothers believed that their children's food habits had improved; vegetables were accepted more readily, interest was taken in foods which had better nutritive value, and basic food

guides were followed more often.

Studies reported here clearly show there is a need for nutrition education at the elementary school level. However, if nutrition education programs are to be effective in improving food intakes and food habits, each program must be a continuous, flexible process which focuses on the specific problems of the groups concerned.

School feeding programs and nutrition education cannot be separated if children are to experience an improvement in immediate food intake and to learn good food habits. In order to plan a school feeding program and develop a relevant nutrition education program, feasibility studies should be done (7, 13, 15, 18).

One feasibility study carried out in a depressed section of Boston investigated food intake, biochemical status and food habits of elementary school children (7). The specific nutrient deficiencies and poor food habits, particularly the omission of breakfast and inadequate lunches, resulted in the recommendation to introduce a "school brunch". Furthermore, it was recommended that the existing nutrition education programs should be revised and directed at meeting the needs of these particular children. These investigators (7) and others (13, 18, 64, 65) recognized that parents, nutritionists, and school nurses as well as teachers should be involved in planning and implementing the program. This broad perspective of community involvement has been summarized in the following diagram by Todhunter (49).



Some investigators (4, 19, 49) believed that the economic status of families was an important factor to consider when planning school lunches and nutrition education programs. It was recommended that portion sizes and special servings would need adjusting for children who had very poor diets (18). To meet the Recommended Allowances for the majority of a heterogeneous group, the researchers (18) suggested that the school meal should provide one-half of the Recommended Allowances for calories, protein, phosphorus, and iron, two-thirds for calcium, and one-half to four-fifths for vitamin D.

To summarize, it appears that the school lunch as an integral part of the education program can contribute to the total development of children by improving their nutrient intakes and teaching them good food habits only if it is planned by a trained nutritionist so that it complements the home diet. The socio-economic background of the sample population, the availability of food, personnel resources, and regional differences are important factors to consider in setting up the school lunch program as part of the education program.

RESEARCH DESIGN

Objectives of the Study

The objectives of this study were twofold:

1. to evaluate the nutrient intakes of elementary school children living in a low income area of central Winnipeg in relation to the Canadian Dietary Standard;
2. to examine the nutrient intakes as well as the food practices of the children at the noon meal in order to investigate the possible need for a school lunch program.

Hypothesis

In order to carry out the objectives of this study, the following hypotheses were formulated.

1. The daily nutrient intakes of the children would be below the recommended allowances of the Canadian Dietary Standard.
2. The nutrient intakes of the children at the noon meal would not meet one-third of the recommended allowances of the Canadian Dietary Standard.
3. The children surveyed would benefit nutritionally from a school lunch program.

The objectives of this study and the limited time available to collect the dietary data were the major factors which influenced the method used in the survey.

The most appropriate interview method used to assess nutrient intake of groups is controversial (66, 67, 68, 69, 70, 71, 72, 73,

74, 75). A study carried out by Young and Trulson (70) reported that the objectives of the study and the hypothesis to be tested determined the methods used for obtaining and evaluating dietary data. In all methods there appeared to be limitations; the greatest being the limitation of human error. In a comparative study of the 7-day food record, the diet history, and the 24-hour recall, Trulson (71) concluded that it was best to use only one interview method with full recognition of its limitations. If more than one method was employed, the researcher should realize that differences in food intake figures occurred.

In an earlier study of 166 grade school, high school, and college students (76) it was found that the more expedient 24-hour recall could be substituted for the 7-day food record for estimating the mean nutrient intake of groups provided that the sample size contained at least fifty persons. Chamberlain and Pike (72) reported similar results when they compared nutrient intakes of college freshmen obtained by 7-day weighed food records and the 24-hour recall interview.

It has been shown that children can give accurate information about their past food intake provided that they are knowledgeable about names of foods and beverages, have developed a sense of time, have a good memory and attention span, as well as a willingness to co-operate. If a long period of recording is required, children can lose interest and become careless in keeping food records (77,

78, 79, 80, 81). Bransby, Daubny and King (80) studied fifty 10 to 15 year old children in order to investigate the accuracy with which they recalled all foods and beverages consumed in the previous 24-hour period. All foods consumed by the children were either weighed or recorded in household measures. When the children were questioned about their food intake over the previous 24-hour period, it was found that the quantities of foods and beverages estimated were as accurate as the measured or weighed food intake. A more recent study of Swedish school children (81) reported similar results.

In an early British study (82) it was shown that 155 children ages eight to fifteen years were able to estimate the quantities of food they consumed the previous day within ten percent of the actual weight. After each child was questioned about the foods and beverages consumed during the previous 24-hour period, they were shown weighed samples of the foods and were asked to select the amounts of foods they had consumed.

Another early study (77) of children nine to eleven years of age showed that this age group were "able to recall easily the foods eaten over a 24-hour period and delight in measuring the quantity of food eaten". After the age of eleven years it was believed that children might have acquired information about foods they should eat which would bias their reports but would not influence their food habits.

A study (78) designed to assess the ability of school children nine to eighteen years to recall foods and beverages consumed in the school lunch, reported that the foods most commonly omitted were bread, margarine, and celery. Names of fruit juices were sometimes confused and the quantity of juice consumed was most often reported in lesser amounts. From the results of the survey the investigators concluded that on a group basis errors of estimation cancelled out in such a way that reasonable values of the average nutrient intake were obtained.

Although the primary purpose of a recent study (79) was to assess the effectiveness of school feeding programs on the nutritional status of children, six to twelve years old, the investigators were able to evaluate the accuracy of the children's ability to recall their previous food intake also. The children were interviewed at school by a nutritionist to obtain information on all foods and beverages consumed the previous day. Mothers were interviewed by telephone and were asked to recall the child's diet for the same day as that reported by the child. Results of this study showed that the majority of mother-child pairs provided the same information regardless of the child's age.

Consideration of the advantages and disadvantages of various methods appeared to justify the use of the 24-hour recall of food intake as compared to the dietary history or food record in this study. Because preliminary plans prior to the field work

took longer than anticipated, it was not possible to obtain the research data until near the end of the school term. Furthermore, although classroom teachers co-operated well with the researcher, only one interview of short duration was permitted for each child so that class routine could be maintained.

Selection of the Sample

Since this study was directed at gathering food intake data from elementary school children who lived in a low income urban area, the 1961 census tract was used to locate families living in central Winnipeg who earned an annual median income of $3000 or less which is considered to be at the poverty level. The area chosen was located in the North section of Winnipeg (Appendix A) and was predominantly inhabited by families of Anglo-Saxon, Portuguese, Chinese, and Canadian Indian origin. A number of the families were receiving welfare assistance and some families were supported by only one parent. Many of the children transferred to different schools throughout the year; some as often as six times.

Preliminary Approval of the Research Study

The schools located in the low income area were all in School Division No. I. In order to carry out any research work in the schools in this Division, a draft of the proposed study had to be submitted to the Inter-University Research Committee for approval.

Selection of the Schools; Preliminary Work

When the project had been approved, the Assistant Superintendent

of School Division No. I selected elementary schools at random within the designated area in which grade V classes were taught, and then contacted each school principal to elicit co-operation. In order to obtain a sample large enough for statistical analysis, eight schools were selected for the survey; Norquay, David Livingstone, William Whyte, Victoria Albert, Pinkham, Somerset, Montcalm, and Dufferin.

Selection of the Students

The sample was chosen by classroom rather than age in order to minimize the number of classes that would have to adjust their normal routine of school work for the survey. Grade V classes, with boys and girls ranging in age from ten to twelve years, were selected for it was believed that children of this age range would be able to provide food recall information and answer interview questions.

In each school, grade V classroom teachers were consulted and names, ages, and addresses of all grade V students were obtained. A verbal explanation about the purpose of the study was given to each grade V classroom by the researcher. A letter was sent to each home informing parents about the study. Attached to the letter was a consent slip for the parents to sign and return (Appendix B). In seven schools, a positive reply was requested while in one school, upon the advice of the principal, parents were asked to reply only if they did not wish their child to participate. Response from parents varied but generally it was poor. Upon the

recommendation of some of the principals, home visits were made to a number of families who failed to respond. It was found that several families had not received the letter, some had been unable to interpret it and some were unwilling to allow their child to participate. When consent slips had been returned it was found that 211 children were eligible to take part in the study.

Setting Up Interview Schedules

Upon consultation with each principal and the grade V classroom teachers, interview schedules were arranged so that only a minimum amount of class time would be lost for each child during the interview. A pre-test of research instruments was carried out in one classroom in David Livingstone School. Each child in the class was asked to record the foods and beverages consumed in the previous 24-hour period. The recording was carried out in the classroom after lunch; each child was asked to recall what he had consumed for lunch, for breakfast, and for snacks that day, as well as the evening meal and evening snacks on the previous day. This group classroom method was not feasible because the children were unable to spell names of foods and would not listen to instructions.

Final Interview Schedule

Individual interviews with each child were arranged so that the researcher recorded the food intake on the 24-hour recall food

intake record (Appendix C). A Home Economics graduate with a major in Nutrition assisted with the interviews. To increase the accuracy with which quantitative information was reported, plastic food models and various sizes of spoons, cups, and glasses were used. Quantities of foods and beverages were recorded directly in grams as given on the food models or in household measures and converted to grams later. The questionnaire (Appendix D) concerned with the noon meal was completed following the 24-hour recall. Information about where lunch was eaten, how often lunch was omitted, and whether or not vitamin preparations were consumed was recorded. The weight, height, and triceps skinfold measurements of each child were taken. Scales were tested with a known weight for accuracy before each interview period. Children were weighed to the nearest quarter pound in indoor clothing without shoes and measured to the nearest eighth of an inch. Triceps skinfold measurements recorded in millimeters were carried out by one individual using Lange skinfold calipers. Each interview lasted from fifteen to twenty minutes so that approximately eighteen children were interviewed each afternoon.

All the field data were obtained in the period from May 10 to June 21, 1972.

The Data

The final data were obtained from eighty-two boys and one hundred and seven girls, the majority being eleven years of age.

Data from the 24-hour recall food records was transferred to computer data sheets and key punch cards. Each child's food intake in each school was then analyzed by computer for kilocalories protein, fat, carbohydrate, calcium, phosphorus, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid. Food composition data were obtained from Agriculture Handbook No. 8 (83). The computer program used, categorized the food intake of each child into three meals and three snacks for the survey day and gave the caloric and nutrient content of each meal and snack. The percentage contribution for each nutrient for each meal or snack was also obtained. The mean caloric and nutrient values were obtained for all the children in each school as well as standard deviations and percentage contribution of nutrients to meals and snacks. As a standard of adequacy the recommended allowances for kilocalories and the eight nutrients suggested in the Canadian Dietary Standard (84) were used.

The standard used for an adequate lunch was one-third of the Canadian Dietary Standard (84) recommended allowances. The food intake at lunch, categorized by food groups, was tabulated for milk, animal and non-animal protein, fruits and vegetables high in ascorbic acid and vitamin A, other kinds of fruits and vegetables, fats, foods high in carbohydrates and beverages. Milk was recorded in cups. If less than one-eighth cup was used in mixed dishes, the amount was not recorded. The consumption of chocolate milk, tea, coffee, soft drinks and fruit flavoured drinks was recorded in

8 ounce servings. Other foods were recorded as fractions of the standard serving. The standard serving for meat, fish, and poultry was three ounces and for milk products one ounce. Eggs were recorded as the actual number eaten. Bread and bacon were recorded in number of slices consumed and other fats in teaspoonsful. Cooked and canned fruits and vegetables were recorded in fractions of cups, the standard amount being one-half cup. Fresh varieties of fruits were recorded as the actual amount eaten, e.g., one apple, one orange. The standard for foods high in carbohydrate, such as macaroni or spaghetti, was one cupful. The percentage of the children who consumed the standard amount or more of the various food groups was calculated for the noon lunch also. As a further measure of adequacy, the children's noon meal was compared to the Type "A" lunch used in the U.S.A. National School Lunch Program (Appendix E). This lunch provides a minimum of one-third of the Recommended Daily Allowances for calories and the nutrients.

The height, weight, and skinfold measurement data obtained in the present study has been compared to the Canadian average figures (85). These average numbers provide only a guide or reference point which must be interpreted carefully. An absolute value for weight should not be used as a standard for it does not take into account differences in rates of growth, body build, and bone structure among individuals (26, 61). In order to allow for variation among the children in this study, a 10% range above and below the Canadian average values has been used. Any measurement

for weight, height, and skinfold which was 10% above or 10% below the average value was considered to be within normal limits.

RESULTS AND DISCUSSION

The children who were interviewed were all enrolled in grade V classes and ranged in age from 10 to 12 years; 13% were 10 years, 60%, 11 years, and 27%, 12 years. The sample numbers of boys and girls in each age category in the eight schools surveyed is shown in Table I.

One hundred eighty-nine children, 107 girls and 82 boys, were able to recall the foods and beverage consumed during the 24-hour period prior to the interview. Twenty-two additional food recall records were considered incomplete, and therefore, were not included in the final analysis.

Daily Nutrient Intakes

Although several investigators (6, 7, 8, 16, 23, 27, 30, 46, 47, 61) have reported that the nutrient intakes of boys and girls differ, analysis of variance showed that there were not any statistically significant differences between the girls and boys in the present study. However, the mean intakes of all nutrients with the exception of calcium and ascorbic acid, were greater for the boys as compared to those of the girls. The mean intakes of kilocalories and the eight nutrients for the boys and girls appear in Appendix F.

When the total daily food intake of each individual child was compared to the Canadian Dietary Standard (84), 4.7% of the group consumed diets which were adequate for kilocalories and the

TABLE I Distribution of 189 Grade V Children

by Age and Sex in Each School

SCHOOL	10 YEARS		11 YEARS		12 YEARS		TOTALS	
N = 189	Male	Female	Male	Female	Male	Female	Male	Female
Norquay N = 15	1	1	4	6	0	3	5	10
David Livingstone N = 25	4	6	4	4	5	2	13	12
Wm. Whyte N = 41	2	1	9	19	3	7	14	27
Vic. Albert N = 36	1	5	9	15	1	5	11	25
Dufferin N = 22	0	2	5	8	5	2	10	12
Pinkham N = 18	0	0	8	6	2	2	10	8
Somerset N = 14	0	1	5	2	2	4	7	7
Montcalm N = 18	0	0	7	3	5	3	12	6
TOTALS	8	16	51	63	23	28	82	107

eight nutrients. The number and percentage of children whose diets met the Canadian Dietary Standard for kilocalories and the eight nutrients is shown in Table II.

More than 50% of the children selected diets which met the Canadian Dietary Standard for protein, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid (Table II). A less favourable picture was presented with respect to kilocalories, calcium, and iron; less than 33% of the group consumed diets which met the recommended allowances (Table II).

Although less than 5% of the total group consumed diets which were nutritionally adequate when compared to the Canadian Dietary Standard, it is not possible to conclude that the majority of the children were nutritionally deficient. The Canadian Dietary Standard was not intended for, nor is it valid as, a measure of nutritional status (84, 86). The recommended intakes in the standard were set well above minimum levels and therefore failure to meet these recommendations does not necessarily mean nutritional deficiency. However, by comparing the nutrient intakes of specific groups to the Canadian Dietary Standard, a researcher may obtain information about the relative adequacy of the diets. Such information may be useful in isolating nutritional problems which might be alleviated by dietary supplementation such as school feeding programs, or by nutrition education.

The mean intakes of kilocalories and each of the nutrients for the entire group appear in Table III. The mean intakes for kilocalories

TABLE II Number and Percentage of 189 Grade V Children Whose Diet Met the Canadian Dietary Standard for Kilocalories and the Eight Nutrients

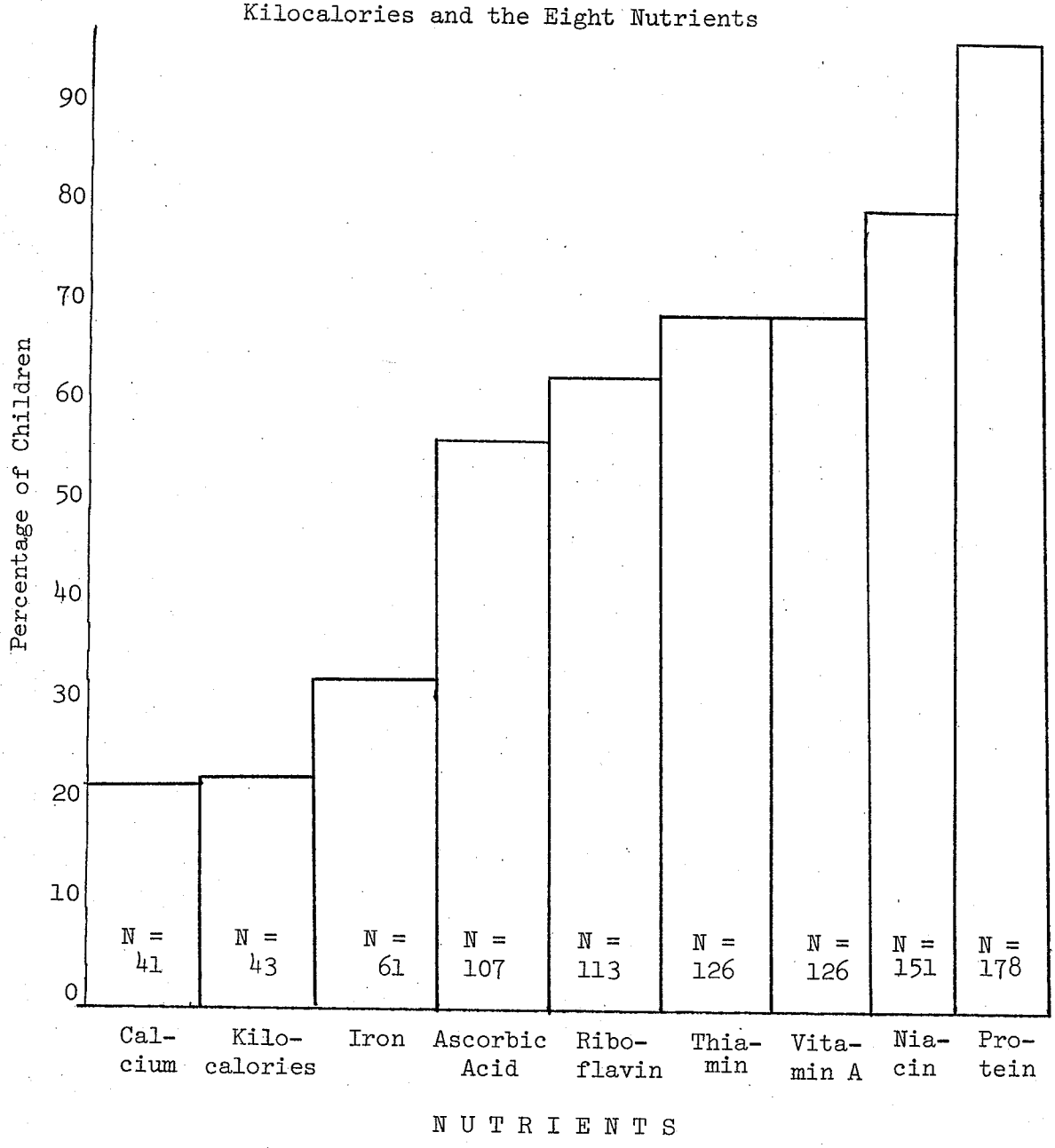


TABLE III Mean Total Daily Intake of Kilocalories and Eight Nutrients of 189 Grade V Children, As Compared with Canadian Dietary Standard

NUTRIENTS	MEAN INTAKE	CANADIAN DIETARY STANDARD
Calories (Kilocal.)	2003 ± 789	2500
Protein (Gm.)	72.1 ± 31.4	30
Calcium (Mg.)	833 ± 488	1200
Iron (Mg.)	10.4 ± 4.6	12
Vitamin A (I.U.)	4292 ± 8809	2000
Thiamin (Mg.)	1.14 ± 0.62	.8
Riboflavin (Mg.)	1.71 ± 1.03	1.3
Niacin (Mg.)	14.8 ± 7.9	8
Ascorbic Acid (Mg.)	65 ± 74	30

and the eight nutrients for the children in each of the schools is shown in Appendix G.

Only 22% of the children (41 children) consumed diets which met the recommended allowance for calcium (Table II); 1200 mg. per day (Table III). The mean intake of calcium for the total group was 833 mg. daily (Table III) or 69% of the Canadian Dietary Standard. Perhaps this low dietary intake of calcium could be attributed to the lack of milk, and milk products in the diets. A similar trend has been reported by other investigators (6, 8, 9, 11, 12, 13, 14, 16, 20, 21, 27, 29, 30, 46, 47, 55, 59, 61). It was also noted in the present study that more girls than boys had a dietary intake of calcium which met the Canadian Dietary Standard and that the girls consumed more milk, cottage cheese, cheese, ice-cream and yogurt. In contrast to this study and that of Myers (7), other researchers (6, 8, 11, 16, 21, 30, 47, 48) have reported that boys drank more milk than girls, and that their calcium intake met the recommended allowances more frequently.

Although a positive relationship between income and the consumption of milk has been reported by several researchers (5, 6, 9, 14, 15, 40), price did not appear to be an important factor in the present study. Soft drinks which cost more than milk per serving were purchased by the majority of the families. This finding is in agreement with Shaver (62) who believed that food preferences were more important than income in determining children's milk consumption. In his study only one in 360 mothers gave the

cost of milk as a factor related to an inadequate intake of milk following an increase in food prices. Approximately 50% of the children who had low intakes of milk consumed generous amounts of sweet foods which also had risen in cost. The most prevalent explanation for the lack of milk in the diet was the dislike of the beverage. Other investigators have also reported that children often show a preference for soft drinks and other sweetened beverages even when milk is readily available (40, 52, 55, 62). These investigators indicated that nutrition education might be used to help improve food buying practices.

Because calcium intake was low in the majority of diets, it was expected that the diets would also be low in riboflavin, for both these nutrients are supplied mainly by milk and milk products. Therefore, it was not surprising that over one-third of the children failed to consume diets which met the Canadian Dietary Standard for riboflavin, 1.3 mg. daily (Table III). Although the mean riboflavin intake, 1.7 mg. per day (Table III) exceeded 100% of the Canadian Dietary Standard, the standard deviation indicates that there is great variability in the individual intakes. Other researchers (8, 9, 16, 17, 18, 19, 24, 25, 28, 40, 46, 49, 58) have found that riboflavin consumption was generally adequate, and agreed that milk and milk products were important sources of this nutrient. In one study (14) it was recommended that for families restricted to a low income budget, milk should supply 85% of the calcium and 70% of the riboflavin.

Mean caloric intakes ranged from 28% to 183% of the Canadian Dietary Standard. For the entire group, the mean intake was 2003 kilocalories daily (Table III) or 80% of the Standard. Significant numbers of the children consumed less than the recommended 2500 kilocalories. Table II shows that only 23% of the group (43 children) consumed diets which met or exceeded the recommended allowance.

Daily caloric intake influences the rate of growth and development of children. If the caloric intakes are consistently inadequate over a period of time, growth and development may be retarded. Since the present study provided anthropometric data for only one period of time, a valid relationship between caloric intake and growth cannot be made. Furthermore, the large differences in the number of children in each age category made it difficult to compare their anthropometric measurements to other standards (87, 88, 89, 90).

The average value and the 10% range for weight is shown in the first column of Table IV. The number and percentage of children in each age category whose weight was within the defined limits appear in the second and third columns (Table IV). The number and percentage of children whose weights were below or above the defined values appear in the last four columns (Table IV)

There appears to be a trend for the weights of the 12-year-old girls to be below the normal limits more often than the other age groups; 56% of the 12-year-olds as compared to 13% of the 10-year-olds

TABLE IV Number and Percentage of 187 Grade V Children
Falling into Various Weight Categories as Compared to Canadian Averages

Children	Standard	No. 10% Above and Below Standard (Av. Range)	10% Above and Below Standard (Percentage)	No. Below Av. Range	% Below Av. Range	No. Above Av. Range	% Above Av. Range
10 Yr. Girls N = 15	31.3 kg. 28.2-34.4 A.R.*	6	40.0	2	13.3	7	46.7
10 Yr. Boys N = 7	31.8 kg. 28.7-34.9 kg. A.R.	2	28.6	2	28.6	3	42.8
11 Yr. Girls N = 63	34.9 kg. 31.5-38.3 kg. A.R.	21	33.3	16	25.4	26	41.3
11 Yr. Boys N = 52	34.9 kg. 31.5-38.3 kg. A.R.	26	50.0	12	23.1	14	26.9
12 Yr. Girls N = 27	41.7 kg. 37.6-45.8 kg. A.R.	8	29.6	15	55.6	4	14.8
12 Yr. Boys N = 23	38.1 kg. 34.3-41.9 kg. A.R.	8	34.8	9	39.1	6	26.1

* A.R. - Average Range

and 25% of the 11-year-old girls were below the defined values. Furthermore, only 15% of the 12-year-olds as compared to over 40% of the 10- and 11-year old girls were above the normal weight limits (Table IV). Although no valid conclusion can be made about a relationship between caloric intake and weight, it appears that the 12-year-old group of girls had the lowest mean caloric intake as compared to all the other age groups. With regard to the boys, there was a trend showing that fewer boys were above the normal weight limits as they approached adolescence.

The number and percentage of children whose height measurements were within the defined limits as well as the number and percentage of children whose height measurements were below or above the defined normal values appear in Table V.

A smaller percentage of the 12-year-old girls as compared to the other age groups were within the defined height limits as shown in Table V. Furthermore, a larger percentage of this age group were below 10% and not any were above 10% of the average range in height. Although the 10-year-old boys appeared to be short as compared to the Canadian average values, the small number (7 boys) makes comparisons questionable.

Table VI shows the number and percentage of boys and girls in each age category whose skinfold measurement was within the defined normal limits and those whose skinfold measurement was above or below the defined values.

TABLE V Number and Percentage of 187 Grade V Children Falling into Various Height Categories as Compared to Canadian Averages

Children	Standard	No. 10% Above and Below Standard (Av. Range)	10% Above and Below Standard (Percentage)	No. Below Av. Range	% Below Av. Range	No. Above Av. Range	% Above Av. Range
10 Yr. Girls N = 15	13.54 cm. A.R. 121.86-148.94	14	93.3	0	0	1	6.7
10 Yr. Boys N = 7	135.9 cm. A.R. 122.31-149.49	6	85.7	1	14.3	0	0
11 Yr. Girls N = 63	140.5 cm. A.R. 126.45-154.55	60	95.2	0	0	3	4.8
11 Yr. Boys N = 52	140.7 cm. A.R. 126.63-154.77	50	96.2	1	1.9	1	1.9
12 Yr. Girls N = 27	147.8 cm. A.R. 133.1-162.5	25	92.6	2	7.4	0	0
12 Yr. Boys N = 23	145.8 cm. A.R. 131.3-160.3	23	100.0	0	0	0	0

TABLE VI Number and Percentage of 186 Grade V Children Falling Into Various Categories for Skinfold Measurement as Compared to Canadian Averages

Children	Standard	No. 10% Above and Below Standard (Av. Range)	10% Above and Below Standard (Percentage)	No. Below Av. Range	% Below Av. Range	No. Above Av. Range	% Above Av. Range
10 Yr. Girls N = 15	9.5 mm. A.R. 8.55-10.45mm.	1	6.1	7	46.7	7	46.7
10 Yr. Boys N = 7	7.4 mm. A.R. 6.66-8.14 mm.	2	28.6	1	14.3	4	57.1
11 Yr. Girls N = 63	10 mm. A.R. 9-11 mm.	14	22.2	27	42.9	22	34.9
11 Yr. Boys N = 50	7.9 mm. A.R. 7.11-8.69 mm.	14	28	13	26	23	46
12 Yr. Girls N = 26	10.5 mm. A.R. 9.45-11.05 mm.	4	15.4	8	30.8	14	53.8
12 Yr. Boys N = 25	8 mm. A.R. 7.2-8.8 mm.	5	20	5	20	15	60

It is apparent that the majority of children had a skinfold measurement above the defined limits. Less than 30% of the group had a skinfold measurement within the normal values while 15% or more had a measurement below the defined limits. The skinfold measurements could have been affected by lack of standardization of the measurements in this study.

Only 32% of the group (61 children) consumed diets which met the Canadian Dietary Standard for iron (Table II). The mean intake of iron was 10 mg. daily or 87% of the recommended allowance, 12 mg. daily. If the mean intake of iron is used to evaluate the adequacy of iron in the individual diets, it appears that the children's diets were good. However, the large standard deviation and the fact that 68% of the children consumed less than 12 mg. of iron daily indicates that many diets may lack foods which are good sources of this nutrient. Although meat appeared frequently in the diets of the majority of children, liver, eggs, whole grain cereals, and dark green vegetables, also good sources of iron, were not consumed in appreciable amounts. Other investigators (9, 12, 13, 21, 29, 30, 61) have also reported that the diets of elementary school children appear to be low in iron as compared to recommended amounts.

Patterson (12) reported that approximately 50% of the children surveyed failed to consume diets which provided two-thirds of the Recommended Allowance. Another American survey (9) carried out in ten states showed that the intakes of iron were lower than any

other nutrient among adolescent children, and thus recommendations were made to include more high iron-to-caloric ratio foods in the diets. In contrast to these studies other investigators (8, 11, 14, 15, 16, 20, 26, 27, 40, 46, 47, 55) have found that the majority of children usually consumed diets which were adequate in iron, a finding which was attributed to an adequate consumption of meat, eggs, enriched bread and cereals as well as dark green vegetables.

In the present study, the girls had a lower mean intake of iron than the boys (Appendix F), a finding which was in agreement with several other studies (9, 11, 12, 21, 26, 29, 46, 47, 61). The lower intake of iron in this study may be partially attributed to the girls' lower consumption of meat. Also on the particular day of this survey, some boys ate liver, which is very rich in iron, and which greatly increased the mean intake of the group. Another factor which might help to explain why a high percentage of children failed to consume diets which met the standard for iron was that the standard may be set too high for the majority of individuals.

The mean intake for ascorbic acid was 65 mg. daily which was more than twice the amount recommended in the Canadian Dietary Standard, 30 mg. daily (Table III). However, the large standard deviation and the fact that only slightly over half of the children actually consumed 30 mg. of ascorbic acid on the survey day would indicate that the mean value distorted the true picture of ascorbic

acid intake. The low intake of ascorbic acid would appear to result from a lack of citrus fruits and vegetables in the majority of diets. It seemed that the main sources of ascorbic acid for this particular group of children were provided by potatoes, ascorbic acid fortified drinks, and fruits and vegetables other than the citrus variety. Past surveys (8, 9, 12, 14, 15, 16, 20, 21, 22, 23, 25, 26, 27, 29, 30, 40, 46, 47, 56, 57, 58, 59, 60, 61) have also reported that children's diets are frequently deficient with regard to fruit and vegetables and that an inadequate intake of these foods, particularly of the citrus variety, contributed to the lack of dietary ascorbic acid. The present study and studies of other researchers (8, 9, 11, 27) found that girls more often than boys met recommended allowances for ascorbic acid, and that the girls consumed more citrus fruits and vegetables. It was also interesting to note that the mean intakes of ascorbic acid increased with age and that the 12-year-old girls had a higher mean intake than any other age group. Perhaps the older girls ate more fruits and vegetables than the boys and the younger girls because of their concern about weight and personal appearance.

Although several factors may be involved in the dietary lack of fruits and vegetables, some investigators (5, 6, 12, 15) believed that an inadequate income was the major factor while others (10, 14, 56) believed that the need for nutrition education directed at improving food selection was the most important factor.

Because the majority of the children consumed small quantities of fruit and vegetables, a probable assumption would be that their dietary intake of vitamin A would be low. Table II shows that approximately two-thirds of the group (126 children) consumed diets which contained at least 2000 I.U. of vitamin A, the recommended amount in the Canadian Dietary Standard (Table III). The mean intake for vitamin A was 4292 I.U. daily (Table II) or 214% of the Canadian Dietary Standard. Because 33% of the children consumed less than 2000 I.U. per day, the mean intake has questionable validity. A few very large dietary intakes of vitamin A resulted in a mean intake which distorted the true average intake. It is interesting to note that in the present study the mean vitamin A intake of the boys as compared to the girls is greater (Appendix F). This finding could partly be attributed to the boys' larger consumption of liver and fats such as butter and margarine. Results of other dietary studies showed that vitamin A was often below recommended allowances for elementary school children (8, 9, 12, 13, 16, 21, 24, 40, 46, 47, 55), a finding attributed to a low consumption of fruits and vegetables, particularly the dark green and yellow varieties.

Protein, thiamin, and niacin are mainly provided in the diet by the food group which includes meats and meat substitutes. Table II shows that two-thirds of the children (126 children) met the Canadian Dietary Standard for thiamin (0.8 mg. daily) and

three-quarters met the Standard for protein (30 mg. daily) and niacin (8 mg. daily) (Table II). The mean daily intakes (Table III), 72 mg. for protein, 1.1 mg. for thiamin, and 15 mg. for niacin, were all over 140% of the Canadian Dietary Standard. Since the children in this study consumed fairly adequate quantities of meat and enriched flour products, it was not surprising that their dietary intakes of protein, thiamin and niacin were good. Most investigators have reported similar findings (8, 9, 11, 12, 13, 16, 20, 26, 27, 28, 29, 30, 40, 46, 47, 55, 61) and early studies (14, 15, 24) which reported contrasting results might partially be explained by the lack of enrichment of flour and cereal products at that time.

One of the objectives of this study was to evaluate the need for a school lunch program based on the nutritional adequacy of the diets of a population of elementary school children. It was found that the daily nutrient intakes were significantly below the Canadian Dietary Standard for calcium, kilocalories, and iron. Other investigators (7, 8, 15, 16, 17, 44, 45, 46, 47, 48, 49, 50) have suggested that diets lacking in specific nutrients could be improved through a well planned school lunch program. Therefore, the present noon lunches were compared to one-third of the Canadian Dietary Standard as well as Type "A" lunch (Appendix E) which provides one-third of the Recommended Dietary Allowances (91).

Data from Lunch Questionnaire

In the present study analysis of the lunch questionnaire (Appendix D) showed that in five of the eight schools surveyed, Norquay, Pinkham, Somerset, Victoria Albert, and Dufferin, all the school children went home for lunch. Of the three remaining schools, David Livingstone, William Whyte, and Montcalm, two of the children ate lunch at school, one at a babysitter's, and two with a grandmother. During the five-day school week, the majority of children who were interviewed ate the noon lunch regularly. Only 3% reported that lunch was omitted at least once during the week and another 4% reported that lunch was omitted at least twice a week.

It was of interest to find that 8% of the group consumed vitamin pills regularly. Since none of the children could name the vitamin preparation taken, these supplements could not be included in the analysis of the diets. Several other children indicated that they took vitamins only during the winter season. The number of children in the homes varied but the average number of children present at meals was 4.3.

Nutrient Intake for Lunch

When the individual food intake at lunch was compared to one-third of the Canadian Dietary Standard, only 2% of the children ate lunches which were adequate for kilocalories and the eight nutrients. The number and percentage of children who consumed diets which met one-third of the recommended allowances for kilocalories and the nutrients appear in Table VII.

TABLE 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

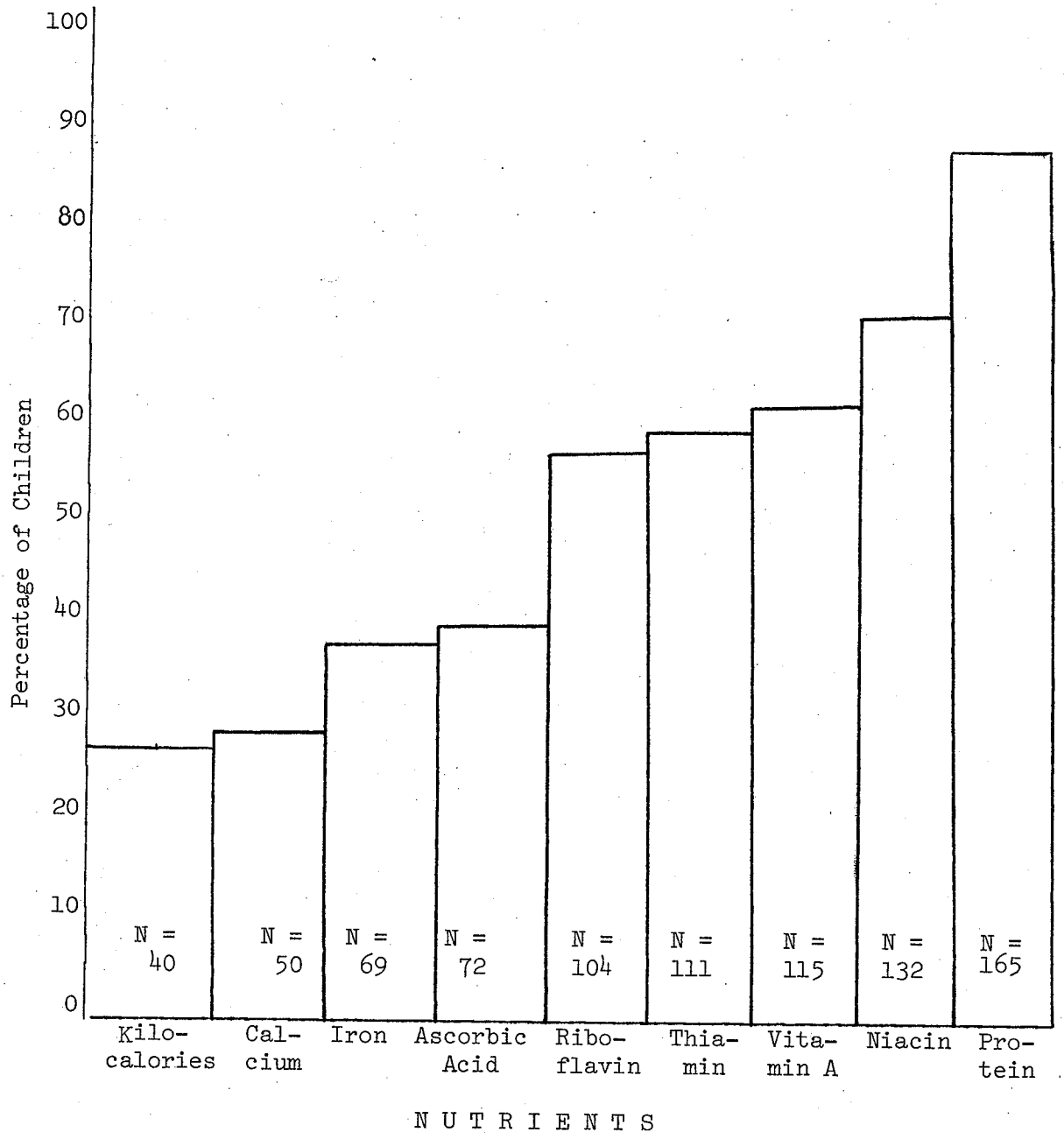


Table VII shows that over 50% of the children ate lunches which met one-third of the Canadian Dietary Standard for protein, niacin, vitamin A, thiamin and riboflavin and that less than 50% consumed lunches which contained one-third of the recommended amount for ascorbic acid, iron, calcium, and kilocalories.

The mean intake for kilocalories and the eight nutrients at the noon lunch is shown in Table VIII. One-third of the recommended allowance for kilocalories and the nutrients appears in the third column and has been included as a standard for an adequate lunch (14). The mean intake for kilocalories and the nutrients at lunch for the children by school appears in Appendix H.

Table VII shows that only 26% of the children (50 children) ate a noon meal which contained one-third of the Canadian Dietary Standard for calcium. The mean intake was 241 mg. daily or 66% of the recommended allowance (Table VIII). The mean intake for the girls as compared to the boys was slightly greater (Appendix I) but statistically significant differences could not be shown.

Because calcium intake is largely determined by the intake of milk and milk products, the consumption of these foods at noon by the children has been shown in detail. The number and percentage of boys and girls and the amounts of milk and milk products which were consumed appear in Table IX.

It is apparent that the intake of milk and milk products was particularly low. Although 33% of the lunches included at least

TABLE VIII Mean Intake at Lunch of Kilocalories and Eight Nutrients for 189 Grade V Children, As Compared with One-Third Canadian Dietary Standard

NUTRIENTS	MEAN INTAKE	ONE-THIRD CANADIAN DIETARY STANDARD
Calories (Kilocal.)	593 ± 238	758
Protein (Gm.)	23.2 ± 16.0	10
Calcium (Mg.)	241 ± 238	364
Iron (Mg.)	3.4 ± 2.4	3.6
Vitamin A (I.U.)	1448 ± 2455	606
Thiamin (Mg.)	0.35 ± 0.33	0.24
Riboflavin (Mg.)	.50 ± .37	0.39
Niacin (Mg.)	4.5 ± 4.0	2.4
Ascorbic Acid (Mg.)	18 ± 37	10

TABLE IX Number and Percentage of 189 Grade V Children and the Quantities of Milk and Milk Products Consumed

Children	Amounts of Milk and Milk Products									
	< 1 cup		> 1 cup		No Milk		Chocolate Milk		Milk Products	
Boys N = 82	No. 12	14.6%	No. 25	30.5%	No. 42	51.2%	No. 3	3.6%	No. 4	4.8%
Girls N = 107	8	7.4%	37	34.5%	51	47.6%	1	0.9%	16	14.1%
Totals = 189	20	10.5%	62	33%	93	54%	4	2%	20	10.5%

one cup of milk, 54% did not include any milk. A slightly greater percentage of girls (34.5%) as compared to boys (30.5%) consumed at least one cup of milk with lunch. Ice-cream, cottage cheese, cheese, and yogurt were eaten by only 14% of the girls and 5% of the boys. Because the girls consumed more milk and more milk products than the boys at lunch, it is not surprising that their mean intake for calcium was greater. Other investigators (8, 11, 13, 14, 16, 47) agreed that calcium intake in the children's noon lunches was frequently below recommended allowances. However, in contrast to the present findings, other studies (6, 8, 9, 11, 16, 30, 48) found that boys more often than girls drank milk, and thus met recommended allowances for calcium more frequently.

Because there was a lack of fruit and vegetables in the daily diet, a possible assumption would be that the noon lunches contained less than one-third of the Canadian Dietary Standard for ascorbic acid and vitamin A. Table VII shows that only 38% of the group (72 children) ate lunches which met one-third of the Canadian Dietary Standard for ascorbic acid (9 mg. daily) and that 61% (115 children) consumed lunches which contained one-third of the recommended allowance for vitamin A (606 I.U. daily). The mean intake for all children for ascorbic acid and vitamin A was 18 mg. and 1448 I.U. per day, respectively (Table VIII). Although the mean intakes were 180% or more of the

recommended allowances, the large standard deviation indicates that there was significant variability in the ascorbic acid and vitamin A intakes. The number and percentage of children who ate ascorbic acid rich and carotene rich fruits and vegetables appear in Table X.

It is apparent in Table X that the lack of citrus fruits and vegetables was related to the low intake of ascorbic acid and that carotene rich fruits and vegetables were not the major sources of Vitamin A for these children. However, soups, particularly vegetable, chicken noodle and tomato as well as tomato ketchup and tomato sauces were included in many noon lunches and were not included in the fruit and vegetable group. This was considered to be a major factor contributing to the apparent adequate intake of Vitamin A.

The mean intake of iron at the noon lunch was 3.4 mg. daily, just slightly below one-third of the Canadian Dietary Standard (Table VIII). Although the mean intake of iron appeared fairly adequate, only 38% of the children (69 children) actually consumed lunches which contained 3.6 mg. of iron. Perhaps the low intake of iron for this group of children at the noon lunch was due to their low consumption of liver, eggs, whole grain cereals, and dark green vegetables. A recent survey carried out in the United States (9) also found that children, particularly those who did not participate in the school lunch program, consumed inadequate dietary iron. From this study, it was demonstrated that a specific nutrient deficiency among children could be improved through an adequate school lunch .

The noon lunches appeared to be fairly adequate with regard to protein, thiamin, riboflavin, and niacin. The intake of protein

TABLE X Number and Percentage of 189 Grade V Children and the Quantities of Fruits and Vegetables Consumed

Fruits and Vegetables	BOYS N = 82				GIRLS N = 107				TOTAL N = 189			
	# 1 Serving	%	# No Serving	%	# 1 Serving	%	# No Serving	%	# 1 Serving	%	# No Serving	%
High in Ascorbic Acid	7	8.5	75	91.5	18	16.8	89	83.2	25	13.2	164	86.8
High in Carotene	3	3.6	79	96.4	2	1.8	105	98.2	5	2.6	184	97.4

at lunch more often met one-third of the Canadian Dietary Standard than of any other nutrient. Eighty-seven percent of the children consumed a noon meal which contained 10 grams or more of protein daily (Table VII); 59% of the group (111 children) ate lunches which met one-third of the Canadian Deitary Standard for thiamin while 70% met one-third of the recommended allowance for niacin (Table VII). The mean intakes for thiamin, 0.35 mg. daily (Table VIII), and for niacin, 4.5 mg. daily, were well above one-third of the Canadian Dietary Standard.

Fewer of the children consumed diets at noon which met one-third of the Canadian Dietary Standard for riboflavin as compared to the other three nutrients (Table VII). The lower intake of riboflavin might be attributed to the lack of milk and milk products in the noon lunches.

It would appear that the adequacy of protein, thiamin, riboflavin, and niacin in the noon lunches could largely be attributed to the children's dietary intakes of meat and meat substitutes, peanut butter, enriched bread and bakery products made with enriched flour, as well as the smaller intakes of milk, milk products and eggs.

Home Lunches as Compared to Type "A" Lunch

Schools which participate in the National School Lunch Program are required to provide Type "A" lunch (Appendix E) which includes the following foods in the noon meal: 1 cup of milk; 2 ounces of meat, fish, poultry, or cheese, or 1 egg, or 4 tablespoons peanut butter,

or ½ cup of dry beans or peas; ¾ cup serving of two or more fruits or vegetables; 1 slice of whole grain bread or a substitute; 1 teaspoon butter or margarine. When compared to the standard amounts of foods in the Type "A" lunch not any of the children ate lunches which contained the recommended amounts of all the five food groups. Table XI shows the amount of each of the five food groups which is suggested for the Type "A" lunch as well as the number and percentage of boys and girls in the present study whose home lunches contained those foods in the recommended amounts. The number and percentage of children as defined by age and sex who consumed a lunch similar to Type "A" lunch appear in Appendix J.

Table XI shows that only 33% of the group consumed one cup of milk or more at lunch. Approximately 20% drank soft drinks or other sweetened beverages, 7% drank tea or coffee, and 2% drank ascorbic acid fortified beverages. Adelson (40) reported that milk consumption appeared to be decreasing in the home. Such a trend was attributed to the increased participation by the children in school feeding programs. Several researchers (2, 8, 9, 14, 16) have reported that children who participated in the school lunch regularly consumed more milk than children who did not participate. However, other researchers (40, 47, 52, 55, 62) have reported that a ready supply of milk did not necessarily increase the children's milk consumption. In order to

TABLE XI Number and Percentage of 189 Grade V Children Meeting Type "A" Lunch

Food Groups	Recommended Amount	Boys N = 82	% Boys	Girls N = 107	% Girls	Total N = 189	% Total
Milk	1 cup	25	30.4	37	34.6	62	32.8
Meat and Meat Substitutes	2 oz. meat OR 1 egg OR 4 T. Peanut Butter OR ½ c. Dried Beans or Peas	48	58.5	52	48.6	100	52.1
Fruits and Vegetables	¾ cup two or more	6	4.0	7	6.5	13	6.8
Whole Grain Bread	1 slice	54	65.8	60	56.1	114	60.3
Butter or Margarine	1 Tsp.	27	32.9	26	24.3	53	28.0

change food habits, nutrition education as well as an easy access to milk was believed to be the most beneficial plan.

Fifty-two percent of the children ate a lunch which included at least two ounces of meat or a meat substitute such as eggs, peanut butter, dried beans or peas (Table XI). Although eighty-nine children did not consume the recommended amount of meat at lunch, the majority of children's diets did include a one ounce portion of either meat or a substitute. Meat, particularly hamburger and cold cuts, were eaten in larger quantities and more often by the boys as compared to the girls. Fish was not a popular lunch food; it was included in only two of the noon meals. Although only 5% of the group ate a two-ounce serving of poultry at lunch, smaller amounts were eaten by several of the children.

Nine percent of the children ate four tablespoons of peanut butter, which was the quantity recommended in place of two ounces of meat and several children had eaten smaller amounts of this food for lunch. It was interesting to note that many children preferred peanut butter as a spread for bread instead of butter or margarine. It was also noted that peanut butter was more popular among the girls. Only one child had eaten a serving of cooked dried peas and approximately 8% had eaten cooked beans or tinned pork and beans.

Fruits and vegetables, particularly citrus and carotene rich varieties, were lacking in the children's noon lunches; only 4%

of the boys and 7% of the girls had eaten two or more three-quarter cup servings of any kind of fruit or vegetable. Other researchers (14, 47, 48) reported that one means of improving a lack of fruits and vegetables in the children's diets was to include at least one serving in the school lunch. However, these researchers emphasized that if the school lunch was to be effective in improving fruit and vegetable consumption, an educational program was needed to improve the food habits of the children.

Approximately 60% of the children consumed at least one serving of a whole grain or an enriched bread product for lunch (Table XI). The majority of children, 53%, ate white bread and indications were that the children preferred white bread to brown or rye bread. Boys ate more bread at noon as compared to girls. The twelve-year-old girls particularly ate small quantities of bread; only 20% had consumed one slice or more in the noon lunch. Whole grain cereals and enriched bread products contributed non-animal protein, thiamin, riboflavin, niacin and iron to the diets of the children. Since the majority of the children had an adequate intake for protein, thiamin, riboflavin, and niacin (Table XI), it would seem that this food group is consumed in adequate amounts by most of the children at the noon meal.

Enriched foods closely related to whole grain cereals include macaroni, spaghetti, and rice. This group of foods which are considered to be high carbohydrate foods can also provide a con-

siderable amount of non-animal protein to the diet. Macaroni was more popular than spaghetti or rice at the noon lunch, particularly among the girls.

It was difficult to determine the quantity and kind of fat eaten by the children. They had difficulty distinguishing between butter and margarine as well as in estimating how much fat was used in cooking. Therefore, only fats that were spread on bakery products were included in this study. This is one reason perhaps that the fat intake appears low. Only 28% of the group had at least one teaspoon of butter or margarine for lunch (Table IX). Lard was used as a spread in place of butter by only three children. Perhaps the low intake of fat could partially explain the low mean caloric intake at lunch. The mean caloric intake was only 593 kilocalories (Table VIII) or 78% of the recommended allowance. Because only 26% of the group (49 children) (Table VII) met one-third of the Canadian Dietary Standard for kilocalories, it would seem that by increasing the caloric intake of the children, an increase in the other nutrients would follow.

Another category of foods that is of major concern to the nutritionist when planning children's diets is sweets, candy, cookies, cake, and pastry. However, the children in this study did not consume a large quantity of sweets at noon. Only sixteen children had eaten sweets, particularly the 11-year-old girls and boys. Returning to school after lunch and going home after

school were the times when the children most often ate snacks such as candy bars, potato chips, pop, and ice-cream.

Further analysis of the children's total daily food consumption showed that approximately 14% had not eaten breakfast on the day of the survey while only 2% had missed the noon meal. Other studies (7, 23, 45, 50) have shown that the omission of breakfast by children may affect their academic, physical and emotional progress as well as the total nutrient intake. It has also been shown that children generally consumed a large portion of their milk requirement for breakfast either on cereal or as a beverage (23). Perhaps the low consumption of milk could be related to the omission of or an inadequate breakfast. Furthermore, citrus fruits and fruit juices are often served at the morning meal. Because this group of children consumed low quantities of citrus fruits, it seems reasonable to conclude that the omission of breakfast could be a factor.

Implications of the Study

Since the schools were within walking distance to the homes, 93% of the children in this study went home for lunch regularly. The remaining 7% had alternate arrangements which were satisfactory. Although more than 50% consumed lunches which did not provide one-third of the nutrient allowances in the Canadian Dietary Standard for kilocalories, calcium, iron, and ascorbic acid, supplements of specific foods rather than a complete noon meal would be the most beneficial means to improve nutrient intake.

Omission of breakfast occurred more frequently than the omission of lunch or the evening meal; 14% omitted breakfast while only 2% missed eating lunch the day of the survey. Analysis of the morning and noon meals showed that breakfast was more often inadequate than the noon lunch with regard to milk and fruit. These findings would imply that a nutrition survey focused on investigating the nutrient intake at breakfast as well as the children's food habits at breakfast is needed. It has been reported that children who consumed inadequate amounts of food at meals tended to snack frequently on foods high in kilocalories and low in nutrients, e.g., chips, soft drinks. In the present study snacking was popular. Morning snacks were eaten by 26%, afternoon snacks by 48% and evening snacks by 68%. Because snacking occurred least often in

the morning and was also the time when a meal was most frequently omitted, the food supplement would be most beneficial in the morning for this particular group of children.

Suggested supplements might include milk to increase calcium intake, citrus fruit or fruit juice to increase ascorbic acid intake and some type of cookie made with enriched flour to increase the iron and caloric intake. Furthermore, since families moved frequently within this area of the city and the same foods were lacking in the children's diets in all the schools surveyed, it would appear that supplementary foods should be standardized.

The suggested supplementary foods, milk, fruit, juice, and cookies, could be made available to the children through the use of vending machines, which require limited space and operating personnel. Provision of nutritious snacks would provide an alternative choice to soft drinks, chips, candy, chocolate bars, popsicles, and gum. It appeared that the majority of children had money to buy snacks and therefore cost was not the main reason for the low consumption of milk which was less costly than soft drinks per serving. Since snacking has become an important part of current life styles, nutritious snacks which contain a high proportion of nutrients to calories should be made available. Because other investigators (40, 47, 52, 55, 62) have shown that a readily available supply of milk did not always insure increased consumption, a relevant nutrition education program aimed at improving food habits

and motivating children to want to eat nutritious meals and snacks should be a major part of the supplementary food program.

It is hoped that with any type of nutrition education in the schools there will be an improvement in home dietary practices. Since other investigators (17, 18) have reported that parents were not as concerned with good nutrition practices when the school lunch provided the main meal of the day; it is hoped that the introduction of food supplements would complement meals prepared in the home. There was evidence in the present study that nutritious foods were not always readily available in the home for the children who had to prepare their own meals. If preparation of well balanced, easily prepared, economical meals was part of the school nutrition education program, children could influence parents to buy nutritious foods for meals and snacks.

It was evident in the present study that families did not always make wise food purchases. Information regarding food groups showed that meat, one of the most expensive food items, was consumed by the majority of children while fruits and vegetables, also expensive at the time of the survey, were lacking in most diets. A nutrition education program should teach the children how to obtain adequate amounts of protein, thiamin, riboflavin and niacin from foods which are less expensive, e.g., dried beans and peas, peanuts and peanut butter, eggs, cheese.

By choosing less expensive yet nutritionally adequate foods in the meat food group, more money would be available to buy fruits and vegetables.

Because there was a trend for the twelve-year-old girls to have the most inadequate diets, as compared to the other age groups, it would seem that another study should be carried out to determine if their apparent inadequate diets were the result of poor food habits. Information obtained would be useful in designing a nutrition education program that would focus on the needs of the specific group concerned. It is around this age that girls often become concerned about their weight and personal appearance and as a result avoid eating foods they consider fattening, e.g., milk. Information about choosing a well balanced diet and the positive effects of good nutrition on personal appearance could be part of the nutrition education program. Because boys generally want to excel in sports, a nutrition education program could be related to achievement in sports.

Because the 24-hour recall was used to collect dietary data in this study, only trends could be noted and conclusions about nutritional deficiencies could not be made. The mean caloric and nutrient intake values appeared to be distorted particularly for vitamin A and ascorbic acid. Results of this survey would imply that the 24-hour recall must be interpreted with caution and that more than one 24-hour recall should be done during the survey period.

Another implication of this study was that Canadian standards for nutrient intake and physical measurements may not always be applicable. Twelve-year-old boys and girls have the same nutrient allowances in the Canadian Dietary Standard yet different standards for weight and height and skinfold measurements. The ten- and eleven-year-old girls as compared to the ten- and eleven-year-old boys were shown to have smaller mean weight and height values while the reverse was true for the twelve-year-old boys and girls. Skinfold average measurements were larger for the girls than for the boys in each age category. Because of the apparent difference in the rate of growth, one would assume that there would be differences in nutrient requirements.

There are certain limitations in this study which may have influenced the validity of the data obtained. Therefore, the implications and conclusions derived from the results of this study must be interpreted with recognition of the following factors.

One obvious limitation is the 24-hour recall method used to collect the dietary intake data. In the present study only one 24-hour recall was carried out. Therefore, it was not possible to determine past food habits, individual variations, and seasonal differences. Several 24-hour recalls taken over a period of time would have been needed to obtain this type of data. The particular day that the survey was conducted was not a typical day for the girls in one of the schools. A party to celebrate the completion of

the school term resulted in deviations from their usual food patterns. A small percentage of the children in some of the schools also reported that their food consumption on the survey day was not typical. However, the majority of children said that this particular day was fairly representative of their usual dietary pattern.

The 24-hour recall records were not validated. In view of the fact that in many families both parents worked, validation by interviewing parents did not appear to be feasible. Therefore, all the food intake data were collected from the children. Errors in omission of foods and beverages, inaccurate estimates of food quantities and lack of knowledge of the kinds of foods consumed are factors which could effect the results.

The dietary data was evaluated by using food tables. Food tables may not give accurate values for a particular food or beverage consumed because only a limited variety of foods and beverages can be analyzed and included in food tables.

The difference in numbers of children in each age category made it difficult to compare the food habits of specific age groups. The large number of eleven-year-old children as compared to ten- and twelve-year-olds in this particular grade would imply that children should perhaps be chosen by age instead of grade.

CONCLUSION

Since the majority of children in this study ate their noon meal at home, it is questionable whether a noon school lunch is needed. However, daily nutrient intakes of the children were below the Canadian Dietary Standard for calcium, iron, and ascorbic acid as well as for kilocalories. These same nutrients also appeared in lowest amounts in the noon meal.

It would appear that a supplementary food program which focuses on the specific nutrient deficiencies rather than a complete noon meal would benefit this group of children. Because more children omitted eating breakfast than omitted the noon meal, it is recommended that the food supplements should be included in the morning program. Milk, juice, and enriched bread products are possible food supplements which could be used to increase the nutrient intakes for calcium, ascorbic acid, iron, and kilocalories.

As a major part of the food supplement program, nutrition education should be included. In order to teach the children good food habits, the parents, school nurses, and nutritionists as well as the teachers, should be involved in planning and implementing the program.

BIBLIOGRAPHY

1. Beaton, G.H. (1970). Nutritional status of Canadians -- an unknown entity. Canad. J. Pub. Health, 61:193.

2. Christakis, G., A. Miridjanian, L. Nath, H.S. Khurana, C. Cowell, M. Archer, O. Frank, H. Ziffer, H. Baker and G. James (1968). Nutritional epidemiological investigation of 642 New York City children. Amer. J. Clin. Nutr., 21:107.

3. Zayaz, S., P. Mack, P. Sprague and P. Bauman, (1940). Nutritional status of school children in a small industrial city. Ch. Dev., 11:1.

4. Lowther, M., P. Mack, C. Logan, A. O'Brien, J. Smith and P. Sprague (1940). The school lunch as a supplement to the home diet of grade school children. Ch. Dev., 11:203.

5. Hardy, M., A. Spohn, G. Austin, S. McGiffert, E. Mohr and A. Peterson (1943). Nutritional and dietary inadequacies among city children from different socio-economic groups. J. Amer. Dietet. Assoc., 19:173.

6. Trulson, M., D. Hegsted and F. Stare (1949). New York State nutrition survey, I. A nutrition survey of public school children. J. Amer. Dietet. Assoc., 25:595.

7. Myers, M., S.C. O'Brien, J. Mabel, F. Stare (1968). A nutrition study of school children in a depressed urban district, I. Dietary findings. J. Amer. Dietet. Assoc., 53:226.

8. Velat, C., A. Mickelsen, M. Hathaway, S. Adelson, F. Meyer and B. Peterkin (1951). Evaluating school lunches and nutritional status of children. U.S. Dept. of Agriculture Circular #859, Washington, D.C.

9. Ten State Nutrition Survey (1968-70). Dept. Health, Education and Welfare, Health Services and Mental Health Administration, Atlant, Georgia. DHEW Publication No. (HSM) 72-8133.

10. Lockhart, H. and E. Whitehead (1952). Nutrition education in elementary and secondary schools. Dept. of Nutrition, Harvard University, School of Public Health. The Nutrition Foundation Inc., Chrysler Bldg., N.Y.

11. Marlatt, A., E. Eppright, M. Hathaway and M. Patton (1956). Nutrition of children in three selected schools in Iowa, Kansas and Ohio: A pilot study. North Central Region Publication 70, Technical Bulletin 81, Kansas State College.

12. Patterson, L. (1971). Dietary intake and physical development of Phoenix area children. J. Amer. Dietet. Assoc., 59:106.

13. Emmons, L., M. Hayes and D.L. Call (1972). A study of school feeding programs. J. Amer. Dietet. Assoc., 61:262.

14. Tisdall, F.F., E.C. Robertson, T.G. Drake, S.H. Jackson, J.A. Long, H.M. Fowler, L. Brouha, R.G. Ellis, A.J. Phillips, R. Stevenson (1952). The Canadian Red Cross Society's School Meal Study 1947-1949. Univ. of Toronto Press, Toronto.

15. Stiebeling, H. (1950). Trends in family food consumption. J. Amer. Dietet. Assoc., 26:248.

16. Patton, M.G., D. Tyrrell, A.F. Carver, F.E. Hunt and M. Thornbury (1961). Nutrition of a group of school children in Ohio with improved diets. Research Bulletin 887, Ohio Agricultural Experiment Station.

17. Moser, A. (1945). Nutritional condition of children in relation to school lunches in two South Carolina rural communities. Bulletin 359, South Carolina Agriculture Experiment Station.

18. Mack, O. (1947). A nine-year study of the school lunch. J. Home Ec., 39:73.

19. Harris, R., E. Weeks and M, Kinde (1943). Effect of a supplementary food on the nutritional status of school children. J. Amer. Dietet. Assoc., 19:182.

20. Moschette, K., K. Causey, E. Cheely, M. Dallyn, L. McBryde and R. Patrick.(1952). Nutritional status of preadolescent boys and girls in selected areas of Louisiana. Louisiana Technical Bulletin 465, Louisiana State University.

21. Morgan, A.F. (1959). Nutritional status, U.S.A. Bulletin 769. California Agriculture Experiment Station, University of California.

22. Potgieter, M. and E. Morse (1955). Food habits of children. J. Amer. Dietet. Assoc., 31:794.

23. Sidwell, V.D. and E.S. Eppright (1953). Food habits of Iowa children - breakfast. J. Home Ec., 45:401.

24. Sylvestre, J.E. (1947). Nutrition and school children. Canad. J. Pub. Health, 38:182.

25. Webb, J.F. and F.B. Swan (1946). Nutritional aspects of a school health study in Marysville, New Brunswick. Canad. J. Pub. Health, 37:399.

26. Dean, W.T., B.C. Davis and S.L. McConnell (1954). Nutritional status of pre-adolescent boys and girls in the Blacksburg School District. Technical Bulletin 122, Virginia Polytechnic Institute.

27. Chalmers, F.W., L.L. Chapman, J.J. Lawless, W.L. Lewis, S. Stregevsky, O.L. Voth and A.H. Van Landangham (1955). Nutritional status studies in Monongalia County, West Virginia. Bulletin 375 T. West Virginia University Agricultural Experiment Station.

28. Eppright, E.S., V.D. Sidwell and P.P. Swanson (1954). Nutritive value of diets of Iowa school children. Jour. Nutr., 46:299.

29. Wilcox, E.B. and L.S. Galloway (1954). Children with and without rheumatic fever. J. Amer. Dietet. Assoc., 30:345.

30. Young, C.M., V.L. Smudski and B.F. Steele (1951). Fall and spring diets of school children in New York State. J. Amer. Dietet. Assoc., 27:289.

31. Young, C.M. and H.L. Pilcher (1950). Nutritional status survey of Groton Township, New York. 2. Nutrient usage of families and individuals. J. Amer. Dietet. Assoc., 26:776.

32. Tucker, R.E., F.W. Chalmers, H.N. Church, M.M. Clayton, W.D. Foster, L.O. Gates, G.C. Hagan, B.F. Steele, A.W. Wertz and C.M. Young,(1952). Co-operative nutrition status studies in the North East Region, four dietary findings. Bulletin 319, Contribution 802, Rhode Island Agriculture Experiment Station.

33. Eppright, E.S. and C. Roderick (1955). Diet and nutritional status of Iowa School children. Amer. J. Pub. Health, 45:464.

34. Edwards, C.H., G. Hogan, S. Spahr and Guildord County Nutrition Commission (1964). Nutrition survey of 6200 teenage youths. J. Amer. Dietet. Assoc., 45:543.

35. Milton, M. (1971). An investigation of the relationship between nutrition knowledge and dietary practices of two groups of high school girls. M.Sc. Thesis, University of Manitoba.

36. Trenholme, M. and H. Milne (1963). Studies of teenage eating in Ontario. Canad. J. Pub. Health, 54:455.

37. Robbins, G.E. (1972). Ten State Nutrition Survey: Educational Implications. J. Nutr. Educ., 4:157.

38. Statistics on Low Income in Canada (1967). Dominion Bureau of Statistics #13-536.

39. Stiebeling H. and E. Phipard (1939). Diets of families of employed wage earners and clerical workers in cities Circular 507, United States Dept. of Agriculture, Washington, D.C.

40. Adelson, S.F. (1968). Changes in diets of households, 1955 to 1965. J. Home Ec., 60:448.

41. Carpenter, R.S. and H.K. Stiebeling (1936). Diets to fit the family income. Farmer's Bulletin 1757. United States Dept. of Agriculture, Washington, D.C.

42. Dhalla, N.K. (1966). These Canadians. McGraw-Hill of Canada Limited, Toronto.

43. Baker, H., O. Frank, S. Feingold, G. Christakis and H. Ziffer (1967). Vitamins, total cholesterol and triglycerides in 642 New York City school children. Amer. J. Clin. Nutr., 20:850.

44. Abbott, O.D., R.D. Townsend, R.B. French and C.F. Ahmann (1946). Effectiveness of the school lunch in improving the nutritional status of school children. Bulletin 426, Agricultural Experiment Station, Florida.

45. Taylor, B.P. (1969). Statement in Hearings before the Select Committee on Nutrition and Human Needs. 3. The National Nutrition Survey, Washington, D.C., Govt. Printing Office, p.958.

46. Lantz, E. and P. Wood (1958). Nutritional condition of New Mexican children. J. Amer. Dietet. Assoc., 34:1199.

47. Eppright, E.S., A. Marlatt and M.B. Patton (1955). Nutrition of 9, 10 and 11 year old public school children in Iowa, Kansas and Ohio. Dietary Findings Research Bulletin 434, Iowa Agricultural Experiment Station, Iowa State College.

48. Clayton, M.M. and D.E. Ullman (1949). Remodelling the school lunch for the teenager. Bulletin 475, Maine Agricultural Experiment Station.

49. Todhunter, E.N. (1948). Child feeding problems and the school lunch program. J. Amer. Dietet. Assoc., 24:422.

50. Hose, R. (1968). Breakfast boosters. Nutr. News., 31:5.

51. McMillan, T.J. and E.N. Todhunter (1946). Ascorbic acid content of lunches served at school. J. Amer. Dietet. Assoc., 22:404.

52. Dawson, R.M. (1970). Development of a school meal service in Newfoundland schools. Canad. J. Pub. Health, 61:257.

53. Report of a Food Habits Study of certain school-aged children in a Southern New Brunswick Community (1961). Maternal and Child Health Division, Dept. of Health, New Brunswick.

54. Crawford, R., J. Leeson, E.W. McHenry and W. Mosley (1944). Nutritional aspects of the Hartman Jones Memorial School Health Study. Canad. J. Pub. Health, 37:351.

55. Dong, A. and M.C. Feeney (1968). The nutrient intake of Indian and non-Indian school children. Canad. J. Pub. Health, 59:115.

56. Wardlaw, J., E. Beamish and C. Trerice (1957). A study of food habits of 4,425 Toronto school children. J. Canad. Dental Assoc., 23:344

57. Campbell, A.M., R.J. Grass, D.B. Hacker, M. Hotopp and E.M. Lantz (1953). The relation of vitamin C to the condition of the gums of New Mexico school children in selected areas. Bulletin 380. Agricultural Experiment Station, New Mexico College of Agriculture and Mechanic Arts.

58. Morrison, R. and L. McBryde (1957). Food habits of Louisiana boys and girls, how good are they? Bulletin 510. Agricultural Experiment Station. Louisiana State University and Agricultural and Mechanical College.

59. Clayton, M.M. (1944). A four-year study of the food habits and physical condition of grade-school children in Newport, Maine. Bulletin 430. The Maine Agricultural Experiment Station, University of Maine.

60. Potgieter, M. and V. Everitt (1950). A study of children's eating habits. J. Home Ec., 42:363.

61. Wilcox, E.B., H.G. Gillum and M.M. Hard (1956). Co-operative nutritional status studies in the Western Region. Nutrient intake. Bulletin 383. Utah State Agricultural College, U.S.D.A.

62. Shaver, E.M., E.M. Esler, W. Mosley and E.W. McHenry (1948). Nutritional aspects of the Hartman Jones Memorial School Health Study, II. Report after two years. Canad. J. Pub. Health, 39:395.

63. Boysen, S.C. and R.A. Ahrens (1972). Nutrition instruction and lunch surveys with second graders. J. Nutr. Educ., 4:172.

64. Trainer, L.R. (1955). The National School Lunch Program - A Report. J. Amer. Dietet. Assoc., 31:18.

65. Cortes, M.P. and B.R. Standal (1973). Nutrition education practices in elementary schools in Hawaii. J. Nutr. Educ., 5:18.

66. Huenemann, R.L. and D. Turner (1942). Methods of dietary investigation. J. Amer. Dietet. Assoc., 18:562.

67. Young, C.M., F.W. Chalmers, H.N. Church, M.M. Clayton, L.O. Gates, G.C. Hagan, B.F. Steele, R.E. Tucker, A.W. Wertz and W.D. Foster (1952). Co-operative nutritional status studies in the Northeast Region. III. Dietary Methodology Studies. Bulletin 469, University of Massachusetts Agricultural Experiment Station, Amherse, Mass.

68. Eppright, E.S., M.B. Patton, A.L. Marlatt and M.L. Hathaway (1952). Dietary study methods, V. Some problems in collecting dietary information about groups of children. J. Amer. Dietet. Assoc., 28:43.

69. Adelson, S.F. (1960). Some problems in collecting dietary data from individuals. J. Amer. Dietet. Assoc., 63:453.

70. Young, C.M. and M.F. Trulson (1960). Methodology for dietary studies in epidemiological surveys, II. Strengths and weaknesses of existing methods. Amer. J. Pub. Health, 50:803.

71. Trulson, M.F. (1954). Assessment of dietary study methods, I. Comparison of methods for obtaining data for clinical work. J. Amer. Dietet. Assoc., 30:991.

72. Chamberlain, K. and M. Pyke (1948). An experimental study of the accuracy of a method of survey of individual diets, not directly based on weighing. Ministry of Food, London. (Taken from Dietary Intake Methodologies - A Review, 1960, Technical Report 03188-2-T, School of Public Health, University of Michigan, edited by B.G. Becker, B.B. Indik and A.M. Beeuwkes.)

73. Trulson, M.F. and M.B. McCann (1959). Comparison of dietary survey methods. J. Amer. Dietet. Assoc., 35:672.

74. Maynard, L.A. (1950). Evaluation of dietary survey methods. Fed. Proc., 9:598.

75. Eads, M.G. and A.P. Meredith (1948). Nutrition studies 2. Methods of collecting dietary data. Pub. Health Rep. 63:777

76. Young, C.M., G.C. Hagan, R.E. Tucker and W.D. Foster (1952). A comparison of dietary study methods, II. Dietary history vs. seven-day record vs. 24-hour recall. J. Amer. Dietet. Assoc., 28:218.

77. Bosley, B. (1947). A practical approach to nutrition for children. J. Amer. Dietet. Assoc., 23:304.

78. Meredith, A., A. Mathews, M. Zickefoose, E. Weagley, M. Wayave and E.G. Brown (1951). How well do school children recall what they have eaten? J. Amer. Dietet. Assoc., 27:749.

79. Emmons, L. and M. Hayes (1973). Accuracy of 24-hour recalls of young children. J. Amer. Dietet. Assoc., 62:409.

80. Bransby, E.R., C.G. Daubney and J. King (1948). Comparison of results obtained by different methods of individual dietary survey. Br. J. Nutr., 2:89.

81. Samuelson, G. (1972). An epidemiological study of child health and nutrition in a northern Swedish county, 2. Methodological study of the recall technique. Nutr. Abstracts and Reviews, 42:240.

82. Chattaway, F.W., F.C. Happold and A.M. Happold (1946). Nutrition of school children in Leeds, winter 1943 and summer 1944. Br. Med. J., 1:429.

83. Watt, B.K. and A.L. Merrill (1963). Composition of foods - raw, processed, prepared. Rev. USDA Agric. Handbook No. 8.

84. Canadian Dietary Standard,(1968 revised) Canadian Bulletin on Nutrition, Vol. 6, No. 1.

85. Pett, L.B. and C.F. Ogilvie (1957). The Canadian weight-height survey. Canadian Bulletin on Nutrition, Vol. 5, No. 1:177.

86. Sabry, Z.I. (1970). The Canadian dietary standard. J. Amer. Dietet. Assoc., 56:195.

87. Welch, P.P., E.J. Winsor and S.M. Mackintosh (1971). The distribution of height and weight, and the influence of socio-economic factors, in a sample of Eastern Canadian urban school children. Canad. J. Pub. Health, 62:373.

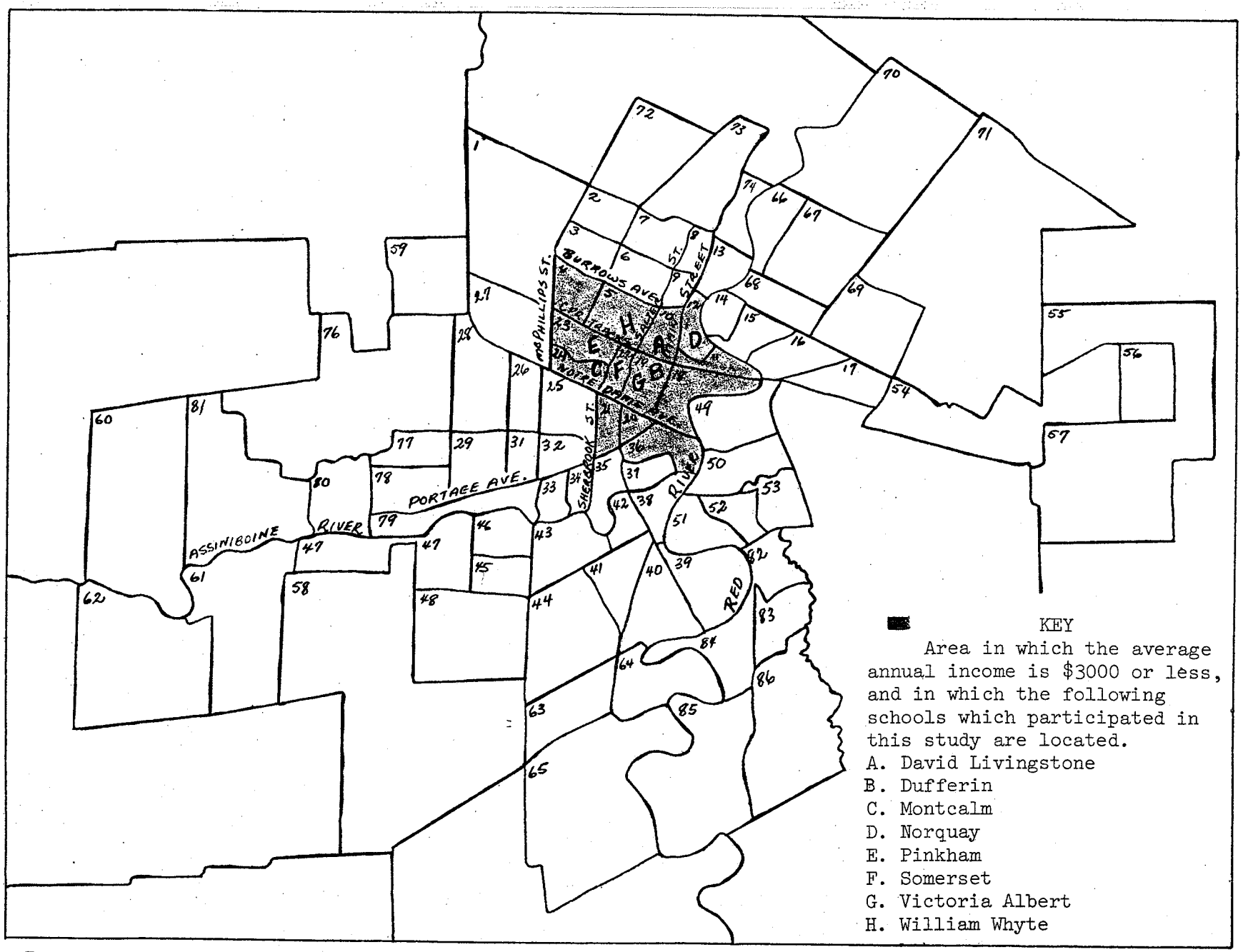
88. Stuart, H.C. and H.V. Meredith (1946). Use of body measurements in the school health program. Amer. J. Pub. Health, 36:1365.

89. Stennett, R.G. and D.M. Cram (1969). Cross-sectional, percentile height and weight norms for a representative sample of urban, school-aged Ontario children. Canad. J. Pub. Health, 62:373.

90. Jenicek, M. and A. Demirjian (1972). Triceps and subscapular skin-fold thickness in French-Canadian school-age children in Montreal. Amer. J. Clin. Nutr., 25:576.

91. National Research Council. Food and Nutrition Board (1968) Recommended Dietary Allowances, Seventh Edition. Natl. Acad. Sci. Pub. 1964.

APPENDIX A



Index Map of Census Tracts of the Metropolitan Area; Winnipeg Census of Canada - 1961

APPENDIX B

Faculty of Graduate Studies
University of Manitoba
1972

I am a graduate student studying in the field of nutrition in the Faculty of Home Economics at the University of Manitoba. Part of my research work involves a study of school children's food intake. I will require information from your child with regard to all foods eaten during a specified twenty-four hour period. I will also be weighing them, measuring their height and skinfold thickness.

I would appreciate your cooperation in signing the enclosed form and returning it with your child to me as soon as possible.

This research project has been cleared by the University of Manitoba Review Committee and Principal of the school. All information will be kept confidential.

Thank you for your anticipated cooperation.

Yours truly,

I agree to let my child be interviewed and measured by Carol Ann Smirl (Graduate Student).

_____
Signature

APPENDIX C

Please write down all you ate and drank in the last 24 hours.

If you ate nothing for a meal or snack, please write nothing. Do not write down what you think you should eat.

Be sure to include all snacks. Estimate where you can, how much of a food you ate.

E.g.	MEAL	FOOD	DESCRIPTION	AMOUNT
	Breakfast	Bread	white, toasted	1 slice
		Margarine		1 teaspoon
		Jam	strawberry	1 teaspoon

Be sure to write your Name, Age, Sex (Male, Female), School, Day of the week on which you are filling out the record and the Date.

24 Hour Food Recall Record

NAME _____ AGE _____ SEX _____

SCHOOL _____

DAY _____ DATE _____

MEAL	FOOD	DESCRIPTION	AMOUNT
Morning Meal			
Snack			

Noon Meal

Snack

Evening Meal

Snack

Please Check ( )

Is this what you usually eat during a day?

No _____ Yes _____ If no, explain. _____

APPENDIX D

THE UNIVERSITY OF MANITOBA

FACULTY OF HOME ECONOMICS

Name _____

School _____

These questions are aimed at getting information about your food habits at lunch time. Please answer all questions as accurately as possible.

Start at question 1 and work towards the end. Follow the directions as given in each question.

1. Did you have lunch today? Please check ( )

   Yes _____ No _____

2. If yes, where did you have lunch today? Please check ( )

   (a) at home _____

   (b) at a neighbour's home _____

   (c) at school _____

   (d) at a restaurant or snack bar _____

   (e) at a school friend's home _____

   (f) other _____. If other, please write down where you did eat lunch.

3. How many days during the school week do you usually eat lunch? Please circle.

   5 4 3 2 1

4. Do you take vitamin pills? Please check ( )

   Yes _____ No _____

5. How many children are there in your home? _____

Please do not write below this line.

WEIGHT _____ SKINFOLD MEASUREMENT _____

HEIGHT _____ _____

_____

Average _____

APPENDIX E

Tha National School Lunch Program in March, 1968, required schools preparing lunches to include, as a minimum, the following for Type A lunches.

(1) One-half pint of fluid whole milk as a beverage;

(2) Two ounces (edible portion as served) of lean meat, poultry, or fish; or 2 ounces of cheese; or one egg; or one-half cup of cooked dry beans or peas; or 4 tablespoons of peanut butter; or an equivalent quantity of any combination of the above listed foods. To be counted in meeting this requirement, these foods must be served in a main dish and with one other menu item;

(3) A three-fourths cup serving consisting of two or more vegetables or fruits or both. Full-strength vegetable or fruit juice may be counted to meet not more than one-fourth cup of this requirement;

(4) One slice of whole-grain or enriched bread; or a serving of cornbread, biscuits, rolls, muffins, etc., made of whole-grain or enriched meal or flour; and

(5) Two teaspoons of butter or fortified margarine. (This requirement has since been reduced to one teaspoon.)

APPENDIX F

Mean Daily Nutrient Intake of 189 Grade V Children by Sex

NUTRIENTS	BOYS N = 82	GIRLS N = 107
Calories (Kilocal.)	2128	1888
Protein (Gm.)	72.0	69.4
Fat (Gm.)	89.7	81.7
Carbohydrate (Gm.)	263.7	224.0
Calcium (Mg.)	774	802
Phosphorous (Mg.)	1177	1132
Iron (Mg.)	11.4	9.6
Vitamin A (I.U.)	8451	3220
Thiamin (Mg.)	1.22	1.05
Riboflavin (Mg.)	1.92	1.57
Niacin (Mg.)	16.8	13.7
Ascorbic Acid (Mg.)	59	69

APPENDIX G

Mean Daily Nutrient Intake for 189 Grade V Children by Schools

School	Calories (kilocal.)	Protein (gm.)	Fat (gm.)	Carbo-hydrate (gm.)	Calcium (mg.)	Iron (mg.)	Vitamin A (I.U.)	Thiamin (mg.)	Ribo-flavin (mg.)	Niacin (mg.)	Ascorbic Acid (mg.)
Norquay N = 15	1574	60.5	64.3	192.3	550	8.3	2578	0.74	1.17	13.8	41
David Livingstone N = 25	2295	77.9	95.9	286.3	895	12.8	9077	1.37	2.13	18.2	72
Victoria Albert N = 36	2046	77.4	87.7	242.1	797	10.5	3850	1.12	1.65	15.4	79
Dufferin N = 22	1933	66.3	78.0	243.2	563	10.8	4306	1.17	1.44	14.7	71
Wm. Whyte N = 41	1837	65.8	79.8	219.2	738	8.9	2573	1.05	1.47	13.2	42
Pinkham N = 18	2047	76.8	85.4	239.4	1065	10.1	3639	1.22	2.06	13.9	53
Montcalm N = 18	2324	82.5	96.5	290.3	1198	11.8	5946	1.19	2.13	14.2	89
Somerset N = 14	1952	67.9	84.6	238.1	844	10.0	5492	1.26	1.79	14.9	73

APPENDIX H

Mean Nutrient Intake for Lunches for 189 Grade V Children by Schools

School	Calories (kilocal.)	Protein (gm.)	Fat (gm.)	Carbo-hydrate (gm.)	Calcium (mg.)	Phos-phorus (mg.)	Iron (mg.)	Vita-min A (I.U.)	Thiamin (mg.)	Ribo-flavin (mg.)	Niacin (mg.)	Ascorbic Acid (mg.)
Norquay N = 15	462	17.1	18.3	56.9	157	228	2.5	512	0.21	0.34	3.2	3
David Livingstone N = 25	625	22.3	25.7	76.7	250	356	3.6	1034	0.38	0.46	4.0	17
Victoria Albert N = 36	648	24.8	28.9	73.1	264	386	3.5	1497	0.37	0.52	4.9	20
Dufferin N = 22	617	24.7	28.9	62.2	158	318	3.8	1107	0.33	0.42	5.3	24
Wm. Whyte N = 41	500	20.1	24.9	51.6	192	304	3.0	1008	0.34	0.44	4.1	10
Pinkham N = 18	639	24.9	27.9	72.0	335	442	3.3	1415	0.37	0.60	4.2	15
Montcalm N = 18	517	22.3	22.6	56.4	355	397	2.6	2396	0.29	0.63	3.8	29
Somerset N = 14	541	21.2	21.7	67.5	186	296	3.4	2360	0.35	0.44	4.7	23

APPENDIX I

Mean Nutrient Intake for Lunches of 189 Grade V Children by Sex

NUTRIENTS	BOYS N = 82	GIRLS N = 107
Calories (Kilocal.)	667	513
Protein (Gm.)	25.1	22.0
Fat (Gm.)	31.3	21.8
Carbohydrate (Gm.)	73.1	56.8
Calcium (Mg.)	225	239
Phosphorous (Mg.)	372	325
Iron (Mg.)	3.5	3.8
Vitamin A (I.U.)	1508	1039
Thiamin (Mg.)	0.39	0.29
Riboflavin (Mg.)	0.50	0.46
Niacin (Mg.)	5.1	4.2
Ascorbic Acid (Mg.)	21	17

APPENDIX J

Number of 189 Grade V Children Meeting Requirements of Type "A" Lunch

Food Groups	Recommended Amount	10 Yr. Girls		10 Yr. Boys		11 Yr. Girls		11 Yr. Boys		12 Yr. Girls		12 Yr. Boys		Totals for 189 Children
		N = 16		N = 5		N = 63		N = 51		N = 28		N = 23		
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Milk	1 cup	5	31.2	2	25	21	33.3	18	35.2	11	39.2	5	21.7	33%
Meat and Meat Substitute	2 oz. meat OR 1 egg OR 4 T. peanut butter OR ½c. dried beans or peas	10	62.4	6	75	32	50.7	26	50.9	10	35.7	16	69.5	53%
Fruits and Vegetables	¾ cup two or more servings	3	18.7	0	0	4	6.3	4	7.8	0	0	2	8.6	6.8%
Whole Grain Bread	1 slice	10	62.4	6	75	41	65.0	36	70.5	9	32.1	12	52.1	60%
Butter or Margarine	1 Tsp.	6	37.5	5	62.5	15	23.8	17	33.3	5	17.8	5	21.7	28%