THE INTAKE OF PROTEIN AND SELECTED NUTRIENTS IN THE DIETS OF PRESCHOOL CHILDREN OF LOW SOCIOECONOMIC GROUPS LIVING IN NORTH TEXAS

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF SCIENCE IN
NUTRITION IN THE GRADUATE SCHOOL OF
THE TEXAS WOMAN'S UNIVERSITY

COLLEGE OF
HOUSEHOLD ARTS AND SCIENCES

BY

BETTY PRIGGIE COYNE, B. S.

DENTON, TEXAS

JANUARY, 1970

A C K N O W L E D G M E N T S

The investigator wishes to express her appreciation to the following individuals for assistance throughout the investigation:

To Dr. Jessie W. Bateman, Dean of the College of Household Arts and Sciences, for assistance in editing the manuscript.

To Dr. Wilma A. Brown, Professor of Foods and Nutrition, who devoted many hours of assistance and guidance as Chairman of the investigator's committee.

To Dr. Betty B. Alford, Assistant Professor of Nutrition Research, for guidance in the development of forms used in the study.

To Dr. Nicholas L. Lund, Assistant Professor of Education, for guidance in the presentation of data.

To Kem Kelly, M. D., for assistance in organization and collection of data.

To Mrs. Olga Uribe, R. N., for translation of the record forms to Spanish, and as interpreter during the collection of data.

To the investigator's husband, John A. Coyne, whose continuous support and encouragement throughout the period of graduate study made this investigation possible.

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CHAPTER I

I N T R O D U C T I O N

There is growing concern in this country regarding the food habits and nutritional status of the preschool child. It is noteworthy that a paucity of information is available concerning the nutritional status and food patterns of children in over 30 developing countries, yet few in-depth studies exist regarding the nutritional status of preschool children in the United States (20). Recent Federal legislation will make possible the conduct of such studies on both a national and local level, with emphasis for study of children from low socioeconomic groups (11).

Recent concern has been shown by both professional and non-professional people regarding the nutritional status and general well-being of the population. This concern has precipitated a need for further study.

This study was designed to evaluate the intake of selected nutrients in the diet of the preschool child from low socioeconomic groups.

REVIEW OF LITERATURE

Food Habits and Nutrient Intake

Studies of the dietary habits and nutrient intake of families with regard to economic status began to appear in the literature in the middle 1930's and early 1940's. In 1942, 1943, and 1944, Youmans and co-workers (31, 32, 33) reported results obtained from a survey of a rural population in middle Tennessee. Participating in the survey were approximately 1200 subjects, both Negro and Caucasian, ranging in age from infancy to 99 years. Nutritional status was determined by seven day food intake records, medical histories, physical examinations, and laboratory data. Annual incomes of the participating families ranged from less than $500 per year to $2000.

Results showed that the highest incidence of not meeting the Recommended Dietary Allowance (RDA) for calories occurred in the one to three year age group. The mean protein intake for Caucasian children one to three years of age was 38 grams; mean intake for children four to six years of age was 47 grams, contributing 12.6 per cent and 12.2 per cent of the total calories respectively. The mean protein intake for Negro children one to three years of age was 23 grams; mean protein intake for children four to six years was 33 grams, contributing 13.1 per cent of the total calories

in both cases. Vitamin A deficiency was greatest in Caucasians in the one to three age group and in Negroes in the four to six age group.

In 1943 Hardy and associates (12) reported a survey conducted between January, 1939 and August, 1941 on 7363 children from various ethnic and socioeconomic groups in Chicago. Neighborhoods of all economic levels were included. Income levels of families ranged from public welfare levels to amounts in excess of $10,000 annually. The children in the study were ages two through 18 years; included were Negro, Mexican, and white ethnic groups.

Results showed that the general nutritional condition was directly associated with socioeconomic status. Ninety two per cent of the diets of the lowest socioeconomic level children were inadequate. However, at the highest socioeconomic level there was dietary inadequacy in 41 per cent of the cases. Seventy two per cent of all participating children did not meet recommendations for minimum adequacy of dietary levels. Inadequacies most commonly found were in the fruit and vegetable group, whereas protein foods were least inadequate. There was a definite improvement in the diets of the children from the low socioeconomic groups upon issuance of food stamps to their families.

Beal (1) reported the results of an extensive study conducted by the Child Research Council on children from upper middle class families in the Denver area. Articles appeared in the early and middle fifties. The children were followed from early in the prenatal period through growth and development into adulthood.

The first article by Beal (1) reported 604 nutrition histories obtained on 46 children. The total intake of calories, carbohydrate, and fat increased throughout the period from birth to five years. The protein intake showed a plateau occurring from 18 months to three years, with the median intake being above the RDA during the first two years of life, and about the same as the 1953 RDA after two years.

Beal (2) obtained calcium, phosphorus, and iron data from 795 histories on 58 children during the first five years of life. After a rapid rise in calcium intake during the first six months, a less rapid increase was noted between six to nine months. A decrease to a lower calcium level was noted at two to three years of age. The author stated that

> . . . phosphorus intake increases during the first year, then shows a pattern intermediate between the stationary intake of protein and the markedly decreased intake of calcium in the early preschool years, increasing again between three and four years.

The high iron intake noted in the first year, as a result of the high iron content of infant cereals, is decreased as

other foods replace cereals in the diet. Although the iron intake levels increased after three years of age, more than 75 per cent of the intakes were below the 1953 RDA for children between the ages of two and one-half to five years.

Thiamine, riboflavin, and niacin data were obtained by Beal (3) from 934 histories on 36 children. Thiamine intake rose until age 15 months and remained level until slightly after age three years when it increased again. The median was slightly above the 1953 RDA. Riboflavin intake decreased during the second and third years, then rose again between ages three to five years. Seventy five per cent of the children failed to meet the RDA for niacin; however, the inadequacy of their intakes was not manifested by deficiency symptoms or growth rate.

Beal (4) obtained data on vitamin A, vitamin D, and ascorbic acid from 1008 histories on 64 children. More than three-fourths of the children were found to have intakes of vitamin A in excess of the RDA from food sources alone. On the average, vitamin concentrates were given to the children 64 per cent of the time. Vitamin D intake level was high in the first year of the study because of the use of concentrates and irradiated milk. Intake declined gradually to a level of 380 international units by age five. Ascorbic acid intake in the first year reached a high level because of the

general use of concentrates. The diet supplied an increasingly larger amount for the balance of the five years.

In 1962, Metheny and associates (22) reported a study conducted with children from the age of two and one-half through five and one-half years attending nursery school and day care centers in Columbus, Ohio. The dietary patterns of the children were related to employment of the mother, family income level, and family marketing habits. In addition, information was sought as to the source of the mother's knowledge about feeding the family. The energy value, protein, riboflavin, niacin, calcium, iron, vitamin A, and ascorbic acid content of the diet were calculated on information obtained from dietary records.

To classify the diets in the above study three levels of nutrient content were established:

1) All nutrients meeting 100 per cent of the National Research Council (NRC) recommended allowances.

2) One or more nutrients less than 100 per cent but all in excess of 67 per cent of the NRC recommended allowances.

3) One or more nutrients less than 67 per cent of the NRC recommended allowances.

With the above classifications established as criterion for dietary evaluation, results showed that 21 per cent of the diets were in the first classification, 61 per cent were in

the second classification, and 18 per cent were in the third classification. Vitamin A was the single nutrient found to be consistently provided in adequate amounts, and only one diet did not meet the full allowance of that nutrient. The most poorly supplied nutrient was iron. Forty nine per cent of the children had obtained less than the recommended allowance. Further analyses revealed that approximately 40 per cent of the diets were supplying less than the recommended allowances for calcium, thiamine, and energy value. Protein, riboflavin, ascorbic acid and niacin allowances were being met by 85 per cent or more of the diets. Children from low income groups ($3700 or below) made up the group having the greatest percentage of inadequate diets. Children whose mother's were working had slightly better diets than those whose mothers were not employed. Past experience, education, and printed materials were the most important sources of information used by the mothers for feeding their families.

In 1962 Dierks and Morse (10) studied the food habits and nutrient intakes of 121 children ranging in age from two to six years whose parents were living in a married student housing project at the University of Minnesota. One or both of the parents were undergraduate or graduate students; thus, the general educational level was higher than would be expected for the general population. In many instances, one or both parents were working full or part time.

The intake of calories, protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin, and ascorbic acid was calculated from dietary records kept by the mother. Intakes were classified as follows:

1) Children whose intake exceeded 75 per cent of the RDA.

2) Children whose intake fell between 50 and 74 per cent of the RDA.

3) Children whose intake was less than 50 per cent of the RDA.

These classifications were categorized as "good", "fair", and "poor". The contributions of snacks to the total nutrient intake were also evaluated.

In comparing the diets in the study by Dierks and Morse (10) with the RDA, it was found that the mean total nutrient intake of calories, protein, iron, vitamin A, thiamine, riboflavin, and ascorbic acid either met or was in excess of the Recommended Dietary Allowances. However, when compared with the 1964 RDA, the intake of iron fell below the recommendation. Few children were found to have intakes for individual nutrients which were below 50 per cent of the RDA, and no children had intakes which were low in all nutrients. The diets were calculated omitting vitamin supplements. However, at least 71 per cent of the children were receiving vitamin supplements daily.

Hootman and associates (16) found that the nutrient intake of children included in their study did not show major nutritional inadequacies. This investigation was conducted in the Summer of 1963 and included over 50 children between the ages of three and 17 years from low income families in Story County, Iowa. The families selected were receiving commodity foods and many of them were receiving Aid to Dependent Children. The monthly income averaged $290 with a range of $176 to $450. The family incomes supported an average of seven persons with a range of four to 12 persons per family. The average educational level of the parents was ninth grade with the range being from completion of the fourth grade to high school graduate.

Information in the above study concerning the food practices of the family, eating habits and food attitudes of the children was obtained through interviews with the mothers. Protein, calcium, iron, vitamin A, thiamine, riboflavin, ascorbic acid and energy values were estimated from the interview record for assessment of nutrient intake. Diet histories were patterned after Burke's form. The 1964 RDA was used to evaluate the diets and the following classification was designated:

Group I. All nutrient intakes meeting or exceeding 100 per cent of the recommended allowances.

Group II. At least one nutrient intake below 100 per cent but none below 67 per cent of the recommended allowances.

Group III. At least one nutrient intake below 67 per cent of the recommended allowances.

Diets classified as Group I or Group II were said to be adequate. Seventy nine per cent of the diets analyzed were classified as adequate.

Inadequate levels were found only for calcium, iron, and ascorbic acid. However, in the three year to 10 year old age group, ascorbic acid was the only nutrient failing to meet 67 per cent of the recommended allowance. While the overall results indicated no gross inadequacies, only 45 per cent of the cases studied had fully adequate diets.

A study published in 1968 by Kerrey and co-investigators (18) indicated that the diets of children from low income groups compared favorable with the Recommended Dietary Allowances. This study was conducted on 40 preschool children, three and one-half to five and one-half years of age, living in Lincoln, Nebraska. The subjects were divided into two groups with 20 subjects per group. The first group contained subjects who were attending the Child Development Laboratory at the University of Nebraska. The second group was composed of children who were from families receiving public assistance. Information was obtained from food records kept by the mothers.

The records were kept in most instances for three consecutive days. Nutrients evaluated were protein, fat, calcium, iron, vitamin A, thiamine, riboflavin, ascorbic acid, pantothenic acid, niacin equivalents, and calories. The calculations did not include dietary supplements.

Each child's nutrient intake was compared with the RDA and scored in accordance with the following:

1) Meeting or exceeding 75 per cent of the RDA.
   Score--positive one

2) More than 25 per cent but less than 75 per cent of the RDA.
   Score--neuter

3) Twenty five per cent or less of the RDA.
   Score--negative one

Each child's score was totaled and his diet classified as low, medium, or high. Scores of five or less were classified as low; scores of six to seven were medium; and scores of eight were high.

Results of the Kerrey study (18) indicated that the mean caloric intake was slightly below the recommended allowance for each of the study groups; however, the mean intake for all nutrients except iron either met or was above the recommended allowance for both study groups. Even though the mean intakes indicated that the diets were adequate, there were children whose intakes were less than that recommended

for the nutrients studied. As with the previous studies reviewed, calcium, iron, and ascorbic acid were the nutrients most often supplied in a deficient amount.

The diets were individually evaluated using two-thirds of the RDA as adequate. All nutrients except iron, ascorbic acid and vitamin A were found adequate for 90 per cent or more of the children. Generally, the child of the low socioeconomic group compared more favorably with the RDA than other children included in the study.

In analyzing the sources of nutrients in the diet, it was found that 32 per cent of the total calories were provided by the bread and cereal group for children from the low socioeconomic group, whereas milk and milk products were the best sources of calories for the higher income group. The bread and cereal group also provided the best sources of iron and thiamine in the diets for both groups.

Owen and Kram (25), in a study conducted in Mississippi during the Fall of 1967 through the Spring of 1968, noted that energy values, as well as calcium, riboflavin and ascorbic acid were the nutrients most often appearing inadequately in the diet. Five hundred fifty eight children ages one to six were included in the study. The average per capita income of the families included in the study was $1,124 per year with

the median income being $925. Twenty five per cent had incomes below $375 per person. The children were divided into groups according to per capita income of families as follows:

Group A--less than $500
Group B--$500 to $1,000
Group C--$1,000 to $1,500
Group D--more than $1,500

The caloric intake of the children in Groups C and D was higher than the caloric intake for the children in Groups A and B. The children from Group C and D received more calories from dairy products, while the children from Groups A and B received more calories from legumes and grain products. The total calcium intake was also lower for the children from Groups A and B than for those included in Groups C and D. The children of Group D received more than three-fourths of their calcium supply from dairy products, while those of Group A received less than half their supply from dairy products, indicating that as income level increased, better sources of calcium appeared in the diet.

The protein intake ranged from 3.0 grams per kilogram for Group A to 3.8 grams per kilogram for Group D. Approximately 60 per cent of the protein was provided by animal sources for all four groups.

Iron intake appeared about the same for all the groups, but the children in Group A received a greater portion of their iron in the form of legumes. Ascorbic acid was provided about equally from vegetables and fruits for Group A; however, as income level increased, not only did ascorbic acid content increase as a result of vitamin supplementation, but fruits contributed a greater share of ascorbic acid to the diet. It is noted that 20 per cent of the children in Group A received vitamin supplements, whereas 50 per cent of the children in the other three groups received vitamin supplements. Vitamin supplements also contributed to a higher amount of vitamin A, thiamine, and riboflavin in the diets of the three higher income levels.

Recommended Dietary Allowances

The Recommended Dietary Allowances were published first in 1943, with revisions appearing in 1945, 1948, 1953, 1958, 1964, and 1968 (26, 28). In using the Recommended Dietary Allowances it is imperative that one does not lose sight of the purposes of the allowances. Sebrell (28) states:

> If their purpose is misinterpreted, one is led to the erroneous conclusion that the recommendations are too high. They are set at levels which will maintain good nutrition in practically all healthy persons in the United States and are intended to serve as goals in planning food supplies and as guides for the interpretation of food consumption records of groups of people. It

> must be stressed that since the recommendations are intended to meet the full needs of practically everybody, they will be considerably higher than some persons will need.

Since the allowances are intended to be adequate for all groups of people living in the United States, a margin of safety is provided for individual variations. An individual whose diet does not meet the Recommended Dietary Allowances may not be malnourished (26, 28). It is important that other criteria such as evaluation of clinical symptoms, biochemical studies, anthropometric measurements, and past and present nutrient intake be considered in evaluating the total nutritional status of an individual.

A summary of the Recommended Dietary Allowances, 1968, for children between the ages of two through six and a summary of the Recommended Allowances for this age group from 1943 to 1968 may be found on the following pages. One of the major changes appearing in the 1968 allowances is the breakdown of ages for children into yearly categories up to the age of four. Of particular note is the 37.5 per cent reduction in protein requirement for children in the age group one to three years, and the 40 per cent reduction in children of the four to six year age group during the period 1943 through 1968. Iron was raised 114.5 per cent for the one to three year age group and 25 per cent for the four to six year age group. For children from one to three years of

RECOMMENDED DAILY DIETARY ALLOWANCES[a], REVISED 1968 (28)

Age[b] Years	Weight kg (lb)	Height cm (in)	Kcalories	Protein gm	Fat-Soluble Vitamins: Vitamin A Activity I.U.	Vitamin D I.U.	Vitamin E activity I.U.	Water-Soluble Vitamins: Ascorbic Acid mg	Folacin[c] mg	Niacin mg equiv.[d]	Riboflavin mg	Thiamine mg	Vitamin B_6 mg	Vitamin B_{12} mcg	Minerals: Calcium gm	Phosphorus gm	Iodine mcg	Iron mg	Magnesium mg
2-3	14(31)	91(36)	1,250	25	2,000	400	10	40	0.2	8	0.7	0.6	0.6	2.5	0.8	0.8	60	15	150
3-4	16(35)	100(39)	1,400	30	2,500	400	10	40	0.2	9	0.8	0.7	0.7	3	0.8	0.8	70	10	200
4-6	19(42)	110(43)	1,600	30	2,500	400	10	40	0.2	11	0.9	0.8	0.9	4	0.8	0.8	80	10	200

[a]The allowance levels are intended to cover individual variations among most normal persons as they live in the United States under usual environmental stresses. The recommended allowances can be attained with a variety of common foods providing other nutrients for which human reqirements have been less well defined. See text for more detailed discussion of allowances and of nutrients not tabulated.

[b]Entries on lines for age range 22-35 years represent the reference man and woman at age 22. All other entries represent allowances for the midpoint of the specified age range.

[c]The folacin allowances refer to dietary sources as determined by *Lactobacillus casei* assay. Pure forms of folacin may be effective in doses less than ¼ of the RDA.

[d]Niacin equivalents include dietary sources of the vitamin itself plus 1 mg. equivalent for each 60 mg. of dietary tryptophan.

RECOMMENDED DIETARY ALLOWANCES AND MINIMUM DAILY REQUIREMENTS FOR CHILDREN (23)

Year	Weight	Height	Kcalories	Protein	Calcium	Iron	Vitamin A Activity	Thiamine	Riboflavin	Niacin	Ascorbic Acid	Vitamin D
Recommended Dietary Allowances: Children 1 to 3 years of age												
	kg(lb)	cm(in)		gm	gm	mg	I.U.	mg	mg	mg	mg	I.U.
1941			1,200	40	1.0	7	2,000	0.6	0.9	6	35	400
1943			1,200	40	1.0	7	2,000	0.6	0.9	6	35	400
1945	13(29)		1,200	40	1.0	7	2,000	0.6	0.9	6	35	400
1948	12(27)		1,200	40	1.0	7	2,000	0.6	0.9	6	35	400
1953	12(27)	87(34)	1,200	40	1.0	7	2,000	0.6	1.0	6	35	400
1958	12(27)	87(34)	1,300	40	1.0	7	2,000	0.7	1.0	8'	35	400
1964	13(29)	87(34)	1,300	32	0.8	8	2,000	0.5	0.8	9'	40	400
1968[a]	12(26)	81(32)	1,100	25	0.7	15	2,000	0.6	0.6	8'	40	400
	14(31)	91(36)	1,250		0.8				0.7			
Recommended Dietary Allowances: Children 4 to 6 years of age												
1941			1,600	50	1.0	8	2,500	0.8	1.2	8	50	400
1943			1,600	50	1.0	8	2,500	0.8	1.2	8	50	400
1945	19(42)		1,600	50	1.0	8	2,500	0.8	1.2	8	50	400
1948	19(42)		1,600	50	1.0	8	2,500	0.8	1.2	8	50	400
1953	18(40)	109(43)	1,600	50	1.0	8	2,500	0.8	1.2	8	50	400
1958	18(40)	109(43)	1,700	50	1.0	8	2,500	0.9	1.3	11'	50	400
1964[b]	18(40)	107(42)	1,600	40	0.8	10	2,500	0.6	1.0	11'	50	400
1968[c]	19(42)	110(43)	1,600	30	0.8	10	2,500	0.8	0.9	11'	40	400

[a]First value is for children 1 to 2 years of age; second, 2 to 3 years. Where recommendations are the same for both groups only one value is shown. Recommended Dietary Allowances for children 3 to 4 years of age are the same as those cited for children 2 to 3, except for kcalories (1,400), protein(30 gm.), iron (10 mg.), vitamin A (2,500 I.U.), thiamine (0.7 mg.), riboflavin (0.8 mg.), and niacin (9 mg.).

[b]Children 3 to 6 years of age.

[c]Recommended Dietary Allowances for children 3 to 4 years of age are the same as cited, except for kcalories (1,400), thiamine (0.7 mg.), riboflavin (0.8 mg.), and niacin (9 mg.).

'Niacin equivalents. Includes sources of vitamin itself plus 1 mg. equivalent for each 60 mg. tryptophan.

age there has been a drop in the caloric, calcium, and riboflavin allowances, with an increase in the thiamine and niacin allowances in 1968 over that recommended in 1964. In the children ages four through six, an increase is noted in the thiamine allowance, whereas the riboflavin and ascorbic acid allowances have decreased during this same period.

Because of their general promulgation, it is common procedure to make assessments of dietary surveys on the basis of the current Recommended Dietary Allowances. In comparing previous data and studies, the year of the Recommended Dietary Allowance used in the studies must be taken into consideration for proper evaluation.

Methodology

Measuring the dietary intake of human individuals is a complex problem and merits careful consideration in the selection of the approach to use in the collection of nutrition information. Final decisions as to choice of method(s) will depend on the purpose and objectives of the study undertaken.

According to Burke (8), the best method for obtaining accurate research information is the use of balance studies. However, balance studies are expensive, time consuming, and difficult to execute. Another method employed to obtain

accurate dietary record information is to weigh the food served per meal, weigh the food left over, and calculate the difference to obtain actual intake (8, 19). Aliquot samples of food for the meals are analyzed to obtain actual nutrient content. This technique is used under controlled conditions, and the major disadvantage is that an atypical situation is created and one does not obtain information which is indicative of normal eating habits. A modification of this method is to have an individual weigh his food in his own environment, but subjects frequently are unwilling to do this for an extended period of time.

The limitations of the previous methods for studying the nutrient intake of individuals limits the choice of method used to the 24 hour intake or some type of dietary history. Burke (8) has stated that the best person to take the dietary history is a trained nutritionist familiar with the techniques of interviewing and skilled in obtaining information by means of dietary histories. In addition, the nutritionist must be familiar with the cultural influences on the eating habits of the group involved, possess knowledge concerning food values, and have an awareness of the economic and social conditions of the group. Establishment of rapport with the interviewee is essential if accurate information is to be obtained.

Hendel (15) stated that "the major socioeconomic factors influencing children's diets are income, urbanization, education of the mother, and number of children in the family." Brill (7) pointed out that in communicating with members of lower socioeconomic groups, three major barriers exist:

1) Differences in values
2) Imputing our own feeling and attitudes to others
3) Lack of acceptance of people as they are

One must understand these differences and use the knowledge acquired to obtain a better understanding of these differences if one is to work effectively in achieving desired results with groups of people from the lower socioeconomic levels.

Wakefield (29) pointed out that errors which appear in an interview are:

1) Bias arising from the effects of the interviewer on the interviewee
    a) Inappropriate appearance or behavior
    b) Taking liberties with questions
    c) Variations in the interviewer's probing and technique
    d) Attitudes of the interviewer as they affect respondent
    e) Interviewer's expectation that may cause him to interpret the response in an improper manner

2) Bias arising from the effect of the respondent on the interviewer

   a) Concealment or distortion or a conformity bias of information
   b) Bias in memory
   c) Ignorance of the fact or of the motivation
   d) Respondent who engages in the interview in a half hearted way

3) Bias arising from interviewer-respondent interaction

   a) Low rapport
   b) Interview not structured enough
   c) Possible rejection of the respondent by the interviewer himself

Young (34) has pointed out that before beginning, the objective of the interview must be understood by the interviewer. The appropriate technique used will depend on the purpose of the interview and what is to be accomplished. The method of processing data obtained will also be influenced by the technique used (35).

Reed and Burke (27), in outlining several aspects of the dietary history as an instrument in gathering nutrition information, pointed out the importance of a "cross check" to help the interviewer judge the reliability of the information obtained. The "cross check" used during the interview, together with the usual food intake record, will help in determining the amount of each food or group of foods which make up the average daily intake of an individual.

The information appearing in the literature indicates that there is lack of agreement as to which is the optimum length of time to keep dietary intake records on individuals. Length of time varies from one day to one week, depending on the specific purposes of the study. Metheny and associates (22) obtained information by having the mothers keep a consecutive three-day record of what the child ate away from school. Concurrently, a three-day record of what the child was eating in school was obtained for the same time interval. Hootman and others (16) interviewed mothers regarding the food practices of the family and diet histories were obtained by the method reported by Burke (8). Beal (1) calculated the nutrient intake from nutritional histories using the 24 hour intake as a "cross check".

Kerrey and co-investigators (18) used a three-day food record to obtain dietary information, with the days being consecutive in most instances. Mothers were given both verbal and written instructions for recording the amounts of food eaten by the children. Amounts were recorded by volume for liquid and soft foods and by measurement for other foods. Plate waste was recorded and subtracted from the original measurements. Dierks (10) interviewed the mothers and used a three day food intake record. Amounts of food were recorded in common household measurements. Mothers also rated the diets as "good", "fair", and "poor". Muto (24) used a questionnaire and three day dietary record for a study.

Calculations of nutrients in all the above studies were conducted primarily using United States Department of Agriculture Handbook Number 8; however, Bowes and Church Food Values of Portions Commonly Used was also cited. In using food composition tables, the values reported are average food values (13, 30). The reliability of calculations made of nutrient intake using food tables depends on an accurate description of the kind and amounts of foods eaten.

To enable the dietary information which has been collected to be meaningful, basic types of information should be collected about an individual in addition to the dietary information. Young and Trulson (35) suggest such things as age, sex, occupation, activity, height, and weight history. The authors pointed out that any additional information needed to make the data collected meaningful should be obtained at the time of collection of primary data.

Evaluation of growth progress of a child can be made through the use of various kinds of growth charts. Hootman and associates (16) evaluated mean height and weights of children in a study using the Jackson-Kelly growth chart, and plotted height and weight for age on the Wetzel Grid. Christakis (9) plotted height and weight values on the Stuart Chart. Muto (24) plotted the height and weights of Japanese children on the Jackson-Kelly growth charts, as did McGanity (21) in a nutrition survey conducted in Texas.

PURPOSES OF THE STUDY

The study was designed to meet the following objectives:

1) To evaluate the dietary intake of the following selected nutrients

   a) Calories
   b) Protein
   c) Fat
   d) Carbohydrate
   e) Calcium
   f) Phosphorus
   g) Iron
   h) Vitamin A
   i) Thiamine
   j) Riboflavin
   k) Ascorbic acid

2) To evaluate the sources of protein in the daily diets of the preschool children participating in the study.

3) To obtain information concerning participation of the children's families in the commodity food program.

4) To learn the sources of nutrition information utilized by the mothers of the children participating in the study.

5) To develop a food intake record form which could be kept with ease by the mother and also provide dependable information for use by the nutritionist.

6) To obtain information beneficial to nutritionists in planning nutrition education programs for mothers of preschool children from low socioeconomic groups.

Preschool children from low socioeconomic groups were selected for this nutrition study since there is a growing concern in America concerning the general well being of the members

from this age group. The limited information which has appeared in the literature added further justification for the study.

CHAPTER II

PLAN OF PROCEDURE

The general purpose of this study was to evaluate the intake of a selected number of nutrients in the diets of preschool children from low socioeconomic groups. Special emphasis was given to the evaluation of the protein intake and sources of dietary protein.

THE STUDY GROUP

Information was obtained on 54 preschool children 2 through 5 years of age. The children were members of families who lived in the Dallas, Texas area and attended various medical out-patient clinics operated for children in this area. Both male and female subjects were included, and more than one child from a family in the specified age group was considered eligible for the study by the investigator. The study was not limited to any one ethnic group. Children diagnosed as having metabolic disorders or mental and physical handicaps were excluded from the study. The data were collected during the late Spring, early Summer, and Fall of 1969.

THE INSTRUMENTS

The "Interview Form" and the set of forms entitled "Food Intake Record" were used to obtain information for the study. Both forms were developed by the author. The information was obtained by the investigator through a personal interview with the mother of the child selected for the study, and instructions for keeping the food record form were given by the investigator to the mother at the time of the interview. In the case of a non-English speaking mother, the interview and instructions were given through an interpreter with the author present. The interpreter was a bilingual registered nurse who had experience working in the area in which the study was conducted.

The Interview Form

The objectives of this instrument were threefold:

1) To determine certain vital statistics concerning the child
2) To obtain information about the general eating habits of the child
3) To obtain pertinent family information.

The information sought enabled the investigator to establish rapport with the mother during the interview.

The birthdate was used to classify the children according to age groups, and the present height and weight were

used for charting current growth and development status on the Iowa Growth Charts (17).

Information obtained concerning the general eating habits of the child enabled the investigator to ascertain what appeared to be a typical day's meal pattern and the foods most commonly offered in the home. The information provided a "cross check" for the data obtained from the food record and aided the investigator in determining the authenticity of the food record.

The family information provided data concerning participation in the commodity food program and sources of nutrition information which the mother had received regarding feeding her family. The investigator was of the opinion that information about the commodity food program and the sources of the mother's nutrition knowledge would be helpful to nutritionists planning nutrition education programs for mothers of preschool children of low socioeconomic groups. Information was obtained on the family income, number in the family, and educational level of the mother.

The "Supplement for Additional Children in a Family" information sheet was used if more than one child in a family participated in the study. A copy of the "Interview Form" and the "Supplement for Additional Children in a Family" form follow.

THE INTERVIEW FORM

Family Number_____

Name_____Sex_____Age____Birthdate_____

Birth Weight_____Birth Length_____Full-term Yes___No___

Premature Yes___No___ Present Weight____Present Height____

Mother employed outside the home Yes___ No___

If yes, who cares for the child?

Where is the child cared for?

If cared for outside the home, what meals, if any are provided?

Number of meals usually eaten per day by the child:

Number of snacks usually eaten per day:

Regularity of meal pattern:

What does your child usually eat for:

Breakfast:

Between Breakfast and Lunch:

Lunch:

Between Lunch and Supper:

Supper:

After Supper:

Do you give your child vitamin supplements or any kind of dietary supplement?

If so, what kind?

How much?

Which of the following kinds of foods do you usually use: (circle)

Milk:	whole low fat (2.0 per cent) skim powdered skim canned other
Breads:	white whole wheat "diet" bread tortilla other
Cereals:	cooked dry both
Spreads:	butter margarine mayonnaise other
Fruits:	canned frozen fresh dried
Fruit juices:	canned frozen fresh
Vegetables:	canned frozen fresh dried
Potatoes and potato substitutes	potatoes beans rice macaroni other all
Soups:	homemade canned both

Are you receiving commodity foods? Yes___ No___

Which foods do you use most?

Which commodity foods do you find most helpful in feeding your child?

Are you receiving donated milk? Yes___ No___

If yes, from whom.

Which of the following sources have been the most help to you about feeding your child? Circle three sources and of the three selected, indicate the one most helpful.

magazines	dietitian
radio	books
newspaper	friend
television	relative
doctor	nutritionist
nurse	homemaking classes

Comments:

Date Interview:

SUPPLEMENT FOR ADDITIONAL CHILDREN IN A FAMILY

Family Number_____

Name of Child_____Sex_____Age____Birthdate_____

Birth Weight_____Birth Height_____Full-term Yes___ No___

Premature Yes___ No___ Present Height____Present Weight__

What does your child usually eat for:

Breakfast:

Between Breakfast and Lunch:

Lunch:

Between Lunch and Supper:

Supper:

After Supper:

The Food Intake Form

The purpose of the food intake form was to obtain information concerning what the participating preschool child ate over a consecutive three day period. The form was developed with the following objectives considered:

1) To have a simple form understandable to the participating parents

2) To facilitate the recording of foods served, methods of preparation, and amounts of food consumed

3) To obtain as accurate a record as possible within the limitations of the recorder

4) To enable the record form to be translated into Spanish.

Detailed instructions for recording the food intake were developed. Foods were recorded using common household measurements. A set of household measuring cups and spoons were given to each mother to use in recording the amounts of food served to the child. A sample meal pattern was included with the instructions for recording the food. The mothers were requested to be as explicit as possible in recording the food and beverages served to the child, amounts in terms of household measurements, and how the foods were prepared. When the child had finished eating, the mother was to check the amount of food actually eaten. This was to be indicated

as "ate all", "ate three-fourths", "ate one-half", "ate one-fourth", or "ate none".

A verbal explanation was first given to the mother on how to record the food for the three day recording period. The investigator discussed each written point of instruction with the mother, discussed the various items on the food record form, and then went over sections of the sample menu. The mother was instructed to re-read the instructions and sample menu again before beginning the recording of food. The mother was given the opportunity to ask questions about any procedures discussed both during and at the end of the interview period. Upon completion of the three day recording period, the mother was instructed to mail the record in a self-addressed, stamped envelope given to her at the conclusion of the interview.

The instructions for recording the food intake of the child, the sample menu, and the record forms were available in Spanish for those mothers who could not read English. For non-English speaking mothers the above procedure was followed by the interpreter. The interpreter had been instructed in the procedure by the investigator, and the investigator was present during the instruction period with the mother.

A copy of the "Food Intake Record" and set of instructions in both English and Spanish follow.

F O O D I N T A K E R E C O R D

Instructions for Recording the Food Intake of Your Child

1. Write the name of your child, the date, and the day of the week on each page of the food record.

2. List all the food your child eats and drinks for three days in a row.

3. Write the amount of food and beverages you serve your child using the following measuring aids provided for you:

   1) a measuring cup
   2) a set of measuring spoons

4. Be sure to write down how you prepared the food and what kind of food you used. For example:

   a. How prepared--fried, boiled, baked or creamed.
   b. Kind of food--fresh, frozen, canned, or dried.
   c. Fruits and vegetables--fresh or canned.
   d. Meats--hamburger meat or stew meat.
   e. Milk--whole, skim, 2 per cent or canned milk.
   f. Cereal--cooked or dry.

5. If you add sugar and milk to your child's cereal, or use mayonnaise or salad dressing on sandwiches, list the amounts used.

6. Remember to measure the amount of food served to your child and when your child has finished eating, check (✓) the approximate amount of each food or beverage he has actually eaten.

7. A sample of a food pattern is attached to help you.

8. When you have finished the three day record, put it in the attached self-addressed, stamped envelope and mail it.

Thank you for keeping this record.

FOOD INTAKE RECORD

Family Number _____

Name of Child MARY SMITH Date February 21, 1969 Day Friday

Kind of Food and Beverage Served	Amount of Food and Beverage Served	How Food is Prepared	Check (✓) Amount Eaten				
			ate all	ate 3/4	ate 1/2	ate 1/4	ate none
Breakfast:							
Cornflakes with milk and sugar	1/2 cup cornflakes 2 teaspoons sugar 1/4 cup milk				✓		
Buttered white toast	1 slice with 1 teaspoon butter						✓
Orange juice	1/2 cup	canned			✓		
Whole milk	1/2 cup		✓				
Between Breakfast and Lunch:							
Oatmeal-raisin cookies	2		✓				
Lunch:							
Vegetable soup	1/2 cup	canned				✓	
Peanut butter and jelly sandwich on white bread	2 slices bread 1 tablespoon peanut butter 1 teaspoon jelly		✓				
Apple	1	raw			✓		
Whole milk	1/2 cup		✓				
Between Lunch and Supper:							
Fritos	one 10¢ bag		✓				
Soda water or soda pop	1 bottle		✓				
Supper:							
Chicken	1/2 drumstick	fried	✓				
Potatoes	1/4 cup	mashed	✓				
Cream gravy	1 tablespoon	creamed	✓				
Turnip greens	2 tablespoons	boiled					✓
Banana	1/3 cup	fresh	✓				
Whole milk	1/2 cup			✓			
After Supper:							
Jelly sandwich on white bread	1 slice bread 1 teaspoon jelly		✓				

FOOD INTAKE RECORD

Family Number _____

Name of Child _____ Date _____ Day _____

Kind of Food and Beverage Served	Amount of Food and Beverage served	How Food is Prepared	Check (✓) Amount Eaten				
			ate all	ate 3/4	ate 1/2	ate 1/4	ate none
Breakfast:							
Between Breakfast and Lunch:							
Lunch:							
Between Lunch and Supper:							
Supper:							
After Supper:							

Record de Candidad de Comida

INSTRUCCIONES PARA ANOTAR LE COMIDA QUE SU NINO COME Y TOMA

1. Escriba el nombre de su niño, la fecha y el dia de la semana en cada página de el record.

2. Marque tóda la comída que su niño come o tome por tres dias seguidos.

3. Escríba la cantidad de comída o bebidas que usted le sirve a su niño usando las siguientes ayudas para medir que se le dara hoy.

   1) Una taza de medir.
   2) Un grupo de cucharas para medir.

4. Esté segura de anotar como preparó la comída y que clase de comída usó. Por ejémplo:

   a. Como la preparó--frita, herbida, cocida en el horno, o en crema.
   b. Clase de comída--fresca, congelada, de bote, o seca (desecado).
   c. Frútas y vegetáles (legumbres)--frescas, o de bote.
   d. Carne--Carne picada (Hamburger) o estofádo (carne de res en pedazos).
   e. Leche--fresca, leche desnatada, de 2% de gordura, o de bote.
   f. Cereal--cocido o seco.

5. Si usted le agrega azucar y leche al cereal del niño, o usa mayonesa o salad dressing en sus lonches, porfavor indíque la cantidad que usa.

6. Acuérdese de medir la cantidad de comída que le sirve a su niño y cuando termine de comer, anote con una (✓) marca aproximadamente la cantidad que comió y bebió.

7. Una copia de una muestra de comida esta incluido para ayudarle.

8. Cuando haya terminado el record de tres dias, pongaló en el sobre con estampilla ya incluida y depositelo en el correo.

Muchas gracias por haber guardado este record.

Record de Candidad de Comida

Numero de Familia _____

Nombre de Nino Mary Gonzales Fecha Febrero 21, 1968 Dia Viernes

Clase de comida o bebida servida	Cantidad de comida y bebida que se sirvio	Como preparo la comida	Indique (✓) cantidad comida				
			comio todo	comio 3/4	comio 1/2	comio 1/4	No comio
Desayuno:							
Cereal seco de maiz (Cornflakes) con leche y azucar	1/2 taza 2 cucharitas de azucar y 1/2 taza de leche				✓		
Pan-blanco tostado con mantequilla	1 tajada de pan y una cucharadita de mantequilla						✓
Jugo de naranja	1/2 taza	de bote			✓		
Leche Fresca	1/2 taza		✓				
Entre medio de des - ayuno y comida:							
Galletas de avena y pasas	2		✓				
Comida:							
Caldo de vegetal	1/2 taza	de bote				✓	
Lonche de mantequilla de cacahuate y jalea en pan blanco	2 rebanadas de pan 1 cuchara de mantequilla de cacahuate 1 cucharita de jalea		✓				
manzana	1 manzana	fresco			✓		
leche fresca	1/2 taza		✓				
Entre medio de comida y cena:							
Fritos	una bolsa de 10¢		✓				
agua de soda	una botella		✓				
Cena:							
Gallina	1/2 de una patita	frita	✓				
Papas	1/2 taza	molidas	✓				
Caldillo de crema (Gravy)	1 cucharada	en crema	✓				
Verdura verde de nabo	2 cucharadas	herbidas					✓
platano	1/3 taza	fresca	✓				
Leche fresca	1/2 taza			✓			
Despues de Cena:							
Lonche de jalea en pan blanco	1 rebanada de pan 1 cucharita de jalea		✓ ✓				

Record de Candidad de Comida

Numero de Familia_____

Nombre de Nino_____Fecha_____Dia_____

Clase de comida o bebida servida	Cantidad de comida y bebida que se sirvio	Como preparo la comida	Indique (✓) cantidad comida				
			comio todo	comio 3/4	comio 1/2	comio 1/4	No comio
Desayuno:							
Entre medio de desayuno y comida:							
Comida:							
Entre medio de comida y cena:							
Cena:							
Despues de Cena:							

TECHNIQUES OF DATA ANALYSIS

The three day food records were analyzed using the values for foods obtained in Food Values of Portions Commonly Used by Bowes and Church (6). The values obtained for each child were compared with the Recommended Dietary Allowances (RDA) for the corresponding age group. Pearson Product-Moment Correlation was used to evaluate the relationship of selected variables.

CHAPTER III

RESULTS AND DISCUSSION

The study was designed to evaluate the intake of a selected number of nutrients in the diets of 54 preschool children ages 2 through 5 from low socioeconomic groups. Each child's diet was evaluated for calories, protein, carbohydrate, fat, calcium, phosphorus, iron, vitamin A, thiamine, riboflavin, and ascorbic acid. The diets were then compared with the 1968 Recommended Dietary Allowances (RDA) for the appropriate age group.

Information was obtained on family income level, vitamin supplementation, sources of nutrition knowledge of the mother, and height and weight for the children. Whenever possible the educational level of the mother was obtained. The sources of nutrition information were grouped into the following categories:

Group I: Oral Communication Media--Radio and Television

Group II: Oral Communication Media--Professional Individuals

Group III: Oral Communication Media--Non-professional Individuals

Group IV: Written Communication Media

Group I included radio and television media; Group II included the doctor, nurse, dietitian, nutritionist, and homemaking instructor; Group III included relatives and friends, and Group IV included magazines, newspapers,and books.

The data obtained on height and weight were plotted on the University of Iowa Growth Standards. Each child was evaluated from the charts in terms of the number of standard deviations above or below the mean.

GENERAL INFORMATION

Two Year Old Children

The two year old children numbered seven boys and six girls providing a combined total of 13 children for this age group. The mean annual family income for the group was $3724.92. The mean family size was 2.15 adults and 4.08 children for a family total of 6.23 persons. The mean weekly per capita income was $12.45. Two of the 13 children were from families who were receiving commodity or supplemental foods.

The mean educational level of the mothers of the children was 8.04 years. Sources of nutrition knowledge for the mothers included one reported source from Group I, 10 from Group II, seven from Group III, and five from Group IV.

Four children were receiving daily vitamin suplementation. The mean per capita weekly income for the families of these four children was $12.78.

The 13 children ranged in age from 24 to 35 months, with a mean age of 27.61 months. The weight of the children ranged from 23 to 32 pounds, with a mean weight of 28.34 pounds. The height ranged from 30.5 to 36.5 inches, with a mean height of 34.21 inches. After the weight for each child had been plotted on the Iowa Growth Standards (17), it was found that four boys and two girls were one standard deviation above or below the mean. One boy and one girl were more than one standard deviation above the mean, and one boy and three girls were more than one standard deviation below the mean. The weight of one child was identical with the mean. The height for each child was plotted indicating that four boys and two girls were within one standard deviation above or below the mean. No boys and only one girl were more than one standard deviation above the mean. Three boys and three girls were more than one standard deviation below the mean. Further evaluation indicated that one girl was more than one standard deviation above the mean for both height and weight, and one boy and two girls were more than one standard deviation below the mean for both height and weight.

Three Year Old Children

The three year old children numbered eight boys and four girls providing a combined total of 12 children for this age group. The mean annual family income for the group was $3889.33. The mean family size was 1.83 adults and 4.25 children for a total of 6.08 persons. The mean weekly per capita income was $10.99. Two of the 12 children were from families who were receiving commodity or supplemental food.

The mean educational level for the mothers of these children was 7.93 years. Sources of nutrition knowledge reported by the mother included no source from Group I, nine from Group II, seven from Group III, and two from Group IV.

Five children were receiving daily vitamin supplementation. The mean weekly per capita income for the families of these five children was $11.96.

The 12 children in this group ranged in age from 36 to 45 months, with a mean age of 41.33 months. The weight of the children ranged from 28 to 36 pounds with a mean weight of 31.75 pounds. The height ranged from 36.00 to 40.75 inches with a mean height of 37.58 inches. The weight for each child was plotted on the Iowa Growth Standards (17). Four boys and one girl were one standard deviation above or below the mean. One boy was more than one standard deviation above the mean, and three boys and two girls were more than one standard

deviation below the mean. The weight for one girl was identical with the mean. When the height was plotted, it was found that four boys and two girls were one standard deviation above or below the mean. None were more than one standard deviation above the mean. Four boys and two girls were more than one standard deviation below the mean. Further evaluation indicated that three boys and two girls were more than one standard deviation below the mean for both height and weight.

Four Year Old Children

The four year old children numbered six boys and 11 girls providing a total number of 17 children in the group. The mean annual family income for the group was $4072.75. The mean family size was 2.11 adults and 4.70 children for a family total of 6.81 persons. The mean weekly per capita income was $13.09. One child was from a family receiving commodity or supplemental foods.

The mean educational level of these mothers was 7.45 years. The sources of nutrition knowledge for the mother included one source from Group I, 10 from Group II, nine from Group III, and five from Group IV.

Seven children were receiving daily vitamin supplements. The mean weekly per capita income of the families of the seven children was $10.60.

These 17 children ranged in age from 48 to 59 months with a mean age of 51 months. The weight of the children ranged from 31.50 to 57.00 pounds with a mean weight of 38.63 pounds. The height ranged from 37.00 to 45.00 inches with a mean height of 41.24 inches. When the weight for each child was plotted on the Iowa Growth Standards (17), it was found that two boys and nine girls were one standard deviation above or below the mean. Two boys and one girl were more than one standard deviation above the mean, and two boys and one girl were more than one standard deviation below the mean. The height was plotted for each child, revealing that two boys and nine girls were one standard deviation above or below the mean. Two boys were more than one standard deviation above the mean and two boys and two girls were more than one standard deviation below the mean. Further evaluation indicated that two boys were more than one standard deviation above the mean for both height and weight. Two boys were more than one standard deviation below the mean in both height and weight.

Five Year Old Children

The five year old children numbered five boys and seven girls providing a combined total of 12 children. The mean annual family income for this group was $3182.67. The mean family size was 1.83 adults and 4.25 children for a family total of 6.08 persons. The mean weekly per capita income

was $8.27. Two of the children were from families who were receiving commodity or supplemental foods.

The mean educational level of the mothers of these children was 7.19 years. The sources of nutrition knowledge for the mother included one source from Group I, nine from Group II, eight from Group III, and none from Group IV.

Nine children were receiving vitamin supplements. The weekly per capita income of the families of these children was $7.89.

The 12 children in this group ranged in age from 64 to 70 months with a mean age of 66.67 months. The weight of the children ranged from 29.90 to 44.50 pounds with a mean weight of 41.10 pounds. The height ranged from 38.50 to 48.00 inches with a mean height of 43.33 inches. When the weight of the child was plotted on the Iowa Growth Standards (17), it was found that three boys and six girls fell within one standard deviation above or below the mean. One girl was more than one standard deviation above the mean, and two boys were more than one standard deviation below the mean. The height was plotted for each child. Three boys and four girls were found to be one standard deviation above or below the mean. One girl was more than one standard deviation above the mean, and two boys and two girls were more than one standard deviation

below the mean. Further evaluation revealed that one girl was more than one standard deviation above the mean for both height and weight, and one boy was more than one standard deviation below the mean for both height and weight.

The Study Group

The total study included 26 boys and 28 girls for a combined total of 54 preschool children. The mean annual family income for the group ranged from no income to $5200 annually. Two children in the group had families who reported having no income at the time of the interview; one family had been living on savings, and the other child's father had no steady employment. Seven children in the group were from families who participated in the commodity food program.

The educational level was obtained for the mothers of 37 children. The mean educational level of the mothers was 7.67 years with a range being from no formal education to high school graduate. The type of education which had been received included self education and education both in the American and Mexican school systems.

Sources of nutrition knowledge for the mothers included three sources reported from Group I, 38 from Group II, 31 from Group III, and 12 from Group IV. Group II, professional people, providing the greatest source of knowledge, included

the homemaking instructor, nurse, doctor, nutritionist, and dietitian respectively. Relatives followed by friends provided the greatest source of nutrition information from non-professional individuals, Group III. Magazines were the most frequently reported source of written communication, Group IV.

Metheny and associates (22) reported that homemakers relied most on past experience, education, and printed materials as sources for feeding their families. Relatives were rated first as influential sources more than were friends. More of the mothers consulted pediatricians for professional help than consulted the nutritionist, dietitian, or home economist. Radio and television were seldom used as sources of information.

Vitamin supplementation was provided daily to 25 of the 54 children. The distribution of supplementation by sex and age groups was as follows:

	Vitamin Supplementation			
Age	Boys	Girls	Total	Per cent of Total Number
2	2	2	4	16.0
3	3	2	5	20.0
4	2	5	7	28.0
5	5	4	9	36.0
Total	12	13	25	100.0

The mean per capita weekly income for the families of the 25 children receiving vitamin supplements was $10.25.

Dierks and Morse (10), in a study of 121 preschool children, reported that 71 per cent of the children were receiving vitamins all the time and 10 per cent part of the time. Owen (25) reported that 20 per cent of the children from per capita income groups of less than $500, and 50 per cent of children in per capita income groups ranging from $500 to $1500 were receiving vitamin supplementation.

The 54 children in the study ranged in age from 24 to 70 months with a mean age of 47.65 months. The weight of the children ranged from 28 to 57 pounds with a mean weight of 34.60 pounds. The height ranged from 30.50 to 48.00 inches with a mean height of 39.02 inches. Weight was compared with the Iowa Growth Standards (17). A total of 31 children were one standard deviation or less above or below the mean weight. Seven children were more than one standard deviation above the mean and 14 children were more than one standard deviation below the mean. Weights of two children were identical with the mean. Height comparisons indicated that 30 children were one standard deviation or less above or below the mean. Four were more than one standard deviation above the mean and 20 were more than one standard deviation below the mean.

Table I summarizes the mean weight and height for the group. Figures 1 and 2 present the individual heights and weights plotted on the Iowa Growth Standards (17) for the study group.

McGanity (21) reported, in a nutrition survey conducted in Texas, body heights and weights for children 0 to 6 years of age followed the 16th percentile or the lower curve when data were plotted on the Iowa Growth Standards (17). Both boys and girls had height and weight growth rates which were six to nine months less than expected.

Hootman (16) found that the mean heights and weights of the children studied compared favorably to the standards of the Iowa Growth Standards (17). The plotting of individual data revealed that heights and weights of three to nine year old boys tended to fall below the mean; however, deviations from the mean were slight.

Kerry and co-workers (18) reported height and weight data on 40 preschool children from both low and high socio-economic groups. Mean height and weight were lower for the children from low socioeconomic groups.

NUTRIENT INTAKE

The nutrient intake was evaluated for each child in the study from food records kept by the mother. Foods were

TABLE I

SUMMARY OF HEIGHTS AND WEIGHTS OF 54 PRESCHOOL CHILDREN

Age	Number of Children	Mean Age (months)	Height in Inches		Weight in Pounds	
			Mean	Standard Deviation	Mean	Standard Deviation
24-35 months	13	27.61	34.21	± 2.34	28.34	± 5.33
Boys	7	27.14	34.43	± 2.24	28.86	± 2.97
Girls	6	28.17	33.96	± 2.83	27.75	± 7.55
36-47 months	12	41.33	37.58	± 1.38	31.88	± 3.57
Boys	8	41.25	37.84	± 1.58	32.56	± 4.14
Girls	4	41.50	37.06	± .77	30.50	± 1.68
48-59 months	17	51.00	41.24	± 2.30	38.63	± 6.27
Boys	6	56.67	42.13	± 3.25	41.00	±10.02
Girls	11	52.55	40.75	± 1.56	37.34	± 2.90
60-71 months	12	66.67	43.33	± 2.42	41.02	± 3.62
Boys	5	65.60	42.60	± 2.46	39.55	± 6.89
Girls	7	67.43	43.86	± 2.43	42.07	± 3.78

DEPARTMENT OF PEDIATRICS, STATE UNIVERSITY OF IOWA

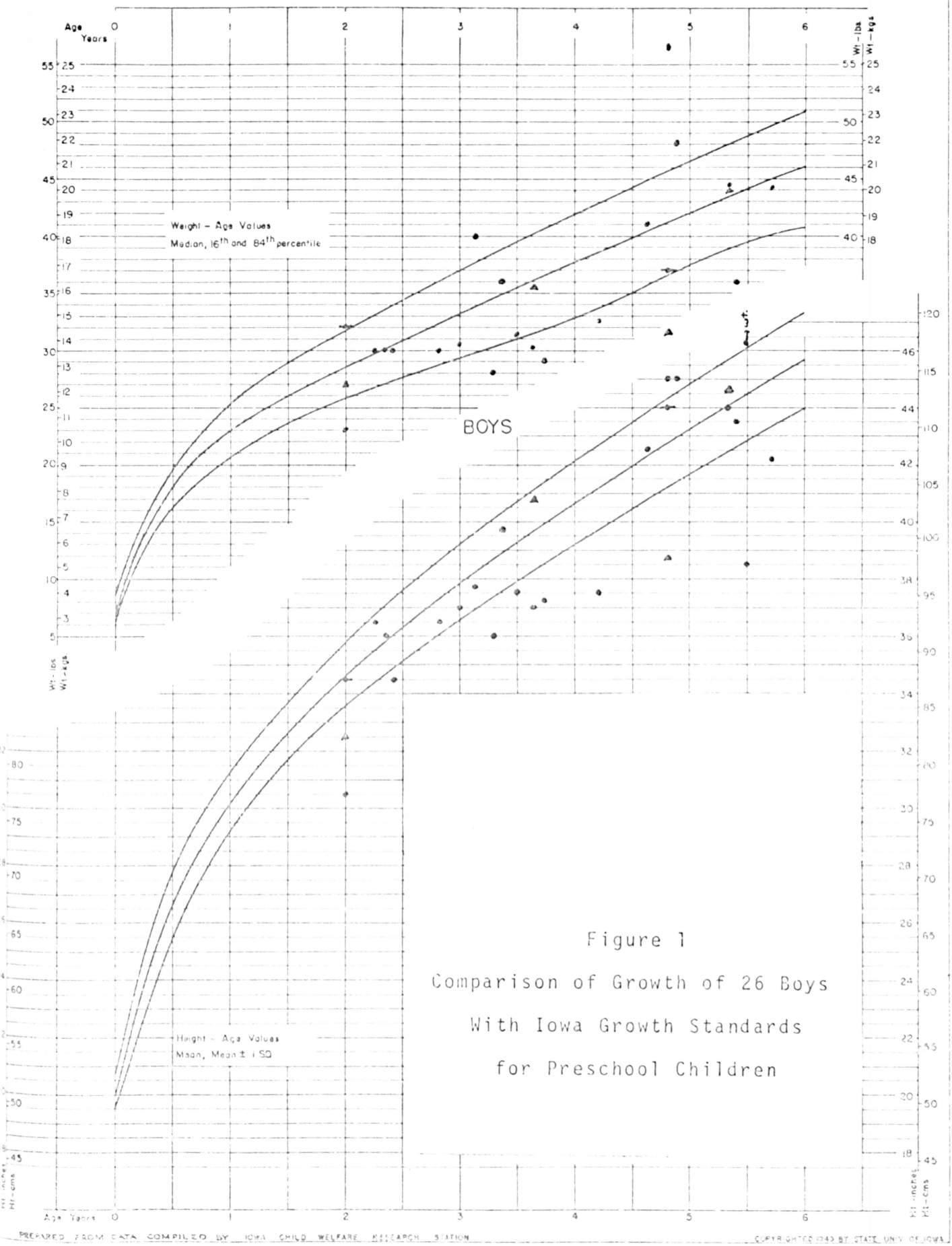

Figure 1

Comparison of Growth of 26 Boys With Iowa Growth Standards for Preschool Children

PREPARED FROM DATA COMPILED BY IOWA CHILD WELFARE RESEARCH STATION

NO 251-B

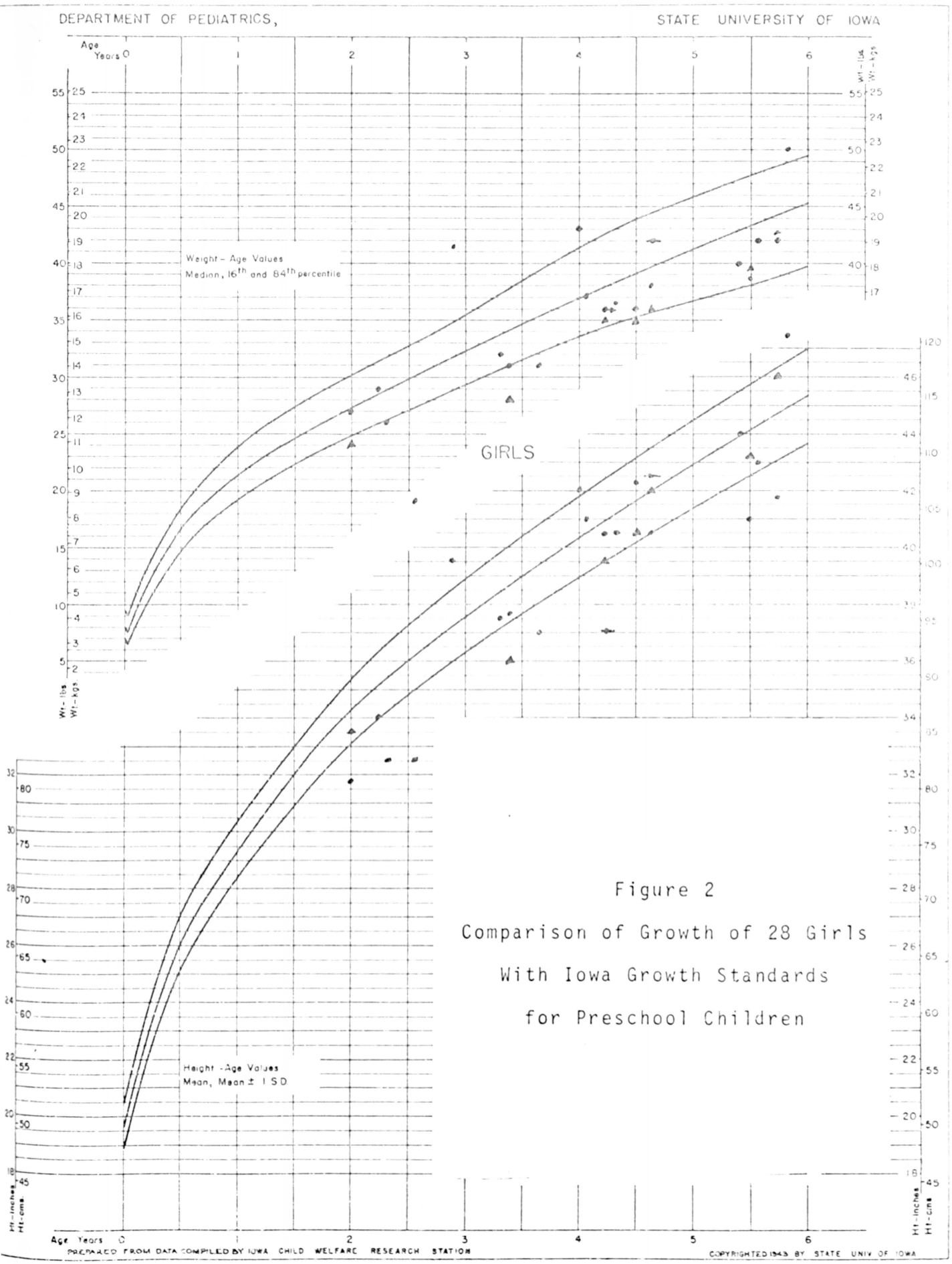

Figure 2

Comparison of Growth of 28 Girls With Iowa Growth Standards for Preschool Children

recorded in common household measurements for a period of three consecutive days. Records which had been kept in Spanish were translated for the investigator by the bilingual registered nurse who had previously acted as interpreter during the instruction period. Analysis of the intake of nutrients was done using values obtained from Bowes and Church's (6) Food Values of Portions Commonly Used. The nutrient intake was analyzed for each day and an average intake computed for the three days. The data presented have been calculated using the average daily intake for each child.

Intake for each nutrient and energy value were compared with the Recommended Dietary Allowances (RDA) for the appropriate age group. The following classification was used by the investigator for comparisons with the RDA:

Class I: Intake equal to or exceeding 100 per cent of the RDA.

Class II: Intake equal to or exceeding two-thirds but less than 100 per cent of the RDA.

Class III: Intake less than two-thirds of the RDA.

The comparisons with the RDA were made for each age group as designated by the 1968 revision (26).

The diets were analyzed by meals and the percentage contribution of each meal to the total intake was calculated. Additionally, the intake of each meal was analyzed with respect to the meal's contribution to the RDA.

Two Year Old Children

The two year old children numbered seven boys and six girls for a combined total of 13 children. The caloric intake for the boys ranged from 891 to 1763 calories with a mean of 1348 calories. The intake for girls ranged from 1036 to 2019 calories with a mean of 1485 calories. The meals which made the greatest contribution to caloric intake were breakfast for the boys and between meal eating for the girls.

The caloric intake for the 13 children ranged from 891 to 2019 calories with a mean of 1412 calories. Lunch made the greatest contribution to the caloric intake for the two year old group. Seven children met the requirements for Class I, six children for Class II, and no children were included in Class III. The mean number of calories per kilogram of body weight was 109.59 calories.

The total protein intake for the boys ranged from 35.77 to 81.06 grams with a mean of 55.26 grams. The protein intake for girls ranged from 37.63 to 94.52 grams with a mean of 56.69 grams. The meal which contributed the most to protein intake was dinner for both the boys and girls.

The total protein intake for the group ranged from 35.77 to 94.52 grams with a mean of 55.92 grams. Dinner made the greatest contribution to protein intake for the two year old children. All 13 children met the requirements for

Class I. The mean grams of protein per kilogram of body weight was 4.34 grams.

Animal protein intake for boys ranged from 25.93 to 64.99 grams with a mean of 41.78 grams. The intake for girls ranged from 26.00 to 69.33 grams with a mean of 40.82 grams. Dinner contributed the greatest amount of animal protein for both boys and girls. Animal protein intake for the 13 children ranged from 25.93 to 69.33 grams with a mean of 41.34 grams. Dinner made the greatest contribution to animal protein for this age group.

Vegetable protein intake for the boys ranged from 7.62 to 23.37 grams with a mean intake of 13.48 grams. Vegetable protein intake for the girls ranged from 8.57 to 25.18 grams with a mean intake of 15.87 grams. Lunch provided the best source of vegetable protein for both boys and girls. Vegetable protein intake for the entire group ranged from 7.62 to 25.18 grams with a mean intake of 14.58 grams. Lunch made the greatest contribution to vegetable protein intake for the two year old children.

The carbohydrate intake for the boys ranged from 101.83 to 205.90 grams with a mean intake of 151.43 grams. Carbohydrate intake for the girls ranged from 115.69 to 236.31 grams with a mean intake of 180.53 grams. Between meal eating made the greatest contribution to the total carbohydrate intake for both boys and girls.

The carbohydrate intake for the 13 children ranged from 101.83 to 236.31 grams with a mean intake of 164.85 grams. Between meal eating contributed more to carbohydrate intake than did any of the three meals of the day. The mean intake of carbohydrate per kilogram of body weight was 12.79 grams. The RDA does not provide a basis for comparison of carbohydrate intake.

The fat intake for boys ranged from 41.47 to 83.45 grams with a mean intake of 63.46 grams. The intake for girls ranged from 47.09 to 100.30 grams with a mean intake of 68.87 grams. Breakfast for boys and lunch for girls made the greatest contribution to fat intake.

The fat intake for the entire group ranged from 41.47 to 100.30 grams with a mean intake of 65.96 grams. Lunch made the greatest contribution to fat intake for the group as a whole. The mean intake of fat per kilogram of body weight was 5.12 grams. The RDA does not provide a basis for comparison of fat intake.

The calcium intake for boys ranged from .264 to 1.423 grams with a mean intake of .783 grams. The intake for girls ranged from .549 to 2.190 grams with a mean intake of .948 grams. The greatest contribution to calcium intake was made by breakfast for the boys and by between meal feedings for the girls.

The calcium intake for the entire group ranged from .264 to 2.190 grams with a mean intake of .859 grams. Breakfast was the meal which made the greatest contribution to calcium intake. Five children met the requirements for Class I. Seven children met the requirements for Class II, and one child was classified in Class III.

The phosphorus intake for boys ranged from .591 to 1.562 grams with a mean intake of .968 grams. The intake for girls ranged from .708 to 2.208 grams with a mean intake of 1.092 grams. The meal which provided the greatest contribution of phosphorus was breakfast for the boys, and between meal eating made the greatest contribution for the girls.

Phosphorus intake for the 13 children in the two year old group ranged from .591 to 2.208 grams with a mean of 1.025 grams. Breakfast made the greatest contribution to the total phosphorus intake. Eight children met the requirements for Class I. Five children were categorized in Class II, and no children were included in Class III.

The iron intake for the boys ranged from 3.15 to 8.49 milligrams with a mean intake of 6.20 milligrams. The intake for the girls ranged from 4.43 to 13.93 milligrams with a mean of 7.65 milligrams. Dinner made the greatest contribution to iron intake for both boys and girls.

The iron intake for the entire two year old group ranged from 3.15 to 13.93 milligrams with a mean of 6.87 milligrams. Dinner was the meal which made the greatest contribution to iron intake for this age group. No children met the requirement for Class I. Two children met the requirements for Class II, and 11 children were included in Class III.

The vitamin A intake for boys ranged from 1632 to 3942 International Units with a mean of 2396 International Units. The intake for girls ranged from 1633 to 9005 International Units with a mean intake of 4591 International Units. Breakfast for boys and dinner for girls were the meals which made the greatest contribution to vitamin A intake.

The vitamin A intake for the 13 children ranged from 1632 to 9005 International Units with a mean of 3410 International Units. Dinner made the greatest contribution to the total vitamin A intake for this age group. Seven children met the requirements for Class I. Six children were included in Class II, and no children were classified in Class III.

Vitamin A intake from animal sources ranged from 768 to 2074 International Units for the boys with a mean of 1454 International Units. Intake for the girls ranged from 1112 to 5362 International Units with a mean intake of 2595 International Units. Breakfast for boys and dinner for girls

contributed the most to vitamin A intake from animal sources. The vitamin A intake from animal sources for the group ranged from 768 to 5362 International Units with a mean of 1982 International Units. Dinner was the meal which made the greatest contribution to vitamin A intake from animal sources.

Vitamin A intake from vegetable sources ranged from 291 to 2238 International Units for boys with a mean intake of 942 International Units. Intake for girls ranged from 521 to 6536 International Units with a mean of 1996 International Units. Dinner was the meal which contributed the greatest amount to vegetable sources of vitamin A intake for both boys and girls. The entire two year old group ranged from 291 to 6536 International Units with a mean intake of 1428 International Units. Dinner was the meal which made the greatest contribution to vegetable sources of vitamin A for this age group.

The thiamine intake for boys ranged from .422 to .966 milligrams with a mean intake of .695 milligrams. The intake for girls ranged from .606 to 1.051 milligrams with a mean intake of .831 milligrams. Breakfast for boys and dinner for girls were the meals which made the greatest contribution to thiamine intake.

The thiamine intake for the entire two year old group ranged from .422 to 1.051 milligrams with a mean of .757 milligrams. Breakfast was the meal contributing the most to total thiamine intake. Eleven children met the requirements for Class I. Two children were included in Class II, and no children were classified in Class III.

The riboflavin intake for boys ranged from .797 to 2.322 milligrams with a mean intake of 1.412 milligrams. The intake for girls ranged from 1.080 to 3.477 milligrams with a mean intake of 1.723 milligrams. The greatest contribution to riboflavin intake was made by breakfast for the boys and by between meal eating for the girls.

The riboflavin intake for the 13 children ranged from .797 to 3.477 milligrams with a mean intake of 1.556 milligrams. Breakfast was the meal which made the greatest contribution to riboflavin intake. All 13 two year old children met the requirements for Class I.

The ascorbic acid intake for boys ranged from 19.24 to 74.95 milligrams with a mean intake of 45.67 milligrams. The intake for girls ranged from 10.72 to 102.56 milligrams with a mean intake of 65.19 milligrams. Between meal feedings made the greatest contribution to ascorbic acid intake for both boys and girls.

The ascorbic acid intake for the entire group of two year old children ranged from 10.72 to 102.56 milligrams with a mean intake of 54.69 milligrams. Between meal feedings contributed the greatest amount of ascorbic acid to the total intake. Eight children met the requirements for Class I. Two children were classified in Class II and three children in Class III.

Table II shows the number and percentage of two year old children included in each of the three classifications for the nine nutrients. The RDA was being met or exceeded for protein and riboflavin intake for all children. A total of 84.6 per cent met less than two-thirds of the RDA for iron intake.

Three Year Old Children

The three year old children numbered eight boys and four girls for a combined total of 12 children. The caloric intake for the boys ranged from 964 to 1833 calories with a mean of 1232 calories. The intake for girls ranged from 863 to 1923 calories with a mean of 1396 calories. The meals which made the greatest contribution to caloric intake were dinner for the boys and between meal eating for the girls.

The caloric intake for the 12 children ranged from 863 to 1923 calories with a mean intake of 1287 calories. Between

TABLE II

COMPARISON OF NUTRIENT INTAKES WITH THE RECOMMENDED DIETARY ALLOWANCE FOR TWO YEAR OLD CHILDREN

Nutrient	Classification					
	Class I		Class II		Class III	
	Number	Per cent	Number	Per cent	Number	Per cent
Calories	7	53.8	6	46.2	0	0.0
Protein	13	100.0	0	0.0	0	0.0
Calcium	5	38.5	7	53.8	1	7.7
Phosphorus	8	61.5	5	38.5	0	0.0
Iron	0	0.0	2	15.4	11	84.6
Vitamin A	7	53.8	6	46.2	0	0.0
Thiamine	11	84.6	2	15.4	0	0.0
Riboflavin	13	100.0	0	0.0	0	0.0
Ascorbic acid	8	61.5	2	15.4	3	23.1
Total	72	61.5	30	25.6	15	12.9

Class I: Met or exceeded 100 per cent of the RDA
Class II: >66.67 per cent but <100 per cent of the RDA
Class III: <66.67 per cent of the RDA

meal eating made the greatest contribution to caloric intake. Four children met the requirements for Class I, seven children for Class II and one child for Class III. The mean number of calories per kilogram of body weight was 88.83 calories.

The total protein intake for the boys ranged from 33.71 to 66.30 grams with a mean of 46.91 grams. The intake for the girls ranged from 39.30 to 63.04 grams with a mean of 52.87 grams. The meal which contributed the most to protein intake was dinner for both boys and girls.

The total protein intake for the three year old group ranged from 33.71 to 66.30 grams with a mean intake of 48.89 grams. Dinner made the greatest contribution to protein intake. All 12 children met the requirements for Class I. The mean intake of protein per kilogram of body weight was 3.37 grams.

Animal protein intake for boys ranged from 19.57 to 50.97 grams with a mean intake of 31.54 grams. The intake for girls ranged from 24.59 to 43.64 grams with a mean of 35.80 grams. Dinner contributed the greatest amount of animal protein for both boys and girls. Animal protein intake for the 12 children ranged from 19.57 to 50.97 grams with a mean of 32.96 grams. Dinner made the greatest contribution to animal protein for the group as a whole.

Vegetable protein intake for the boys ranged from 9.20 to 29.38 grams with a mean intake of 15.37 grams. The intake for girls ranged from 14.71 to 21.37 grams with a mean intake of 17.07 grams. Lunch provided the best source of vegetable protein for both boys and girls. Vegetable protein intake for the entire group ranged from 9.20 to 29.38 grams with a mean intake of 15.93 grams. Lunch made the greatest contribution to intake of vegetable protein sources for the three year old children.

The carbohydrate intake for the boys ranged from 110.02 to 235.08 grams with a mean intake of 149.40 grams. The intake for the girls ranged from 104.24 to 259.67 grams with a mean intake of 175.02 grams. Between meal eating made the greatest contribution to carbohydrate intake for both the boys and girls.

The carbohydrate intake for the 12 children ranged from 104.24 to 259.67 grams with a mean intake of 157.92 grams. Between meal eating contributed more to carbohydrate intake than did the three meals of the day. The mean intake of carbohydrate per kilogram of body weight was 10.90 grams. The RDA does not provide a basis for comparison of carbohydrate intake.

The fat intake for boys ranged from 35.26 to 79.62 grams with a mean intake of 55.39 grams. The fat intake for girls ranged from 39.37 to 83.65 grams with a mean intake of

63.45 grams. The meals which contributed the most to fat intake were dinner for the boys and breakfast for the girls.

The fat intake for the entire three year old group ranged from 35.26 to 83.65 grams with a mean intake of 58.07 grams. Breakfast made the greatest contribution to fat intake for the group as a whole. The mean intake of fat per kilogram of body weight was 4.01 grams. The RDA does not provide a basis for comparison of fat intake.

The calcium intake for boys ranged from .170 to .979 grams with a mean of .493 grams. The intake for girls ranged from .439 to 1.178 grams with a mean calcium intake of .690 grams. The greatest contribution to calcium intake was provided by breakfast for both the boys and girls.

The calcium intake for the entire three year old group ranged from .170 to 1.178 grams with a mean of .559 grams. Breakfast contributed the most to calcium intake. Two children met the requirements for Class I. Three children were included in Class II and seven children in Class III.

The phosphorus intake for boys ranged from .495 to 1.120 grams with a mean intake of .739 grams. The intake for girls ranged from .692 to 1.376 grams with a mean intake of .921 grams. The meal which provided the greatest contribution of phosphorus was breakfast for both boys and girls.

Phosphorus intake for the group ranged from .495 to 1.376 grams with a mean intake of .801 grams. Breakfast made the greatest contribution to the total phosphorus intake. Five children met the requirements for Class I, five for Class II, and two for Class III.

The iron intake for the boys ranged from 4.75 to 11.53 milligrams with a mean intake of 7.27 milligrams. The intake for girls ranged from 5.74 to 10.01 milligrams with a mean intake of 7.88 milligrams. Dinner made the greatest contribution to iron intake for both boys and girls.

The iron intake for the 12 children ranged from 4.75 to 11.53 milligrams with a mean intake of 7.47 milligrams. Dinner was the meal contributing the most to iron intake. Two children met the requirements for Class I, four for Class II and six for Class III.

The vitamin A intake for boys ranged from 953 International Units to 9420 International Units with a mean intake of 2559 International Units. The intake for girls ranged from 1316 to 4487 International Units with a mean intake of 2774 International Units. Lunch for boys and breakfast for girls were the meals which made the greatest contribution to vitamin A intake.

The vitamin A intake for the three year old group ranged from 953 to 9420 International Units with a mean intake

of 2630 International Units. Lunch made the greatest contribution to the total vitamin A intake. Four children met the requirement for Class I, two for Class II, and six for Class III.

Animal sources of vitamin A intake ranged from 282 to 1352 International Units with a mean intake of 895 International Units for the boys. The intake for girls ranged from 1062 to 2570 International Units with a mean intake of 1661 International Units. Breakfast for both boys and girls contributed the greatest amount to the intake of vitamin A. The vitamin A intake from animal sources ranged from 282 to 2570 International Units with a mean intake of 1149 International Units for the three year old group. Breakfast was the meal which made the greatest contribution to animal sources of vitamin A intake for this age group.

Vitamin A intake from vegetable sources ranged from 133 to 8067 International Units for the boys. The mean intake was 1664 International Units. The intake for girls ranged from 254 to 1979 International Units with a mean intake of 1113 International Units. Lunch was the meal which made the greatest contribution to vegetable sources of vitamin A intake for both boys and girls. The intake for the group ranged from 133 to 8067 International Units with a mean of 1481 International Units. Lunch was the meal which

made the greatest contribution to vegetable sources of vitamin A intake for the three year old children.

The thiamine intake for boys ranged from .435 to 1.167 milligrams with a mean intake of .715 milligrams. The intake for girls ranged from .379 to .988 milligrams with a mean intake of .705 milligrams. The meals which contributed the most to thiamine intake were dinner for the boys and breakfast for the girls.

The thiamine intake for the group ranged from .379 to 1.167 milligrams with a mean intake of .711 milligrams. Breakfast was the meal which contributed the most to the thiamine intake. Five children met the requirement for Class I, five for Class II, and two for Class III.

The riboflavin intake for the boys ranged from .676 to 1.764 milligrams with a mean intake of 1.043 milligrams. The intake for the girls ranged from .895 to 2.045 milligrams with a mean intake of 1.317 milligrams. The greatest contribution to riboflavin intake was made by breakfast for both the boys and girls.

The riboflavin intake for the group ranged from .676 to 2.045 milligrams with a mean intake of 1.134 milligrams. Breakfast was the meal which made the greatest contribution to the riboflavin intake. Nine children met the requirement

for Class I, three for Class II, and no children were included in Class III.

The ascorbic acid intake for boys ranged from 17.25 to 104.28 milligrams with a mean of 52.25 milligrams. The intake for the girls ranged from 39.64 to 119.69 milligrams with a mean of 65.93 milligrams. Lunch for the boys and between meal eating for the girls contributed the most toward the total intake of ascorbic acid for this age group.

The ascorbic acid intake for the 12 children in the group ranged from 17.25 to 119.69 milligrams with a mean of 56.81 milligrams. Between meal feeding contributed the most to total intake. Nine children met the requirement for Class I, one child for Class II, and two for Class III.

A comparison of nutrient intakes with the RDA for the 12 children in the three year old age group may be found in Table III. All 12 children met or exceeded the RDA for protein. Seventy-five per cent of the chidlren met or exceeded the RDA for riboflavin and ascorbic acid. Fifty per cent or more of the children failed to meet two-thirds of the recommended allowances for iron, calcium, and vitamin A.

TABLE III

COMPARISON OF NUTRIENT INTAKES WITH THE RECOMMENDED DIETARY ALLOWANCE FOR THREE YEAR OLD CHILDREN

Nutrient	Classification					
	Class I		Class II		Class III	
	Number	Per cent	Number	Per cent	Number	Per cent
Calories	4	33.3	7	58.3	1	8.4
Protein	12	100.0	0	0.0	0	0.0
Calcium	2	16.7	3	75.0	7	58.3
Phosphorus	5	41.7	5	41.7	2	16.6
Iron	2	16.7	4	33.3	6	50.0
Vitamin A	4	33.3	2	16.7	6	50.0
Thiamine	5	41.7	5	41.7	2	16.6
Riboflavin	9	75.0	3	25.0	0	0.0
Ascorbic acid	9	75.0	1	8.3	2	16.7
Total	52	48.1	30	27.8	26	24.1

Class I: Met or exceeded 100 per cent of the RDA
Class II: >66.67 per cent but <100 per cent of the RDA
Class III: <66.67 per cent of the RDA

Four Year Old Children

The four year old children numbered six boys and 11 girls for a combined total of 17 children. The caloric intake for the boys ranged from 842 to 1922 calories with a mean of 1299 calories. The intake for girls ranged from 801 to 1903 calories with a mean of 1374 calories. Between meal eating made the greatest contribution to the caloric intake.

The caloric intake for the 17 children ranged from 801 to 1922 calories with a mean intake of 1349 calories. Between meal eating made the greatest contribution to the caloric intake for the group as a whole. Four children met the requirement for Class I, eight for Class II, and five for Class III. The mean number of calories per kilogram of body weight for the four year old children was 76.82 calories.

The total protein intake for the boys ranged from 39.86 to 66.68 grams with a mean of 53.71 grams. The intake for the girls ranged from 25.61 to 79.38 grams with a mean intake of 52.38 grams. Dinner made the greatest contribution to total protein intake for both boys and girls.

The total protein intake for the four year old group was 25.61 to 79.38 grams with a mean of 52.85 grams. Dinner contributed the most to the total protein intake. Sixteen children met the requirement for Class I, and one child met

the requirements for Class II. The mean grams of protein per kilogram of body weight were 3.01 grams.

Animal protein intake for boys ranged from 27.33 to 51.91 grams with a mean intake of 37.48 grams. The intake for girls ranged from 10.08 to 59.09 grams with a mean of 32.72 grams. Dinner was the meal which contributed the most to animal protein intake for both boys and girls. Animal protein intake for the 17 children ranged from 10.08 to 59.09 grams with a mean intake of 34.39 grams. Dinner made the greatest contribution to animal protein for the group as a whole.

Vegetable protein intake for the boys ranged from 12.10 to 23.71 grams with a mean intake of 16.23 grams. The intake for the girls ranged from 8.67 to 37.06 grams with a mean intake of 19.66 grams. Dinner provided the best source of vegetable protein for both boys and girls. Vegetable protein intake for the entire group ranged from 8.67 to 37.06 grams with a mean intake of 18.46 grams. Dinner made the greatest contribution to vegetable protein intake for the four year old children.

The carbohydrate intake for the boys ranged from 107.49 to 245.13 grams with a mean intake of 166.13 grams. The intake for the girls ranged from 127.96 to 232.94 grams with a mean intake of 181.20 grams. Between meal eating made the

greatest contribution to carbohydrate intake for both the boys and girls.

The carbohydrate intake for the 17 children ranged from 107.49 to 245.13 grams with a mean intake of 175.86 grams. Between meal eating contributed more to carbohydrate intake than did the three meals of the day. The mean intake of carbohydrate per kilogram of body weight was 10.02 grams. The RDA does not provide a basis for comparison of carbohydrate intake.

The fat intake for boys ranged from 37.27 to 86.50 grams with a mean intake of 60.62 grams. The intake for the girls ranged from 26.10 to 99.08 grams with a mean intake of 63.50 grams. Between meal eating contributed most to the total fat intake for both boys and girls.

The fat intake for the entire four year old group ranged from 26.10 to 99.08 grams with a mean intake of 62.49 grams. Between meal eating contributed more to the fat intake than any of the meals of the day. The mean intake of fat per kilogram of body weight was 3.56 grams. The RDA does not provide a basis for comparison of fat intake.

The calcium intake for boys ranged from .484 to 1.137 grams with a mean of .755 grams. The intake for the girls ranged from .209 to 1.223 grams with a mean intake of .673

grams. The greatest contribution to calcium intake was between meal eating for the boys and breakfast for the girls.

The calcium intake for the entire four year old group ranged from .209 to 1.223 grams with a mean of .703 grams. Breakfast contributed the most to calcium intake. Four children met the requirement for Class I, eight for Class II, and five for Class III.

The phosphorus intake for boys ranged from .700 to 1.360 grams with a mean intake of .964 grams. The intake for girls ranged from .348 to 1.555 grams with a mean of .889 grams. The meal which contributed most to the phosphorus intake was dinner for the boys and breakfast for the girls.

The phosphorus intake for the entire four year old group ranged from .348 to 1.555 grams with a mean intake of .917 grams. Breakfast made the greatest contribution to the total phosphorus intake. Twelve children met the requirement for Class I, four for Class II, and one for Class III.

The iron intake for the boys ranged from 4.82 to 9.41 milligrams with a mean intake of 7.59 milligrams. The intake for the girls ranged from 4.62 to 10.38 milligrams with a mean of 7.51 milligrams. Dinner was the meal contributing the most to iron intake for both the boys and girls.

The iron intake for the four year old children as a whole ranged from 4.62 to 10.38 milligrams with a mean of 7.53 milligrams. Dinner contributed the most to the iron intake for the four year old group. Only one child met the requirement for Class I. Ten children were classified in Class II, and six in Class III.

The vitamin A intake for the boys ranged from 895 to 4398 International Units with a mean of 2086 International Units. The intake for girls ranged from 699 to 6271 International Units with a mean of 2370 International Units. Between meal eating for the boys and dinner for the girls made the greatest contribution to the total vitamin A intake.

The vitamin A intake for the 17 chidlren in the four year old group ranged from 699 to 6271 International Units with a mean of 2270 International Units. Between meal eating contributed most to total vitamin A intake. Five children met the requirement for Class I, five for Class II, and seven for Class III.

Vitamin A intake from animal sources for boys ranged from 767 to 2132 International Units with a mean intake of 1325 International Units. The intake for girls ranged from 430 to 5651 International Units with a mean intake of 1646 International Units. Breakfast contributed the most to vitamin A intake from animal sources for both boys and girls.

The intake for this group ranged from 430 to 5651 International Units with a mean intake of 1533 International Units. Breakfast was the meal which made the greatest contribution to animal sources of vitamin A intake for the four year old group.

Vegetable sources of vitamin A intake for the boys ranged from 128 to 2523 International Units with a mean intake of 761 International Units. The intake for girls ranged from 350 to 2489 International Units with a mean intake of 724 International Units. Lunch for the boys and between meal eating for the girls contributed most to vitamin A intake from vegetable sources. The intake for the entire four year old group ranged from 128 to 2523 International Units with a mean of 713 International Units. Between meal eating contributed the most to vitamin A intake from vegetable sources for the group as a whole.

The thiamine intake for the boys ranged from .569 to .885 milligrams with a mean intake of .704 milligrams. The intake for the girls ranged from .499 to 1.023 milligrams with a mean of .736 milligrams. The meals which contributed most to thiamine intake were breakfast for the boys and dinner for the girls.

The thiamine intake for the four year old group ranged from .499 to 1.023 milligrams with a mean of .725 milligrams.

Dinner contributed the most to thiamine intake. Eight children met the requirement for Class I, six for Class II, and three for Class III.

The riboflavin intake for the boys ranged from .915 to 1.933 milligrams with a mean intake of 1.354 milligrams. The intake for the girls ranged from .436 to 2.556 milligrams with a mean intake of 1.265 milligrams. Between meal eating for the boys and breakfast for the girls contributed the most to thiamine intake.

The riboflavin intake for the four year old group ranged from .436 to 2.556 milligrams with a mean intake of 1.295 milligrams. Breakfast contributed most to the total intake. Fourteen children met the requirement for Class I, two for Class II, and one for Class III.

The ascorbic acid intake for the boys ranged from 7.00 to 115.66 milligrams with a mean intake of 51.38 milligrams. The intake for girls ranged from 13.97 to 124.82 milligrams with a mean intake of 56.88 milligrams. Breakfast for the boys and between meal eating for the girls contributed the most to total ascorbic acid intake.

The ascorbic acid intake for the four year old group ranged from 7.00 to 124.82 milligrams with a mean intake of 54.94 milligrams. Between meal eating contributed the most

to total ascorbic acid intake. Ten children met the requirement for Class I, two for Class II, and five for Class III.

A comparison of the nutrient intakes with the RDA for four year old children is shown in Table IV. For no nutrient investigated did all four year old children met or exceed 100 per cent of the RDA; however, 94.1 per cent of the children met the requirement for Class I for protein, 78.9 per cent for riboflavin, and 71.0 per cent for phosphorus. A total of 40.4 per cent for vitamin A and 35.3 per cent for iron failed to meet two-thirds of the RDA for these nutrients.

Five Year Old Children

The five year old children numbered five boys and seven girls for a combined total of 12 children. The caloric intake for the boys ranged from 900 to 2408 calories with a mean caloric intake of 1710 calories. The intake for girls ranged from 715 to 2748 calories with a mean intake of 1517 calories. Dinner for the boys and between meal eating for the girls were the meals contributing the most calories.

The caloric intake for the 12 children ranged from 715 to 2748 calories with a mean intake of 1598 calories. Dinner was the meal contributing the most calories for the group as a whole. Six children met the requirement for Class I, three for Class II, and three for Class III. The mean number of calories per kilogram of body weight was 85.53 calories.

TABLE IV

COMPARISON OF NUTRIENT INTAKES WITH THE RECOMMENDED DIETARY ALLOWANCE FOR FOUR YEAR OLD CHILDREN

Nutrient	Classification					
	Class I		Class II		Class III	
	Number	Per cent	Number	Per cent	Number	Per cent
Calories	4	23.1	8	47.1	5	29.8
Protein	16	94.1	1	5.9	0	0.0
Calcium	4	23.1	8	47.1	5	29.8
Phosphorus	12	71.0	4	23.1	1	5.9
Iron	1	5.9	10	58.8	6	35.3
Vitamin A	5	29.8	5	29.8	7	40.4
Thiamine	8	47.1	6	35.3	3	23.6
Riboflavin	14	78.7	2	15.4	1	5.9
Ascorbic acid	10	54.8	2	15.4	5	29.8
Total	74	48.4	46	30.2	33	21.4

Class I: Met or exceeded 100 per cent of the RDA
Class II: >66.67 per cent but <100 per cent of the RDA
Class III: <66.67 per cent of the RDA

The total protein intake for the boys ranged from 40.41 to 139.37 grams with a mean intake of 73.10 grams. The intake for girls ranged from 36.60 to 93.76 grams with a mean intake of 57.26 grams. The meal which contributed the most to the protein intake was dinner for both boys and girls.

The total protein intake for the five year old group ranged from 36.60 to 139.37 grams with a mean intake of 63.88 grams. Dinner was the meal which contributed the most to total protein intake. All 12 children met the requirement for Class I. The mean grams of protein per kilogram of body weight was 3.42 grams.

Animal protein intake for boys ranged from 23.80 to 114.21 grams with a mean intake of 51.60 grams. The intake for girls ranged from 22.97 to 77.34 grams with a mean intake of 35.91 grams. Dinner contributed the most to animal protein intake for both boys and girls. Animal protein intake for the five year old group ranged from 22.97 to 114.21 grams with a mean intake of 42.46 grams. Dinner contributed the most to animal protein intake for this group.

Vegetable protein intake for boys ranged from 8.27 to 31.04 grams with a mean intake of 21.50 grams. The intake for girls ranged from 8.48 to 35.62 grams with a mean intake of 21.35 grams. Dinner was the meal contributing the most to vegetable protein intake. The vegetable protein intake

for the five year old group ranged from 8.27 to 35.62 grams with a mean intake of 21.42 grams. Dinner contributed the most to vegetable protein intake for the group as a whole.

The carbohydrate intake for the boys ranged from 119.81 to 306.13 grams with a mean intake of 206.39 grams. The intake for girls ranged from 90.16 to 416.56 grams with a mean of 188.63 grams. The meal which contributed the most to the carbohydrate intake was dinner for the boys and between meal eating for the girls.

The carbohydrate intake for the 12 children ranged from 90.16 to 416.54 grams with a mean intake of 196.03 grams. Dinner contributed the most to the carbohydrate intake. The mean grams of carbohydrate per kilogram of body weight was 10.50 grams. The RDA does not provide a basis for comparison of carbohydrate intake.

The fat intake for boys ranged from 40.05 to 129.40 grams with a mean intake of 78.27 grams. The intake for girls ranged from 29.27 to 112.29 grams with a mean intake of 63.98 grams. Lunch for the boys and dinner for the girls contributed the most to the fat intake.

The fat intake for the entire five year old group ranged from 29.27 to 129.40 grams with a mean intake of 69.95 grams. Lunch made the greatest contribution to fat

intake for the group as a whole. The mean intake of fat per kilogram of body weight was 3.74 grams. The RDA does not provide a basis for comparison of fat intake.

The calcium intake for boys ranged from .499 to 2.006 grams with a mean of 1.046 grams. The intake for girls ranged from .466 to 1.468 grams with a mean intake of .750 grams. The greatest contributions to calcium intake were provided by between meal eating for the boys and dinner for the girls.

The calcium intake for the entire five year old group ranged from .466 to 2.006 grams with a mean intake of .874 grams. Between meal eating contributed the most to calcium intake. Five children met the requirement for Class I, three for Class II, and four for Class III.

The phosphorus intake for boys ranged from .699 to 2.769 grams with a mean intake of 1.408 grams. The intake for girls ranged from .593 to 1.757 grams with a mean intake of 1.023 grams. Between meal eating for boys and dinner for girls contributed the most to phosphorus intake.

The phosphorus intake for the five year old group ranged from .593 to 2.769 grams with a mean intake of 1.183 grams. Dinner made the greatest contribution to the total phosphorus intake. Nine children met the requirement for Class I, three for Class II, and no children were included in Class III.

The iron intake for the boys ranged from 5.35 to 12.78 milligrams with a mean intake of 9.23 milligrams. The intake for girls ranged from 4.82 to 11.12 milligrams with a mean of 8.51 milligrams. Dinner made the greatest contribution to iron intake for both boys and girls.

The iron intake for the 12 children ranged from 4.82 to 12.78 milligrams with a mean intake of 8.93 milligrams. Dinner was the meal contributing the most to iron intake. Four children met the requirement for Class I, five for Class II, and three for Class III.

The vitamin A intake for boys ranged from 755 to 3382 International Units with a mean intake of 2421 International Units. The intake for girls ranged from 1144 to 8636 International Units with a mean intake of 4460 International Units. Breakfast for boys and dinner for girls were the meals which made the greatest contribution to vitamin A intake.

The vitamin A intake for the five year old group ranged from 755 to 8636 International Units with a mean intake of 3609 International Units. Dinner made the greatest contribution to the total vitamin A intake. Seven children met the requirement for Class I, two for Class II, and three for Class III.

Vitamin A intake from animal sources ranged from 612 to 2074 International Units with a mean intake of 1329 International Units for the boys. The intake for girls ranged from 757 to 6219 International Units with a mean of 2106 International Units. Breakfast for the boys and lunch for the girls made the greatest contributions to vitamin A intake from animal sources. The intake for the group ranged from 612 to 6219 International Units with a mean intake of 1781 International Units. Breakfast was the meal which made the greatest contribution to vitamin A intake from animal sources for this age group.

Vegetable sources of vitamin A intake for boys ranged from 144 to 1483 grams with a mean intake of 1092 International Units. The intake for girls ranged from 106 to 5941 International Units with a mean intake of 2354 International Units. Dinner was the meal which made the greatest contribution to vitamin A intake from vegetable sources for both boys and girls. The intake for the 12 children ranged from 106 to 5941 International Units with a mean intake of 3609 International Units. Dinner was the meal which contributed the most to the intake of vegetable sources of vitamin A.

The thiamine intake for the boys ranged from .565 to 1.064 milligrams with a mean intake of .807 milligrams. The

intake for girls ranged from .507 to 1.213 milligrams with a mean of .874 milligrams. Dinner was the meal which contributed the most to thiamine intake for both boys and girls.

The thiamine intake for the five year old group ranged from .507 to 1.213 milligrams with a mean intake of .870 milligrams. Dinner contributed the most to total thiamine intake. Seven children met the requirement for Class I, four for Class II, and one for Class III.

The riboflavin intake for boys ranged from .906 to 2.077 milligrams with a mean intake of 1.580 milligrams. The intake for girls ranged from .888 to 2.770 milligrams with a mean of 1.405 milligrams. The greatest contribution to riboflavin intake was made by dinner for both the boys and girls.

The riboflavin intake for the five year old group ranged from .888 to 2.770 milligrams with a mean intake of 1.478 milligrams. Dinner made the greatest contribution to riboflavin intake for the group as a whole. Eleven children met the requirement for Class I, and one for Class II.

The ascorbic acid intake for boys ranged from 11.05 to 87.55 milligrams with a mean of 41.25 milligrams. The intake for girls ranged from 14.00 to 86.33 milligrams with a mean of 47.33 milligrams. Dinner for the boys and between meal eating for girls contributed the most to ascorbic acid intake.

The ascorbic acid intake for the 12 children in this group ranged from 11.05 to 87.55 milligrams with a mean intake of 44.80 milligrams. Between meal eating contributed the most to the ascorbic acid intake for the group as a whole. Five children met the requirement for Class I, three for Class II, and four for Class III.

A comparison of the nutrient intake for five year old children is shown in Table V. All 12 five year old children met or exceeded the recommended allowance for protein. A total of 91.7 per cent of the children met the RDA for riboflavin and 75.0 per cent met the RDA for phosphorus. One-third of the children failed to meet two-thirds of the RDA for calcium and ascorbic acid and one-fourth for iron and calories.

The Study Group

The entire group numbered 26 boys and 28 girls for a combined total of 54 children. Nutrient intake classification for calories indicated that 21 of the children met the requirement for Class I, 24 for Class II, and nine for Class III. These were 38.9 per cent, 44.4 per cent and 16.7 per cent respectively. Between meal eating contributed the greatest amount to total calorie intake, followed by dinner, breakfast, and lunch for the group as a whole.

TABLE V

COMPARISON OF NUTRIENT INTAKES WITH THE RECOMMENDED DIETARY ALLOWANCE FOR FIVE YEAR OLD CHILDREN

Nutrient	Classification					
	Class I		Class II		Class III	
	Number	Per cent	Number	Per cent	Number	Per cent
Calories	6	50.0	3	25.0	3	25.0
Protein	12	100.0	0	0.0	0	0.0
Calcium	5	41.7	3	25.0	4	33.3
Phosphorus	9	75.0	3	25.0	0	0.0
Iron	4	33.3	5	41.7	3	25.0
Vitamin A	7	58.3	2	16.7	3	25.0
Thiamine	7	58.3	4	33.4	1	8.3
Riboflavin	11	91.7	1	8.3	0	0.0
Ascorbic acid	5	41.7	3	25.0	4	33.3
Total	66	61.1	24	22.2	18	16.7

Class I: Met or exceeded 100 per cent of the RDA
Class II: >66.67 per cent but <100 per cent of the RDA
Class III: <66.67 per cent of the RDA

Figure 3 presents the mean daily intake of calories for the study group. The caloric intake for boys dropped between the ages of two and three, began to rise between three and four years of age, and continued to rise and exceeded the RDA at four and one-half to five years. The intake for girls dropped between two and four years, then rose at age four to five years. The mean intake for the entire group dropped between ages two and three, then began to rise at age three, meeting 99.9 per cent of the RDA at age five.

Table VI presents the average daily caloric intake of each child in the study distributed by age and sex. The data were grouped according to the relationship with the RDA. Class I included daily intakes equal to or greater than the allowance. Class II groups included daily intakes less than the daily allowance but exceeding 66.67 per cent of the RDA. Class III included the daily intakes less than 66.67 per cent of the RDA. The mean intake of each age group is given to show the individual intakes as related to the group mean.

Kerrey and co-workers (18) reported a mean caloric intake slightly lower than the RDA for children from both high and low socioeconomic groups. Metheny and associates (22) indicated in a study that 40 per cent of the diets of children studied supplied less than 100 per cent of the RDA for energy value. Dierks and Morse (10) reported that 98 per cent of children two to three years of age and 97 per

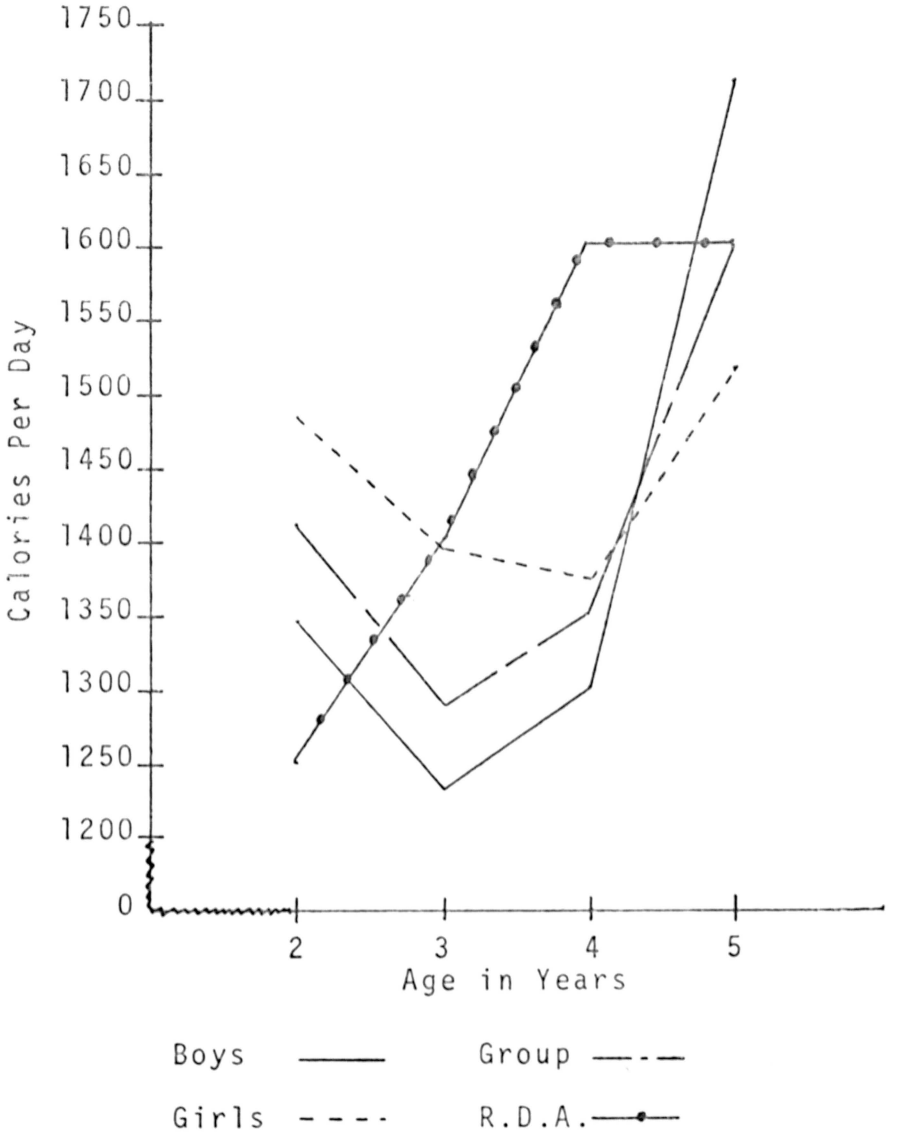

Figure 3

Mean Intake of Calories for Preschool Children

Age Two Through Five Years

TABLE VI

DISTRIBUTION OF CALORIE INTAKE FOR

54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
1,763 1,636 1,608 1,348*	2,019 1,811 1,505 1,485* 1,476	1,833 1,536	1,923 1,782	1,922	1,903 1,819 1,714	2,408 2,080 1,710* 1,622	2,748 2,007 1,827
Class II							
1,244 1,217 1,176 891	1,066 1,036	1,294 1,232* 1,217 1,056 978 975 964	1,396* 1,018	1,424 1,397 1,363 1,299*	1,596 1,455 1,383 1,374* 1,368 1,271	1,536	1,517* 1,192 1,190
Class III							
			863	875 842	1,052 1,003 801	900	939 715
Mean							
1,348	1,485	1,232	1,396	1,299	1,374	1,710	1,517
1,412		1,287		1,349		1,598	

*Mean

cent of children four to six years of age had an intake which was above 75 per cent of the 1964 RDA.

Figure 4 presents the mean daily intake of energy sources for the 54 children. The meal contributing the most to fat intake was lunch, followed by between meal eating, breakfast, and dinner. Between meal eating made the greatest contribution to carbohydrate intake, followed by dinner, breakfast, and lunch.

Table VII presents the average daily carbohydrate intake of each child in the study distributed by age and sex. The mean intake of each age group is given to show the individual intakes as related to the group mean. The RDA does not provide a basis for comparison of carbohydrate intake.

The mean intakes for both boys, girls, and the entire group for carbohydrate, fat, and protein dropped between ages two to four, then rose between ages four to five years. The average daily fat intake of each child in the study distributed by age and sex is presented in Table VIII. The mean intake of each age group is given to show the individual intakes as related to the group mean. The RDA does not provide a basis for comparison of fat intake.

Nutrient intake classifications for protein indicated that 53 or 98.1 per cent of the children met the requirement

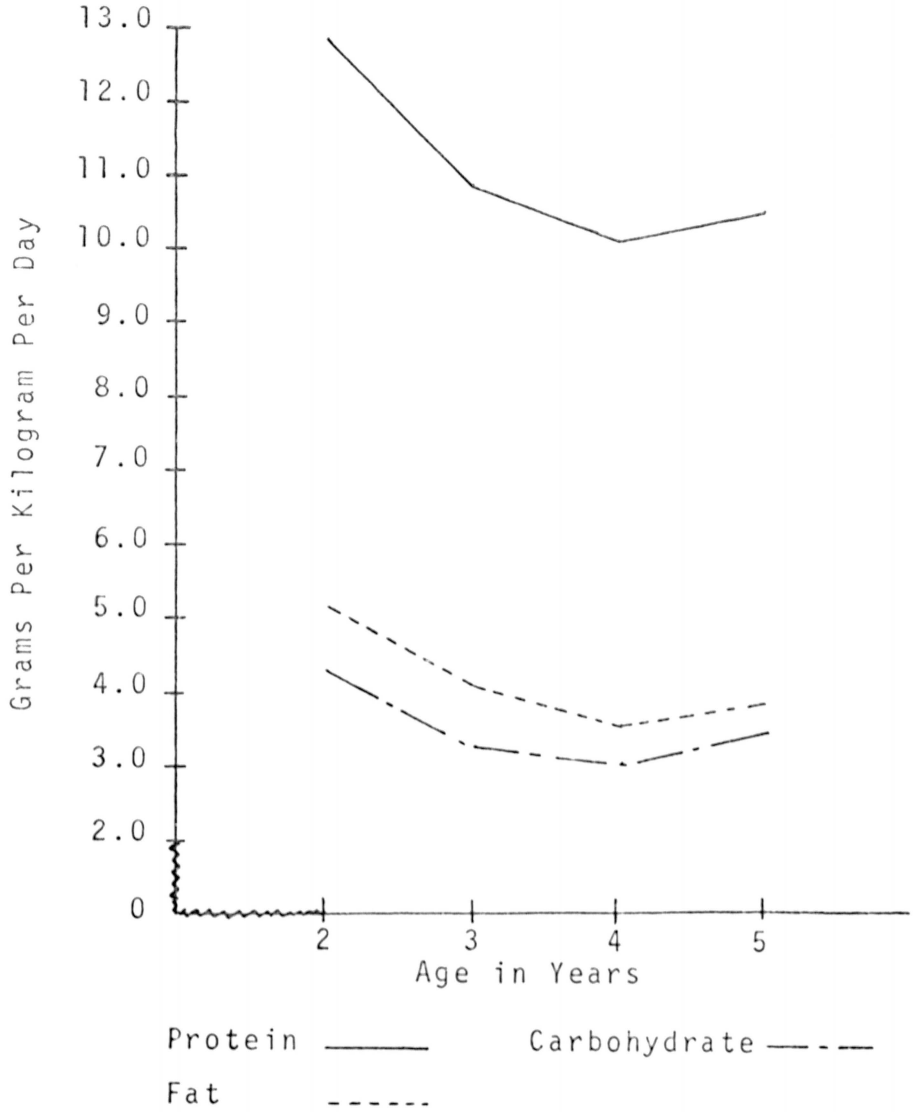

Figure 4

Mean Intake of Energy Sources for Preschool Children

Age Two Through Five Years

TABLE VII

DISTRIBUTION OF CARBOHYDRATE INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
205.90	236.31	235.08	259.67	245.13	232.94	306.13	416.56
185.94	206.53	160.82	209.74	191.52	221.98	233.12	197.25
177.01	203.07	150.90	175.02*	171.30	216.08	206.39*	188.63*
151.43*	195.33	149.40*	126.42	166.13*	214.31	186.68	159.74
142.97	180.53*	144.91	104.24	132.32	181.20*	186.21	152.52
132.31	126.22	144.70		116.00	177.83	119.81	152.12
113.97	115.69	134.60		107.49	176.54		152.10
101.83		114.08			167.87		90.16
		110.02			162.16		
					157.37		
					138.21		
					127.96		
Mean							
151.43	180.53	149.40	175.02	166.13	181.20	206.39	188.63
164.85		157.92		175.86		196.03	

*Mean

TABLE VIII

DISTRIBUTION OF FAT INTAKE FOR 54

PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
83.45	100.30	79.62	83.65	86.50	99.08	129.40	112.29
78.97	92.90	78.40	82.18	72.09	87.07	79.36	99.69
69.71	68.87*	62.58	63.45*	66.66	85.48	78.27*	63.98*
67.13	66.33	55.39*	48.61	63.85	74.21	76.52	57.76
63.46*	56.85	50.00	39.37	60.62*	73.05	66.03	53.72
52.00	49.76	49.55		37.38	72.46	40.05	48.93
51.56	47.09	47.34		37.27	63.50*		46.24
41.47		40.39			61.28		29.27
		35.26			48.77		
					41.84		
					29.19		
					26.10		
Mean							
63.46	68.87	55.39	63.45	60.62	63.50	78.27	63.98
65.96		58.07		62.49		69.95	

*Mean

for Class I. One child was classified in Class II. The protein intake for the entire group met two-thirds or more of the RDA. The mean for each age group minus the standard deviation was greater than the RDA for that particular age group. Dinner was the meal which contributed the most to the protein intake followed by lunch, breakfast, and between meal eating.

Figure 5 presents the mean daily protein intake for the study group. The intake for boys dropped between ages two to three, then continued to rise to age five. The intake for girls dropped between ages two to three, continued to show a slight drop between three and four, and then began to rise between four and five years. The mean intake for the 54 children as a group dropped between ages two to three and continued to rise between ages three to five years.

Table IX presents the average daily protein intake of each child distributed by sex and age. The data were grouped according to the relationship with the RDA. Class I included daily intakes equal to or greater than the allowances. Class II groups included daily intakes less than the daily allowance but exceeding 66.67 per cent of the RDA. Class III included the daily intakes less than 66.67 per cent of the RDA. The mean intake of each age group is given to show the individual intakes as related to the group mean.

Figure 5

Mean Intake of Total Protein for Preschool Children

Age Two Through Five Years

TABLE IX

DISTRIBUTION OF PROTEIN INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
81.06	94.52	66.30	63.04	66.68	79.38	139.37	93.76
65.79	76.77	59.91	60.81	65.10	70.73	73.10*	65.35
65.56	56.69*	58.32	52.87*	58.09	69.68	69.81	57.26*
55.26*	51.72	46.91*	48.30	53.71*	58.87	64.70	55.87
49.10	40.31	44.39	39.30	50.81	55.35	51.23	55.17
46.68	39.23	41.63		41.63	52.38*	40.41	52.77
42.75	37.63	39.27		39.86	50.18		40.22
35.77		35.96			47.88		36.60
		33.71			44.45		
					42.77		
					31.40		
Class II							
					25.61		
Class III							
Mean							
55.26	56.69	46.91	52.87	53.71	52.38	73.10	57.26
55.92		48.89		52.85		63.88	

*Mean

Metheny and associates (22) reported the protein content of the diet of 89 per cent of the children met or exceeded the daily allowances and all the diets provided in excess of 66.67 per cent of the RDA. Dierks and Morse (10) reported that 100 per cent of children two to three years of age and 100 per cent of children four to six years of age had a protein intake above 75 per cent of the 1964 RDA.

Figure 6 presents the mean daily intake of animal protein for the group. Animal protein intake for the boys dropped between ages two to three, then rose between the ages of three to five years. The intake for the girls dropped between ages two to four and began to rise between age four and five years. The mean animal protein intake for the entire group dropped between ages two and three and then rose from age three to five years. The mean animal protein intake for all ages of the study group exceeded the RDA for total protein intake.

Table X presents the average daily animal protein intake of each child in the study distributed by sex and age. The mean intake of each age group is given to show the individual intakes as related to the group mean.

Figure 7 presents the mean daily intake for vegetable protein for the entire group of 54 children. The mean daily intake for boys, girls and the group as a whole rose between

Figure 6

Mean Intake of Animal Protein for Preschool Children

Age Two Through Five Years

TABLE X

DISTRIBUTION OF ANIMAL PROTEIN INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
64.99	69.33	50.97	43.64	51.91	59.09	114.21	77.34
52.76	56.05	45.02	41.68	44.75	45.30	51.60*	36.38
42.43	40.82*	31.54*	35.80*	42.98	40.14	42.97	35.91*
41.78*	31.78	30.53	33.29	37.48*	34.83	38.77	29.74
39.58	31.14	30.20	24.59	29.53	33.44	38.25	28.95
38.53	30.65	30.07		28.36	32.72*	23.80	28.12
28.15	26.00	25.58		27.33	32.62		26.87
25.93		24.64			31.65		22.97
		19.57			30.18		
					22.74		
					19.87		
					10.08		
Mean							
41.78	40.82	31.54	35.80	37.48	32.72	51.60	35.91
41.34		32.96		34.39		42.46	

*Mean

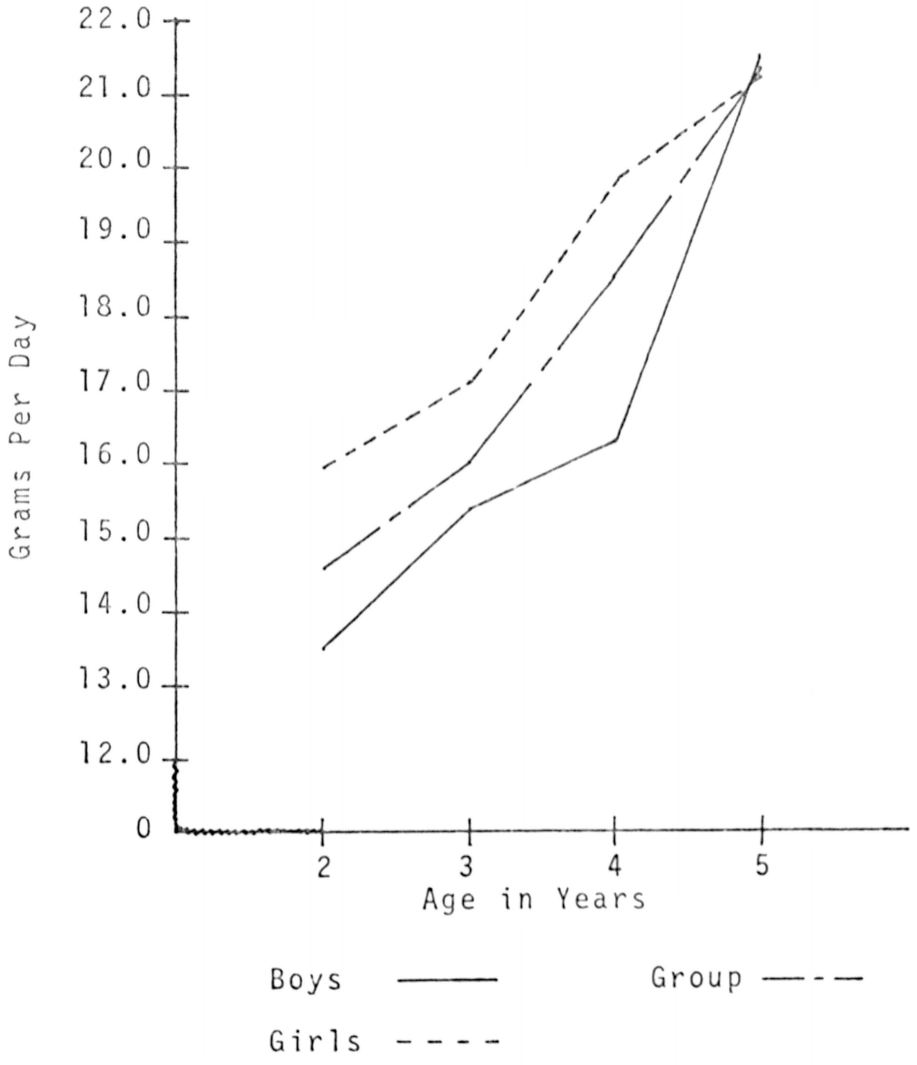

Figure 7

Mean Intake of Vegetable Protein for Preschool Children Age Two Through Five Years

the ages of two to five years. The major source of vegetable protein in the diets of the children was pinto beans. It would appear that the continuous rise of vegetable protein intake helps to offset the drop in animal protein intake noticed during the years before age four.

Table XI presents the average daily vegetable protein intake for each child in the study. Mean intakes for each age group are given to show the individual intakes as related to the group mean.

Nutrient intake classifications for calcium showed that 16 of the children met the requirements for Class I, 21 for Class II, and 17 for Class III. These were 29.6 per cent, 38.9 per cent, and 31.5 per cent respectively. Breakfast was the meal which contributed the most to the total calcium intake for the group as a whole. This was followed by between meal feeding, dinner, and lunch.

Figure 8 presents the mean daily intake of calcium for the study children. The mean intake for boys dropped between the ages of two to three, then rose from ages three to five, exceeding the RDA between ages four and five. The mean for girls was above the RDA for age two, but dropped to below the RDA at age three, and continued to drop until age four. A rise occurred between ages four to five, but was not sufficient to meet the RDA. The mean intake for the entire group

TABLE XI

DISTRIBUTION OF VEGETABLE PROTEIN INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
23.37	25.18	29.38	21.37	23.71	37.06	31.04	35.62
16.82	20.74	16.99	17.17	22.45	25.43	26.45	29.80
16.07	19.93	15.37*	17.07*	16.23*	22.90	25.16	26.92
13.48*	15.87*	15.33	15.01	13.35	20.52	21.50*	21.35*
12.81	11.63	14.19	14.71	13.19	20.29	16.61	18.78
9.52	9.17	14.13		12.54	19.66*	8.27	16.12
8.14	8.57	13.30		12.10	18.73		13.36
7.62		10.38			16.73		8.48
		9.20			16.23		
					15.54		
					14.28		
					8.67		
Mean							
13.48	15.87	15.37	17.07	16.23	19.66	21.50	21.35
14.58		15.93		18.46		21.42	

*Mean

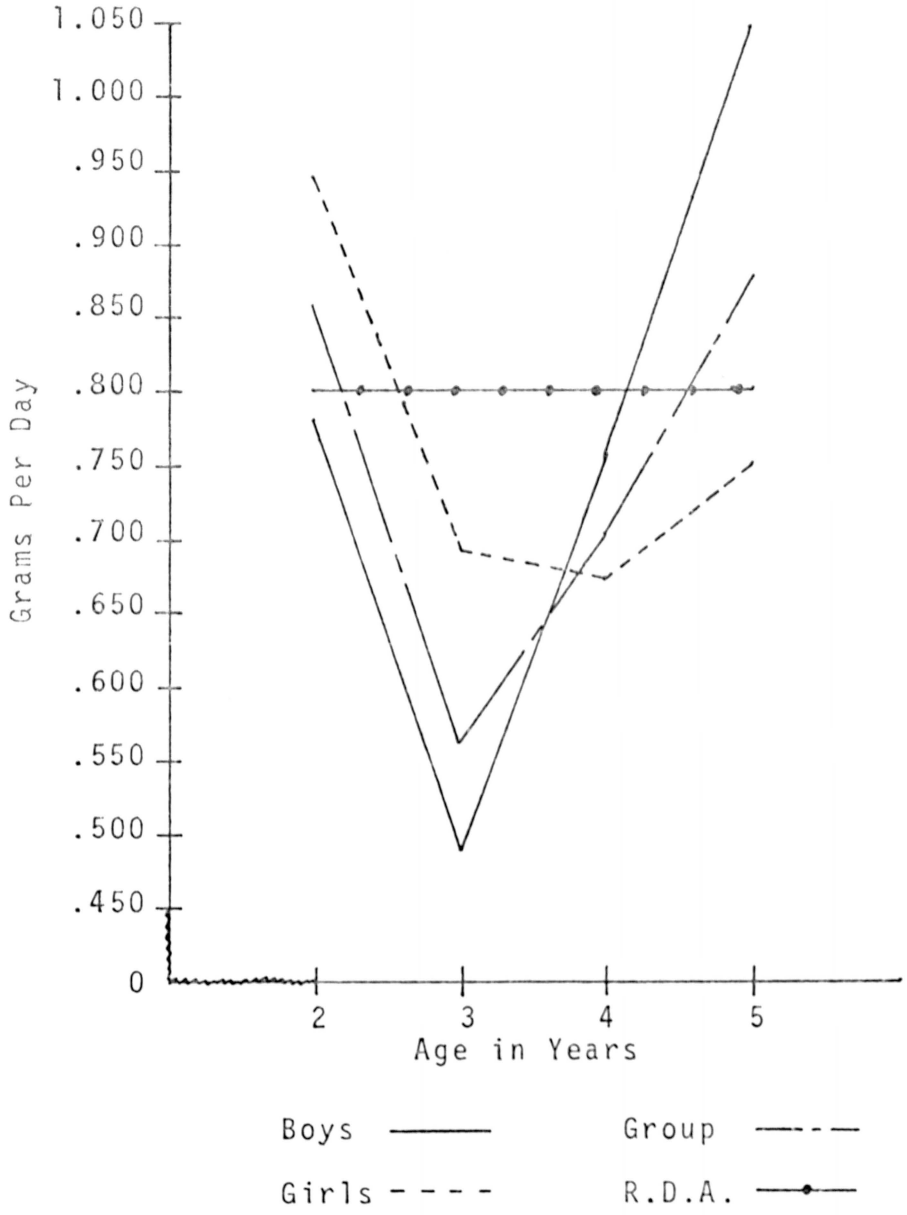

Figure 8

Mean Intake of Calcium for Preschool Children

Age Two Through Five Years

exceeded the RDA at age two, but fell below RDA at age three. However, the mean intake rose from ages three to five, exceeding the RDA between ages four and five years.

The average daily calcium intake of each child in the study is given in Table XII. The data were grouped according to the relationship with the RDA. Class I included daily intakes equal to or greater than the allowance. Class II groups included daily intakes less than the daily allowance but exceeding 66.67 per cent of the RDA. Class III included the daily intakes less than 66.67 per cent of the RDA.

Metheny and associates (22) reported that of the children studied,data indicated that 37 per cent of the diets supplied less than 100 per cent of the RDA. Dierks and Morse (10) reported that 92 per cent of the children two to three years of age and 97 per cent of the children four to six years of age had intakes which were above 75 per cent of the RDA for calcium. Beal (2) noted a drop in calcium intake between the ages of two and three years.

Nutrient intake classifications for phosphorus indicated that 34 of the study children met the requirement for Class I, 17 for Class II, and three for Class III. These were 62.8 per cent, 31.5 per cent, and 5.7 per cent respectively. The meal which contributed the most to the phosphorus intake for the entire group was dinner, followed by breakfast, between meal eating, and lunch.

TABLE XII

DISTRIBUTION OF CALCIUM INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
1.423 .885 .825	2.190 .996 .948*	.979	1.178	1.137 1.092	1.223 1.200	2.006 1.199 1.046* .922	1.468 .819
Class II							
.793 .783* .685 .603	.741 .630 .586 .549	.695 .538	.690* .625	.755* .622 .616 .553	.791 .734 .714 .673* .666 .603	.605	.773 .750* .728
Class III							
.264		.493* .474 .452 .325 .308 .170	.522 .439	.484	.472 .444 .341 .209	.499	.528 .472 .466
Mean							
.783	.948	.493	.690	.755	.673	1.046	.750
.859		.559		.703		.874	

*Mean

Figure 9 presents the mean daily phosphorus intake for the group. The mean intake for boys dropped from above the RDA at age two to below the RDA at age three, then rose continuously until age five, exceeding the RDA between ages three and four years. The mean intake for girls dropped between ages two to four and rose between ages four to five; however, the mean intakes for girls did not drop below the RDA. The mean dropped from ages two to three years, then rose from age three to five years. The mean of the group dropped to the RDA at age three, but was not below the RDA.

Table XIII presents the average daily phosphorus intake of each child in the study distributed by sex and age. The data were grouped according to its relationship with the RDA.

Nutrient intake classifications for iron indicated that seven children met the requirement for Class I, 21 for Class II, and 26 for Class III. These were 12.9 per cent, 38.9 per cent and 48.2 per cent respectively. The meal which contributed the most to total iron intake for the group as a whole was dinner, followed by lunch, breakfast, and between meal eating.

Figure 10 presents the mean daily intake of iron for the 54 children. The mean intake for boys rose between ages two to three years, showed a slight rise from ages three to four, then continued to rise from ages four to five years. The

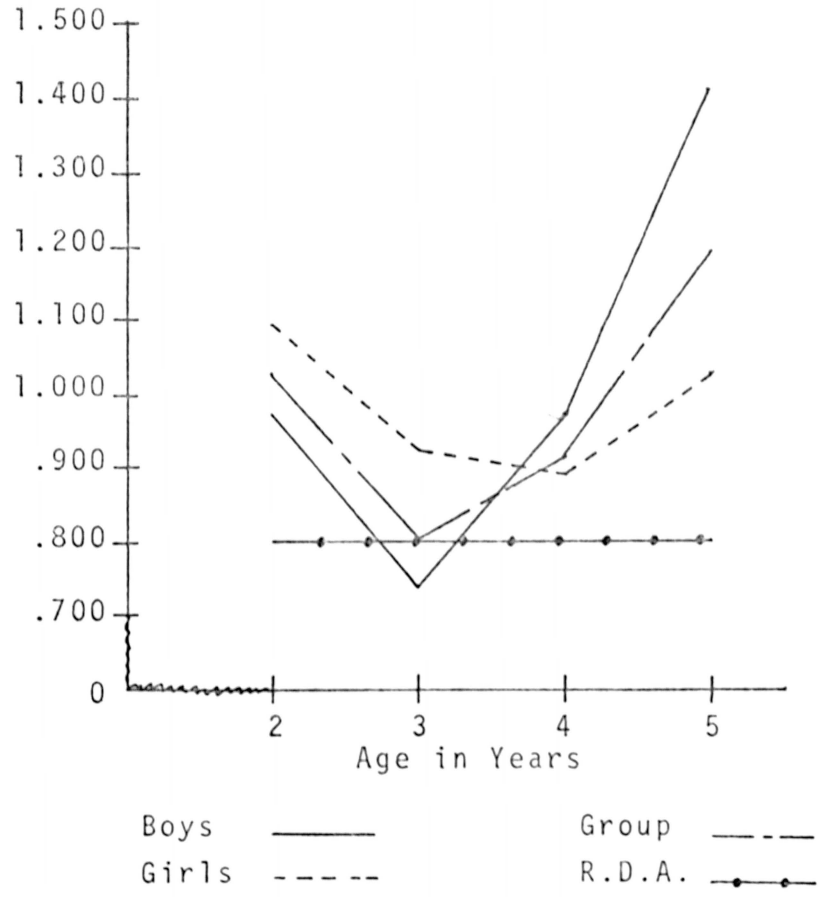

Figure 9

Mean Intake of Phosphorus for Preschool Children

Age Two Through Five Years

TABLE XIII

DISTRIBUTION OF PHOSPHORUS INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
1.562 1.067 1.053 .968* .881 .813 .805	2.208 1.404 1.092*	1.120 .919 .808	1.376 .921* .915	1.360 1.211 .964* .918 .857	1.555 1.400 1.030 .972 .944 .890 .889* .878 .836	2.769 1.418 1.408* 1.183 .968	1.757 1.245 1.072 1.023* .958 .869
Class II							
.591	.782 .738 .716 .708	.783 .739* .717 .559	.703 .692	.750 .700	.796 .534	.699	.670 .593
Class III							
		.516 .495			.348		
Mean							
.968	1.092	.739	.921	.964	.889	1.408	1.023
1.025		.801		.917		1.183	

*Mean

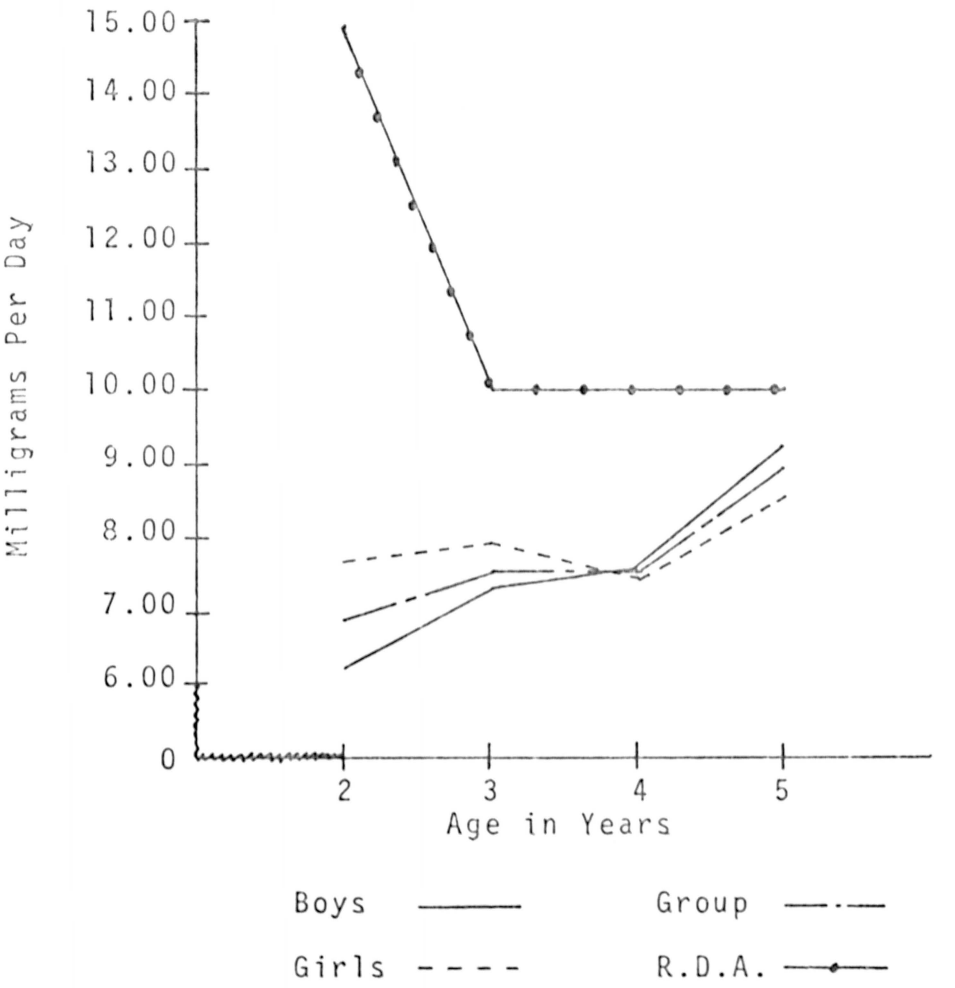

Figure 10

Mean Intake of Iron for Preschool Children

Age Two Through Five Years

mean intake for girls and the entire study group rose between ages two to three years, dropped slightly between three and four, then rose again between four and five years. No mean intake met or exceeded the RDA.

The average daily iron intake of each child in the study distributed by age and sex is presented in Table XIV. The data were grouped according to the relationship with the RDA. Class I included daily intakes greater than the allowance. Class II groups included daily intakes less than the daily allowance but exceeding 66.67 per cent of the RDA. Class III included the daily intakes less than 66.67 per cent of the RDA.

Metheny and associates (22) reported that iron was the nutrient least well supplied in the diets of children studied and that 51 per cent of the children had diets which did not meet the RDA. Dierks and Morse (10) reported that 71 per cent of children two to three years of age and 91 per cent of children four to six years of age had iron intakes which were above 75 per cent of the 1964 RDA. Owen (25) reported that a greater contribution of iron was being supplied by legumes in the diets of children with a per capita income of $500 or less than for the other income groups.

Nutrient classifications for vitamin A indicated that 23 children met the requirement for Class I, 15 for Class II,

TABLE XIV

DISTRIBUTION OF IRON INTAKE FOR 54

PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
		11.53	10.01		10.38	12.78 11.40 11.02	11.12
Class II							
	13.93 10.74	9.10 8.93 7.27* 7.19	9.22 7.88*	9.41 9.16 8.36 7.59* 7.25	8.83 8.55 8.27 8.15 8.02 7.81 7.51*	9.23*	9.60 8.90 8.57 8.51* 8.31 8.30
Class III							
8.49 7.50 6.69 6.41 6.20* 6.03 5.19 3.15	9.58 7.65* 4.69 4.54 4.43	6.42 5.17 4.98 4.75	6.52 5.74	6.48 4.82	6.58 5.84 5.43 4.62	5.60 5.35	4.82
Mean							
6.20	7.65	7.27	7.88	7.59	7.51	9.23	8.51
6.87		7.47		7.53		8.93	

*Mean

and 16 for Class III. These were 42.6 per cent, 27.8 per cent and 29.6 per cent respectively. Dinner contributed the greatest amount to total vitamin A intake followed by breakfast, lunch, and between meal eating.

Figure 11 presents the mean daily intake of total vitamin A for the children. The mean intake for boys was above the RDA at age two, rose between ages two and three, then dropped between ages three to four, falling below the RDA at this age level. The mean intake rose between four and five years but did not meet the RDA. The mean intake for girls dropped between ages two to four, falling below the RDA between three and one-half to four years of age. Between age four to five years the intake rose, exceeding the RDA by age five. The mean for the group dropped between ages two to four, then rose between ages four to five, exceeding the RDA at age five.

Table XV presents the average daily total vitamin A intake of each study child. The data were grouped according to its relationship with the RDA. The mean intake of each age group is given to show the individual intakes as related to the group mean.

Metheny and associates (22) reported that vitamin A was the single nutrient found to be consistently present in adequate amounts in a study of preschool children. Only one

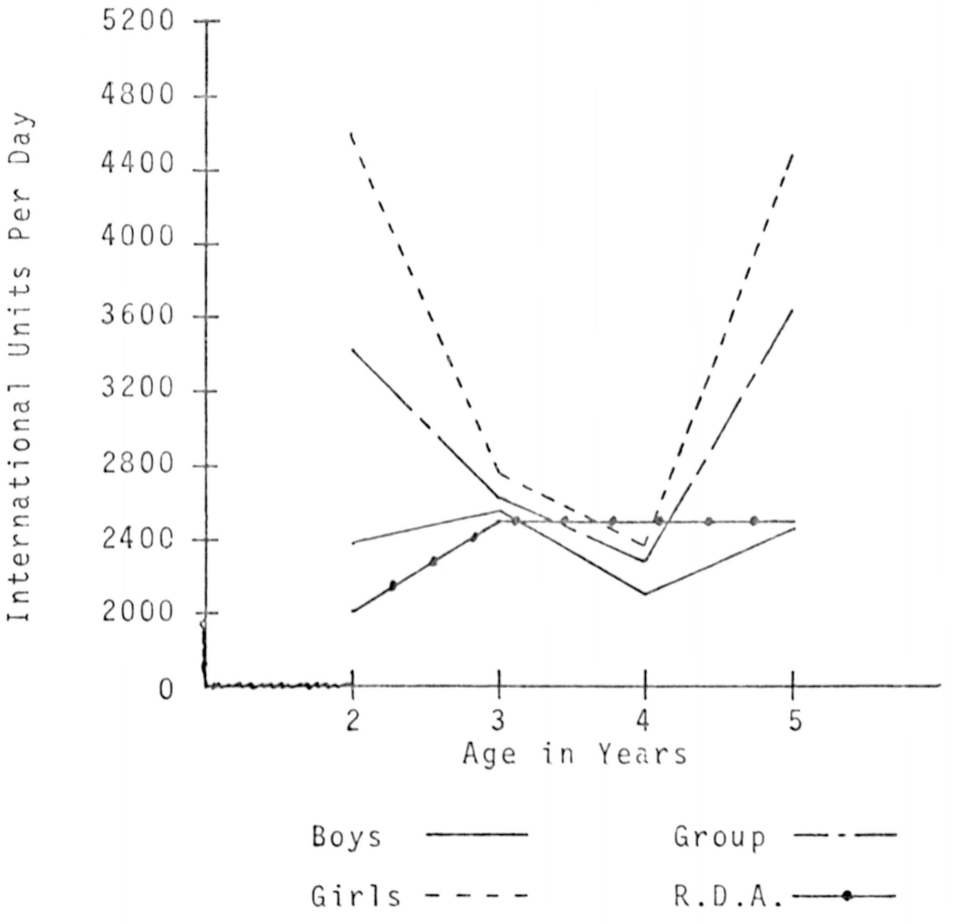

Figure 11

Mean Intake of Total Vitamin A for Preschool Children Ages Two Through Five Years

TABLE XV

DISTRIBUTION OF VITAMIN A INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
3942	9005	9420	4487	4398	6271	3382	8636
3166	5965	2559*	3923	3195	3570	2828	7530
2487	4961	2500	2774*		3046	2658	6934
2396*	4591*						4460*
	4277						3261
Class II							
1976	1707	2087		2086*	2370*	2472	2452
1793	1633	1848			2192	2421*	
1780					2095		
1632					2040		
					1998		
					1728		
Class III							
		1310	1369	1526	1637	755	1279
		1025	1316	1366	804		1144
		998		1132	699		
		953		895			
Mean							
2396	4591	2559	2774	2086	2370	2421	4460
3410		2630		2270		3609	

*Mean

child had a diet which did not meet the full allowance for vitamin A. Dierks and Morse (10) reported that 94 per cent of children two to three years of age and 89 per cent of children four to six years of age had an intake of vitamin A which was above 75 per cent of the 1964 RDA.

Figure 12 presents the mean daily intake for vitamin A from animal sources for the 54 children. The mean intake for boys dropped between ages two to three, then rose between ages three to four, tending to level off at age four to five. The mean intake for girls dropped between ages two to three, dropped slightly between ages three to four, and rose between ages four to five. The mean for the entire group dropped between ages two to three, then rose between ages three to five years. Breakfast followed by dinner, between meal eating and lunch contributed the most to vitamin A intake from animal sources for the entire study group.

Table XVI presents the average daily intake of vitamin A from animal sources. The RDA does not present a basis for comparison of vitamin A from animal sources.

Figure 13 presents the mean daily intake of vegetable sources of vitamin A for the entire group. Vegetable sources for the boys rose from ages two to three years, dropped from three to four, then rose again from four to five years. The intake for the girls dropped from ages two to four years,

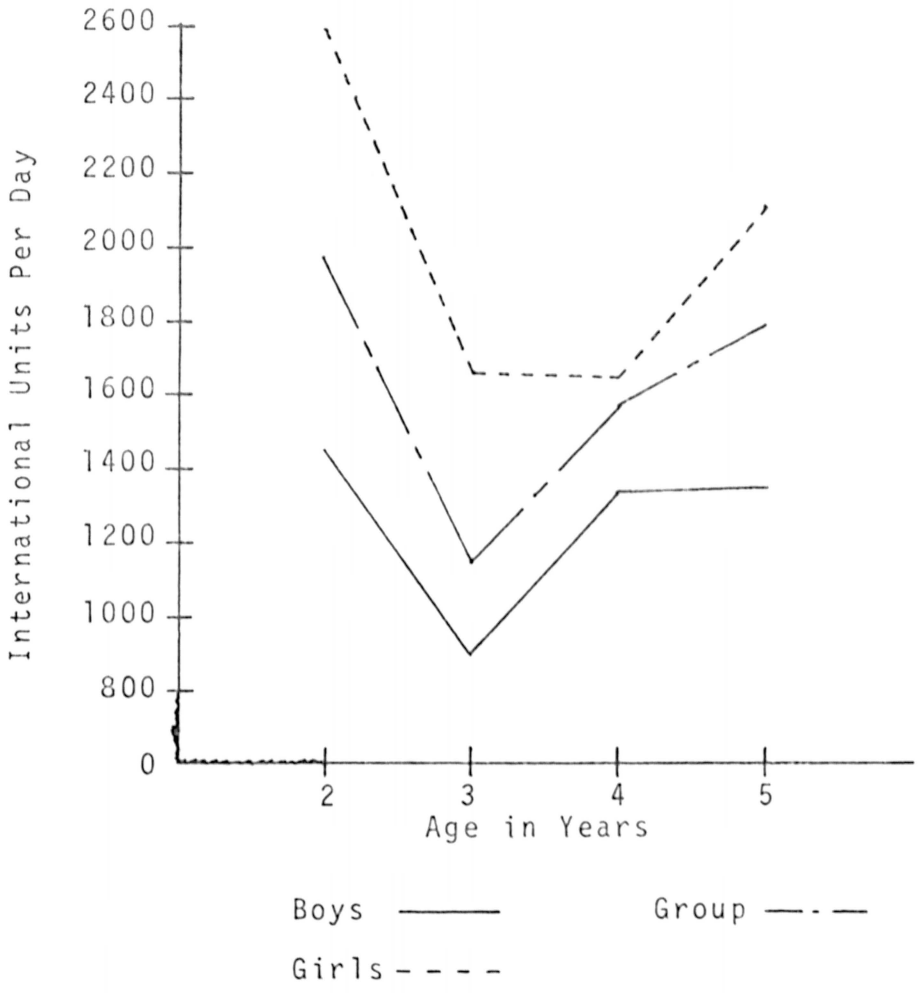

Figure 12

Mean Intake of Vitamin A From Animal Sources for Preschool Children Ages Two Through Five Years

TABLE XVI

DISTRIBUTION OF VITAMIN A INTAKE FROM ANIMAL SOURCES FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2074	5362	1352	2570	2132	5651	2074	6219
1704	4053	1107	1944	1875	2447	1450	2695
1598	2595*	1088	1661*	1325*	1842	1346	2106*
1595	2469	895*	1067	1140	1728	1329*	1987
1454*	1396	892	1062	1052	1707	1162	1089
1341	1187	874		979	1646*	612	1038
1102	1112	791		767	1514		955
768		772			1350		757
		282			1081		
					995		
					897		
					430		
Mean							
1454	2595	895	1661	1325	1646	1329	2106
1982		1149		1533		1781	

*Mean

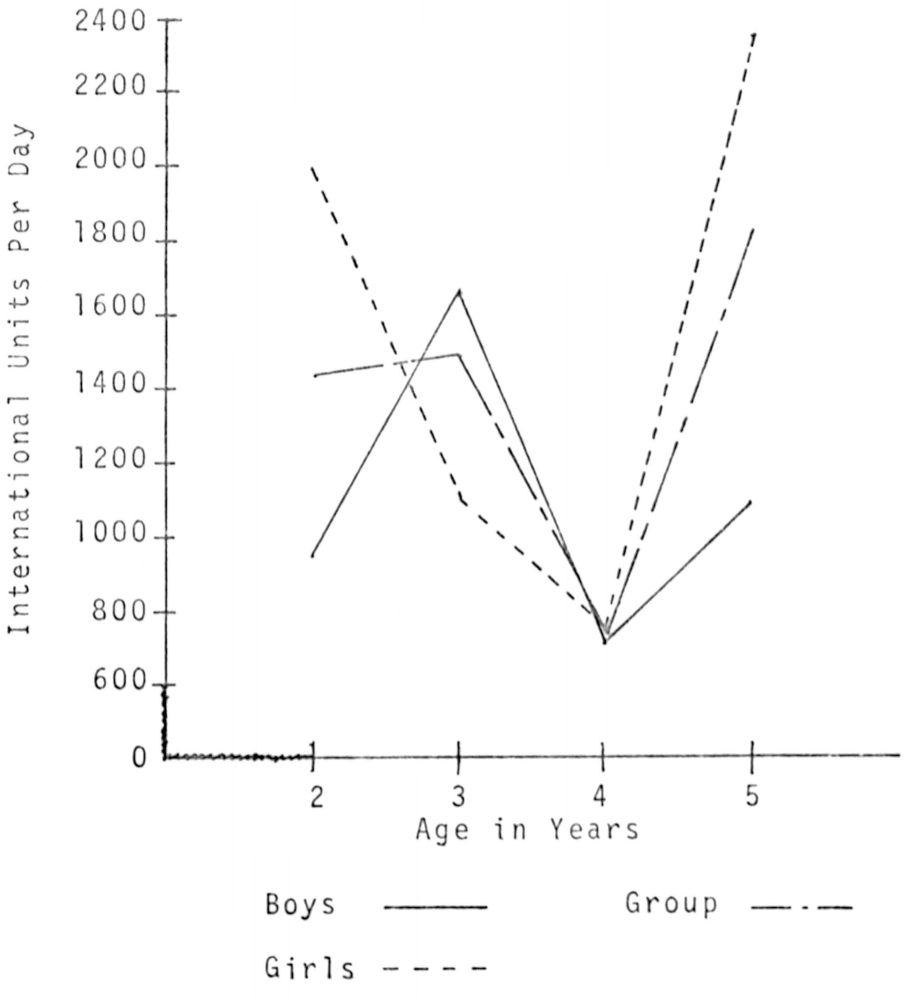

Figure 13

Mean Intake of Vitamin A From Vegetable Sources for Preschool Children Ages Two Through Five Years

then rose between four and five years. The mean intake of vegetable sources of vitamin A for the group as a whole rose between two and three years, dropped from two to four, and rose from four to five years of age. The meal contributing the most to vegetable sources of vitamin A intake was dinner, followed by lunch, between meal eating and breakfast for the 54 children in the group.

Table XVII presents the average daily vitamin A intake from vegetable sources for each child in the study. The mean intake of each age group is given to show the individual intakes as related to the group mean.

Nutrient intake classifications for thiamine indicated that 31 children met the requirement for Class I, 17 for Class II, and six for Class III. These were 57.4 per cent, 31.5 per cent and 11.1 per cent of the group respectively. Dinner was the meal which contributed the most to thiamine intake followed by breakfast, lunch, and between meal eating.

Figure 14 presents the mean daily intake of thiamine for the entire group. The thiamine intake for boys rose between ages two to three years, dropped between three and four years, then rose between four and five years. The intake for girls dropped between ages two and three and rose between three and five years of age. The mean for the entire group dropped between ages two to three years, then continued

TABLE XVII

DISTRIBUTION OF VITAMIN A INTAKE FROM VEGETABLE SOURCES FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2238	6536	8067	1979	2523	2489	1483	5941
1092	2882	1710	1917	1063	740	1311	5845
1024	1996*	1664*	1113*	761*	734	1308	2354*
942*	908	999	302	474	724*	1208	2305
889	603	974	254	226	648	1092*	1311
679	521	672		154	619	144	522
381	521	227		128	599		465
291		203			528		106
		133			374		
					367		
					350		
Mean							
942	1996	1664	1113	761	724	1092	2354
1428		1481		713		3609	

*Mean

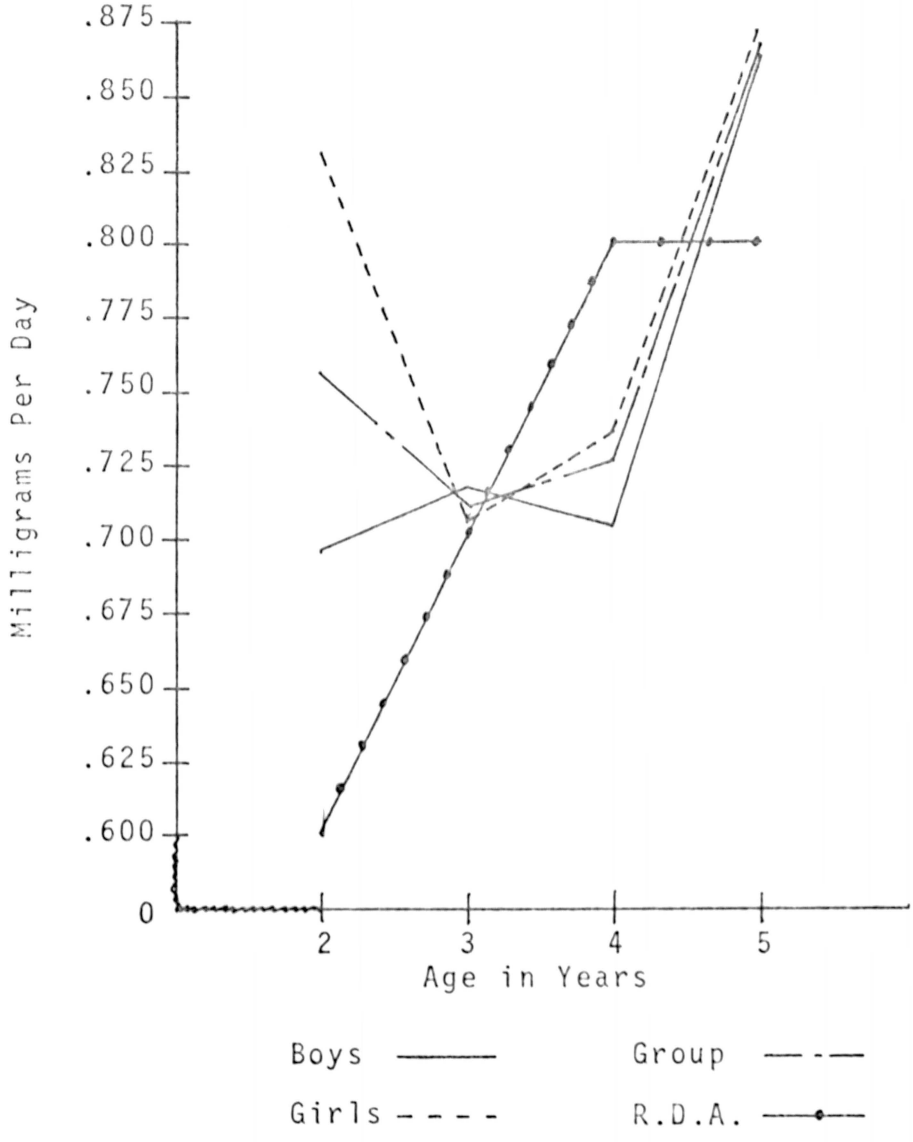

Figure 14

Mean Intake of Thiamine for Preschool Children

Ages Two Through Five Years

to rise between three and five years of age. All the mean intakes exceeded the RDA between four and five years of age.

The average daily thiamine intake of each child in the study distributed by sex and age is presented in Table XVIII. The data were compared according to the relationship with the RDA. Intakes equal to or greater than the allowance were included in Class I. Class II groups included daily intakes less than the daily allowance but exceeding 66.67 per cent of the RDA. Class III included the daily intakes less than 66.67 per cent of the RDA.

Metheny and associates (22) reported 41 per cent of the diets of preschool children supplied less than 100 per cent of the RDA. Beal (3) found that the thiamine intake showed a steady rise in children during the first 15 months, then a plateau was reached and maintained until the age of three years. After the age of three, the thiamine intake showed a steady increase. Dierks and Morse (10) reported that 100 per cent of the children aged two to six had an intake of thiamine which was above 75 per cent of the 1964 RDA.

Nutrient intake classifications for riboflavin indicated that 47 of the children in the group met the requirement for Class I, six for Class II, and one for Class III. These were 87.0 per cent, 11.1 per cent, and 1.9 per cent of the group as a whole. The meal which made the greatest

TABLE XVIII

DISTRIBUTION OF THIAMINE INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
.966	1.051	1.167	.988	.885	1.023	1.064	1.213
.877	.999	.806	.801	.836	1.014	1.025	1.200
.861	.872	.715*	.705*		.957	.839	.981
.697	.831*	.714			.808	.807*	.874*
.695*	.766				.807		.804
.603	.687				.800		
	.606						
Class II							
.432		.692	.649	.704*	.779	.648	.718
.422		.672		.684	.736*	.565	.697
		.653		.646	.564		
		.571		.615			
				.569			
Class III							
		.435	.379		.526		.507
					.512		
					.499		
Mean							
.695	.831	.715	.705	.704	.736	.807	.874
.757		.711		.725		.870	

*Mean

contribution to riboflavin intake was breakfast, followed by dinner, between meal eating, and lunch.

Figure 15 presents the mean daily intake of riboflavin for the entire group. The mean intake for the boys and the mean intake for the entire group dropped between two and three years of age, then rose between three and five years of age. The mean intake for the girls dropped between two and four years of age and rose between four and five years of age. The mean intakes for the boys, girls, and the group as a whole was above the RDA at all times.

Table XIX presents the average daily riboflavin intake of each child in the study. The data were grouped according to the relationship with the RDA. The mean intake of each age group is given to show the individual intakes as related to the group mean.

Beal (3) reported in a study on preschool children that the riboflavin intake decreased during the second and third years, then began to rise between the ages of three and four years. Metheny and associates (22) reported that 5.0 per cent of the diets of children studied were below the full recommendation for the RDA. Dierks and Morse (10) reported that 100 per cent of the children ages two to six had riboflavin intakes which were above 75 per cent of the 1964 RDA.

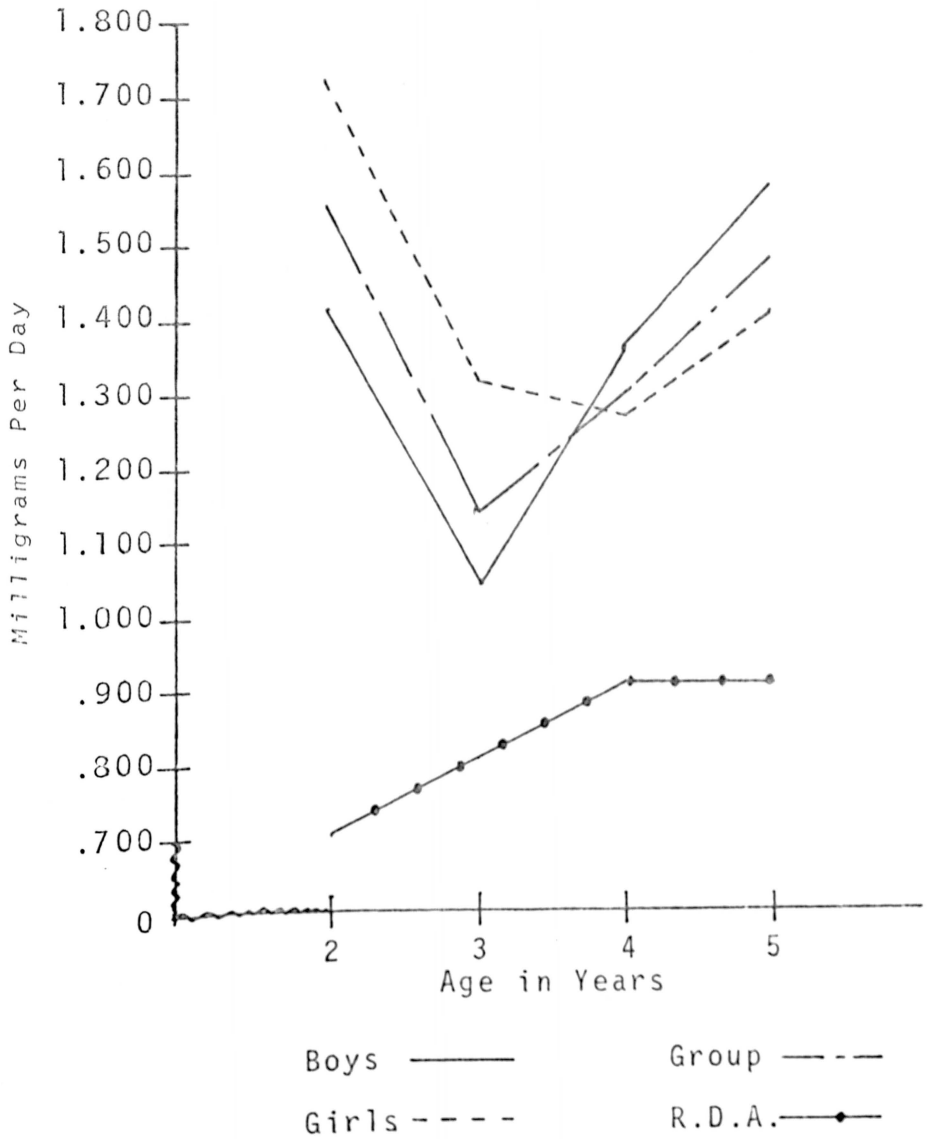

Figure 15

Mean Intake of Riboflavin for Preschool Children Ages Two Through Five Years

TABLE XIX

DISTRIBUTION OF RIBOFLAVIN INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
2.322	3.477	1.764	2.045	1.933	2.556	2.077	2.770
1.502	2.247	1.212	1.320	1.895	1.971	2.021	1.473
1.494	1.723*	1.171	1.317*	1.354*	1.356	1.580*	1.412
1.412*	1.263	1.061	1.009	1.202	1.355	1.556	1.405*
1.402	1.164	1.043*	.895	1.125	1.343	1.344	1.400
1.236	1.104	.998		1.060	1.265*	.906	.961
1.131	1.080			.915	1.194		.934
.797					.968		
					.966		
Class II							
		.755			.880		.888
		.701			.873		
		.676					
Class III							
					.436		
Mean							
1.412	1.723	1.043	1.317	1.354	1.265	1.580	1.405
1.556		1.134		1.295		1.478	

*Mean

Nutrient intake classifications for ascorbic acid indicated that 32 of the children in the group met the requirement for Class I, eight for Class II, and 14 for Class III. These were 59.3 per cent, 14.8 per cent, and 28.9 per cent. Between meal eating contributed the most to the total ascorbic acid intake followed by dinner, breakfast, and lunch.

Figure 16 presents the mean daily intakes for ascorbic acid for the group. The mean daily intakes for boys, girls, and the entire study group rose between ages two to three, then dropped between three to five years of age. The mean intakes are above the RDA at all age levels.

The average daily ascorbic acid intake of each child in the study is presented in Table XX. The data were grouped according to the relationship with the RDA. Class I included daily intakes equal to or greater than the allowance. Class II groups included daily intakes less than the daily allowance but exceeding 66.67 per cent of the RDA. Class III included the daily intakes less than 66.67 per cent of the RDA.

Hootman and associates (16) reported that in a study of preschool children ascorbic acid was the only nutrient for which the intake was less than the RDA. In another study, Metheny and associates (22) reported that the full allowance of ascorbic acid was being consumed by 85 per cent of the

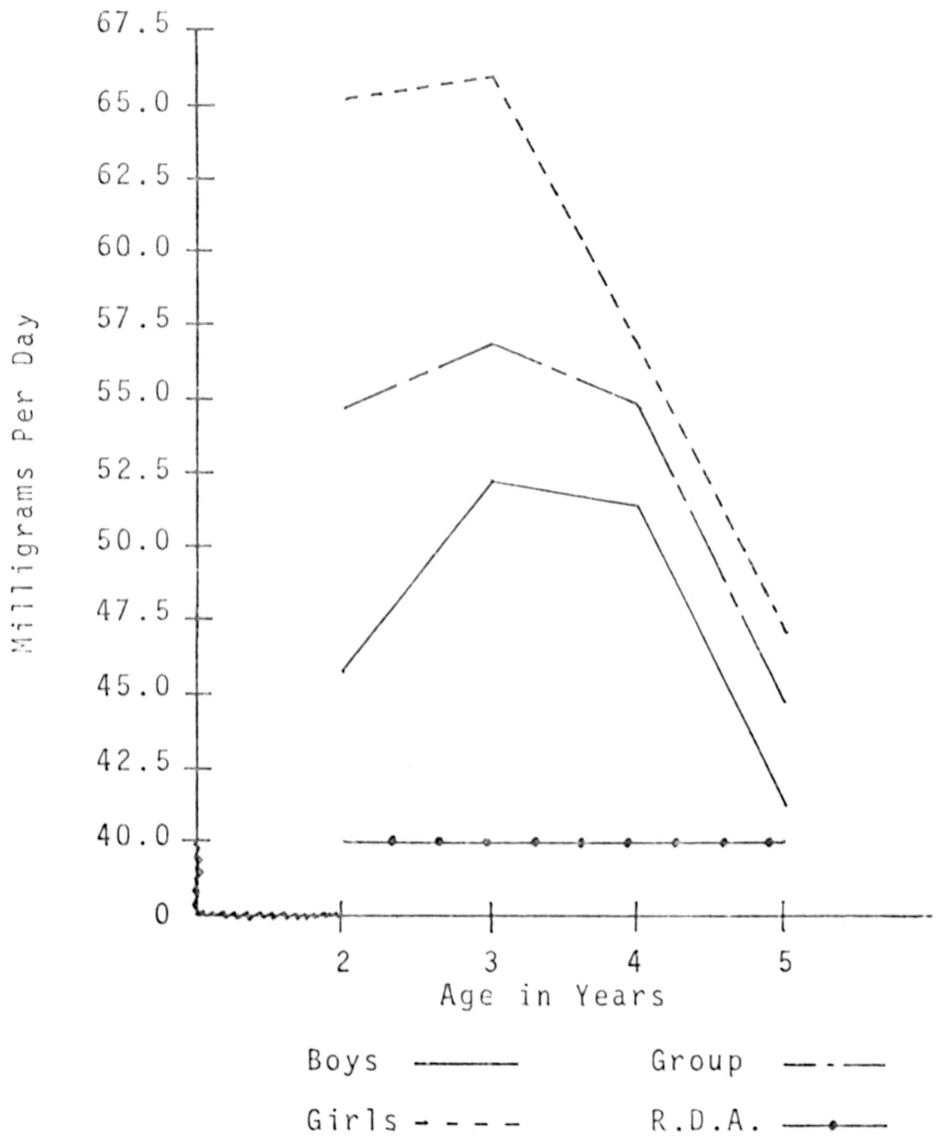

Figure 16

Mean Intake of Ascorbic Acid for Preschool Children

Ages Two Through Five Years

TABLE XX

DISTRIBUTION OF ASCORBIC ACID INTAKE FOR 54 PRESCHOOL CHILDREN

Age of Children							
Two Year Old		Three Year Old		Four Year Old		Five Year Old	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Class I							
74.95	102.56	104.28	119.69	115.66	124.82	87.55	86.33
67.00	91.33	80.69	65.93*	64.83	109.67	41.25*	71.56
66.02	90.25	55.92	59.75	56.92	78.50		61.25
45.67*	65.19*	52.25*	44.75	51.38*	66.78		52.83
	52.33	46.36			58.82		47.33*
	43.92	46.13			56.88*		
		42.00			53.83		
					51.94		
Class II							
38.98			39.64	38.48	29.91	39.34	29.33
29.29						33.42	
Class III							
24.25	10.72	25.33		25.42	19.42	23.92	16.05
19.24		17.25		7.00	18.56	11.05	14.00
					13.97		
Mean							
45.67	65.19	52.25	65.93	51.38	56.88	41.25	47.33
54.69		56.81		54.94		44.80	

*Mean

children studied. Dierks and Morse (10) indicated that 86 per cent of children ages two to three and 91 per cent of the children four to six years of age had an ascorbic acid intake which was above 75 per cent of the 1964 RDA.

The nine nutrients studied and compared with the 1968 RDA revealed that for the 54 children studied Class I requirements were being met 54.3 per cent of the time by the group, Class II requirements 26.7 per cent and Class III requirements 19 per cent of the time (Table XXI). The meal which made the greatest contribution to the total nutrient intake for the group was dinner, followed by breakfast, between meal eating and lunch.

The nutrient found in greatest supply in the diets of the children as a group was protein. Riboflavin, phosphorus, and thiamine in the rank order given were other nutrients for which the highest numbers of children met or exceeded the RDA. The nutrient found to be most often inadequate in the diets of the children was iron. Other nutrients frequently inadequate were calcium, vitamin A and ascorbic acid.

The mean daily intakes of the 26 boys and 28 girls for the 11 nutrients investigated are found in Tables XXII and XXIII. Deviations from the group means were higher for vitamin A and for calories than for other nutrients. This was true for both boys and girls.

TABLE XXI

COMPARISON OF NUTRIENT INTAKES WITH THE RECOMMENDED DIETARY ALLOWANCE FOR THE TOTAL STUDY GROUP

Nutrient	Classification					
	Class I		Class II		Class III	
	Number	Per cent	Number	Per cent	Number	Per cent
Calories	21	38.9	24	44.4	9	16.7
Protein	53	98.1	1	1.9	0	0.0
Calcium	16	29.6	21	38.9	17	31.5
Phosphorus	34	62.8	17	31.5	3	5.7
Iron	7	12.9	21	38.9	26	48.2
Vitamin A	23	42.6	15	27.8	16	29.6
Thiamine	31	57.4	17	31.5	6	11.1
Riboflavin	47	87.0	6	11.1	1	1.9
Ascorbic acid	32	59.3	8	14.8	14	28.9
Total	264	54.3	130	26.7	92	19.0

Class I: Met or exceeded 100 per cent of the RDA
Class II: >66.67 per cent but <100 per cent of the RDA
Class III: <66.67 per cent of the RDA

TABLE XXII

THE MEAN DAILY NUTRIENT INTAKES FOR 26 PRESCHOOL BOYS

Nutrient	Age of Children							
	Two Year Old		Three Year Old		Four Year Old		Five Year Old	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Calories,	1348.0	± 315.59	1232.0	± 314.20	1299.0	± 345.57	1710.0	± 574.29
Protein, gms.	55.26	± 15.62	46.91	± 12.54	53.71	± 11.51	73.10	± 38.16
Fat, gms.	63.46	± 15.53	55.39	± 16.58	60.62	± 19.63	78.27	± 32.51
Carbohydrates, gms.	151.42	± 38.38	149.40	± 38.79	166.13	± 52.99	206.39	± 69.07
Calcium, gms.	.783	± .351	.493	± .253	.755	± .694	1.0462	± .190
Phosphorus, gms.	.968	± .308	.739	± .217	.964	± .833	1.408	± .225
Iron, mg.	6.20	± 1.71	7.27	± 2.42	7.59	± 5.55	9.23	± 3.48
Vitamin A I.U.	2396.0	± 868.30	2259.0	±2852.43	2086.0	±1510.98	2421.0	± 990.39
Thiamine, mg.	.695	± .232	.715	± .215	.704	± .016	.867	± .070
Riboflavin, mg.	1.412	± .149	1.043	± .359	1.354	± .443	1.580	± .154
Ascorbic acid, mg.	45.69	± 23.08	52.25	± 28.42	51.38	± 37.82	41.25	± 9.24

TABLE XXIII

THE MEAN DAILY NUTRIENT INTAKES FOR 28 PRESCHOOL GIRLS

Nutrient	Age of Children							
	Two Year Old		Three Year Old		Four Year Old		Five Year Old	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Calories,	1485.0	± 392.28	1396.0	± 533.45	1374.0	± 350.23	1517.0	± 711.97
Protein, gms.	56.69	± 23.64	52.87	± 11.12	52.38	± 16.54	57.26	± 18.89
Fat, gms.	68.87	± 23.02	63.45	± 22.79	63.50	± 24.21	63.98	± 30.27
Carbohydrate, gms.	180.53	± 48.33	175.02	± 72.44	181.20	± 35.32	188.63	± 105.30
Calcium, gms.	.948	± .188	.690	± .106	.672	± .321	.750	± .349
Phosphorus, gms.	1.092	± .194	.921	± .320	.889	± .343	1.023	± .399
Iron, mg.	7.65	± 4.04	7.88	± 2.07	7.51	± 1.69	8.51	± 1.20
Vitamin A, I.U.	4591.0	±2780.75	2774.0	±1629.24	2370.0	±1538.30	4460.0	±3150.55
Thiamine, mg.	.831	± .175	.705	± .814	.736	± .201	.874	± .267
Riboflavin, mg.	1.723	± .966	1.317	± .518	1.265	± .602	1.405	± .652
Ascorbic acid, mg.	65.19	± 29.20	65.93	± 36.82	56.84	± 36.69	47.73	± 28.04

The distribution of frequency of nutrient intakes meeting less than 66.67 per cent of the RDA is presented in Table XXIV. Seventeen children had diets which provided 100 per cent or more of the RDA in all nutrients. One child had a diet which provided less than two-thirds of the RDA for seven nutrients.

The Pearson-Product Moment Correlation technique was used to study the relationship which existed between certain variables. The 1.0 per cent level of significance was selected for the study.

No significant relationship was found when per capita income was investigated in relation to intake of each nutrient. The correlations were again calculated after removing children from families receiving commodity or supplemental food as it was thought that an atypical situation may have resulted. However, no correlation of significance was found except for iron. A positive correlation coefficient of 0.41 was found. Therefore, no evidence of increasing nutrient intake accompanying increasing per capita income was found. Table XXV presents the correlation coefficients from the analysis of per capita income with nutrient intake for the whole sample.

The contributions of each nutrient resulting from between meal eating and the total intake of each nutrient were

TABLE XXIV

DISTRIBUTION OF FREQUENCY OF NUTRIENT INTAKES MEETING LESS THAN 66.7 PER CENT OF THE RDA

Frequency of Deficiency	Age of Children								Total	
	Two Year Old		Three Year Old		Four Year Old		Five Year Old			
	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
0 Nutrients	-	2	2	2	2	3	3	3	7	10
1 Nutrients	4	3	1	-	2	1	-	2	7	6
2 Nutrients	3	1	1	-	-	4	1	-	5	5
3 Nutrients	-	-	2	-	-	1	-	1	2	2
4 Nutrients	-	-	1	2	1	1	1	-	3	3
5 Nutrients	-	-	1	-	1	-	-	-	2	0
6 Nutrients	-	-	-	-	-	-	-	1	0	1
7 Nutrients	-	-	-	-	-	1	-	-	0	1
8 Nutrients	-	-	-	-	-	-	-	-	-	-
9 Nutrients	-	-	-	-	-	-	-	-	-	-

TABLE XXV

CORRELATION COEFFICIENTS FROM THE ANALYSIS OF PER CAPITA INCOME WITH NUTRIENT INTAKES

Measures Correlated	Correlation Coefficients
Per capita income with calories	- 0.04 n.s.
Per capita income with protein	- 0.09 n.s.
Per capita income with fat	0.10 n.s.
Per capita income with carbohydrate	- 0.06 n.s.
Per capita income with calcium	- 0.13 n.s.
Per capita income with phosphorus	- 0.14 n.s.
Per capita income with iron	0.24 n.s.
Per capita income with vitamin A	- 0.07 n.s.
Per capita income with thiamine	- 0.03 n.s.
Per capita income with riboflavin	- 0.10 n.s.
Per capita income with ascorbic acid	0.15 n.s.

n.s. = non-significant

analyzed (Table XXVI). Between meal eating was found to make a significant contribution to the intake of each nutrient with the exception of vitamin A. The balance of the nutrients all yielded correlation coefficients significant at the .01 level. Calories, protein, fat, carbohydrate, calcium and phosphorus had correlation coefficients which ranged from 0.72 to 0.82.

The investigator reclassified the diet of each child after deducting the amount of each nutrient attributable to between meal eating. Analysis of the total intake of the nine nutrients studied revealed that 81 per cent of the group met or exceeded two-thirds of the RDA, and 19 per cent had intakes less than two-thirds of the RDA. Analysis of nutrient intake reduced by the contribution of between meal eating and compared with the RDA showed 65 per cent of the study group with intakes equal to or greater than 66.67 per cent of the RDA. Thirty-five per cent had intakes less than 66.67 per cent of the RDA.

Protein intake was evaluated in relation to intake of each of the other nutrients studied. Correlation coefficients significant at the .01 level were found with calories, fat, carbohydrate, calcium, and phosphorus. Coefficients, significant at the .05 level, were found for vitamin A and ascorbic acid. A particularly high correlation coefficient (.961)

TABLE XXVI

CORRELATION COEFFICIENTS FROM THE ANALYSIS OF BETWEEN MEAL EATING WITH TOTAL NUTRIENT INTAKE

Measures Correlated	Correlation Coefficients
Calories from snacks with total calories	0.80 *
Protein from snacks with total protein	0.72 *
Fat from snacks with total fat	0.78 *
Carbohydrate from snacks with total carbohydrate	0.80 *
Calcium from snacks with total calcium	0.78 *
Phosphorus from snacks with total phosphorus	0.82 *
Iron from snacks with total iron	0.56 *
Vitamin A from snacks with total vitamin A	0.28 n.s.
Thiamine from snacks with total thiamine	0.45 *
Riboflavin from snacks with total riboflavin	0.49 *
Ascorbic acid from snacks with total ascorbic acid	0.56 *

*Significant at the .01 level

n.s. = non-significant

was found for protein intake in relation to phosphorus intake. Table XXVII presents the correlation coefficients from the analysis of protein intake with other nutrients studied.

Analysis of age, height, and weight with selected nutrients was made. No significant correlations were found. Table XXVIII presents the correlation coefficients from the analysis of age, height, and weight with selected nutrients.

Protein was further analyzed according to animal and vegetable sources with selected nutrients. In all cases except for the relationship of vegetable protein with calcium analysis yielded correlation coefficients significant at the .01 level. In this excepted case, significance was at the .05 level. Table XXIX presents the correlation coefficients from the analysis of animal and vegetable sources of protein with selected nutrients.

TABLE XXVII

CORRELATION COEFFICIENTS FROM THE ANALYSIS OF PROTEIN INTAKE WITH SELECTED NUTRIENTS

Measures Correlated	Correlation Coefficients
Protein with calories	0.747 *
Protein with fat	0.823 *
Protein with carbohydrate	0.445 *
Protein with calcium	0.810 *
Protein with phosphorus	0.961 *
Protein with iron	0.718 *
Protein with vitamin A	0.289 **
Protein with thiamine	0.225 n.s.
Protein with riboflavin	0.776 *
Protein with ascorbic acid	0.275 **

*Significant at the .01 level

**Significant at the .05 level

n.s. = non-significant

TABLE XXVIII

CORRELATION COEFFICIENTS FROM THE ANALYSIS OF AGE, HEIGHT, AND WEIGHT WITH SELECTED NUTRIENTS

Measures Correlated	Correlation Coefficients
Age with calories	0.146 n.s.
Weight with calories	0.265 n.s.
Age with protein	0.156 n.s.
Height with protein	0.191 n.s.
Weight with protein	0.158 n.s.
Age with animal protein	0.060 n.s.
Weight with fat	0.205 n.s.
Weight with carbohydrate	0.198 n.s.
Height with calcium	0.082 n.s.

n.s. = non-significant

TABLE XXIX

CORRELATION COEFFICIENTS FOR THE ANALYSIS OF ANIMAL AND VEGETABLE SOURCES OF PROTEIN WITH SELECTED NUTRIENTS

Measures Correlated	Correlation Coefficients
Animal protein with calories	0.611 *
Vegetable protein with calories	0.581 *
Animal protein with calcium	0.808 *
Vegetable protein with calcium	0.314 **
Animal protein with phosphorus	0.902 *
Vegetable protein with phosphorus	0.463 *
Animal protein with iron	0.513 *
Vegetable protein with iron	0.705 *

*Significant at the .01 level

**Significant at the .05 level

CHAPTER IV

SUMMARY AND CONCLUSIONS

The general purpose of the study was to evaluate the intake of a selected number of nutrients in the diets of preschool children from low socioeconomic groups. Special emphasis was given to the evaluation of the protein intake and sources of dietary protein. Other nutrients analyzed were carbohydrate, fat, calcium, phosphorus, iron, vitamin A, thiamine, riboflavin, ascorbic acid and energy value.

Information was obtained on family income level, vitamin supplementation, sources of nutrition knowledge of the mother, and height and weight for the study group. The educational level of the mother was obtained whenever possible.

Data were obtained on 54 preschool children 2 through 5 years of age. Both male and female subjects were included. The study was not limited to any one ethnic group. Data were collected during the late Spring, early Summer and Fall of 1969.

The "Interview Form" and the "Food Intake Form" developed by the investigator were used to collect information. Data were obtained by personal interviews with the mothers and

from food records kept for three consecutive days by the mothers of the children. Foods were recorded in common household measurements. The Food records were analyzed using Bowes and Church's Food Values for Portions Commonly Used. The Pearson-Product Moment Correlation technique was used to study the relationship between certain variables. The level of significance selected for the study was the .01 level.

The children numbered 26 boys and 28 girls for a combined total of 54 children. The children ranged in age from 24 to 70 months with a mean age of 47.65 months. The mean annual per capita income for the families of the children was $582.94. The educational level of 41 mothers revealed a mean of 7.19 years. Twenty five of the children were receiving vitamin supplementation. The mothers indicated that the greatest source of knowledge about feeding the families was obtained from the oral communication media; namely professional individuals.

The nine nutrients studied and compared with the 1968 RDA revealed that Class I requirements (met or exceeded the RDA) were being met 54.3 per cent of the time; Class II requirements (66.67 to 99.9 per cent of the RDA), 26.7 per cent of the time; and Class III requirements (less than 66.7 per cent of the RDA), 19.0 per cent of the time.

Protein was the nutrient found to be in greatest supply in the diet. It was found that 98.2 per cent of the children met or exceeded the RDA for protein intake. All of the diets of the children met or exceeded 66.67 per cent of the RDA for protein intake. The mean animal protein intake dropped between the ages of two to three years, and then began to rise from ages three to five years. Mean vegetable protein intake rose during the period from two to five years of age.

Other nutrients found to be present in good supply in individual diets were riboflavin and phosphorus. The nutrients found to be most often inadequate in the diets were iron, calcium, vitamin A, and ascorbic acid. No correlation of significance was found in the study of per capita income as related to intake of individual nutrients. Between meals were found to make a significant contribution to the intake of each nutrient with the exception of vitamin A.

Protein intake was evaluated in relation to intake of each of the other nutrients studied. Correlation coefficients significant at the .01 level were found for protein intake as related to calories, fat, carbohydrate, calcium and phosphorus intakes. Coefficients of significance at the .05 level were found for protein intake as related to vitamin A and ascorbic acid intakes.

Analysis of age, height, and weight with selected nutrients was made. No significant correlations were found.

Protein was further analyzed according to its animal and vegetable sources as related to intakes of selected nutrients. All correlations except vegetable protein as related to calcium analysis yielded highly significant correlation coefficients. In the excepted case, the correlation coefficient was significant at the .05 level.

The study has shown the significant contribution of between meal eating to the total daily intake of nutrients for the study group. It is recommended by the investigator that further nutrition education programs be planned to include proper counseling of the mothers of children from this age group in the selection of proper foods for between meal eating as well as for the three meals of the day. This would be especially important when intakes of certain nutrients are low or inadequate.

The investigator recommends further evaluation of the nutritional status of the preschool child from low socio-economic groups. This study was limited in that biochemical, anthropometric, and psychological data were not collected for the study group.

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A P P E N D I X

TABLE XXX

CONTRIBUTION OF THE NUTRIENT INTAKE FROM THE BREAKFAST MEAL TO THE RECOMMENDED DIETARY ALLOWANCE AND TO THE TOTAL NUTRIENT INTAKE

Nutrient	Nutrient Intake From Breakfast							
	Age of Children							
	Two Year Old		Three Year Old		Four Year Old		Five Year Old	
	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total
Calories	28.4	25.1	23.9	26.0	19.9	23.6	22.5	22.5
Protein	52.8	23.6	40.6	24.9	38.7	21.9	43.1	20.2
Fat	0.0	23.9	0.0	27.7	0.0	23.0	0.0	24.5
Carbohydrate	0.0	24.9	0.0	23.5	0.0	21.1	0.0	21.6
Calcium	35.1	32.7	27.1	38.8	30.8	35.0	28.3	26.0
Phosphorus	36.8	28.7	32.0	32.0	32.8	28.6	30.8	20.8
Iron	9.2	20.1	17.7	23.7	14.1	18.7	16.6	18.6
Vitamin A	36.4	21.3	24.2	23.0	24.6	27.1	29.5	20.4
Thiamine	34.3	27.2	31.3	30.8	25.5	28.1	23.3	21.4
Riboflavin	67.7	30.5	48.5	34.2	45.4	31.6	43.8	26.7
Ascorbic acid	28.0	28.5	31.5	22.1	30.8	22.4	15.2	13.6

TABLE XXXI

CONTRIBUTION OF THE NUTRIENT INTAKE FROM THE LUNCH MEAL TO THE RECOMMENDED DIETARY ALLOWANCE AND TO THE TOTAL NUTRIENT INTAKE

Nutrient	Nutrient Intake From Lunch							
	Age of Children							
	Two Year Old		Three Year Old		Four Year Old		Five Year Old	
	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total
Calories	29.4	26.1	18.4	20.0	18.3	21.7	24.3	24.3
Protein	60.5	27.0	34.6	21.2	40.7	23.1	53.0	24.9
Fat	0.0	28.9	0.0	21.1	0.0	24.8	0.0	26.8
Carbohydrate	0.0	23.6	0.0	21.4	0.0	20.5	0.0	24.6
Calcium	12.3	20.7	15.3	21.8	16.8	19.1	21.3	19.5
Phosphorus	29.8	23.2	20.0	20.0	24.6	21.5	31.4	21.2
Iron	12.3	26.8	15.8	21.2	16.1	21.4	23.4	26.2
Vitamin A	35.3	20.7	36.6	34.8	21.0	23.1	44.0	30.5
Thiamine	32.0	25.4	20.7	20.4	17.1	18.9	25.3	23.2
Riboflavin	48.1	21.7	28.1	19.8	27.3	19.0	37.9	23.1
Ascorbic acid	23.0	16.8	33.2	23.4	28.3	20.6	21.0	18.7

TABLE XXXII

CONTRIBUTION OF THE NUTRIENT INTAKE FROM THE DINNER MEAL TO THE RECOMMENDED DIETARY ALLOWANCE AND TO THE TOTAL NUTRIENT INTAKE

Nutrient	Nutrient Intake From Dinner							
	Age of Children							
	Two Year Old		Three Year Old		Four Year Old		Five Year Old	
	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total
Calories	27.7	24.5	23.3	25.3	20.9	24.8	26.8	26.8
Protein	72.2	32.3	61.9	38.0	60.5	34.3	76.5	35.9
Fat	0.0	26.0	0.0	26.0	0.0	24.1	0.0	27.6
Carbohydrate	0.0	22.2	0.0	20.6	0.0	24.7	0.0	28.5
Calcium	23.9	22.2	8.8	12.5	15.6	17.8	28.9	26.4
Phosphorus	35.0	27.3	27.8	27.7	31.6	27.6	47.0	31.8
Iron	16.8	36.7	29.5	39.5	32.7	43.4	37.3	41.8
Vitamin A	72.1	42.3	22.8	21.6	20.3	22.4	52.9	36.6
Thiamine	33.8	26.8	26.9	26.4	26.0	28.7	38.5	35.4
Riboflavin	58.0	26.1	30.6	21.6	33.9	23.6	51.9	31.6
Ascorbic acid	30.2	22.1	32.2	22.7	29.1	21.2	36.6	32.7

TABLE XXXIII

CONTRIBUTION OF THE NUTRIENT INTAKE FROM BETWEEN MEAL EATING TO THE RECOMMENDED DIETARY ALLOWANCE AND TO THE TOTAL NUTRIENT INTAKE

Nutrient	Nutrient Intake From Between Meal Eating							
	Age of Children							
	Two Year Old		Three Year Old		Four Year Old		Five Year Old	
	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total	Per cent RDA	Per cent Total
Calories	27.5	24.3	26.3	28.7	25.2	29.9	26.3	26.4
Protein	38.2	17.1	25.9	15.9	36.3	20.7	40.3	19.0
Fat	0.0	21.2	0.0	25.2	0.0	28.1	0.0	21.1
Carbohydrate	0.0	29.3	0.0	34.5	0.0	33.7	0.0	25.3
Calcium	26.1	24.4	18.7	26.9	24.7	28.1	30.8	28.1
Phosphorus	26.5	20.8	20.3	20.3	25.6	22.3	38.7	26.2
Iron	7.5	16.4	11.7	15.6	12.4	16.5	12.0	13.4
Vitamin A	26.7	15.7	21.6	20.6	24.9	27.4	18.0	12.5
Thiamine	26.1	20.6	22.7	22.4	22.0	24.3	21.7	20.0
Riboflavin	48.5	21.7	34.6	24.4	37.3	25.8	30.6	18.6
Ascorbic acid	55.5	40.6	45.1	31.8	49.2	35.8	39.2	45.0