

DIETARY BEHAVIOR OF PRESCHOOL CHILDREN

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INTRODUCTION

Understanding the characteristics of preschool children and providing a positive environment for food acceptance can help children to develop positive food habits. During the preschool years, language skills are mastered and children learn to ask for foods. Development of fine motor skills enables children to feed themselves and to prepare simple foods. Preschool children test and learn limits and develop a sense of independence. Because growth rate slows during this period their appetites may diminish. Decreased interest in food is attributable in part to increased interest in the environment.

Even though food is secondary in importance to the preschooler, experiences at this time can influence acceptance of foods throughout life. Children's awareness can be increased and knowledge of foods and nutrition expanded by providing activities that will stimulate their curiosity. In early childhood education programs cooking projects, films, puppets, games, flannel board stories and snack time should be planned to give the preschooler the opportunity to discuss various food experiences.

The following report is a review of research conducted in the area of dietary behavior of preschool children. Information on dietary status, food preferences, food habits, factors related to food habits and nutrition education is included.

DIETARY STATUS OF PRESCHOOL CHILDREN

Nutrient Intake Studies

In 1953 Beal (1) reported the dietary intakes of 46 healthy children during the first 5 years of life; she used a series of nutrition histories and 24-hour intakes to provide data on calories, protein, fat and carbohydrate. Data were expressed in quartiles and maximum and minimum intake. Results showed that during the first 15-18 months protein intake increased more than fat and carbohydrate. From 1½ to 3 years, protein intake remained the same and intakes of fat and carbohydrate increased slightly. Protein intake increased in the beginning of the 3rd year. The median protein intake exceeded the 1948 Recommended Dietary Allowances (RDA) during the first 2 years and was similar to the standard between the 3rd and 5th year. Calories showed a slight increase between 18 months and 3 years. The median calorie intake was similar to the RDA during the 5 year period. There was a greater number of intakes of the 4 nutrients above the 75th percentile than below the 25th percentile.

Beal (2) also reported the calcium, phosphorus and iron intakes of 58 healthy children aged 1-5 years. Results showed that intakes of calcium increased rapidly in the first 6 months. The lowest intakes of calcium occurred between 2 and 3 years of age. Iron intakes reached a peak by 1 year of age because of infant cereal consumption. Between 2½ and 5 years of age iron intake of more than 75% of the children was below the 1953 RDA; although, their hemoglobin and erythrocyte levels were satisfactory.

In 1958 Samenfink et al. (3) reported the nutritive value of the noon meals of 16 children aged 3, 4 and 5 years enrolled at the preschool at South Dakota State College. The amounts of food consumed by each child were recorded every Monday and Wednesday for a 5 week period. Food composition tables were used to calculate calories, protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin and ascorbic acid. Comparison with 1953 RDA showed that the mean food intakes of all the children provided one-third or more of the calories and nutrients that were investigated except calcium and iron for the 3 year olds. The mean intakes of vitamin A and ascorbic acid exceeded one-third of the RDA for all 3 age groups.

Metheny et al. (4) investigated the dietary status of 104 preschool children in Columbus, Ohio in 1962. Children's nutrient intake was calculated from a consecutive 3-day food record. The data showed that 21% of the diets of the children met 100% of the 1958 RDA, 61% met 67% of the RDA and at least 1 nutrient was below 67% of the recommendation for 18% of the children. Iron was the nutrient least well supplied in the diets with one half the children receiving less than the RDA. Approximately 40% of the diets were below the recommendations for energy, thiamin and calcium. Protein was consumed in the recommended amount by 89% of the children, riboflavin by 95%, niacin by 97% and ascorbic acid by 85%. Adequacy of the diets was related to the income level of the family. The majority of the children who consumed less than 100% of the RDA were from families with incomes of less than \$3,700.

In 1965, Dierks and Morse (5) calculated the intake of 10 nutrients by 115 Minnesota preschool children from 3-day food records. Mean total

nutrient intake met or exceeded the 1958 RDA for calories, protein, iron, vitamin A, thiamin, riboflavin and ascorbic acid for all children. Diets met the 1964 RDA for calcium but preformed niacin was low compared to the 1958 and 1964 recommendations. Because of the high protein intakes of the children and conversion of tryptophan to niacin the investigators concluded that there was not a shortage of that nutrient. Dietary intakes were grouped as 75%, 50-74% or below 50% of the 1958 and 1964 Recommended Dietary Allowances. For a substantial number of children, iron intake was in the 50-74% group and ascorbic acid fell below 50% of the RDA. Few of the children had intakes of the other nutrients below 50% of the recommended allowances.

Kerrey et al. (6) collected data on nutrient intake of 40 Nebraska preschool children. Intakes of calories, protein, fat, calcium, iron, vitamin A, thiamin, riboflavin, ascorbic acid, pantothenic acid and niacin equivalents contents were calculated from 3-day food records kept by the mothers. Intakes of protein, fat, calories, iron, vitamin A, thiamin, riboflavin and ascorbic acid were compared to the 1964 RDA. A score of -1 indicated that the diet provided less than 25% of the RDA for a specific nutrient; 0, 25-75%, and +1, above 75% of the allowance. The 8 individual nutrient scores were totaled and a score of 8 indicated that the diet furnished more than 75% of the RDA for each nutrient. Diets were classified as high, 8, medium, 6-7, or low, 5 or below. Mean calorie intake was slightly lower than the 1964 RDA in both the high and the low socioeconomic groups. Mean daily intakes of all nutrients, except iron, met or exceeded the recommended allowances for each group of children. Some of the diets of children from both the high and low socioeconomic groups failed to meet the RDA for iron, calcium, calories

and ascorbic acid. Using two-thirds of the RDA as a level of dietary adequacy, iron, ascorbic acid and vitamin A were the nutrients most limiting for the greatest number of children. Diets of children in the low income group were more adequate in iron and thiamin, whereas ascorbic acid and vitamin A were provided more adequately in the high income group.

Owen et al. (7) conducted a survey between 1968 and 1970 on nutritional status of a cross-sectional sample of 3,445 preschool children in the United States. The nutrition survey included a dietary interview to determine intake and sources of nutrients, food habits, family composition and methods of procuring and preparing food. There was also a clinical examination (height, weight, head circumference and skinfold thickness), dental examination and laboratory examination which included analysis of urine and blood samples. Intakes of calories and nutrients, excluding iron and vitamin A in some instances, increased with age and income level. Intake of calcium and ascorbic acid increased as socioeconomic status increased. Protein intakes exceeded the recommended allowances for all but 5% of the children. Iron requirement was not met by 90% of the children under 3 years of age. Vitamin C intake was low for 10-15% of the children.

In 1970, Crumrine and Fryer (8) reported the protein components of blood and dietary intake of 40 preschool children in Manhattan, Kansas. The mother kept a 3-day food record expressed in common household units. Dietary data on calcium, thiamin, protein, fat, carbohydrate, vitamin A, riboflavin, niacin, ascorbic acid and calories were presented in percentiles. A comparison between mean nutrient intake and 1968 RDA indicated that all nutrients but iron met the recommended allowances.

Mean iron intake was lowest compared to the RDA followed by means for calories, calcium and thiamin. Fewer than half the children met the recommendations for calories, iron, calcium and thiamin. Iron intake was below two-thirds of the RDA for 25% of the children. However, 34 of the 40 children had hematocrit and 37 had hemoglobin values in the acceptable range.

In the fall of 1965 the nutritional status of 5,444 preschool children from 2,000 households in 12 states in the North Central Region was investigated. The purpose of the study was to evaluate nutrient quality of the diets, feeding practices, effects of family environment on dietary quality, physical status as shown by height and weight measurements and to collect information for planning nutrition education programs. Trained interviewers collected information and mothers recorded food intake for 3 consecutive days. Nutrient intakes were calculated from food composition tables and information from food companies (9).

In 1971, Fryer et al. (10) reported the intake of calories, protein, fat and carbohydrate of preschool children in a North Central Regional Study. Approximately two-thirds of the children obtained the 1968 RDA for calories and nearly all met the recommendation for protein. Protein represented 14% to 17% of the total daily calories; fat, 34 to 40% and carbohydrate, 43-50%.

Calcium, phosphorus and iron intakes of preschool children in a North Central Regional Study were reported by Fox et al. (11). Intake of calcium increased until 9 months and then decreased to a low level between 2 and 3 years of age. Median intakes for both sexes exceeded the 1968 RDA. Seventy-five percent of the boys between 2 and 6 years

of age met the RDA for calcium (800 mg). Girls' calcium intake was slightly lower than that of the boys. The researchers suggested the RDA for calcium might be too high for the child's slow growth at this time. There was no association between calcium intake and family income; however, calcium intake was positively influenced by amount of money spent on food. Three-fourths of the diets provided the 1968 RDA for phosphorus (800 mg). Phosphorus intakes increased during the preschool years to 1,200 mg with boys having a larger intake than girls. Seventy-five percent of the diets for children between the ages of 3 and 6 provided less than the 1968 RDA for iron. The amount of money spent on food had a more positive influence on intakes of calcium, phosphorus and iron than did income or education of the mother.

Vitamin intakes of preschool children in a North Central Regional Study were reported by Eppright et al. (9). Fifty percent of the children in all age groups did not meet the 1968 RDA for ascorbic acid. Approximately 75% of the diets met the RDAs for vitamin A and thiamin.

Futrell et al. (12) investigated the effect of education and income on nutritional status of preschool children in Mississippi. A 7-day food record was obtained for each child. At a health center, the children were weighed, measured and a blood sample was collected. The nutrients supplied in limited amounts were calories, ascorbic acid, calcium and iron. The average daily intake of iron was below the 1968 RDA (8 mg). Less than 250 mg of calcium were consumed by 29% of the children. The highest intake of nutrients occurred among the children from families with more than \$750 per capita income.

Acosta et al. (13) investigated the nutritional status of 135 Mexican-American preschool children in a border town in 1974. Two-day

food diaries were recorded by parents or the interviewer. Nutrient intakes for energy, protein, fat, carbohydrate, iron, calcium, phosphorus, thiamin, riboflavin, niacin, vitamin A and ascorbic acid were calculated and compared with the 1968 RDA. The number of children in different age groups who failed to meet two-thirds of the RDA were determined. Findings indicated that 12% of the children failed to meet two-thirds of the RDA for energy. Protein intake for all children exceeded two-thirds of the RDA. Intake of calcium met or exceeded two-thirds of the RDA for all but 11% of the children in the 25-36 month age group. Phosphorus intake was adequate except for 4% of the 2 to 3 year old group. Mean iron intake did not meet the RDA for children 13-43 months of age. Biochemical findings supported the low dietary iron intakes. The data indicated that 44% of the children did not meet two-thirds of the RDA for riboflavin; 29% of the children, 13-24 months of age, ingested less than two-thirds of the recommendation for thiamin and in this age group 23% of the children failed to meet two-thirds of the RDA for niacin. Seven percent of the children failed to consume two-thirds of the RDA for vitamin A while 29% did not meet the recommendation for ascorbic acid.

Driskell and Price (14) examined the nutritional status of preschoolers from low income Alabama families. There were 40 children in the study grouped by age (2, 3, 4, and 5 year olds). Interviewers collected a 24-hour recall from each mother and calories, protein, calcium, iron, vitamin A and ascorbic acid values were calculated. Mean nutrient intake for all age groups failed to meet 1968 RDAs for calcium and iron; other mean nutrient intakes exceeded the recommendations.

Forty percent of the children had ascorbic acid intakes below the recommended amounts.

In 1974 Johnson and Futrell (15) reported the prevalence of anemia in a group of black preschoolers in Mississippi using a dietary evaluation and hematological data. Protein, iron, ascorbic acid, folic acid and calories were calculated because of their roles in erythropoiesis. Data showed that as energy value increased, protein and iron intake was greater. Mean daily intake of iron was 6.7 mg; 74% of the preschool children consumed less than 8 mg/day compared to the RDA of 10 mg. The recommendation for iron was met by only 10% of the children. The average daily intake of folic acid was one-fifth the RDA. No children consumed the RDA for folic acid and over 99% consumed less than 100 mg which is one-half the recommendation. There was no significant correlation between iron intake and hematologic variables.

In 1978 Dwyer et al. (16) reported findings concerning dietary status of preschoolers on alternate life style diets as compared with that of 79 non-vegetarian preschool children. Preliminary information on diet was obtained from the parents, usually the mothers. Parents recorded 3-day weighed food intake records. Dietary data showed percentage of calories from various sources in vegetarian diets derived from animal protein, total protein, carbohydrate, animal fat and total fat. Of the total calories, animal protein sources contributed 4%; total protein, 13%; carbohydrate, 61%; animal fat, 8% and total fat, 29%. Animal sources provided less than one-third of the protein in the vegetarian diet.

Fulton et al. (17) investigated the daily dietary intakes of food energy, selected vitamins, minerals and amino acids of 48 preschool

vegetarian children between the ages of 2 and 5 from a commune in Tennessee. The mothers kept 3-day dietary records for their children. The average daily intakes of food energy, protein, fat, carbohydrate, calcium, phosphorus, iron, vitamin A, thiamin, riboflavin, niacin, vitamin B₁₂ and ascorbic acid were calculated. Mean nutrient intakes for all ages exceeded the 1974 RDAs with the exception of food energy, calcium, phosphorus and iron. Mean calcium intake ranged from 41-48% of the RDA. Individual intakes for a number of nutrients were below two-thirds of the RDA, especially vitamin A, riboflavin and niacin. Mean iron intakes were 93% of the recommendations for the 2 and 3 year old girls and mean phosphorus intakes were above two-thirds of the RDA for 4 and 5 year old girls.

Mean nutrient intakes of 701 preschool children, expressed as percentages of the 1980 RDAs, were reported in the United States Department of Agriculture (USDA) Nationwide Food Consumption Survey conducted in 1977 in the 48 conterminous states (18). Children between the ages of 3 and 5 years met the RDAs for protein, phosphorus, thiamin, vitamin A, riboflavin, niacin, vitamin B₁₂ and vitamin C. They met 80-89% of the RDA for calcium, 70-79% for iron and 90-99% for magnesium and vitamin B₆. Mean iron intakes of 1-2 year old children were below 70% of the RDA, but intakes of all other nutrients met the RDAs. Mean caloric intakes for 1-2 year olds was 1215 kcal and 1377 kcal for 3-5 year olds. When average caloric intakes were compared with the 1980 RDA they were below the recommendation by about 10 to 25%.

Dietary Status: An Ecological Approach

Sims and Morris (19) evaluated nutritional status of preschoolers in relation to environmental factors. The family controls the child's intake of food and is therefore responsible for meeting the child's nutrient needs and may influence the child's physical growth. The mothers kept 24-hour food records on 3 different occasions which were used to determine nutrient content of the children's diets. Nutritional status was measured by biochemical indexes ("hydroxyproline index," hemoglobin, hematocrit, serum protein and albumin), physical growth (standing height and weight and triceps and subscapular skinfold) and nutritional anthropometry (measured physical dimension with nutrient intakes). Serum protein and albumin were measured to obtain information concerning protein status. Family environment data were obtained during home interviews. Mothers completed a series of instruments designed to assess psychosocial attributes.

Mean intake of all nutrients, except iron, met or exceeded the 1968 RDA (19). Iron, ascorbic acid, calcium and vitamin A were the most limiting nutrients for the few children who had intakes lower than two-thirds the RDA. A comparison of nutrient intake in relation to family income revealed similar percentages of the 1968 RDA in both high (\$20,000 and above) and low (\$4,000 and below) incomes for all nutrients except ascorbic acid, calories and vitamin A. A greater percentage of children from high than from low income families failed to meet two-thirds the RDA for calories and vitamin A. A comparison of Type 1 mothers (high socioeconomic status, non-authoritarian) and Type 2 mothers (low socioeconomic status and authoritarian) showed that intakes

of ascorbic acid and calcium were higher for children of Type 1 mothers and iron, thiamin, carbohydrate and calories were higher for children of Type 2 mothers. Biochemical measures and family characteristics were not positively correlated.

Caliendo et al. (20, 21) studied the characteristics of food patterns of 113 preschool children and their families to explain dietary inadequacies. Nutritional status was indicated by dietary quality and food diversity scores i.e. number of food items consumed. The food diversity score was based on 20 foods consumed by 20% or more of the children (table 1). Each child received a food diversity score based on the number of selected foods he ate in a 24-hour period. A dietary quality score for the 24-hour food intake was computed as follows:

level 1: Less than one serving from each group in the Basic 4.

level 2: One serving only from each group.

level 3: No more than two servings from any one group.

level 4: Two servings each from milk and meat groups, plus four servings each from bread and vegetable/fruit groups, none of which was an ascorbic acid or a vitamin A source.

level 5: Level 4, with one fruit serving being a citrus fruit (ascorbic acid source).

level 6: Level 5, with one vegetable being dark green or yellow (vitamin A source).

The children's diversity mean score was 9 which indicated a fairly diverse diet (20). Within the 24-hour time period no fruit was consumed by 21% of the children and no vegetable by 13%. Only 20% of the children had consumed foods rich in vitamin A. No vitamin A or ascorbic acid rich foods were eaten by 55% of the children. Child's sex and ordinal position, the mother's employment status and her education status (nutrition education as it related to homemaker attitude and dietary

TABLE 1

Twenty-item food list representing the diversity score (21)

1. milk	11. fruit drinks
2. other dairy products	12. other fruits
3. meat, fish, poultry	13. bread, cereals, crackers
4. peanut butter	14. fats
5. eggs	15. koolaid
6. potato	16. snack foods--chips, pretzels, etc.
7. spaghetti, rice, macaroni, noodles	17. sweet desserts
8. dark green/yellow vegetables	18. concentrated sugars--jams, candy, etc.
9. other vegetables	19. sandwich
10. citrus fruits or juices	20. soup

diversity) were good predictors of dietary quality. Nutrient quality of the child's diet increased as the dietary quality and diversity increased.

Caliendo and Sanjur (21) studied factors affecting the dietary status of 113 preschool children. Demographic and family resource variables in the study were household number, ethnicity, education levels of parents, occupations of parents, family income, housing characteristics and family food expenditure per month. Maternal variables included: nutrition education, communication channels, meal planning and maternal attitudes assessed by the Parental Attitude Research Instrument (22). The variables also were divided into 2 groups, economic (education, occupation, income and housing) and

non-economic (ethnicity, family composition and attitudes).

Correlations, regressions and path coefficient analysis were the methods used to analyze relationships among variables. The latter analysis provided a way of taking into consideration the correlations between independent and environmental variables with the child's dietary quality. Dietary status was determined from a weighted dietary quality score and diversity score based on a 24-hour recall. The diversity score was an indication of variety in the diet. The dietary quality score indicated the extent the diets satisfied the Four Food Group Patterns (table 2).

TABLE 2
Dietary quality scores (n = 113) (21)

Dietary Quality Level	Weighted Score	Number of Children Receiving Score	Percent of Children Receiving Score
Four Food Groups:			
including citrus and dark green or deep yellow vegetable	6	20	18
but no dark green or deep yellow vegetable	5	21	18
but no citrus fruit	4	17	15
only two servings from each Group	3	26	23
only one serving from each Group	2	26	23
less than one serving from any Group	1	3	3

Eighteen percent of the children consumed diets which met the recommended servings of the 4 food groups and included citrus and dark

green or deep yellow vegetable (21). The 2 most limiting foods in the diet were dark green or deep yellow vegetables and citrus fruits. Dietary quality, demographic factors, family resources and maternal variables were positively correlated. Nutrition education was correlated most positively with dietary quality and diversity.

FOOD PREFERENCES

Assessment of Children's Food Preferences

Birch (23) designed a method to assess preschoolers' food preferences. Thirty-seven preschool children were divided into 2 age groups: 3-4 year olds and 4-5 year olds. In assessment 1 bananas, dates, red delicious apples, d'anjou pears, canned unsweetened grapefruit, navel oranges, canned cling peaches in light syrup and canned unsweetened pineapple were cut into bite size pieces and 2 or 3 pieces were put in a clear plastic cup. All the fruits were rank ordered by each child by arranging the cups of fruit on a tray and asking the child to point to the fruit they liked best. The fruit was removed and the procedure was repeated until all the fruits were chosen. In assessment 2 the children's preferences for those fruits was conducted between 4 and 51 days (median of 17 days) after the initial assessment to test the stability of their judgments. In assessments 1 and 2, 2 dimensions, familiarity and sweetness were investigated. Assessment 3 was conducted to verify the food preferences relating to the dimensions of sweetness and familiarity obtained in the first 2 assessments by changing the fruits used; raisins, lemons and kadota figs were added

and d'anjou pears were deleted. In assessment 4 the effects of repeated exposure to an item on the children's preference of the item were investigated.

The results from the 4 assessments (23) showed that children as young as 3 years old can provide reliable and consistent information on food preferences. The data indicated that familiarity and sweetness influenced the food preferences of young children. The 3 year olds were more influenced in their preferences by familiarity whereas the 4 year olds were more influenced by the dimension of sweetness.

Phillips and Kolasa (24) studied the vegetable preferences of 36 preschool children, their ability to report their preferences and the mothers' ability to state their children's vegetable preferences. A 3 point hedonic scale, like, OK or dislike, was used to rate 12 vegetables--beets, broccoli, cooked carrots, raw carrots, corn, cauliflower, green beans, raw green pepper, greens, lima beans, mashed potatoes and spinach. During interviews 1 and 4, children were asked to name the vegetables and point to the face on the hedonic scale which represented his/her feelings about eating the vegetable. Colored photographs of vegetables were used and children were asked to identify and rate the vegetables during interviews 2 and 5. During interview 3 the children tasted and rated the vegetables using the hedonic scale. The children were asked to taste 4 vegetables at a time on 3 separate days to avoid fatigue which might affect the results. Each mother was asked to rate on a hedonic scale her child's vegetable preferences. Demographic data, information concerning meal patterns and frequency of serving the selected vegetables were collected from each mother.

The children identified correctly and preferred familiar vegetables; i.e., those which had been served by their mothers and the day care center (table 3) (24). The children gave consistent ratings during the 5 different interviews. Over half the children preferred green beans, corn, raw carrots and mashed potatoes and disliked spinach, raw cauliflower and greens. The mothers were not able to report accurately the preference ratings of their children for the majority of the vegetables.

TABLE 3
Frequencies of service of test vegetables in the homes (24)

Vegetable	Percentage of Homes Where Vegetable Is Served (n = 34)		
	Frequently ^a	Occasionally ^b	Never
Corn	91%	9%	0%
Green beans	77	21	3
Mashed potatoes	73	24	3
Carrots, raw	65	35	0
Carrots	32	41	27
Broccoli	27	41	32
Green pepper, raw	21	47	32
Beets	21	38	41
Spinach	12	29	59
Lima beans	9	32	59
Cauliflower, raw	6	27	68
Greens	0	12	88

^aFrequently = served at least once each week

^bOccasionally = served three times each month or less

Food Likes and Dislikes

Dierks and Morse (5) interviewed mothers of 115 preschool children to determine their food preferences. Vegetables were disliked or not eaten at all by a large majority of the children. Fourteen children or 12% would not eat any vegetables. Meat was the food most frequently chosen by the children followed by fruits, sweets and cereal products.

Dudley et al. (25) designed a study to determine how the method of preparation influenced the attitudes of 55 nursery school children toward selected vegetables. They postulated that the choices and amounts of the vegetable consumed would indicate the children's attitudes toward each method of preparation. Four vegetables (asparagus, green beans, carrots and rutabagus) not well accepted by the children participating in the study, were served during 3 experimental periods (fall, winter and spring) 4 times during each season at the regular noon meal. The methods of preparation for green beans and asparagus were au gratin (creamed with a bread crumb topping), buttered whole, buttered pieces and creamed. Carrots and rutabagus were served as buttered julienne, buttered grated, creamed and raw sticks. Children received either 10 or 20 g weighed portions in a 3 oz cup and second servings were available. A record was made of method of preparation chosen by each child and the amount of vegetables consumed in grams.

The data (25) were analyzed to determine the children's attitude towards the various vegetable preparations. Creamed vegetables received the lowest score while the raw preparation was the preferred method for carrots and rutabagus. The highest preference for method of preparation of asparagus was au gratin; the preferred method for green beans was

battered cut. The child's familiarity with vegetables may have influenced the choices especially if he/she already had a favorite. There was variation in choices of vegetable preparation made by individual children. Certain children chose similar preparations consistently whereas other children sampled evenly among the different preparations. The data suggested that generalizations about children's preferences for different methods of preparation of vegetables should not be made.

Parental Influences on the Children's Food Preferences

Bryan and Lowenberg (26) investigated the influence of father's food preferences on 61 preschool children. Fathers were asked to indicate their preferences for 36 familiar foods by rating them as like (definite preference), accept (food was eaten whether liked or disliked) or refuse (food not eaten). The mothers used the same technique to indicate their child's preferences for those foods.

The fathers had a higher percentage of "like" ratings in all foods than their children (26). The fathers liked fruits and milk the best whereas children preferred milk and fats (butter and margarine). Vegetables were rated the lowest by children and fathers; breads and cereals also received low ratings by fathers. Children and fathers agreed on 9 of the 12 preferred foods: banana, milk, orange juice, butter, chicken, peach, pear, cheddar cheese and orange as determined by the frequency of "like" ratings. Eleven reasons were stated for the children's and fathers' food dislikes: taste, odor, texture, appearance, method of preparation, ease in eating, time required to eat a food,

frequency with which the food was offered, availability as a child, association of the food with its source or an event and difficulty in digesting a food. The majority of mothers (89%) stated they didn't serve certain foods or served them less often because their husbands didn't like them. The data indicated that the children's food preferences were not related to the fathers' pattern of eating or discipline.

Burt and Hertzler (27) studied 46 families to determine parental influence on the child's preferences for 32 different foods. During an interview each child was asked to select 1 of 3 facial hedonic responses to indicate "like," "dislike," "OK," or "don't know." Parent data were collected by a written questionnaire consisting of the same hedonic scale and questions related to family food preferences. The data showed that the mother did not influence her child's food preferences any more than the father did. Father's food likes had the most important influence on menu planning.

Birch (28) investigated children's food preferences in relation to those of their parents. The study involved 128 preschool children and their parents from the Child Development Laboratory at the University of Illinois. Four different sets of foods (vegetables, fruits, sandwiches and snack food) were evaluated. Each parent-child pair assessed the same set of foods. An interviewer showed each child 3 faces with different expressions denoting like, dislike or neutral. The child tasted each food item and placed it by the appropriate face. The child then rank ordered each item from the 3 different categories. The results were recorded by an observer. Some parents assessed the fruits and sandwiches by rank ordering the items using a similar procedure

followed by the children while other parents rank ordered their food preferences for vegetables and snack food on a questionnaire. Unrelated adults also assessed one set of foods using the rank order procedure. Unrelated adults were randomly paired with a child and preference orders of the pairs were correlated.

Food preferences (28) for parents and children were assessed and rank orders were correlated for mother-child pairs, father-child pairs and unrelated adult-child pairs. Few of the correlations were significant and unrelated adult-child pairs and parent-child pairs values were similar.

Social Influences on Children's Food Preferences

Birch (29) investigated peer influence on the food preferences of 69 preschool children aged 3 to 4 and 4 to 5 whether children would follow peer preferences when the peers were not present. Preferences for 9 vegetables--raw carrot slices, celery sticks, cooked green bean pieces, cooked kernel corn, cooked peas, cooked beets, cooked broccoli, raw cauliflower and raw mushroom slices--were obtained for each child. A tray with all the vegetables in 1 oz clear plastic cups was presented to the child who tasted each vegetable and placed it by the cartoon face representing the face he/she makes when eating specific vegetable--good, bad or OK. The child was asked to identify each vegetable and, if the child did not know the name of the vegetable, the interviewer supplied the correct name. All the vegetables were rank ordered by facial groups. One "target" child, who preferred vegetable A and did not prefer vegetable B, was seated with 3 or 4 peers who preferred

vegetable B. For 4 consecutive days over a 9 week period, the children were presented with the preferred and non-preferred vegetables at lunch time. There were 17 target children from both age groups. On day 1 of the experiment, target children selected the vegetable before the peers and on days 2, 3 and 4 after the peers. The children's consumption was measured in tablespoons and recorded. The children's food preferences were reassessed after the 9 week experimental period.

The target children's choices changed significantly between day 1 and 4 (29). The target children selected "non-preferred vegetables" more often than peers. All of the younger children and 3 of the 8 older children selected the non-preferred vegetable on day 4. The researcher concluded that the younger children were more influenced by peers than the older children. There were no sex differences in relation to choices made by the children. Consumption of the preferred food decreased over the 4 days. Most of the target children (71%) showed a significant increase in preferences for the original non-preferred food whereas the peer children did not increase their preferences for the original non-preferred food. The majority of the target children (82%) showed a significant decrease in preference for the original preferred food; there was no change in the peer children's preferences.

Birch et al. (30) studied the effects of 4 different social-affective contexts on 64 preschoolers' food preferences using a set of 8 snack foods--dry roasted peanuts, raw carrot slices, animal crackers, seedless raisins, dried apples, wheat thins, vanilla wafers and cheese goldfish crackers. The 4 social-affective context conditions were 1) as a reward, 2) noncontingently, paired with adult attention, 3) in a nonsocial context and 4) at snack time. Children's food preferences were assessed

using the procedure described above (29). Assessments were completed 4 times during the study, at the beginning of the study, after 4 weeks of presentations, after 6 weeks (at the completion of the presentations) and 6 weeks later. Each child received the same food throughout the study. The food presented was based on the initial food preference assessment. A neutral food, not strongly liked or disliked, was presented because a neutral food could either increase or decrease in preference. Children in the classroom were divided into 2 groups for each presentation, sweet food (vanilla wafer or animal crackers) or non-sweet food (peanuts or goldfish crackers). For conditions 1-3 listed above children were presented with food 2 times a day for 21 days over a 6 week period.

At snack time children selected from 7 different foods not offered during the presentations (30). All children's choices, amounts of food consumed and any relevant comments were recorded by an observer. Children were given a food reward by a teacher during free-play if they performed a specific behavior. The behaviors were as follows: 1) responding to a verbal request, 2) performing an activity adequately, 3) sustained attention to an activity and 4) cooperative play. The child was praised for performance and then offered a food which they could eat but not give to another child. An observer recorded the relationship between the teacher and child. Ninety-six percent of the children ate the food. During the noncontingent condition, each child was offered a snack food 2 times a day during free play. Once again they could eat the food but not give it to another child. The food was consumed immediately by 95% of the children. In the nonsocial condition, children were informed that they would find a snack in their locker 2

**THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH DIAGRAMS
THAT ARE CROOKED
COMPARED TO THE
REST OF THE
INFORMATION ON
THE PAGE.**

**THIS IS AS
RECEIVED FROM
CUSTOMER.**

times a day. Children did not see who placed the food in the locker. If the child did not eat the food it was removed. The children were told not to give the snack to another child. Eighty-six percent of the children consumed the snack food. In the last presentation, snack-time familiarity control conditions, the researchers studied the effect of repeated exposure on preferences for an initial neutral food during snack time. Children were grouped according to their snack preferences. The children chose their snack from the 8 snack foods.

Food preferences were enhanced in the reward and non-contingent conditions (figure 1) (30). There was no increase in preference for the non-social or snack time familiarity conditions. Formation of food preferences was influenced by the method of presentation. Presenting a food as a reward increased preference which was still evident 6 weeks after completion of the presentations. The same was true but to a

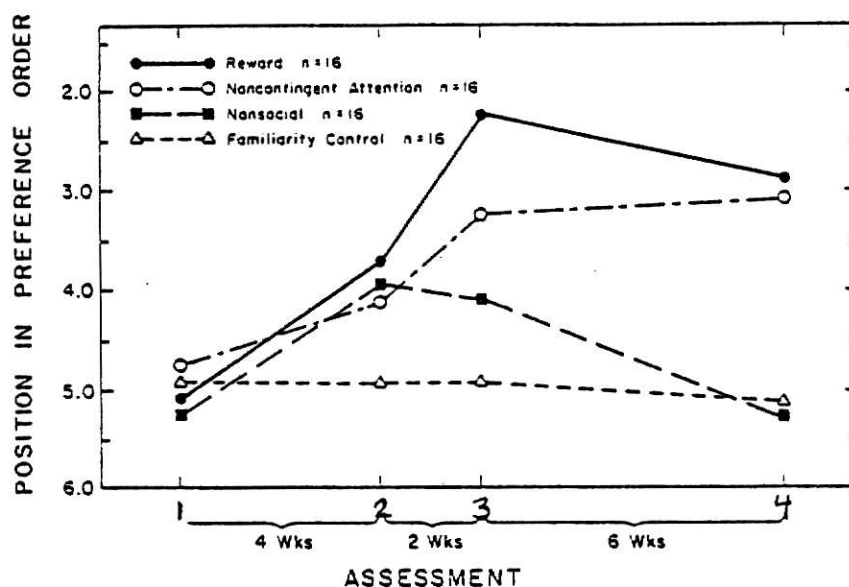


Fig. 1. Effect of presentation context on snack-food preference across successive assessments (30).

lesser extent with the non-contingent presentation. Preferences for both sweet and non-sweet foods were enhanced.

FOOD HABITS

Sanjur and Scoma (31) studied the eating patterns of 149 preschool children of low income Negro families in urban upstate New York and then related the children's eating patterns to family food patterns and other related factors. Analysis of family characteristics showed that 56% of the mothers were born in the South and the majority left the South after 22 years of age; one-third of the mothers were 25-29 years of age and two-thirds were in the 30 years or older group; 69% of the mothers had completed or attended high school. Employment status figures showed that 25% of the mothers in the sample were working full or part time. Mothers relied on information from past experience, mothers or relatives and food preferences of their children for making decisions related to food consumption. Printed material was used as a source of information least often.

A multi-dimensional code for describing and recording dietary patterns (31) was set up consisting of 4 sections: food consumption, food preference, food ideology and socio-cultural. One 24-hour recall for each mother and child provided food consumption data. The mother evaluated 50 food items according to the child's preferences--like, dislike, neutral and never tasted. The food ideology data was recorded as "agrees" or "disagrees" with questions relating to nutrition knowledge and beliefs. These questions were part of the food habit

study because of their effects on the decision making process in relation to food.

Mothers' and children's preferences in the various food groups were compared (31). There was a high association between mother and child preferences for milk and ice cream but not for cottage cheese or skim milk. There was an overall high agreement in the meat group and bread and cereal group whereas the fruit and vegetable groups showed a wide range of variation in food preferences. Mothers and children disliked similar foods but children had a greater number of food dislikes than their mothers. Foods which were unfamiliar to the mother were unfamiliar to the child. More children than mothers had complex diets. Food complexity referred to the diversity of the food items consumed. The fruit group was the only food group not present in the mothers' diet.

Food Attitudes

During the 1940's Baldwin (32) investigated relationships among children's eating habits, their home background and their social adjustment. Nutrition interviews were conducted with 76 mothers to obtain information on the eating habits of their preschool children. Each child was rated on 3 variables--appetite (the amount of food eaten, the consistency of his appetite, speed of eating and frequency of between meal eating), finicalness (likes and dislikes of specific foods, resistance to new foods, new methods of preparation and details of preparation) and table behavior (manners, distractibility, conversation at the table, dawdling and spilling). Appetite indicated the amount of

food eaten, finicalness measured emotional attitude toward types of foods and table behavior revealed conformity to socially accepted rules. Routine home visits were also part of the study so that home environment could be related to specific eating habits.

The majority of the children were rated unsatisfactorily for the 3 variables (32). Table behavior and appetite were highly related whereas finicalness was not related to either of the other variables. The homes of children with good appetites were characterized by strict discipline, approval and acceptance. The children from those homes were well adjusted, popular and tended to be leaders in the nursery school. The homes of children with good table behavior as well as good appetites were characterized as more strict and "less accepting." These children were not well adjusted in the nursery school setting and tended to be socially isolated and shy. There were no differences in social adjustment of children in the nursery school with high finicalness or low finicalness.

Metheny et al. (4) investigated food attitudes of 103 preschool children enrolled in day-care centers or nursery schools. Based on interviews with the mothers the children's attitudes toward food were categorized as: enjoys eating, attitude varies, indifferent, finicky or resistant. Fifty-five percent of the children were classified as enjoying their meals with a positive attitude towards food served at home and in the center, 24% had varied attitudes, 12% were indifferent, 6% were finicky about most foods and 3% were resistant toward food. Some children, who were problem eaters at home, had a more positive attitude toward food at school.

Food Consumption Patterns

Metheny et al. (4) studied mealtime patterns of 103 preschool children. Regular mealtime pattern was defined as meals served at the same time every day of the week, semi-regular referred to regular time during the weekdays, but not the weekend, and irregular to no time schedule. Regular mealtime pattern was maintained by 21% of the families, semi-regular by 40%, and irregular by 39%. Whole meals were missed by 24% of the children. Eight percent of the children missed breakfast, 6% missed dinner and 6% missed all meals during a 2-week period prior to the study. Illness, lack of appetite and lack of time were given as reasons for omitting meals. The time a child spent eating a meal was used as an indicator of the child's attitude toward food and mealtime. All but 3% of the children spent approximately 30 minutes eating breakfast, all but 8% of the children finished dinner in 45 minutes and all the children finished lunch in 45 minutes. The children's eating companions varied with 35% eating breakfast with the whole family, 19% with nursery school students, 16% with siblings and 14% with only 1 parent. Eight percent of the children ate dinner with the whole family and 9% with 1 parent.

Eppright et al. (33) investigated the eating behavior concerns of mothers of preschool children in a North Central Regional Study. The major concern of one-third of the mothers was the limited variety of food at mealtime. Mothers believed it was important to limit the amount of sweets eaten by their children, particularly for 2 to 3 year olds. Seventy-five percent of the mothers reported reluctance of their children to eat at mealtime up until 3 to 4 years of age.

Eppright et al. (34) also studied the type and frequency of meals as they related to nutrient and energy content of the diet. Twelve noon to 1:00 p.m. was the most frequently mentioned eating time followed by 6:00-7:00 p.m. and 8:00-9:00 a.m., although no times appeared typical for the various meals. From 1½ years to 5 years of age, approximately one-third of the meals were classified as snacks. Forty percent of the children ate meals with the family. Most of the children ate meals at home and 1.2% at day care centers or school. The majority of the children (71.2%) ate from 4 to 7 times daily; 4 to 5 times daily was the most common pattern for one-third of the children. There was a relationship between food energy intake and eating less than 4 times a day and 6 or more times a day. Children who ate less than 4 times a day had lower intakes of calcium, protein, ascorbic acid, iron and calories. Calories, calcium and ascorbic acid intakes were affected positively if the child ate more than 5 to 6 times daily.

Beyer and Morris (35) examined food likes and dislikes and snacking patterns of 44 children during their preschool years and again when they were enrolled in early elementary school. Interviews were conducted with the mothers to obtain a dietary history and 2 24-hour food intake records for each child during each time period. Analysis of the data showed that most mothers thought their child's diet was nutritionally adequate. The food group most frequently insufficient in the children's diet was vegetables. According to the mothers, the foods most disliked by their preschool children were cooked vegetables, liver and mixed dishes, a trend which continued into the elementary school years. During the preschool years, approximately 40% liked meat the best

whereas 50% of the elementary children chose meat as their favorite food. Snacks were consumed mainly at home after school.

Based on the 1968 RDAs, dietary intakes of both age groups of children were adequate (35). Preschool children consumed more food as snacks relative to the total day's intake than did elementary children (table 4). There was little difference in snack foods eaten by the 2 age groups. Preschool children consumed more soft drinks, popcorn and potato chips whereas elementary school children drank more milk and fruit juices. The food habits of preschool and elementary children in this study were similar. The researchers suggested that food habits established during the preschool years formed the foundation for dietary practices later in childhood.

TABLE 4
Mean percentage of calories and protein consumed
as meals and snacks (35)

	Preschool		Elementary school	
	meal	snack	meal	snack
calories	78.2	21.8	82.6	17.4
protein	87.8	12.2	90.6	9.4

Birch (36) studied the relationship between young children's food preferences and their food consumption patterns. Seventeen preschool children's preferences for a set of snack foods were assessed and consumption data were obtained at regular snack periods for 4 consecutive days. The snacks were 8 different small, open-faced sandwiches on whole wheat bread: margarine, margarine and mint jelly, peanut butter, peanut butter and grape jelly, cream cheese, cream cheese and honey, cream

cheese and caviar and cheddar cheese spread. Each child rank ordered the set of snack foods using the procedures described above. At snack time observers recorded the number and kind of sandwiches consumed by the individual children as well as plate waste. The preferred sandwich was consumed in larger amounts during snack time. Assessment of snack preferences before or after consumption did not affect the amount consumed. Preferences were influenced by familiarity for a great number of children, whereas sweetness was not an important dimension.

FACTORS RELATED TO FOOD HABITS OF PRESCHOOL CHILDREN

Food and Nutrition Knowledge of Mothers

Metheny et al. (4) interviewed 93 mothers to determine their knowledge of foods that should be included daily in the diets of their preschool children. Twenty-five percent of the mothers indicated that milk, meat, fruits, vegetables and cereals or breads should be eaten every day. Vegetables were listed by 89% of the mothers as being important in the daily diet, milk was listed by 63%, meat by 82%, fruit by 51%, cereals or bread by 50%, eggs by 42%, starchy foods by 32%, juices by 17% and butter or fats by 11%.

In the North Central Regional Study of preschool children (37), relationships among mothers' food and nutrition knowledge, socioeconomic factors and the nutritional quality of their children's diets were investigated. Each mother recorded her child's food intake for a 3 day period, and completed a food and nutrition knowledge test, which included questions concerning meal planning, food preparation, and

permissiveness in child feeding. Nutrition knowledge test scores of mothers living in large cities were lower than those of mothers residing in open country, rural places or small cities and towns. Attitudes toward nutrition and nutrition knowledge were related positively. Mothers with low nutrition knowledge scores had children with total nutrient intake in the lower 10%. Those mothers also tended to have the least favorable attitudes toward meal planning, food preparation and nutrition and a high degree of permissiveness in feeding their children. High degrees of permissiveness also were associated with high food energy intakes of children. Mothers of children in both the high and low groups for food energy intake had low nutrition knowledge scores. With the exception of fat, permissiveness affected negatively all dietary components.

Diet quality of preschool children (37) was more highly influenced by education of the mother than by income. Intakes of calcium, iron, thiamin, riboflavin and ascorbic acid of the children increased as the education of their mothers increased. Ascorbic acid, niacin, phosphorus, protein, riboflavin, calcium and calorie value of the food consumed was significantly related to the nutrition knowledge scores of the mothers.

Phillips et al. (38) studied the effect of food and nutrition knowledge of mothers on their use of presweetened cereals. Thirty mothers and their preschool children, attending a private nursery school in an urban area, were subjects for the study. The families were divided into 2 groups--those in which the preschool child was the oldest and those with preschool age and older children. During a personal interview with each mother, data were collected regarding her age, years of formal education and estimated family income. Each mother

completed a food and nutrition knowledge test and answered questions regarding her child's favorite presweetened cereals and the percentage of those cereals in his/her diet. The preschool children were interviewed twice at the nursery school and asked to rate and rank 6 dry breakfast cereals using a 5 point facial hedonic scale. The data were analyzed to determine relationships among mother's food and nutrition knowledge, mother's perception of her child's preference for presweetened cereals, family purchase of presweetened cereals and the child's actual preferences for presweetened cereals.

All the mothers were between 26 and 46 years of age, had completed high school and 97% had advanced education (38). Five of the 30 mothers were employed full time outside the home. Family incomes ranged from \$11,000 to \$30,000 or above. The 2 groups of mothers had similar characteristics, except for age. Their nutrition knowledge test scores did not differ significantly, but there were significant differences between the 2 groups in the application of knowledge to food behavior. In families where the preschooler was the oldest child in the family, the mother's food and nutrition knowledge was not related to food purchasing practices. In families with older children, percentages of presweetened cereals purchased was positively related to children's preferences. Food and nutrition knowledge was associated positively with use of presweetened cereals in families with preschool age and older children. Mothers with the highest scores purchased fewer presweetened cereals.

Influence of Television

Galst and White (39) investigated the impact of television (TV) commercials on the consumer behavior of 41 preschool children, aged 3 years 11 months to 5 years 11 months. The children viewed taped TV programs individually and pressed a button every 4 seconds to continue viewing the program. Following TV viewing mothers and children were observed during food shopping trip to determine "purchase-influencing attempts" (PIA). PIA was the child's attempt to influence purchasing by making a request, buying an item with personal money or responding to choices made by a parent. These requests were made by asking, pointing, putting it in the shopping basket or grabbing. A record was kept by an observer that indicated the total time spent in the store, number of PIA's, items child requested, location of the item, type of PIA, method of PIA and success of PIA (i.e., purchase of the item). Parents also supplied information on TV exposure at home. There was a significant positive relationship between the exposure to TV commercials and the number of PIA's at the supermarket. There was an average of 15 PIA's, 12 of which were independent and 3 were choices. Sixty-four percent of the PIA's were in front of a product display and 45% of the PIA's were successful. Older children attempted to influence more purchases in the store than younger children. There was a positive relationship between hours of commercial TV viewed at home and the number of PIA's. Cereals and candy, the most frequently advertised food items, were requested more often than meats, fruits, vegetables and dairy products (table 5).

Goldberg et al. (40) studied the use of TV for informing children about the nutritive value of foods. Eighty first graders, 5 to 6 years

TABLE 5
Purchase-influencing attempts (PIA's) classified by
product categories (39)

Product Category	N PIA's	% Total PIA's	% Successful
Grain products			
Cereal	50	8	48
Cookies	29	5	59
Cakes and mixes	20	3	25
Noodles, pasta and rice	16	2	62
Other	15	2	73
Total	130	21	52
Sugars and sweets			
Candy	37	6	27
Other	15	2	27
Total	52	8	27
Dairy products			
Ice cream	25	4	52
Yogurt	13	2	77
Cheese	11	2	64
Other	7	1	57
Total	56	9	61
Juices, beverages and mixes			
Fruit juices	19	3	63
Fruit drinks and mixes	18	3	50
Soda	10	2	40
Total	47	8	53
Vegetables	38	6	47
Fruits	38	6	53
Paper and plastic goods	38	6	34
Salty snacks			
Nuts	10	2	50
Other	19	3	21
Total	29	5	31
Gum	28	4	57
Meat, fish and poultry	27	4	56

TABLE 5 (continued)

Product Category	N PIA's	% Total PIA's	% Successful
Washing goods	27	4	22
Toys	22	4	14
Fats and oils	8	1	50
Miscellaneous food			
Soup	21	3	57
Pet food	13	2	46
Other	27	4	52
Total	61	10	52
Miscellaneous nonfood	15	2	7
Grand total	616	100	45

old, from 3 schools were divided into 5 experimental groups. The groups were:

1. sugared snack and breakfast food commercials (4.5 minutes exposure)
2. repetition of sugared snack and breakfast food commercials (9 minutes exposure)
3. pro-nutrition public service announcements (PSA) for more wholesome snack and breakfast foods (4.5 minutes exposure)
4. repetition of PSA's for more wholesome snack and breakfast foods (9 minutes exposure)
5. control group.

After viewing the TV show with a set of commercials, the children discussed their favorite TV show for 5 minutes. Children then expressed 3 preferences for a set of 6 different snacks representing 3 wholesome foods and 3 foods, advertised and unadvertised, that were lower in nutritive value and higher in glucose content. Children viewed a board (3' x 2') with pictures representing the various choices. The children saw a total of 4 boards representing snack foods and 2 boards representing breakfast foods. The children indicated their preferences by marking with an X the appropriate box on the questionnaire. Children also answered questions on the healthy or unhealthy nature of the various foods.

Results (40) showed that children from groups 3 and 4 who saw the pro-nutrition PSA and groups 1 and 2 who saw the commercials differed significantly in number of sugared foods selected, 8.7 and 12.58, respectively. The children in groups 1 and 2 selected more sugared foods than the control group; there was no significant differences among groups 3 and 4 and the control group. Longer exposure time to commercials increased the number of unadvertised sugared foods chosen

by group 2 as compared to the control group. The children made few errors in indicating healthy and unhealthy foods.

In the second part of the study, "Fat Albert," a pro-nutritional TV program was evaluated to determine its influence on children's preferences. The first graders were divided into 4 groups: 1) pro-nutritional TV program, 2) maximal pro-nutrition, pro-nutrition program plus PSA's, 3) reality conditions, pro-nutritional program plus commercials and 4) control group, not exposed to any program. Fewer sugared foods were chosen by all children in the 3 experimental groups who viewed the Fat Albert program compared to the control group. Children in group 3 who watched Fat Albert and commercials chose slightly more sugared products than children in groups 1 and 2 although the differences were not significant.

NUTRITION EDUCATION

Food Acceptance

Glaser (41) studied the influence of a food acceptance program in a nursery school on the children's food habits in later years. The mid-morning snack period provided opportunity for offering a variety of foods to the children. The goals of the food acceptance program which operated for several years were to: 1) encourage sampling and eating new and unfamiliar foods, 2) develop better acceptance of little-liked foods and 3) encourage selection of foods other than sweets as between-meal snacks. At the end of the food acceptance program, families who had children previously enrolled were contacted. There

were 111 children in the nursery school group and 114 children in the non-nursery school group. Parents and children answered the same questionnaire which listed 40 different foods from the food acceptance program. Data were collected on the following:

1. foods actively disliked by child when he/she was 2½ to 4 years of age
2. the child's present attitude to these foods
3. foods available as snacks in the home
4. child's preference for between-meal snacks
5. possible reason for selection of snack
6. (to the parents) parent's opinion as to the influence of the food acceptance program on food acceptances in the home.

Sixty-two percent of the parents believed the food acceptance program exerted some influence and 27% thought the program had much influence on the present food acceptances of their children. Non-nursery school children chose sweets as snacks more often than the former nursery school children. Parents' opinions as to the child's preferences were often different from the child's responses concerning their food preferences. Children indicated a higher acceptance of foods than the parent stated for the child.

Harrill et al. (42) studied the effect of food acceptance training on consumption of selected vegetables--beets, squash, Brussels sprouts and cauliflower--for 17 preschool children. Foods consumed by each child were weighed using a spring-type dietetic scale over a 4-day period and recorded. Caloric value and 8 nutrients were calculated from the recorded data using food composition tables. Amounts of test vegetables eaten before and after the food education program also were compared. The food education program consisted of a discussion period

and a dramatic exercise or game period. Vegetables were labeled and color, growth, texture, odor, shape, preparation and food value of each vegetable was discussed. The vegetable was served at the noon meal to provide immediate reinforcement. Mean daily intakes of nutrients from food eaten at the preschool were compared to the 1964 RDA. Mean daily intakes of protein, calcium, vitamin A, riboflavin, niacin and ascorbic acid exceeded one-third of the RDA. Mean iron, thiamin and caloric intakes were less than one-third of the recommendation. The amount of vegetables eaten as well as the number of children who ate a portion of the vegetable increased after each lesson (table 6). The 3 year olds increased consumption of vegetables more than the 4 year olds, even though the older children participated more in the discussion.

TABLE 6

Vegetables and amounts consumed by nineteen children before and after a food information program (42)

Vegetable	Before lesson				After lesson			
	Amt. served	Amt. consumed		Children who ate none	Amt. served	Amt. consumed		Children who ate none
		Mean	Range			Mean	Range	
	g	g	g		g	g	g	
Beets	15	5	0-16	7	14	9	0-22	2
Brussels sprouts	16	6	0-18	6	15	10	0-20	3
Cauliflower	15	9	0-28	4	13	10	6-22	0
Squash	11	6	0-12	5	13	7	0-22	3

Developing Positive Food Habits

Williams and Morse (43) evaluated the success and feasibility of teaching nutrition to 18 preschool children between 4 and 5 years of age enrolled at the Winooski, Vermont Day Care Center. A list of teaching objectives and a nutrition quiz to test knowledge were developed. Before the nutrition lessons began a record of food eaten and amount of food left on the plate was observed for each child on 2 consecutive days. The children were asked questions from the quiz by an interviewer who wrote down the exact answers. After the pretest, 12 lessons were presented. Plate records, food eaten and amount of food left on the plate were obtained on 2 consecutive days during the lessons and again a week after completion of the nutrition education program when the nutrition quiz was administered again.

There was an increase from 83 to 116 out of 144 in the number of correct answers on the nutrition quiz (43). The original plate records showed the children ate all the foods at the breakfast and lunch meals. However, the last plate record showed the children asked for 2 servings of various foods found in the meat group, fruit and vegetable group and bread and cereal group. Children were not encouraged during the nutrition education program to take second servings; although second servings were always available. Increases in the number of servings for the meat group and bread and cereal group were statistically significant. The children learned nutrition information quickly and applied this knowledge to the eating situation at the center.

Ireton and Guthrie (44) compared 2 methods, variation in method of preparation and behavior modification, to increase the vegetable

consumption of 19 preschool children enrolled in a nursery school. Mothers were interviewed and 5 unpopular or unfamiliar vegetables rich in vitamin A or ascorbic acid--asparagus, broccoli, cauliflower, spinach and squash--were chosen. The same basic menu was served each time a vegetable was tested. A 20 g portion of vegetable was served in a plastic cup and placed on the dinner plate with the other food items. The amount consumed by each child was recorded. In Phase 1, the preparation methods of the vegetables were varied. Each vegetable was served buttered, with a sauce or with the addition of another food item such as shredded cheese, ground beef, bread crumbs, applesauce or hard cooked egg. In Phase 2, buttered vegetables served in 10, 15 and 20 g portions were used in the behavior modification method (token reinforcement system). In Phase 2, children were awarded a token (gummed sticker) for each portion of the vegetable eaten and were praised verbally by the teacher for eating the vegetable. The children then could use the tokens to obtain another dessert rather than fruit. Results showed that variation in method of preparation in Phase 1 had no significant effect on vegetable intake. The behavior modification method had a positive effect on vegetable intake and frequency with which the child tasted cooked vegetables.

SUMMARY

Nutrient intakes of preschool children and factors affecting their dietary behavior were reviewed. Recent surveys showed that the nutrients most limiting in the diets of preschoolers were calcium, iron, magnesium and vitamin B₆.

Studies indicated that preschool children were capable of providing reliable and consistent information on their food likes and dislikes. Vegetables were the most disliked food although there was great variation in the choices of children. Parental influence was observed on the variety of foods consumed and on enjoyment and acceptance of food and indirectly, these affected nutritional status.

Snacks were an important part of food patterns of preschoolers. Proportionately more calories than protein were provided by snacks. Elementary children ate a smaller proportion of their total food intake as snacks than preschool children but the types of foods eaten as snacks by the 2 groups were similar.

A number of factors that are related to food habits of preschool children have been investigated. Mother's nutrition education scores were related significantly to intake of calories, calcium, phosphorus, riboflavin and niacin. Formal education of mothers and their food attitudes also influenced dietary status. The food preferences of preschool children and purchases in the supermarket were influenced strongly by television. Pro-nutrition programs were more effective than short commercials in influencing preferences.

Nutrition education in the nursery school was effective in developing positive food habits that continued in later years. In food acceptance programs children were encouraged to accept a variety of foods which positively affected the nutrient quality of their diets.

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DIETARY BEHAVIOR OF PRESCHOOL CHILDREN

by

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AN ABSTRACT OF A MASTER'S REPORT

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ABSTRACT

Nutrient intakes of preschool children and factors affecting their dietary behavior were reviewed. Recent surveys showed that the nutrients most limiting in the diets of preschoolers were calcium, iron, magnesium and vitamin B₆.

Studies indicated that preschool children were capable of providing reliable and consistent information on their food likes and dislikes. Vegetables were the most disliked food although there was great variation in the choices of children. Parental influence was observed on the variety of foods consumed and on enjoyment and acceptance of food and indirectly, these affected nutritional status.

Snacks were an important part of food patterns of preschoolers. Proportionately more calories than protein were provided by snacks. Elementary children ate a smaller proportion of their total food intake as snacks than preschool children but the types of foods eaten as snacks by the 2 groups were similar.

A number of factors that are related to food habits of preschool children have been investigated. Mother's nutrition education scores were related significantly to intake of calories, calcium, phosphorus, riboflavin and niacin. Formal education of mothers and their food attitudes also influenced dietary status. The food preferences of preschool children and purchases in the supermarket were influenced strongly by television. Pro-nutrition programs were more effective than short commercials in influencing preferences.

Nutrition education in the nursery school was effective in developing positive food habits that continued in later years. In food

acceptance programs children were encouraged to accept a variety of foods which positively affected the nutrient quality of their diets.