

NUTRITIONAL STATUS OF
PRESCHOOL CHILDREN OF INTERNATIONAL STUDENTS
LIVING IN THE JARDINE TERRACE APARTMENTS

by

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INTRODUCTION

During the past five years, the international student enrollment at Kansas State University has increased from 532 to 801. Many of the international students bring their spouses and children with them to the United States and reside in Jardine Terrace Apartments, which are a part of the KSU Student Housing Complex. Most of these student families have a limited income. Many of the wives do not speak English fluently and some have little or no formal education. The preschool children of those families appear to be well cared for by their parents but their nutritional status has not been evaluated.

The first objective of this study was to calculate the nutritional status of the preschool children of international students who live in the Jardine Terrace Apartments. The second objective was to investigate factors that might affect their nutritional status. The relationships of selected anthropometric measurements, dietary intake and two blood component values of the children were studied. In addition, the mothers were interviewed in regard to family characteristics early and current child feeding practices, nutritional knowledge, and attitudes toward nutrition, eating habits of their children, meal planning and meal preparation.

REVIEW OF LITERATURE

Evaluation of Nutritional Status

Adequate nutrition in the early years of life determines normal

development -- physically, mentally and emotionally -- in an individual. The potential physical growth of the child is predetermined by the genotypes of his parents, but physical growth also is affected by his nutritional status.

There are 4 common methods to evaluate the nutritional status of a population: 1) anthropometric measurements, 2) biochemical analyses, 3) dietary evaluations and 4) clinical examinations. For practical reasons, researchers prefer using 2 or more methods in one study. However, a complete picture of nutritional status should be based on all of those methods because of the diverse origin of nutritional deficiencies and the multiple ways in which deficiencies of various nutrients manifest themselves (1).

Anthropometric Measurements

Childhood is a period of active growth and a well-nourished child can be expected to have a growth pattern characterized by predictable increments in both weight and height. Therefore, physical growth is a readily available standard to assess nutritional status. In recent years many children have been achieving a higher rate of growth and reaching maturity at an earlier age than did those 30 years ago. This is a function not only of improved nutrition but also of good environmental factors and recent advances in medical science that have reduced many of the diseases that affected growth in the first years of life (2).

Anthropometry provides a quick and easy way to assess the individual's protein and calorie reserves. The measurements most commonly obtained are weight, height, triceps skinfold thickness and upper arm circumference. Other measurements that may be made include circumference of head, calf or

thigh, diameter of chest, hip or wrist and skinfold thickness at various sites on the body.

Height and Weight

For children, periodic determinations of height and weight are used to detect normal growth. Weight is the better measurement for short-term judgement of growth and development. However, it fluctuates with illness, especially with dehydration of acute diarrheal disease, and with dietary intake. Height is the preferred measurement for long term assessment of growth (3).

Infants usually increase their birth length by 50% in the first 12 months, double it by 4 years, and triple it by 13 years of age. The average birth length of 50 cm increases to 74 cm by 1 year of age, to 100 to 105 cm by 4 years and to 150 to 155 cm by 15 years. Acceleration of growth in adolescence occurs 2 years earlier in females than in males. After adolescence, growth continues but at a very slow rate until linear growth ceases and the epiphyses close (4).

Weight is the most commonly used somatic measurement for the assessment of nutritional status. Birth weight is related to prenatal environment. A few days after birth there is a weight reduction, but birth weight is usually regained by the tenth day. By 6 months of age, most infants have doubled their birth weight and by 1 year of age, have tripled it. The weight increment during the second year is slightly less than the birth weight (5). A slow but constant rate of weight gain averaging 2.0 kg/year during the first 5 years was reported by Vaughan et al (6). An average increment of 2.3 kg/year from 2 to 5 years was found by Pomerance (6).

Until 1975, the most commonly used growth standards for children

were the Stuart-Meredith growth curves (7) based on measurements of a limited number of white children in Iowa and Boston during the 1930s. In these standards, height for age, indicative of shortness or tallness, and weight for height, indicative of thinness or fatness are considered the most useful relationships. Consideration of weight for age is of limited usefulness (2).

In 1979 the National Center for Health Statistics (NCHS) published new percentile curves for assessing physical growth of children in the United States (8). The curves were based on accurate measurements made on large, nationally representative samples of children. Those curves show the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles for height for age, weight for age, weight for height and head circumference for both sexes. Interpretation of data plotted against NCHS percentiles follows traditional precepts. Measurements between the 25th and 75th percentiles are likely to represent normal growth. Measurements between the 10th and 25th, and 75th and 90th percentiles may or may not be normal, depending on the pattern of earlier and later measurements.

A simple classification of nutritional status in preschoolers was proposed by McLaren and Read (10), using height, weight and age. They observed that at each age a certain amount of weight (in gm) is related with a certain amount of weight (in cm). Compared to percentages of the Boston standards (12) they classified children as overweight (obesity) -- 110% of standard; within the normal range -- 90-110%; underweight (mild protein-calorie malnutrition (PCM) -- 85-90%; moderate PCM -- 75-85% and severe PCM -- 75% which was divided into two categories, marasmus (no edema) and kwashiorkor (with edema).

Arm Circumference

Jelliffe and Jelliffe (26) proposed that arm circumference measurements (AC) should be used as an indicator of growth. They have the advantage of being potentially easier, more rapid, and less expensive to obtain than height and weight. In developing countries, the Quaker Arm Circumference (QUAC) stick (27) has been useful in identifying undernourished children in whom there is normally little change in AC with age. AC measurements below 14.6 cm are considered indicative of malnutrition (2).

There are differences of opinion in regard to the value of the AC measurement in nutritional assessment. Zerfas (28) reported that an AC measurement has as much value as height, weight and skinfold thickness in assessment. However, Rao and Singh (29) said that AC is not an adequate indicator of nutritional status. Blackburn et al. (30) reported that AC allows a simple, but accurate measure of detecting the skeletal muscle depot which reflects protein-calorie status.

Frisancho (31) reported percentiles for AC and skinfold thickness based on a cross-sectional sample of 12,396 white subjects aged 0 to 44 years from the United States Ten-State Nutrition Survey of 1968-1970. Between the ages of 1 and 5 years, AC increases approximately 11% in girls and 15% in boys.

Skinfold Thickness

Measurements of the triceps skinfold thickness have been used frequently in surveys as a measure of nutritional status. They are indirect estimates of body fatness or calorie stores and they correlate well with other measures of body fat (36). There is wide agreement that the triceps (back of the upper arm) site is the best of those that have

been used. Universally, the triceps site is accessible in both males and females. Also in PCM, the triceps site usually is not edematous. However, the measurement of subcutaneous fat may not be a real indicator of nutritional status and growth for groups characterized by a low degree of fatness (31).

Skinfold calipers that exert a specific pressure on a determinate area of skinfold have been developed to measure the thickness of a skinfold in various parts of the body as an indication of the amount of subcutaneous fat (37). Garn and Clark (38) reported that a yearly decrease of fat content of the body is evident during childhood. The triceps skinfold thickness (TST) of children decreases for boys; thereafter a slight increase is apparent in older children. The preschool fatness loss in the male is one of the aspects of changing levels of fatness in the life cycle.

Standards for TST have been published by Frisancho (31). These percentiles were derived from data on all white subjects in the United States Ten-State Nutritional Survey of 1968-1970. He found that while triceps skinfold measurements were not a good indicator of nutritional status for specific cases, they were useful for general classification of populations.

Thigh Circumference

Another anthropometric measurement to assess nutritional status is thigh circumference (TC). This measurement differs from other anthropometric measurements in that a single standard appears applicable for boys and girls. TC has proved slightly more consistent in identifying malnutrition in infants and preschoolers than mid-upper arm circumference.

TC remains unvariable between 1-2 years, during which period the mean thigh skinfold decreases by a couple of mm (40). This decrease suggests that the thigh serves as a storage depot of fat which is used for energy during a period of poor appetite and relatively high energy expenditure when the preschool child is beginning to walk.

Standards for TC were published by Zeitlin in 1979 (40). To calculate those standards, a sample of 1080 economically favored newborn infants and preschoolers to 5½ years of age from the New Haven and Boston area were measured. Tests for sex differences and of the usefulness of TC for identifying poor nutrition were studied by using measurements from Filipino children of low income classes.

Use of Anthropometric Measurements in Surveys

Anthropometric measurements have been used in a number of surveys to evaluate nutritional status. A few recent studies in the U.S. and in some of the native countries of the children in the present study will be reviewed.

U.S. In 1975, a nutritional study in the twelve North Central states was conducted by Fryer et al (11). Height and weight measurements were evaluated on a sample of 3,444 infants and preschoolers (1,828 males and 1,616 females). During the first year there were rapid increases in height and weight in all the children, followed by much slower, but essentially linear increases to 6 years. Means for height and weight for children in the North Central states were slightly lower than those of Ohio children (13) but only small differences were observed from those of Colorado preschoolers (14).

Smith and Brown (15) conducted anthropometry on a sample consisting of 281 2- and 3-year old children from low and middle income families in the city of Honolulu, Hawaii. There were 61 Japanese, 118 Hawaiian and 86 other (pure Filipinos, Chinese, Koreans and Puerto Ricans) children. Height, weight and skinfold thickness were measured. Males were heavier and taller than females of the same age. No significant anthropometric differences were observed between low and middle income groups. No statistically significant differences in skinfold thickness were observed between age categories, low and middle income groups, or ethnic groups. On the basis of weight for height classifications and skinfold standards (16) approximately three-fourths of the Honolulu children appeared to be normal, whereas 10-20% might be considered lean and another 10% might be considered fat.

Standal and Tianga (17) found in their study of Hawaiian preschoolers that no significant differences occurred in mean values of arm size, muscularity, triceps skinfold and fat area between the test group and two mainland US populations.

Alaska. Baker (3) found that 1 to 3 year old Eskimo children were somewhat shorter in stature than American whites but his data did not indicate that this shorter stature was related to a nutritional deficiency.

Colombia Surveys. Ariza et al (18) performed a cross sectional study of growth of Colombian preschool children from two socioeconomic classes during the first six years of life. Height and weight of 1,283 preschool children of both sexes from the lowest socioeconomic class and 1,213 from the upper socioeconomic class of Bogata, Colombia were studied. There were well

marked environmental differences but no ethnic differences between the two classes. The mean body weight and height for boys were higher than for girls for both socioeconomic levels. These differences were larger at the end of the 72 months of age than at earlier ages. Comparisons were made with the standards (19) for U.S. preschool males and females for both socioeconomic classes. Marked differences were observed at birth among the six groups. However, preschool children of both sexes from the upper class had similar growth curves to North American children during their first twelve months of life; thereafter, their growth curves fell slightly below the American standards. The growth achievement for Colombian boys and girls from the low economic class fell below the American and Colombian upper economic levels from birth onwards. The retardation in height and weight observed in the Colombian preschoolers suggested the action of environmental aggressions which might include infections and poor nutrition.

Anthropometric measurements of 138 preschool children from poor families in Bogota, Colombia were made by Gwynn and Sanjur (20). The children, aged 10 to 59 months, were apparently healthy and were not participating in a supplementary feeding program. Of the four anthropometric measurements studied, body weight for age was the most affected by malnutrition, then body weight for height, height for age, and head circumference. The closest relationship was between body weight for age and height for age. There was little relationship between body weight for height and either height for age or head circumference. Sex, but not age, was related significantly with the 4 measurements in the age range studied.

Guatemala. Martorrel et al (21) studied the relationship between

consumption of a protein-calorie supplement and physical growth of 453 rural Guatemalan children studied from birth to 3 years old. Greater supplement intake was clearly related to better growth in supine length, weight, head circumference and arm length. No relationship was observed with growth and arm and calf circumferences. Skinfolds (triceps, subscapular, and medial calf), on the other hand, decreased when supplementation was increased. They concluded that simple and well-known measures such as weight and height should be useful in evaluating public health programs, but that arm circumference was not appropriate for evaluating long-term growth.

Mortorrel et al (32) compared the growth in arm muscle circumference and arm fat area of preschool children from rural Guatemala to that of a standard from the U.S.A. (31). Although the Guatemalan children had reduced arm muscle and fat areas, the relative reduction in arm fat area was greater than in arm muscle area. Also, the upper arm cross-sectional area of Guatemalan children had proportionately more muscle than fat when compared to that of U.S.A. children. Finally, for the same body weight, Guatemalan children had a similar arm muscle area but a clearly smaller arm fat area than the U.S.A. children. It was evident that the main problem was energy rather than protein in the Guatemalan children.

Mexico. Briley et al (22) studied 90 preschoolers (42 boys and 48 girls) living in Juarez, Mexico (a border town of the United States and Mexico). They reported that about 50% of the Juarez children fell below the 50th percentile reported by the National Center of Health Statistics (NCHS) for height and weight (9). Approximately 76% of the boys and 55% of the girls were classified as thin, malnourished, or very malnourished

when plotted on Institute of Nutrition of Central America and Panama (INCAP -growth charts. Findings suggested that poor physical growth and development due to low intakes of essential nutrients, were present in many children in Mexican cities bordering the United States.

Costa Rica. Valverde and Rawson (23) conducted a nutritional survey of children of the central and peripheral areas of San Ramon, Costa Rica. They found that there were differences between the central area and the villages in the intake of selected nutrients and in height and weight of the children. There was primary energy deficiency in the peripheral areas. Anthropometric results indicated that there were nutritional problems in the villages, but in the center of the town 87% of the children had adequate height for age.

Nigeria. Lowenstein and Phillips (33) assessed nutritional status of 200 children from Owerri, Nigeria following the Nigerian Civil War. The children were divided into two groups, 100 from the war front line and another 100 from the war back line. No significant difference was found in skinfold thickness between those children at the front and those back of the line. There was severe malnutrition in the Owerri population. Most children had an upper arm circumference below 80 mm. The relative paucity of edema was never fully explained, but it may reflect a greater proportion of calorie than protein deprivation and also may have contributed to lower edema rates.

Tunisia. Arm circumferences of children in five different socioeconomic groups in Tunisia were reported by Young (34). There was a perfect correlation of rank between larger arm circumferences and upper socio-

economic status.

Haiti. Beghin (35) studied 128 Haitian children ages 1 to 3 years divided into four classes of ascending nutritional status as judged by the Gomez weight classification. He reported that there was a perfect correlation between socioeconomic status and arm circumference.

Beghin et al (24) studied the prevalence of weight deficit among 7129 children aged 0 to 4 years in the Cap Bon area of Tunisia over a two year period. According to international weight standards, 14% of those children were less than 75% of the weight-for-age standards.

Dominican Republic. Ethnic differences in skinfold thickness were studied by Robson et al (39). The sample consisted of 1,389 infants and children between 1 month and 11 years of age from the Dominican Republic. Of these, 630 were boys and 759, girls. They were divided into two groups, African ancestry and Caucasian. With a few random exceptions, there were no differences in the skinfold thickness at each site measured in Dominican boys and girls. Furthermore, there was no significant difference between the subscapular thickness of children of African and Caucasian ancestry.

New Guinea. Malgon (25) observed some of the lowest length, weight and skinfold thickness values ever recorded among Asay Valley toddlers and infants in New Guinea. Significant differences in weight between sexes indicated that the males were affected more than the females.

Dietary Evaluation

The analysis of food intake is useful in providing evidence of

nutritive intake that may be suggestive of deficiencies. It can help to identify individuals or groups in need of further study. Low dietary intake of a specific nutrient is found in conjunction with clinical and biochemical signs of a deficiency. Dietary data serve to confirm diagnosis of deficiencies and provide a basis on which to build a dietary treatment (2). Evaluations of dietary intake are carried out in several ways each with advantages and disadvantages (2). Generally, they can be categorized as indirect and direct..

Indirect Methods

The national food balance sheet is the most common of the indirect methods. It is used to obtain a measure of the kinds and amounts of food and hence of nutrients available to a country. The vital statistics of a country is another indirect way to assess nutrient intake.

Direct Methods

Direct methods involve collection of food records or recalls of a family or an individual of nutrient intake over a specific period of time.

The food inventory is a direct method which may be used in an institution such as a family which eats from a common kitchen. The food consumed for the whole group is calculated and adjustments are made for food eaten away from home. Forgetting food given to pets or spoiled is likely.

Individual food intake records are another direct method. A 24-hour recall may be obtained from a subject by a trained interviewer who asks him to describe the amounts of food consumed in main meals and snacks during

the day. Water, tea and coffee are not included because of their poor nutritive values. A 24-hour dietary recall of food eaten by preschool children was used by Valverde et al (41) and by Chandrapanond et al (42) in rural Guatemala and in Nakorn, Thailand, respectively.

Some researchers believe that food intake records for three weekdays provides a more accurate picture than a one day record. This method gives useful information within a period of time in which one could expect to maintain the cooperation of subjects. However, Martorell et al (21) used both the one-day and the three-day recall methods to explore whether a longer recall span would yield more information than the one-day method. Analysis showed that both had similar reliabilities.

Fryer et al (43) used three-day food records to evaluate the diets of preschool children in the North Central Region of the United States. Intake patterns during the first five years of life were similar to those of Denver children in 1940-1950 (44), but intakes were somewhat higher in the North Central Region for protein and carbohydrate and more for males than females. The difference could reflect a more recent tendency to overfeed preschool children but intakes of North Central children also were higher than those reported for one-to six-year-old Mississippi children by Owen et al (45) in 1969.

Calorie and protein intakes of 286 preschool age children in low income families in Tehran were evaluated by the use of 3-day food records (46). Thirty seven percent of the children received adequate calories and protein. Of the remaining children, 63% were deficient in calories but only 15% were deficient in protein. Dierks and Morse (47) used the 3-day food record to study the food habits and nutrient intakes of preschool children living in a married student housing project at the University of

Minnesota. Relatively few of the children had intakes of individual nutrients which were under 50 percent of the recommended allowances, and the distribution of these lower intakes tended to be sporadic.

Dietary intake for a three-day period was used by Brown et al (48) in a nutritional survey of preschool children in Honolulu. Mean intakes of calcium, riboflavin, and ascorbic acid were significantly higher for middle-income children than those of low-income families.

Dietary Standards

The Recommended Dietary Allowance (RDA) prepared by the Food and Nutrition Board of the National Research Council (49) are the most commonly used dietary standard in the United States. The RDA were first published in 1943 to provide standards serving as a goal for good nutrition. Since 1943, the allowances has been revised at approximately 5-year intervals, as additional data have become available. These standards were established as the result of careful evaluation of evidence of nutritional needs for various nutrients by various population groups and of an evaluation of figures on agricultural productivity, imports and exports to determine the availability of nutrients in the food supply. These standards do not represent minimum requirements, and any failure to consume the recommended amounts must not necessarily be interpreted as evidence of dietary deficiencies.

Use of Dietary Evaluation in Surveys

United States. The diets of 3,444 preschoolers in the North Central Region of the United States were studied by Fryer et al (43). They reported that calorie intake increased rapidly to 18-24 months, then slowly and

steadily to 60-72 months. Intake of calories was more highly correlated with carbohydrate, protein and fat intakes than with the other eight nutrients (Ca, P, Fe, vitamins A and C, thiamin, riboflavin and niacin). During the first 18 months, mean protein intakes of preschoolers increased from 3.4 and 3.9 to 4.9 and 5.4 gm per kilogram and then decreased to 3.9 and 3.6 gm. per kilogram by six years for males and females, respectively. Females had lower intakes of calories and all three major nutrients than did males in comparable age groups. The nutrient intake patterns during the first 60 months of life were similar to those of Denver children (14) and higher than those of Mississippi preschoolers (45). Family income was not significantly related to intake of nutrients by the preschool children.

Ruffin et al (50) conducted a nutritional survey in Marin County, California. They reported that preschool children had deficiencies of some nutrients such as iron, folacin, and vitamin A, C and B₁₂. Owen et al (45) reported a link between Mississippi preschool children from low income homes and nutritional deficiencies, especially notable were the low calcium, iron and ascorbic acid levels. A higher risk rate nutritionally for poor families in comparison with the rest of the population was observed.

Brown et al (48) evaluated the nutritional status of 281 preschool children of low- and middle-income groups in Honolulu, by biochemical, clinical and dietary methods. They found that the children of the low income families were more likely to have inadequate intakes of ascorbic acid, calcium and vitamin A. Calorie intakes were low for both income groups, and about one-fourth of the preschoolers of the sample consumed

diets that were inadequate in iron.

Bilderback (51) reported that overall dietary adequacy was significantly correlated with height, weight, pelvic girdle and shoulder girdle of 3-6 year old boys. However, it was not significantly correlated with any of the anthropometric evaluations of girls of the same age.

Panama. Florez (52) collected 3-day dietary records for 42 families and 82 preschool children from 1 to 5 years old from rural areas of Panama. The families were divided into 3 groups according to socioeconomic status. He reported that rice, meat, fruit and tubers were the main food consumed. Preschool children's diets were deficient in calcium, iron, riboflavin and energy. About one-third of the families consumed diets which were deficient in all nutrients. Twenty percent of the children consumed 60% or less of their energy requirements.

Mexico. In 1978 Williams and coworkers (53) conducted a nutritional study of 98 preschool children in Juarez, Mexico. Dietary evaluations showed a majority of the families existed on starchy vegetables, cooked dry beans and tortillas. Intakes of a number of nutrients were considered below the RDA's and INCAP standards. Approximately one-half of the children failed to meet the established RDA and INCAP criteria for calcium and vitamin A. Consumptions of protein and thiamin were usually adequate. Although more than 50% of the children did not consume recommended amounts of preformed niacin, the protein in their diet, which was generally adequate, provided some tryptophan for conversion to niacin. This survey indicated a need to increase the intake of foods supplying vitamin A, vitamin C, iron, calcium and riboflavin by these children.

Guatemala. Valverde et al (41) measured the short term dietary impact of a high energy supplementation program in rural Guatemala. They gave 2 cookies containing 4 g of protein and 250 calories daily for 4 weeks to every family member in a small Guatemalan village. The energy supplement did not modify protein intakes nor did it alter the consumption of specific foods.

A sample of 113 preschool children from a Guatemalan village were studied by Caliendo et al (54). Step-wise regression indicated that dietary intake was significant in predicting the weight of the child, but not height or hematocrit.

Nigeria. Incidence of protein-calorie malnutrition was high in preschoolers surveyed by Tomkins et al (55) in Nigeria. Gastroenteritis was common among those children.

Japan. Yamakawa et al (56) conducted a nutritional study of preschool children in central and rural areas of Tokyo, Japan. Rural children were shorter, lighter, about the same width per unit height and had less subcutaneous fat than urban children. Rural children consumed less animal protein, vitamin A and ascorbic acid than the urban children.

Iran. Ghassemi et al (46) assessed calorie and protein intakes of a group of preschoolers in Tehran. They reported that 37% of the children received adequate calories and protein; the remaining children (63%) were deficient in calories and 15% in protein. Deficiency of calories was strongly associated with protein deficiency. The major constraint in the diets of these preschoolers was calories and not protein. This is contrary

to the prevailing opinion that protein is the greater limiting factor in the diets of children and is responsible for widespread growth retardation and malnutrition in young children in developing countries.

Biochemical Analyses

One or more biochemical analyses are useful indicators of early change in nutritional state; they support growth progression as judged by anthropometric measures. Tests are commonly done on blood and urine samples, which are easily obtained and presumably reflect the biochemistry of cells, tissues and organs.

Blood Analysis

Blood analysis is an indicative measurement of nutritional status because blood is the body's principal medium of transport (1). Two blood tests which are performed commonly are the hemoglobin determination and hematocrit. An abnormally low concentration of hemoglobin, an iron-containing protein in the red blood cells, indicates anemia, most often caused by a lack of the iron needed for hemoglobin synthesis (57).

In 1963, the ICNND (58) published standards for hemoglobin and hematocrit. The following hemoglobin levels were given for 3-12-year-old children: deficiency, less than 10.0 gm/100 ml; low, for 10.0-10.9 gm/100 ml; and high, greater than 12.5 g/100 ml. The following hematocrit levels were given for 3-12-year-old children: deficiency, less than 30%; low, from 30.0-33.9%; acceptable, from 34.0-36.9%; and high, greater than 37%.

There is a relationship between blood concentration of certain nutrients and the dietary intake. The determination of hemoglobin level is one of the most widely used biochemical analysis in the assessment of

nutritional status. Dietary protein and iron are expected to have a positive relationship with hemoglobin.

Urinary Analyses. Tests on urine include qualitative tests for protein, glucose and ketones. Quantitative studies are sometimes made on a 24-hour collection of urine. A saturation or load test determines the uptake by the tissues of a nutrient when it is given in a large dose. A tryptophan load test is a measure of the body's ability to metabolize the amino acid (62).

United States. Iron deficiency anemia is a significant public health problem among young children (59). In a nutritional study conducted by Sims and Mirris (64) in Lansing, Michigan, of preschoolers, finger-prick blood samples were drawn by a registered medical technologist. Hemoglobin was measured by the cyanmethemoglobin method and hematocrit by microcentrifugation. They reported that evaluation of blood components and the various anthropometric measurements revealed no evidence of gross malnutrition. All but two children had either acceptable or high levels of hemoglobin and hematocrit. Sims et al (65) reported that hemoglobin and hematocrit measures are an indication of the presence of anemia.

Clinical evidence of anemia was detected in 15% of 585 Mississippi preschool children (45). Those children had hemoglobin concentrations below 10 g/100 ml. Nearly 23% of children between 1 and 3 years old in low income families studied in New York City had hemoglobin levels below 10 g/100 ml (60).

Korea. A nutritional study of 473 preschool children in Korea was done by

Choung et al (61). They reported that the mean hemoglobin value was 11.3 ± 0.94 g/100 ml. Sixty eight percent of the children were anemic, with hemoglobin under 11 g/100 ml at 5 years or younger or 12 g when older. The mean hematocrit was 36.1 ± 2.36 . Incidence of anemia was considered high, and it was generally hypochromic.

Clinical Examination

A clinical assessment of an individual's nutritional status indicates the level of health in relation to food consumption (63). The clinical examination is usually made by a physician, although sometimes it may be made by a nurse practitioner or nutritionist (1). The hair, eyes, mouth, mucous membranes, tongue, teeth, thyroid, skin, skeleton, tendon reflexes, and neuromuscular excitability provide clues to the presence or absence of nutrition defects (62).

One disadvantage of this method is that the observations are made by human beings whose judgements are subjective. One physician may consider a thyroid gland definitely enlarged, but another considers the same gland within normal limits. Another disadvantage is that clinically detectable signs of malnutrition are nonspecific. Rough, dry skin is not necessarily the result of vitamin A deficiency; it also can be caused by exposure to weather (57).

PROCEDURES

Selection of Participants

In the early spring of 1981, a list of the international students who lived in Jardine Terrace Apartments (Fig. 1) was obtained from the

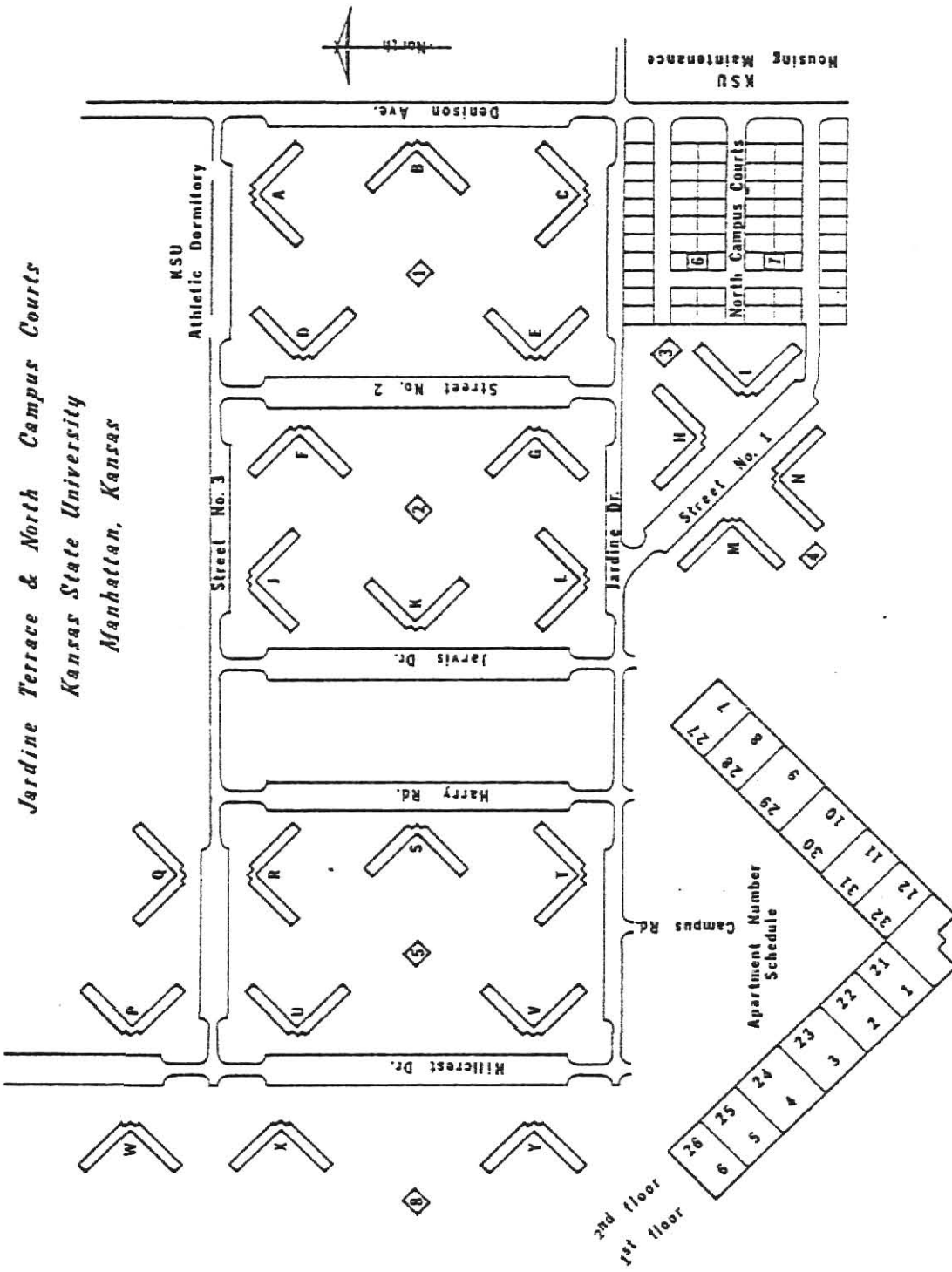


Figure I. Jardine Terrace Apartments Complex.

International Student Center at Kansas State University. The approximate number of preschool children of those students was determined by going "door to door" to the addresses listed. Because there were only about 50 international families with preschool children living in the housing complex, the decision was made to study one child from each family.

Copies of the research proposal were submitted for approval to the mayors of Jardine Terrace Apartments at their June 3 meeting. The minutes of this meeting, which indicated that the project had been approved, were circulated to all residents of the complex. Then, each family that was thought to have a preschool child was called by phone to ascertain if it did actually include a 2- to 5-year-old child. Since some families had moved to the complex after the spring list was made, additional eligible children were located by "word of mouth" as interviews were being conducted.

The research proposal also was reviewed and found to conform to University Policy and U.S. Department of Health and Human Services Regulations by the College of Home Economics Subcommittee on Research Involving Human Subjects on June 2.

The mothers of the preschool children were contacted in their homes by one of two interviewers so that the nature and purpose of the study could be explained. If there were 2 or more preschool children in a family, random sampling was used to select the one child per family to be studied. The mothers were asked to sign a consent form (Appendix A) if they were willing to participate in the study. If they consented, the interviewer asked them to answer the questions in the interview schedule or make an appointment to return to complete the questionnaire.

Interview Schedule

The interview schedule (Appendix A) was a modification of one developed for the North Central Regional Survey of Diets of Preschool Children conducted in 1965 (11, 43). The first section included information pertaining to the characteristics of the family, sources of nutrition information and food purchasing practices of the mother, current and early feeding practices for the child, and health and physical status of the child. The second section consisted of forms to record the food eaten by the child for 3 days. The third section consisted of tests of the mother's nutritional knowledge and her attitudes toward nutrition and eating habits of her child.

The Interview

Interviews were begun on June 12 and continued through July 15, 1981. Of the 50 mothers asked to participate in the study, three refused. In a few cases, the mothers did not speak fluent English so the fathers answered the questions about family background and also helped the mothers to record the food intake of the child. In such cases, it was not possible to administer the tests to the mothers or to complete the information on early and current feeding practices. In a few cases, it was not possible to get any food records because of the language problem. Completion of the total interview schedule usually took two visits by the interviewer -- one visit to complete the information in the first section of the questionnaire and to explain how the food record was to be kept and a second visit to administer the tests to the mother.

The mother was given instructions about keeping the food records and

the first day's record was started by recalling what the child had already eaten that day. The interviewer then made another visit on the second day to check records and answer questions. The completed records were collected at the end of the 3-day period. In two cases, the mothers consented to keeping a record for only one day instead of three days.

Analysis of Dietary Intake

The data base of the DIETCHECK package developed at the University of Nebraska Extension Service was used for nutrient input data for a program developed to convert food intake data into nutrient values by meals. The data base for DIETCHECK was adopted from the U.S.D.A. nutrient data set (66). The U.S.D.A. food data included ten nutrients and calories; data on eight additional nutrients had been added, as well as a number of food items (67). The code and amount eaten for all foods reported as eaten by the preschoolers during the 3-day food record period were marked on the recall form and then transferred to computer cards. Because food composition data were incomplete for saturated, oleic, and linoleic fatty acids, panthothenic acid, vitamin B₁₂, folic acid and vitamin E, those nutrients were not reported.

The meal at which foods were consumed was coded as: breakfast; lunch; dinner; a.m., p.m. or evening snacks. Vitamin and/or mineral supplements were coded as a seventh meal to permit analysis of nutrient intake by meal and for the total day with or without nutrient supplements. "Where eaten" and "with whom" were recorded for each meal. Mean daily energy and nutrient intakes were computed for each child and compared with the NRC/RDA (49).

Anthropometric Measurements

Appointments were made with the mothers to bring their children to be measured on one of the following dates: July 7, 9, 10, or July 18. Measuring instruments were transported on each of these days to one of four centrally-located laundry units at the housing complex. One investigator performed all the measurements of weight, midarm circumference and triceps skinfold thickness; another measured height and thigh circumference.

Height. A 100 cm metric rule was used to calibrate the portable height apparatus¹ shown in Fig. II. The child stood with heels and back in contact with the back of the board, without shoes, and looked directly forward with arms down at side. Reading was taken to the nearest tenth of a centimeter while the right angle board was resting against the child's head.

Weight. The weight of the child was calculated using a portable bench type scale² shown in Figure III. The capacity of the scale was 300 pounds with graduations of one ounce. The scale was calibrated to comply with requirements of the National Bureau of Standards. Three 25-pound weights, certified by the Kansas State Department of weights and measures were used for checking accuracy of the scale. The children were weighed in light-weight summer clothes with shoes removed. Reading was taken to the nearest ounce and data recorded.

¹ Clarence E. Lind, Architect, A.I.A., Omaha, Nebraska.

² Accu-Weigh Model 30QT, Metro Equipment Corporation, Sunnyvale, California.

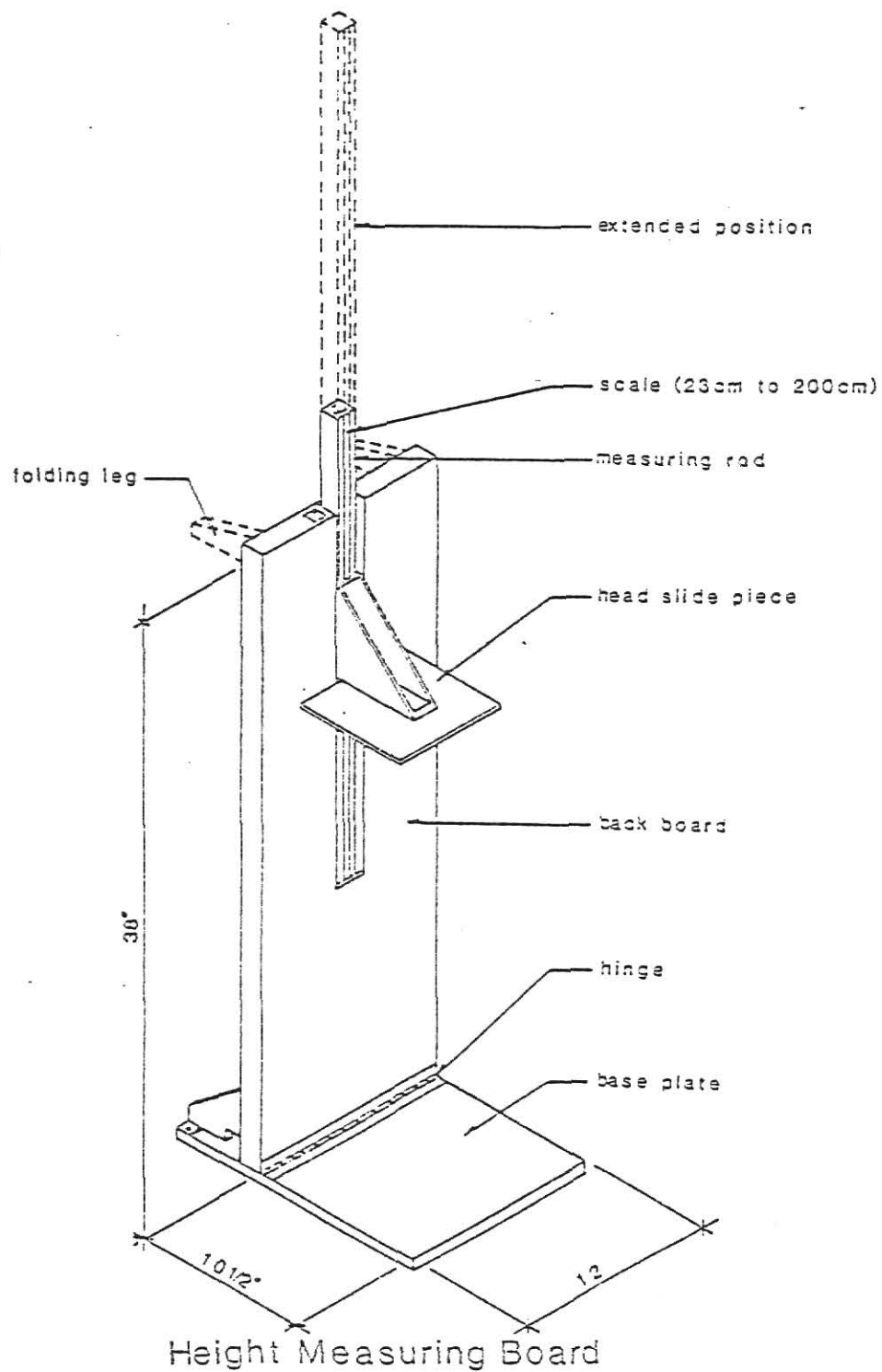


Figure II. Apparatus for measuring height of Jardine preschool children.

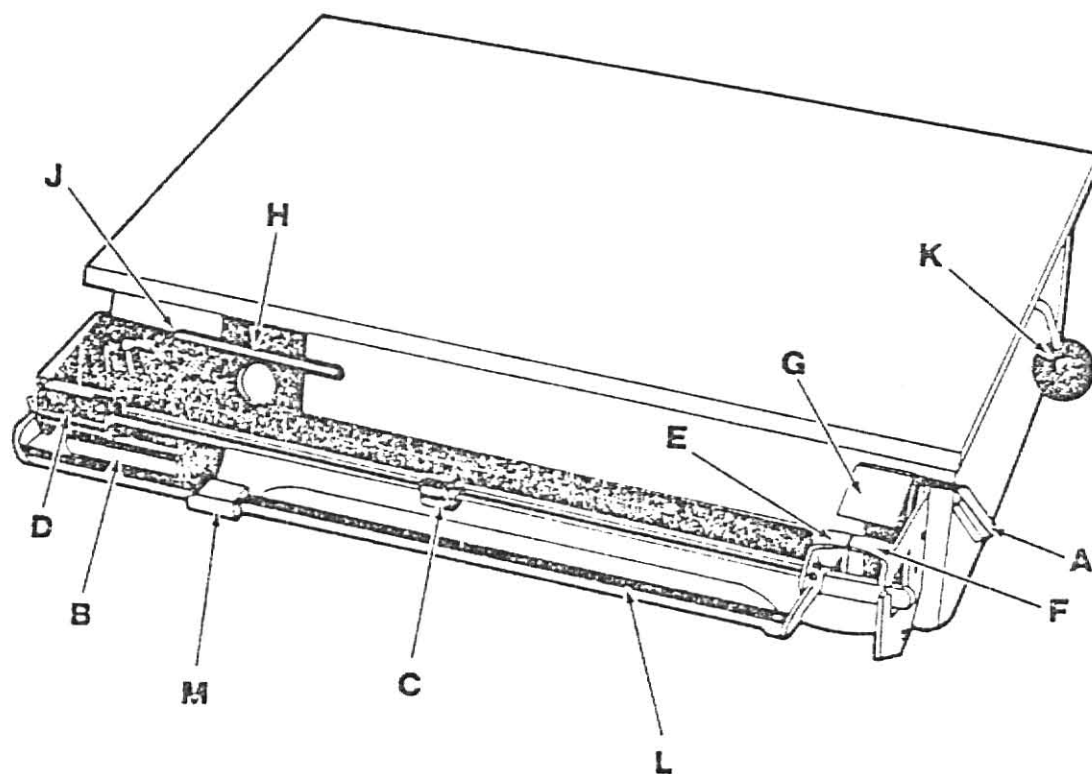


Figure III. Bench beam scale, Accu-Weigh Model 300T, for measuring weight of Jardine preschool children.

Arm Circumference. To calculate arm circumference (AC) a steel measuring tape was used. The child stood with left arm flexed 90° , the midpoint of the upperarm was determined using a string with a knot at one end. The knot was placed on the tip of the acromion process and measured to the tip of the olecranon process. The length of the string was folded in half, and a felt point pen was inserted in loop and a midway mark was made on left upper arm. With the tape in a horizontal plane in light contact with the skin AC was measured. Reading was taken to the nearest tenth centimeter.

Triceps Skinfold. A Lange skinfold caliper was used to measure the triceps skinfold thickness midway between the shoulder (tip of the acromion process) and the elbow (tip of the olecranon process) of the left arm. The skinfold was picked up between thumb and finger about 1 cm above the level marked on the skin for the arm circumference measurement. The caliper jaws were applied at exactly the level marked with the long axis on vertical position. The reading was taken at approximately 2 seconds after the full pressure of the caliper jaws was applied to the skinfold. Three readings to the nearest half of a millimeter were taken on each child.

Thigh Circumference. Thigh circumference was measured at the midpoint of the thigh between the left greater trochanter and left lateral epicondyle. The midpoint was determined by placing one end of a string on the greater trochanter and measuring to the left lateral epicondyle. The string was held on the trochanter and folded in half. A felt point pen was inserted

in the loop and a mid-thigh mark was made on the left thigh. The child stood with feet 8-12 in. apart and weight distributed evenly on both legs. Reading was taken at the mid-thigh point with a Lufkin steel measuring tape and read to the nearest tenth of a centimeter. Long trousers were either pushed up or removed during this measurement.

Blood Collection and Analysis

Immediately after the children were measured, a finger-prick blood sample was taken for determining hemoglobin and hematocrit. Blood samples were transported back to the Food and Nutrition Analytical Laboratory for analysis. Hemoglobin determinations were made using Drabkin's Reagent, a buffered potassium ferricyanide - potassium cyanide solution. Hematocrit determinations were done using a micro-centrifuge.

RESULTS AND DISCUSSION

Description of Subjects and Their Families

Ethnic background, sex and age of children. The 46 children included in this study came from 16 different countries which have been divided into 4 ethnic groups. Ethnic group, sex and age distribution of the sample are given in Table I.

Composition of Family. In 44 of the 46 families, both parents lived in the home. In two cases, the mothers were fulltime students and their husbands had not accompanied them to the university. The number of children per family ranged from 1 to 4 with a mean of 2.0. The age range of siblings was 2 weeks to 13 years.

Table I.--Ethnic group, sex and age distribution of children

Ethnic group ^a	Males				Females				Total Children
	age in years				age in years				
	2	3	4	5	2	3	4	5	
Hispanics	1	0	1	1	1	0	2	1	7
Oriental	3	2	1	1	0	1	1	2	11
Arabs and Iranians	2	3	1	1	5	0	2	2	16
Africans	2	3	1	1	0	2	2	1	12
Total	8	8	4	4	6	3	7	6	46

^aHispanics: Brazil, Colombia, Costa Rica, Guatemala, Venezuela.

Oriental: Japan, Korea, Taiwan, Vietnam.

Arabs and Iranians: Iraq, Libya, Palestine, Sudan, Tunisia, Iran.

Africans: Nigeria.

Ages of Parents. Ages of parents are given in Table 2. Fifty-two percent of the mothers were 26-30 years of age; 28% were older and 20% were younger with 4 mothers under 20 years. All of the fathers were over 25 years of age with 76% of them over 30 years.

Table II.--Ages of parents (in years)

	No.	15-20	21-25	26-30	31-40	Over 40
Fathers	44	0	0	12	30	2
Mothers	46	4	5	24	13	0
Totals	90	4	5	36	43	2

Education of Parents. Education level of the parents if given in Table III. Data were not obtained for the 2 fathers who were not living with their families. Among the 44 fathers, all had attended college and all but 8 were graduate students. Among the 46 mothers, 9 had completed only 1-8 years of elementary school, 16 had gone to high school for 1-4 years, and 21 had 1 or more years of college.

Table III.--Education of parents

	Elementary School	High School	High School	College	College
	Years				
	1-8	1-3	4	1-3	4 or more
Fathers	0	0	0	8	36
Mothers	9	12	4	11	10
Totals	9	12	4	19	46

Employment Status. Employment of the parents is given in Table IV. Among the 44 fathers, 38 were full time students and the rest were working full or part time. Among the mothers, three-fourths were at home, one fourth were students full or part time and just one was working full time. The income of most of the international families came from scholarships awarded by their respective countries.

Table IV.--Employment of Parents

	<u>Working</u>		<u>Student</u>		<u>At Home</u>
	<u>Full-time</u>	<u>Part-time</u>	<u>Full-time^a</u>	<u>Part-time</u>	
Fathers	3	2	38	1	0
Mothers	1	2	2	5	36
Totals	4	4	42	6	36

^aFull-time students include those on part-time assistantships.

Anthropometric Measurements

Mean values for height, weight, TC, AC and skinfold thickness of 24 boys and 18 girls from 2 to 5 years old are given in Table V. Anthropometric measurements for each child are given in Table XV in Appendix C.

Height. In Figs. IV and V, heights of the children are compared to standards from the National Center for Health Statistics (9). Thirteen boys fell between the 25th and 75th percentiles (normal range), 2 between the 75th and 90th percentiles, 1 over the 95th percentile, 6 between the 25th and 10th percentiles, and 2 below the 5th percentile. Thirteen

Table V.--Mean anthropometric measurements of boys and girls by age group.

Age Group	No.	Height cm	Weight lb	TC ^a cm	AC ^b cm	Triceps Skinfold mm
Boys						
2 years	6	88.97	29.88	27.33	16.23	9.03
3 years	9	96.07	33.07	28.70	16.67	10.12
4 years	4	99.98	32.24	27.70	15.38	7.78
5 years	5	111.88	43.46	30.40	16.60	9.36
Girls						
2 years	4	90.65	28.68	28.48	17.25	10.20
3 years	3	96.13	35.53	30.07	18.17	10.83
4 years	7	102.81	36.87	30.53	16.50	11.61
5 years	4	111.98	46.13	34.05	16.75	14.20

^a Thigh circumference

^b Upper arm circumference

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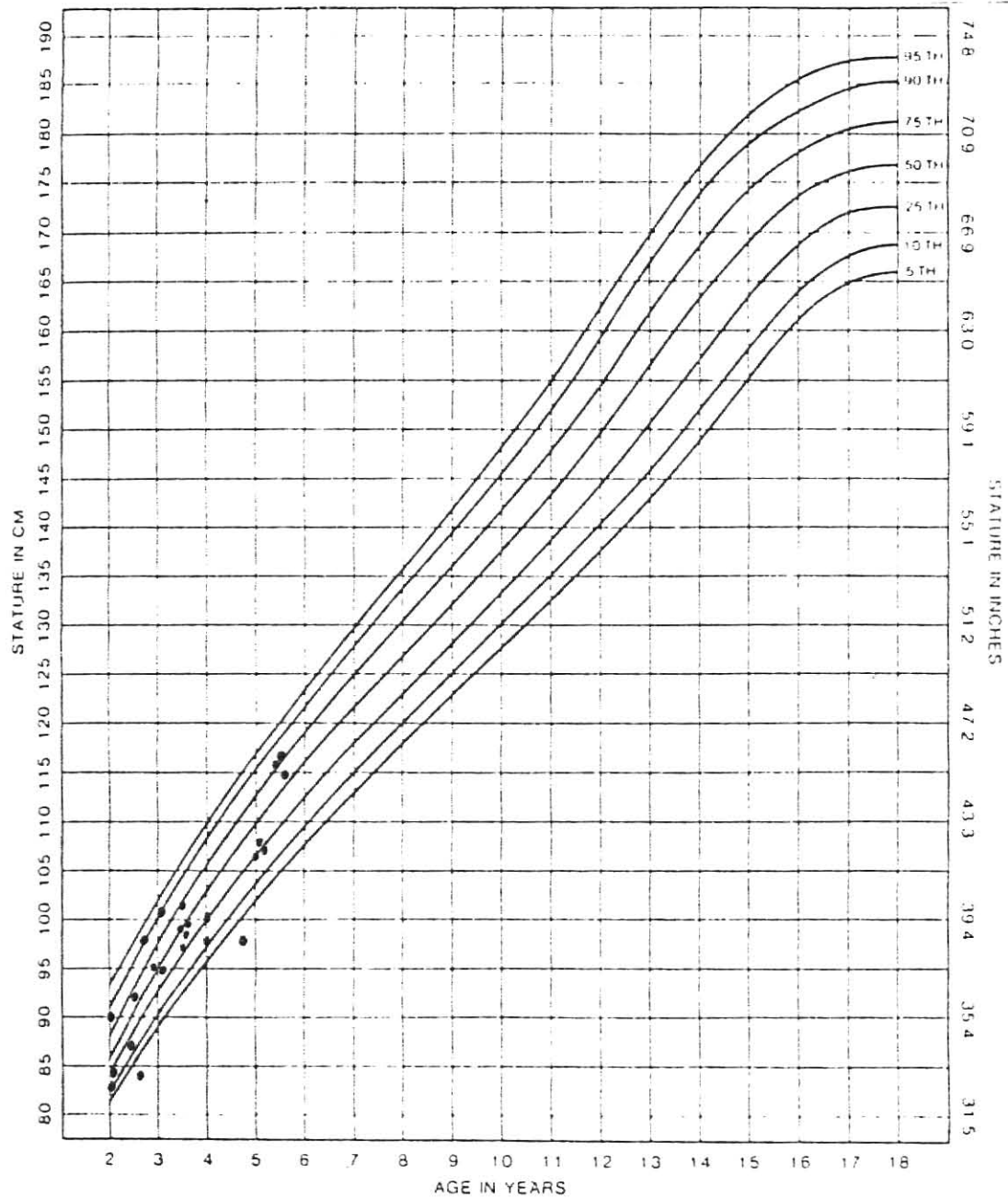


Figure IV. Height of Jardine Preschool boys as compared to NCHS percentiles (Hamill et al, 1979).

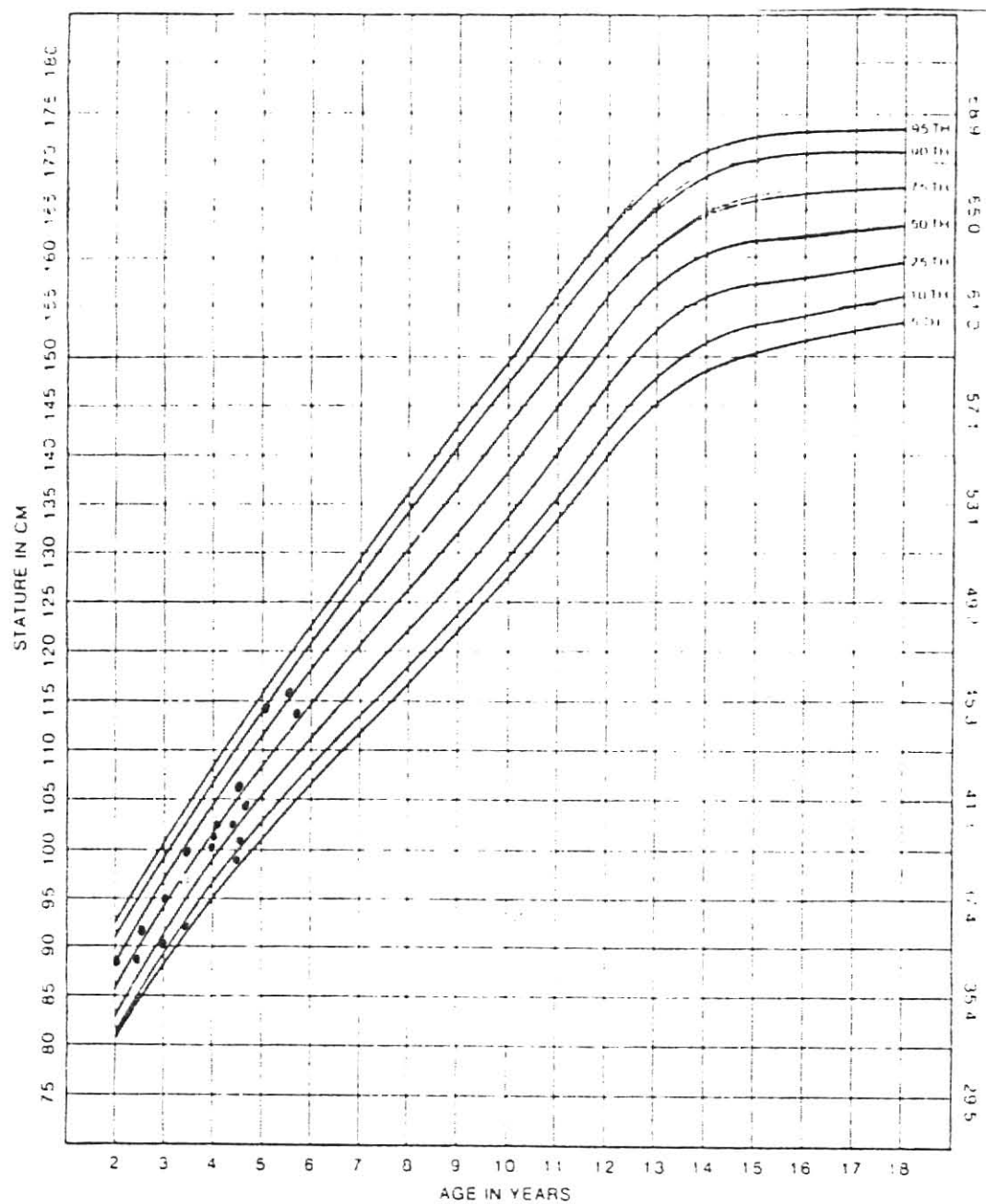


Figure V. Height of Jardine Preschool girls as compared to NCHS percentiles (Hamill et al, 1979).

girls fell between the 25th and 75th percentiles, 1 above the 90th percentile, 2 between the 25th and 10th percentiles and 2 between the the 10th and 5th percentiles.

Weight. Figures VI and VII show the weights of the children plotted against the National Center for Health Statistics weight curves (9). Eleven boys fell between the 25th and 75th percentiles, 2 between the 75th and 90th percentiles, 6 between the 25th and 10th percentiles, 3 between the 10th and 5th percentiles and 2 below the 5th percentile. Twelve girls fell between the 25th and 75th percentiles, 2 between the 75th and 90th percentiles, and 4 between the 25th and 10th percentiles. Boys were shorter than girls at the same age. Boys were also lighter than girls 2, 3 and 4 years. Five year old boys were heavier than girls of the same age.

Comparison with other norms.

Fryer et al (11) and Hansman (14) used tables of mean weight and height and one standard deviation to study North Central Region (NC) and Colorado children, respectively. Jardine data were compared with data of the NC Region and Colorado for weight and height for $2\frac{1}{2}$, $3\frac{1}{2}$, $4\frac{1}{2}$ and $5\frac{1}{2}$ -year-old children as shown in Table VI. Boys of the NC Region and Colorado were heavier than Jardine boys for $2\frac{1}{2}$, $3\frac{1}{2}$ and $4\frac{1}{2}$ years of age. However, similar values were obtained for the three study groups for the $5\frac{1}{2}$ year old. Similar values were obtained for the $2\frac{1}{2}$ year old girls for all 3 study groups. Jardine girls were heavier than NC Region and Colorado girls for the $3\frac{1}{2}$ and $5\frac{1}{2}$ years old respectively. NC Region and Colorado girls were heavier than Jardine girls for the $4\frac{1}{2}$

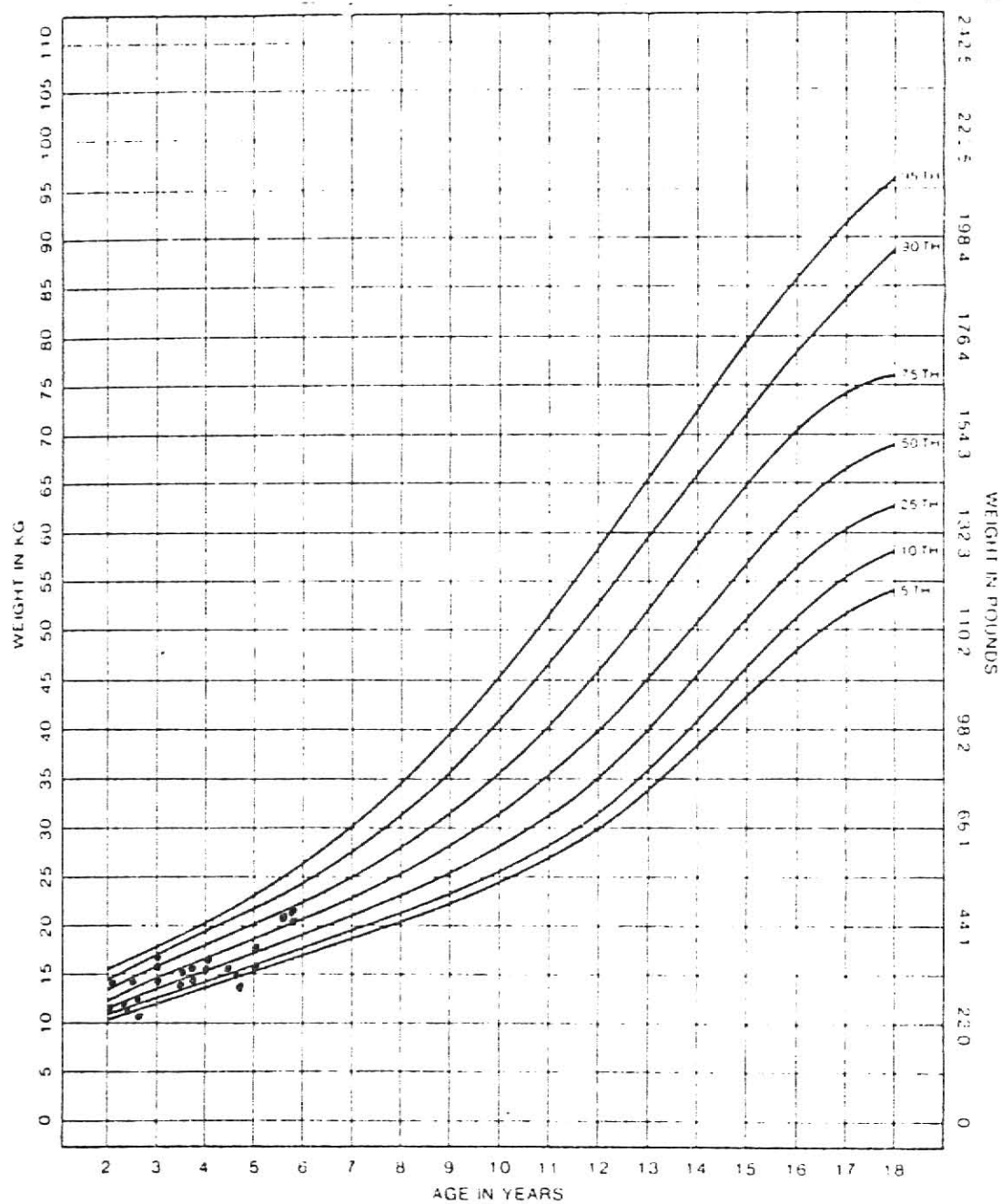


Figure VI. Weight of Jardine Preschool boys as compared to NCHS percentiles (Hamill et al, 1979).

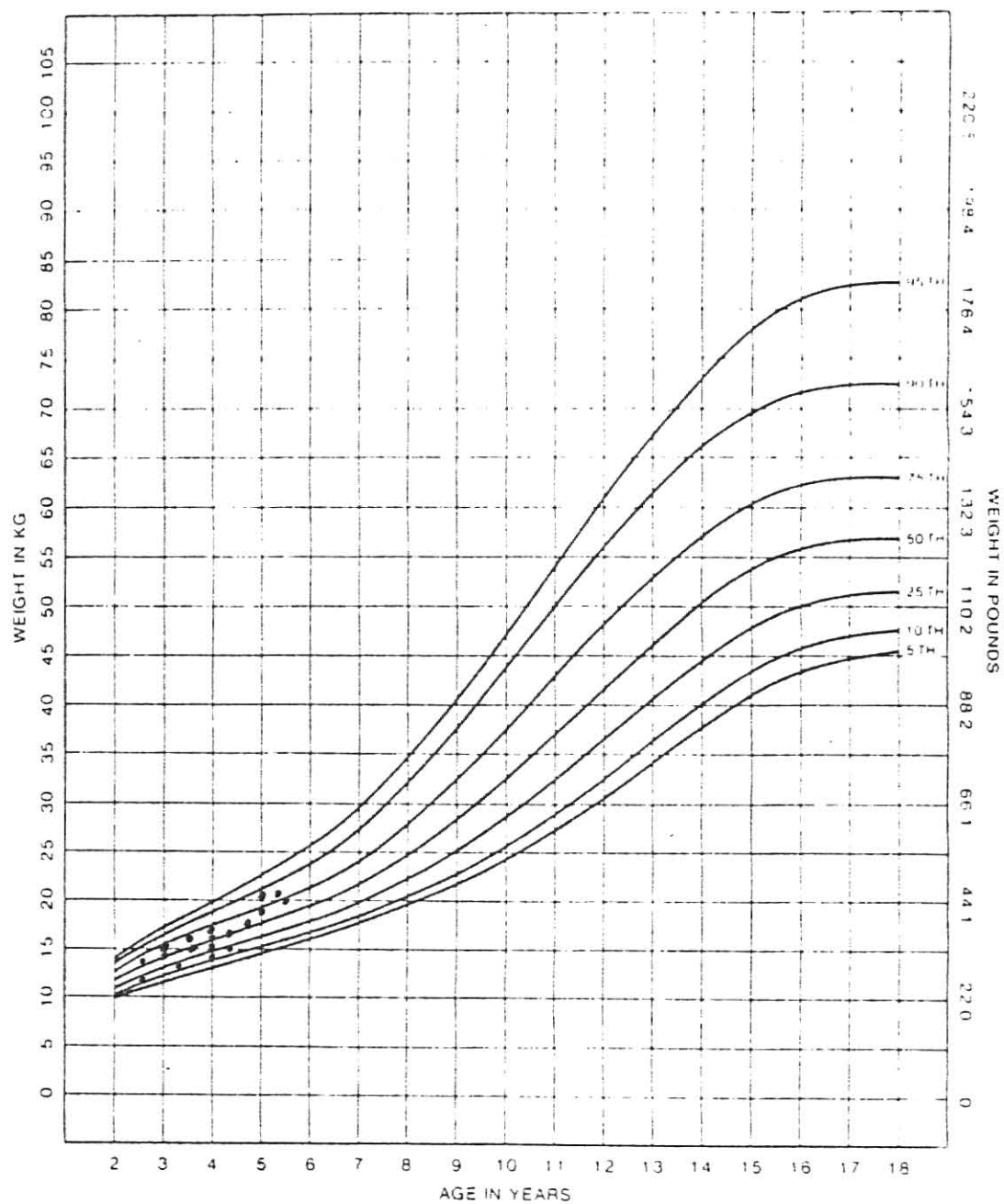


Figure VII. Weight of Jardine Preschool girls as compared to NCHS percentiles (Hamill et al, 1979).

Table VI.--Mean weights and heights of children in Jardine, North Central Region (11) and Colorado (12)

Study	<u>Age</u>		<u>Weight</u>		<u>Height</u>	
	boys	girls	boys	girls	boys	girls
	<u>months</u>		<u>lb</u>		<u>in.</u>	
Jardine	29.0	30.6	29.8	28.6	35.5	35.7
NC Region	29.7	29.7	30.5	28.9	35.9	35.2
Colorado	30.0	29.7	30.0	28.2	35.7	35.1
Jardine	40.1	38	33.0	35.5	38.7	38.7
NC Region	41.7	41.6	34.7	33.3	39.0	38.4
Colorado	42.0	42.0	34.2	33.1	38.8	38.5
Jardine	53.3	57.0	32.2	36.8	39.9	41.1
NC Region	53.5	53.5	39.6	38.8	41.9	41.7
Colorado	54.0	54.0	38.8	37.7	41.8	41.5
Jardine	65.0	64.0	43.4	46.13	44.7	44.7
NC Region	65.4	65.4	43.9	42.4	44.4	44.2
Colorado	66.0	66.0	43.9	42.4	44.4	44.2

years old. For height, boys had similar values for the $2\frac{1}{2}$, $3\frac{1}{2}$ and $5\frac{1}{2}$ years old; however, $4\frac{1}{2}$ year old NC Region and Colorado boys were slightly taller than Jardine boys. Weights of girls in the Jardine, NC Region and Colorado groups were similar for all 4 ages.

Thigh Circumference. Thigh circumference measurements were compared to those of Boston (40) preschool children as shown in Figures VIII and IX. Eight boys fell between the 25th and 75th percentiles, 1 over the 97th percentile, 7 between the 25th and 10th percentiles, 5 between the 10th and 3rd percentiles and 3 below the 3rd percentile. Thirteen girls fell between the 25th and 75th percentiles, 3 between the 25th and 10th percentiles, and 2 between the 10th and 3rd percentiles. Girls had greater TC than boys for all ages.

Arm Circumference. Comparisons of AC were made with percentiles obtained on all white subjects in the United States Ten-State Nutritional Survey of 1968-1970 and published by Frisancho (31) in 1974 (Table VII). ACs of all the boys except one, were above the 85th percentile for all ages. ACs of all but 3 girls were above the 95th percentile, as shown in Table VIII. AC for girls was greater than that for boys for all ages.

Triceps skinfold thickness. Comparisons of TST were done with percentiles reported by Frisancho (31) in 1974 (Table VIII). Only 1 boy fell in the 5th percentile, 6 in the 15th percentile, 14 in the 50th percentile and 3 in the 85th percentile. Three girls fell in the 15th percentile, 7 in the 50th percentile, 4 in the 85th percentile and 4 in the 95th percentile as shown in Table VIII. Girls TST was greater than boys for all ages. Overall, no sign of obesity was detected.

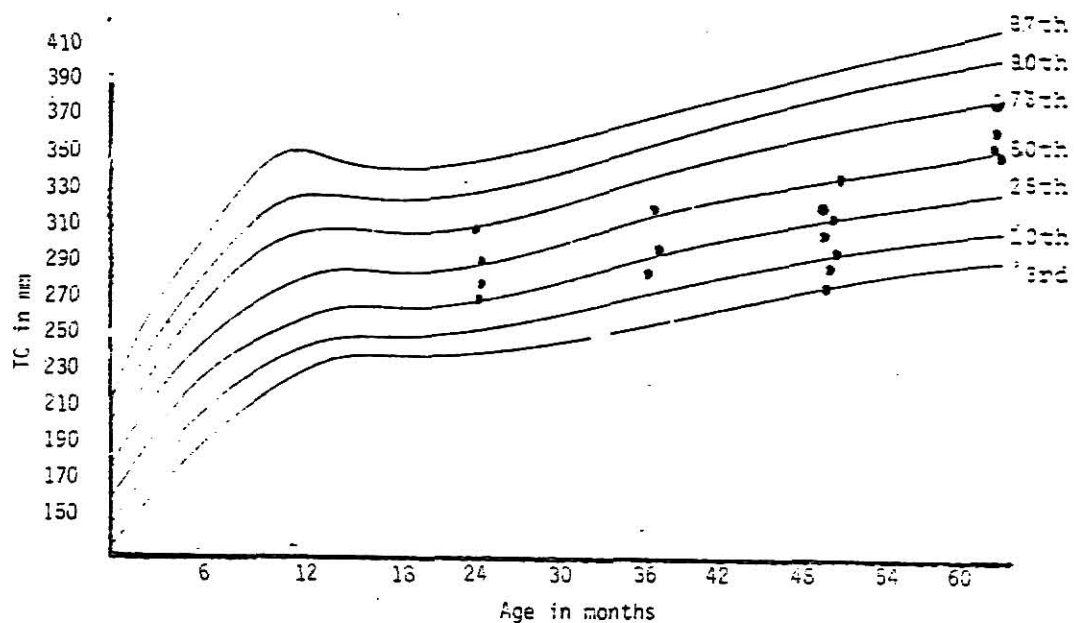


Figure VIII. Thigh circumference of Jardine preschool boys as compared to Zeitlin percentiles (1979).

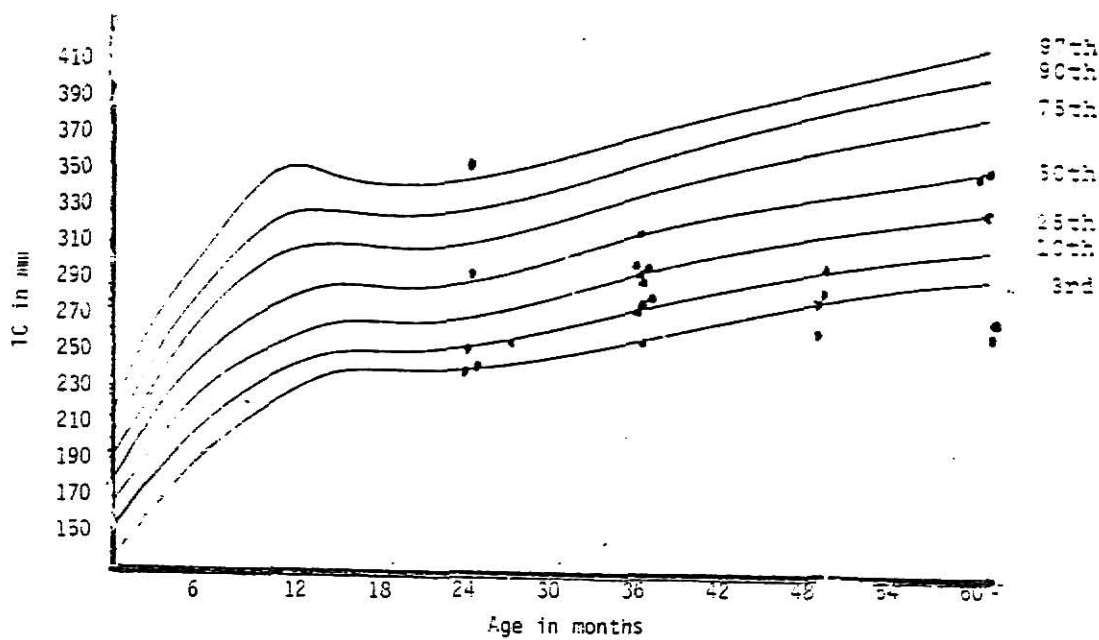


Figure IX. Thigh circumference of Jardine preschool girls as compared to Zeitlin percentiles (1979).

Table VII.--Arm circumference percentiles for Jardine Terrace preschool children as compared to Ten-State Nutrition Survey (Frisancho, 1974).

Age	Boys					Girls				
	5th	15th	50th	85th	95th	5th	15th	50th	85th	95th
2½	0	0	0	1	5	0	0	0	0	4
3½	0	0	0	1	6	0	0	0	0	3
4½	0	0	1	3	2	0	0	0	2	5
5½	0	0	0	2	3	0	1	0	0	3

Table VIII.--Triceps skinfold thickness percentiles for Jardine Terrace preschool children as compared to
Ten-State Nutrition Survey (Frisancho, 1974).

Age	Boys					Girls				
	5th	15th	50th	85th	95th	5th	15th	50th	85th	95th
2½	1	2	2	1	0	0	1	3	0	0
3½	0	1	7	1	0	0	1	1	0	1
4½	0	2	2	0	0	0	1	2	3	1
5½	0	1	3	1	0	0	0	1	1	2

Blood Analysis

Blood samples were collected from 29 preschool children. The blood values for each child are shown in Table IX.

Hemoglobin and Hematocrit. Two children (6.8%) had deficient hemoglobin levels according to ICNND. Three children (10.3%) had low hemoglobin values; acceptable values were observed in 8 children (27%) and high values were observed in 16 children (55%). The highest value was 14.7 gm/100 ml and 9.5 gm/100 ml was the lowest. For hematocrit, deficient and low values were not observed in the children. Acceptable hematocrit values were observed in 4 children (14%) and 25 children (86%) had high hematocrit levels. The highest was 46% and 36% was the lowest. The mean value for hemoglobin was 12.30 gm/100 ml and 39.5% for hematocrit, falling in acceptable and high levels respectively. Girls had greater values than boys for hemoglobin and hematocrit.

Dietary intake

The mean intakes for energy, protein, fat, carbohydrate, vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B₆, calcium, phosphorus, magnesium and iron for boys and girls in each group are given in Table X. Intakes were compared to the 1980 RDA and classified: level I, 100% or more; level II, 67 to 99%; level III, 50 to 66%; and level IV, less than 50% of the RDA according to age group (1-3 and 4-6 yr). Comparisons were made with the NC Region intakes for energy, protein, fat, carbohydrate, calcium, phosphorus and iron as shown in Table XI.

Energy. Levels for energy and nutrient intake of Jardine preschool children are given in Table XII. Only 11 children met the RDA for energy.

Table IX.--Blood values for hemoglobin and hematocrit of Jardine preschool children^a

Child No.	Hemoglobin gm/100ml	Hematocrit %
A-8	13.7	40
B-3	11.5	37
B-10	11.5	40
B-24	13.1	44
B-30	12.5	40
C-23	10.3	36
C-29	13.8	42
D-4	10.4	40
D-5	10.3	38
F-1	12.7	37
F-2	12.5	40
M-29	11.5	36
N-1	9.5	37
N-3	11.7	41
N-9	14.3	42
N-30	13.1	39
T-4	13.1	46
W-1	11.8	42
W-10	12.9	40
W-23	13.5	41
W-30	12.8	38
X-4	13.4	39
X-5	12.8	42
X-9	9.5	36
X-10	11.5	37
Y-3	12.7	40
Y-4	12.4	39
Y-10	14.7	42
Y-30	13.7	36

^a Levels used by ICNND (58).

	Hemoglobin	Hematocrit
Deficient	< 10.0	< 30.0
Low	10.0-10.9	30.0-33.9
Acceptable	11.0-12.4	34.0-36.9
High	> 12.5	> 37.0

Table X.--Means for energy and nutrient intake of Jardine preschool children from 3 - day dietary records

Age group	N	Energy kcal	Protein gm.	Fat gm.	Carbo- hydrate gm.	Vita- minA I.U.	Ascorbic acid mg.	Thiamin mg.	Riboflavin mg.	Niacin mg.	Vitamin B ₆ mg.	Calcium mg.	Phosphorus mg.	Magnesium mg.	Iron mg.
Boys															
RDA:1-3 yr		1300	23.0	-	-	400	45	0.7	0.8	9.0	0.9	800	800	150	15
2 years	8	1206	44.0	47.8	178	744	152	1.15	1.52	10.3	0.85	546	641	138	7.2
3 years	7	1246	60.1	50.0	120	288	102	0.63	1.23	10.1	0.97	772	923	143	8.6
RDA:4-6 yrs		1700	30.0	-	-	500	45	0.9	1.0	11.0	1.3	800	800	200	10
4 years	4	1383	60.8	50.5	142	1043	195	1.00	1.86	16.2	1.37	512	724	102	7.5
5 years	5	1420	57.0	35.0	231	655	218	1.90	2.70	14.0	1.16	605	684	145	7.7
Girls															
RDA:1-3 yr		1300	23.0	-	-	400	45	0.7	0.8	9.0	0.9	800	800	150	15
2 years	5	1440	63.0	50.8	181	715	199	1.19	2.02	16.9	1.46	770	922	180	9.8
3 years	4	1070	40.4	52.0	125	615	276	1.29	1.54	13.0	1.46	412	549	93	7.5
RDA:4-6 yrs		1700	30.0	-	-	500	45	0.9	1.0	11.0	1.3	800	800	200	10.0
4 years	7	1101	42.4	58.0	150	236	194	1.10	1.21	12.2	0.98	483	571	94	6.3
5 years	4	1287	52.0	46.1	268	1327	243	6.40	2.52	25.1	2.27	678	780	123	7.6

Nineteen fell in level II, 10 in level III and 3 in level IV. Boys had greater energy intake than girls as shown in Table X. NC Region preschool children had greater energy intake than Jardine children.

Protein. The intake of protein greatly exceeded the RDA. All the children met the RDA for protein except one which fell in level II. Boys of 3, 4 and 5 years had greater mean protein intakes than girls. NC Region children (except for 2 year olds) had greater protein intakes than Jardine children.

Fat and Carbohydrate. There are no RDA for fat and carbohydrate. Girls had greater intake of fat and carbohydrate than boys. Jardine children had lower intakes of both fat and carbohydrate than NC Region children with one exception, the Jardine 5 year old boys intake of carbohydrate was greater than that of the NC Region boys at the same age.

Vitamin A. Twenty six children met the RDA for vitamin A. Nine fell in level II, 2 in level III and 6 in level IV. Boys had greater intakes than girls. No comparisons for vitamins were made with the NC Region preschool children.

Vitamin C. The mean intakes of vitamin C for boys and girls greatly exceeded the RDA. All but 3 of the children met 100% of the RDA; those 3 fell in level III. Girls (except for 4 year olds) had greater mean intakes than boys.

Water soluble vitamins. Twenty eight children met the RDA for thiamin, 12 fell in level II, 3 in level III. Thirty six children met the RDA for riboflavin, 7 fell in level II. Twenty six met the RDA for niacin, 10 fell in level II, four in level III and 3 in level IV.

Table X1.- Mean energy and dietary intake in Jardine and North Central Region (43)

Study	Age yr.	Energy kcal	Protein gm.	fat gm.	Carbo- hydrate gm.	Calcium mg.	Phos- phorus mg.	Iron mg.
Boys								
Jardine	2½	1,206	44.0	47.8	178	546	641	7.2
NC Region		1,555	60.6	67.2	184	935	1,125	8.23
Jardine	3½	1,246	60.1	50.0	120	772	923	8.6
NC Region		1,634	63.6	70.6	193	961	1,444	8.46
Jardine	4½	1,383	60.8	50.5	142	512	724	7.5
NC Region		1,738	66.9	73.8	204	1,009	1,708	8.98
Jardine	5½	1,420	57.0	35.0	231	605	684	7.7
NC Region		1,882	75.7	81.8	219	1,106	1,099	10.21
Girls								
Jardine	2½	1,440	63.0	50.8	161	770	922	9.8
NC Region		1,440	55.9	67.2	170	854	1,022	7.47
Jardine	3½	1,070	40.4	52.0	105	412	549	7.5
NC Region		1,555	60.9	67.2	184	955	1,118	7.94
Jardine	4½	1,101	42.4	58.0	140	483	571	6.3
NC Region		1,688	61.5	67.9	198	923	1,111	8.61
Jardine	5½	1,287	52.0	46.1	168	678	780	7.6
NC Region		1,718	68.3	74.3	202	1,028	1,226	9.06

Table XII.--Levels for energy and nutrient intake of Jardine Terrace preschool children as compared with 1980 RDA.

	I ^a		II ^b		III ^c		IV ^d	
	n	%	n	%	n	%	n	%
Food energy	11	26	19	44	10	23	3	7
Protein	42	97	1	3	0	0	0	0
Vitamin A	26	60	9	21	2	5	6	14
Vitamin C	40	93	0	0	3	7	0	0
Thiamin	28	66	12	29	3	5	0	0
Riboflavin	36	84	7	16	0	0	0	0
Niacin	26	60	10	23	4	9	3	8
Vitamin B ₆	21	49	11	26	5	11	6	14
Calcium	10	23	15	35	8	19	10	23
Phosphorus	14	32	16	38	7	16	6	14
Magnesium	11	26	13	32	11	26	8	16
Iron	1	3	17	40	11	26	14	31

a I: 100% or more of 1980 RDA.

b II: 67 to 99% of 1980 RDA.

c III: 50 to 66% of 1980 RDA.

d IV: less than 50% of 1980 RDA.

Twenty one children met the RDA for vitamin B₆, 11 fell in level II, 5 in level III and 6 in level IV. In most cases, girls had greater mean intakes of water soluble vitamins than boys.

Calcium. Ten children met the RDA for calcium, fifteen fell in level II, eight fell in level III, and ten fell in level IV. Boys usually had greater intakes than girls. Jardine children had lower values than NC Region children.

Phosphorus. Fourteen children met the RDA for phosphorus, sixteen fell in the level II, seven fell in level III and six fell in the level IV. NC Region children had greater values than Jardine children.

Magnesium. Eleven children met the RDA for magnesium, 13 fell in the level II, 11 in level III, and 8 in level IV. Boys had greater mean intakes than girls in all but one instance.

Iron. Just one child met the RDA for iron, 17 fell in level II, 11 in level III and 14 in level IV. Boys and girls had similar values for iron intake.

Percentage Calorie Distribution. The percentages of calorie distribution of Jardine preschool children are given in Table XVI (Appendix C). Comparisons of Jardine diets with the current U.S. diet and that proposed in the 1977 U.S. Dietary Goals were made. Percentage distribution of calories from fat, protein and carbohydrate for the current U.S. diet, the U.S. Dietary Goals and the Jardine children's diets, respectively, were: fat--42, 30 and 36%; protein--12, 14 and 16%; and carbohydrate--46, 58 and 48%.

Effect of supplementation. Since vitamin and mineral supplementation add to nutrient intake, consideration was given to their effect in raising

the nutritional adequacy of the preschool children's diets. Effects on supplement on nutrient levels are given in Table XIII for some Jardine preschool children. Supplements given to 2 of the children in this study contained iron. The level of adequacy was improved for one or more nutrients.

For vitamin A, one child moved from level IV to level I, one from level III to level I and one from level II to level I. For ascorbic acid, 2 children moved from level II to level I, for thiamin, 2 children moved from the level IV to level I, 1 moved from the level III to level I and 2 moved from the level II to level I. For niacin, 1 child moved from level IV to level I, 3 moved from level III to level I, and 2 from level II to level I. For vitamin B₆, 3 children moved from level IV to level I, 2 moved from level III to level I, 4 from level II to level I. Of the 2 children that had iron supplement, the level of adequacy remained unchanged for 1 and the other moved from level III to level I.

Nutrition knowledge and attitude tests

The test scores of nutrition knowledge and attitude were based on the degree of certainty of the answers of the 35 mothers who completed the tests. Mothers who did not speak and read English fluently did not take the tests. Eight points was the maximum number given to a correct answer where the highest degree of certainty was indicated followed by 5, 3, 2 and 1 for decreasing degree of certainty. When wrong answers were given, the same point scale for the degree of certainty was subtracted from the total score. Where the respondent could not answer a question, as indicated by circling undecided (U), the score was zero. The individual scores of the mothers on the 5 tests and the

Table XIII.--Effect of supplements on nutrient levels^a for some Jardine preschool children

No.	Vitamin A	Ascorbic acid	Thiamin	Riboflavin	Niacin	Vitamin B ₆	Iron
A-8	II-I	II-I	III-I	III-I	II-I	II-I	I
B-3	III-I	I	II-I	III-I	III-I	IV-I	-
C-29	I	I	II-I	II-I	III-I	II-I	-
I-7	I	I	I	I	III-I	IV-I	-
K-27	I	I	IV-I	II-I	I	II-I	-
M-29	I	I	IV-I	II-I	I	II-I	-
N-30	IV-I	I	I	I	IV-I	IV-I	-
R-4	I	I	I	I	I	III-I	-
S-4	I	II-I	I	I	II-I	III-I	-
T-23	I	I	I	I	I	I	III-I

^a I: 100% or more of 1980 RDA.
 II: 67% to 99% of 1980 RDA.
 III: 50 to 66% of 1980 RDA
 IV: less than 50% of 1980 RDA.

levels of ranking of each score are given in Table XVII (Appendix C).

Nutrition Knowledge. In the nutrition knowledge test of 35 statements (Appendix B), the highest possible score was 280. The highest score attained was 197 and the lowest was 69. There were 7 negative scores. The scores of the test on nutrition knowledge were divided in 5 levels. The levels, number and percentage of mothers in each group are given in Table XIV for the 5 tests. Only 1 mother scored in upper level I, 3 in level II, 5 in level III, 19 in level IV and 7 in level V.

Attitude toward nutrition. The attitude of the mother toward nutrition was evaluated through the use of questions 2, 3, 5, 6, 7, 10, 12, 13, 14, 15, 17, 19, 20 and 21 in section III (Appendix). The highest score possible was 112. The highest score obtained in this test was 93 and the lowest was -3; there were 3 negative scores. Seven mothers scored in upper level I, 9 in level II, 9 in level III, 7 in level IV and 3 in level V. This indicated that their attitude toward nutrition was much better than their nutrition knowledge.

Attitude toward meal planning. In the attitude of the mother toward meal planning test of 8 statements (Appendix A), the highest score possible was 64. The highest score attained was 48 and the lowest was -32; there were 7 negative scores. Three mothers scored in upper level I, 7 in level II and 10 in level III, 3 in level IV and 7 in level V. In general, these scores indicated a negative attitude toward meal planning.

Attitude toward food preparation. This test of 11 statements (Appendix B), was used to assess the attitude toward food preparation. The highest possible score was 88. The highest score attained in this study was

Table XIV.--Number and percentage of mothers classified into 5 levels based on nutrition knowledge and attitude tests.

Level	% of Possible Score	Nutrition knowledge		Attitude toward nutrition		Eating habits of preschool child		Meal planning		Food Preparation	
		N	%	N	%	N	%	N	%	N	%
I	75-100	1	3	7	20	0	0	3	9	6	17
II	50-74	3	9	9	26	5	14	7	20	7	20
III	25-49	5	14	9	26	6	17	10	28	16	46
IV	0-24	19	54	7	20	2	1	8	23	5	14
V	negative values	7	20	3	9	22	63	7	20	1	3
Total		35	100	35	100	35	100	35	100	35	100

80 and the lowest was -2, and there was only 1 negative score, indicating that attitude toward food preparation was better than attitude toward meal planning.

SUMMARY

Factors affecting the nutritional status of 46 preschool children of international students living in the Jardine Terrace Apartments at Kansas State University were investigated. Height, weight, thigh circumference, arm circumference, and triceps skinfold thickness were measured. Three-day dietary records were obtained and food energy and 13 nutrients were calculated and compared to the 1980 RDA. Blood samples were collected and analyzed for hemoglobin and hematocrit. Tests of nutrition knowledge and attitudes toward nutrition, eating habits of the child, meal planning and food preparation were given to the mothers.

In comparison with NCHS height percentile curves, 62% of the children fell in the normal range between the 25th and 75th percentiles, 10% were above the 75th percentile and 12% were below the 25th percentile. According to the NCHS weight curves, 55% of the children were between the 25th and 75th percentiles, 10% between the 75th and 90th percentiles and 35% below the 25th percentile. Two boys were below the 5th percentile for both height and weight. In general, girls were taller and heavier than boys at the same age.

Thigh circumferences were compared to Boston standards which indicated that 50% of the children fell in the normal range, 2% were above the 75th percentile and 48% were below the 25th percentile. When arm circumferences were compared to percentiles found in the U.S. Ten-State Survey, 95% of the children fell between the 85th and 95th percentiles and only 5% were below the 50th percentile. When triceps skinfold measurements were compared to percentiles found in the Ten-State

Survey, 26% of the children fell between the 85th and 95th percentiles, 71% between the 15th and 85th percentiles and 3% were below the 15th percentile. In general, girls' measurements for thigh circumference, arm circumference and triceps skinfold thickness were greater than those of the boys.

Mean daily intakes of food energy did not meet the RDA for the age groups studied and only 25% of the individual children's intakes met the RDA for food energy. Mean intakes of protein for all the age groups met the RDA and 97% of the individual children's intakes met the RDA. Boys had greater intakes of calories and protein than girls. However, girls had greater intakes of fat and carbohydrate than boys.

In all but two cases, mean intakes of each of the vitamins for each age group met the RDA. Sixty percent or more of the diets of the individual children met 100% of the RDA for all vitamins except vitamin B₆ (49%) and many of the other diets met at least 67% of the RDA for all vitamins. However, vitamins B₆ and A were below 67% of the RDA in 25 and 19% of the diets, respectively.

Mean intakes of each of the minerals studied for each age group met the RDA in only two cases. Iron, calcium, magnesium and phosphorus were below 67% of the RDA in 57, 42, 42, and 30% of the diets, respectively.

The mean value for hemoglobin was 12.3 gm/100 ml and for hemocrit, 39.5%. None of the children had hemoglobin or hematocrit values that were indicative of anemia.

The test scores of the mothers indicated that their attitude toward nutrition was better than their nutrition knowledge. An attitude of permissiveness prevailed among the mothers in regard to eating habits of

their children. Their attitude toward food preparation was better than their attitude toward meal planning.

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APPENDIX

APPENDIX A



Department of Foods and Nutrition

Justin Hall
 Manhattan, Kansas 66506
 913-532-5508

Dear Parent:

You and your child (2-5 years old) have been selected to take part in a study of "Factors Relating to the Nutritional Status of Preschool Children of International Students Living in Jardine Terrace." The study is being conducted by Orlando Martinez, a M.S. student in the Department of Foods and Nutrition at Kansas State University. Information obtained will be used to plan nutrition education programs.

This project has been approved by the mayors of your living complex. It also has been approved by the College of Home Economics Committee on Research Involving Human Subjects.

You (the mother) will be asked to do the following:

1. Answer questions about the health and eating habits of your child.
2. Keep a 3-day record of all food eaten by your child.
3. Complete a test of your nutrition knowledge and attitudes toward nutrition and feeding of your child.
4. Allow your child to be measured for height, weight, midarm circumference, thigh circumference and triceps skinfold.
5. Allow a technician to take a fingerprick blood sample from your child for determining hemoglobin and hematocrit. If the child appears to be unduly stressed by this procedure, blood sampling will be omitted.

On the bottom portion of this page, please indicate your willingness to participate and to allow your child to take part in the study.

I agree to participate and to have my child participate in the study of "Factors Relating to the Nutritional Status of Preschool Children of International Students Living in Jardine Terrace." I have been informed about the nature and the purpose of the research. The researchers have offered to answer any further questions I may have. I realize that reports will be made of the study and I consent to publication of such without disclosure of my name or my child's name.

Signed _____

Date _____

FACTORS RELATING TO NUTRITIONAL STATUS OF PRESCHOOL CHILDREN
OF INTERNATIONAL STUDENTS LIVING IN JARDINE TERRACE

Name of respondent _____

Address _____

Interviewer _____

CALLS MADE

	Date	Time	
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
5.	_____	_____	_____

Appointment for second interview: Date _____ Time _____

Points to check on second visit: Page Question No.

_____	_____
_____	_____
_____	_____

Comments:

FACTORS RELATING TO NUTRITIONAL STATUS OF PRESCHOOL CHILDREN
OF INTERNATIONAL STUDENTS LIVING IN JARDINE TERRACE

Name of respondent* _____

Address _____ Telephone No. _____

Name of child _____ Sex _____ Date of birth _____
Mo. day Yr.

A. FAMILY CHARACTERISTICS

1. List all children living in this household who are under six years of age. (List in chronological order, starting with youngest child).

	Name	Relationship to * child	Sex	Date of Birth		
				Month	Day	Year
1.						
2.						
3.						
4.						
5.						

Star (*) the child selected for study.

2. List all other people who live in the household by relationship to this child.

	Relationship to child	Age in years	Highest year of school completed	Present occupation	Hours of work per week
1.					
2.					
3.					
4.					
5.					
6.					
7.					

*(Star respondent or person interviewed; respondent should be the mother or the person who is serving as the mother of the child).

**Head of household.

3. Where were this child and his parents and grandparents born? Indicate country.

_____ Child	
_____ Mother	_____ Father
_____ Maternal Grandmother	_____ Paternal Grandmother
_____ Maternal Grandfather	_____ Paternal Grandfather

When did you come to the U.S.? _____ to KSU? _____

4. Are you engaged in activities other than work for pay, such as volunteer work or organizational activities which take you regularly away from home? Yes _____ No _____

If yes, state number of hours you are usually engaged in these activities each week _____. Which hours are you most frequently away from home?

5. Are you employed outside of the home? Yes _____ No _____. If yes, how many days of the week are you away? _____. Which hours of the day are you away? _____

6. How many hours each week is this child usually cared for by someone else?

No. of hours per week	Where	By Whom
1. _____	within own home	_____
2. _____	home of relatives	_____
3. _____	home of someone else	_____
4. _____	nursery school	
5. _____	day care center	
6. _____	kindergarten, first grade	
_____	total hours	

7. If entry in question 6, line 1, 2, or 3, what plans do you make for the food given to this child when you are away from home?

1. _____	written daily or weekly instructions
2. _____	oral daily or weekly instructions
3. _____	general instructions on feeding plan
4. _____	no instructions
5. _____	food prepared in advance by mother
6. _____	other, specify: _____

8. If entry in question 6, line 1, who prepares and serves the food in the home for this child when you are away?

1. _____ father
2. _____ older child
3. _____ other relative
4. _____ household employee
5. _____ other, specify: _____

B. SOURCES OF NUTRITION EDUCATION AND FOOD PURCHASING PRACTICES

9. (a) Have you had any classes or attended group activities concerned with food nutrition? Yes _____ No _____.

(b) If yes, check where you learned about food and nutrition: (Read)

- | Where | Specify grade, class or organization |
|--|--------------------------------------|
| 1. _____ elementary school | _____ |
| 2. _____ junior high school | _____ |
| 3. _____ senior high school | _____ |
| 4. _____ college | _____ |
| 5. _____ public health class or clinic | _____ |
| 6. _____ adult education class | _____ |
| 7. _____ youth organization | _____ |
| 8. _____ prenatal classes held by doctor | _____ |
| 9. _____ Other (specify) | _____ |

10. There are many people from whom homemakers can get information concerning the food needs of families. Check the people from whom you have obtained information. (Read)

1. _____ mother or other relative
2. _____ physician
3. _____ dentist
4. _____ friends or neighbors
5. _____ home economist, dietitian or nutritionist
6. _____ sales person
7. _____ other (specify) _____

11. What are the sources of information on family food needs that you now use?

1. _____ books
2. _____ magazines
3. _____ extension or other government bulletins
4. _____ newspapers
5. _____ radio
6. _____ television
7. _____ other (specify) _____

12. Who does the major food buying?

_____ mother
 _____ father
 _____ mother and father
 _____ other (specify) _____

13. Does this child go with you to the food store?

_____ every shopping trip
 _____ every other shopping trip
 _____ once in awhile
 _____ never

14. Who decides what foods to buy?

_____ mother
 _____ father
 _____ mother and father
 _____ other (specify) _____

15. When do you decide what to buy? (Read each one, check appropriate responses, and circle the most important one.)

_____ as you plan meals
 _____ as you see or hear food advertisements
 _____ as you use up food items
 _____ as you check supplies on hand
 _____ as you see items in the store
 _____ other (specify) _____

16. Do you make a written grocery list?

_____ almost always
 _____ sometimes
 _____ almost never

17. Do you plan to spend or actually budget a certain amount of money each week for food? Yes _____ No _____
 If yes, how much do you budget? \$ _____.
 How much do you usually spend for food per week? \$ _____.
 Does this include soap, paper goods, etc.? Yes _____ No _____.

18. Source of income for family:

19. What foods, if any, do you try to limit in the diet of this child?

<u>Food Limited</u>	<u>Reason</u>
_____	_____
_____	_____

20. Do you use food as a reward to this child for good behavior? Yes ____ No ____
If yes, list the foods you use in this way _____

21. Do you deprive this child of foods as a punishment? Yes ____ No ____.
If yes, list the foods you use in this way _____

22. Do you use foods as pacifiers, or to keep the child quiet? Yes ____
No ____ If yes, list the foods you use in this way _____

23. Who decides which foods this child eats at the following times? (If more than one person checked in any column, rank that column 1 to 4.)

	Breakfast	Noon meal	Evening meal	Snacks
1. Child himself	_____	_____	_____	_____
2. Mother	_____	_____	_____	_____
3. Father	_____	_____	_____	_____
4. Someone else	_____	_____	_____	_____

24. Who decides how much this child eats at these times? (If more than one person checked in any column, rank that column 1 to 4.)

	Breakfast	Noon meal	Evening meal	Snacks
1. Child himself	_____	_____	_____	_____
2. Mother	_____	_____	_____	_____
3. Father	_____	_____	_____	_____
4. Someone else	_____	_____	_____	_____

25. When this child does not want to eat at mealtime, what do you do? _____

26. (a) When planning meals for your family, are you influenced by any of the following: (Read to respondent and check appropriate response.)

1. yes ____ no ____ cost of the food
2. yes ____ no ____ time of preparation
3. yes ____ no ____ husband's likes
4. yes ____ no ____ this child's likes
5. yes ____ no ____ likes of other family members
6. yes ____ no ____ nutritive value of foods
7. yes ____ no ____ health problems of family members
8. yes ____ no ____ other (specify) _____

(b) Which of these is the most important? (Circle the number of the most important.)

27. Do you think this child
1. yes ☐ no ☐ eats too little food or
 2. yes ☐ no ☐ eats too much food
 3. yes ☐ no ☐ chooses limited variety of foods
 4. yes ☐ no ☐ eats too little fruits and vegetables
 5. yes ☐ no ☐ dawdles with food
 6. yes ☐ no ☐ eats too much meat or
 7. yes ☐ no ☐ eats too little meat
 8. yes ☐ no ☐ drinks too little milk or
 9. yes ☐ no ☐ drinks too much milk
 10. yes ☐ no ☐ eats too many sweets
 11. yes ☐ no ☐ other (specify) _____
28. Do you give this child a vitamin, mineral, health food, or other kind of supplement? Yes ☐ No ☐. If yes, give name of supplement _____. Name and address of manufacturer _____. Amount given per dose _____. How often is it given? _____. On whose recommendation? _____. What do you think is the purpose of the supplement? _____
29. If you are not now giving this child a vitamin, mineral, or other type of nutrient supplement, have you given a supplement to him in the past? Yes ☐ No ☐. If yes, when did you discontinue this practice? _____ Why? _____
30. Supply the information requested about the early feeding of mile to this child.
1. Breast-fed completely from birth to _____ weeks.
 2. Combined breast and bottle-feeding from age _____ to _____.
 3. Bottle-fed completely from age _____ to _____.
 4. Complete weaning from breast or bottle at age _____.
31. If the child was not breast-fed, state the reason _____

- What kind of milk or commercial formula was used? _____
Was the formula sterilized? Yes ☐ No ☐. If yes, when was sterilization of formula discontinued? _____
32. (a) At what age were vegetables first given? _____
In what form were they introduced? _____
Did the child refuse any vegetables served? Yes ☐ No ☐.
If yes, which vegetables? _____

- (b) Did you give the child sieved vegetables? Yes ____ No ____.
 If yes, until what age? _____
 Did you give the child chopped vegetables for juniors? Yes ____ No ____
 If yes, until what age? _____
 At what age did this child start eating vegetables as served
 to the family? _____
- (c) Does the child like most vegetables now? Yes ____ No ____?
 If no, name those he refuses or has to be coaxed to eat
 _____.

Indicate below the attitude of other members of the family
 toward vegetables that the child is reluctant to eat.

	Likes	Dislikes	Will eat
Mother	_____	_____	_____
Father	_____	_____	_____
Older brothers	_____	_____	_____
Older sisters	_____	_____	_____

33. (a) Did you give orange juice to this child as an infant? Yes ____ No ____.
 At what age was it first given? _____
- (b) At what age were fruits, other than orange juice, first given
 to the child? _____
- Which fruits were used? _____
 In what form were they served? _____
 Does this child like fruits now? Yes ____ No ____.
34. (a) At what age were meats first given to the child? _____
 Which meats were served? _____
 Did the child use sieved meats? Yes ____ No ____?
 If yes, until what age? _____
 Did he use chopped meats? Yes ____ No ____.
 If yes, until what age? _____
 When did the child start eating meats served to the family? _____
- (b) Does the child refuse to eat any meats that you serve? Yes ____
 No ____.
 If yes, state which ones _____
 Do other members of the family refuse these meats? Yes ____ No ____.
 If so, which meats _____
 and which family members? _____
35. Weight at birth _____ Weight now _____
 Length at birth _____ Length or height now _____
 (Star if mother refers to record)
36. Has this child had colds in the last year? Yes ____ No ____.
 If yes, how many? _____; about how long did they last? _____;

was medication given? Yes____ No____.

37. Has the child had intestinal upsets such as diarrhea during the last year? Yes____ No____. How many times?____
Did he have medication? Yes____ No____.
38. Has the child had other illnesses during the last year? Yes____ No____. Don't know____. What illness did he have then?____
40. Has this child been hospitalized? Yes____ No____; at what age or ages?____ If yes, for what reasons? (list in same order as ages)____
41. Has this child been examined by a doctor during the last year? Yes____ No____. If yes, state number of times____ and give reasons for the examinations.____
42. Has this child been examined by a dentist during the last year? Yes____ No____. If yes, for what reason?____
43. Has this child shown any evidence of eczema? Yes____ No____; hives? Yes____ No____; asthma? Yes____ No____; adenoids? Yes____ No____.
44. Has this child had the following immunizations:
____ DPT or 3 in 1 (diphtheria, whooping cough and tetanus)
____ Polio
____ Smallpox vaccination
____ Measles
45. Has this child had any surgery? Yes____ No____.
If yes, specify____.
46. Does this child have any kind of health condition that affects the kind or amount of food eaten? Yes____ No____. If yes, specify condition____.
47. Were you (the mother) or this child on a WIC program during 1980-81?
Mother ____yes ____no How long?____
Child ____yes ____no How long?____

ANTHROPOMETRIC MEASUREMENTS

NAME____ NUMBER____

HEIGHT____cm

WEIGHT____lb____oz.

TRICEPS SKINFOLD

Reading #1____mm; #2____mm; #3____mm

UPPER ARM CIRCUMFERENCE _____ mm

THIGH CIRCUMFERENCE _____ mm

INSTRUCTIONS FOR RECORD OF FOOD EATEN BY THE PRESCHOOL CHILD
(for Form 2)

1. Record the time when any food is eaten.
2. Record all food the child eats or drinks for three consecutive days.
3. Record amount child eats or drinks using the following utensils for measurements.

(a) set of "standard" measuring cups	(c) set of "standard" measuring spoons
(b) 1 cup liquid measuring cup	(d) ruler

Record only the amount eaten, not what is left on plate.

* * * * *

- | | |
|------------------------------------|--|
| <u>Beverages</u> | <ul style="list-style-type: none"> -list all kinds of beverages as whole milk, chocolate milk, carbonated drink, fruit flavored drink or mix. -record by cups (1/4, 1/3, 1/2, 2/3, 3/4, 1) or tbsp. |
| <u>Bread</u> | <ul style="list-style-type: none"> -list kinds of breads or rolls as whole wheat, rye, white, hamburger bun -record bread in number or parts of slices -record rolls and crackers by number |
| <u>Butter, Mar-garine, Spreads</u> | <ul style="list-style-type: none"> - measure and record butter and margarine, peanut butter, jam and other spreads if used |
| <u>Cereals</u> | <ul style="list-style-type: none"> - list kinds of cereal as raisin bran, cornflakes - measure added milk, cream, or sugar |
| <u>Cheese</u> | <ul style="list-style-type: none"> - list kinds of cheese as cottage, Cheddar - record cottage cheese by tbsp. - record Cheddar cheese in slices as 2" x 2" x 1/8" or by ounce or by slice |
| <u>Desserts</u> | <ul style="list-style-type: none"> -list kind of dessert as apple pie, chocolate pudding, frosted angel food cake -record puddings and ice cream by cups (1/4, 1/2, 1) -record cupcakes and cookies by diameter as 2 3/4" diameter -record pies in fraction as 1/8 of 8" pie |
| <u>Eggs</u> | <ul style="list-style-type: none"> -record number and method of preparation as fried, scrambled, poached |
| <u>Fish, Meat and Poultry</u> | <ul style="list-style-type: none"> -list kind and method of preparation as broiled lamb chop, fried chicken, roast pork -record in inches as 2" x 3" x 1/4" or 1 wing, 1 drumstick, 3" diameter hamburger patty -record number of shrimp, scallops, fish sticks, wieners, sausages |
| <u>Fruits and Fruit Juices</u> | <ul style="list-style-type: none"> -list the form (fresh, frozen, or canned) and kind of fruit -if fresh fruit, specify if small, medium, large -list the form (fresh, frozen or canned) and kind of juice -if fruit flavored drink or mix, specify kind -if sugar added, indicate amount |

- Miscellaneous
- list kind and size of candy bar
 - list kind and number of nuts, pieces of candy
 - record amount of popped corn by cups (1/4, 1/2, 1)
 - record amount of chewing gum
- Mixed Foods
(Casseroles,
Salads)
- any food prepared from a combination of ingredients
 - record proportions of ingredients in recipes
 - record amount child eats
- Vegetables
- list kind of vegetable, as broccoli, potatoes-baked, fried, mashed
 - measure and record added butter and sauces
 - record cooked vegetables by portions of cups (1/4, 1/3, 1/2) or tbsp.
 - record raw celery as portion of 1 stalk
 - record potato chips and French fries by number
- Vitamin or Other- record brand name and amount
Food Supplement

Kind of Food Child Eats and Drinks and Description	Amount Child Eats (cup, tbsp., tsp., number)
Corn Flakes with sugar whole milk	3/4 cup 1/2 tsp. 1/2 cup
Toasted cheese sandwich white bread American cheese margarine	 1 slice 1 slice 3"x3"x3/16" 1 tsp.
Raw apple	1/2 of small apple
Canned peaches	1 peach half 2 tbsp. juice
Fried chicken	1 leg
Roast beef	1 thin slice, 4 1/2"x2"
Mashed potatoes with milk and butter added	1/4 cup

Gravy on potatoes	1 tbsp.
Raw carrot sticks	4 - 3" long
Cherry pie	1/8 of a 9" pie
Milk chocolate bar	1 ounce
Pecan halves	6
Frozen orange juice	3/4 cup
Tuna noodle casserole 1/4 lb. uncooked noodles 1-7 oz. can tuna fish 1 can cream of mushroom soup 1/4 cup crushed potato chips	3/4 cup
XYZ brand vitamin	1 tablet

APPENDIX B

Respondent _____

A. TEST OF NUTRITION KNOWLEDGE

Some statements concerning nutrition are given below. Please indicate whether or not you think a statement is true or false. Circle "T" for true and "F" for false. After you have reached this decision indicate how certain you are about the answer. If you are very confident of your decision, circle "5"; if you are very doubtful, circle "1". Circle other numbers to indicate degrees of certainty between these extremes.

If you are completely unsure of the answer, circle "U" for undecided but do not circle a degree of certainty.

Please be sure to respond twice to every statement:

	True or False or Undecided	Degree of Certainty	
	T F U	5 4 3 2	:
1. Good eating habits are important to health			
2. In a family, including a father, mother, son 16 years old and an 18 year-old daughter, the father should have the largest serving of meat.	T F U	5 4 3 2	:
3. Protein-rich foods, such as meat, milk and eggs, provide liberal amounts of several nutrients needed for the growth of small children.	T F U	5 4 3 2	:
4. It is better not to include orange juice and milk in the same meal because the orange juice causes the milk to curdle in the stomach.	T F U	5 4 3 2	:
5. By the end of the first year babies should have learned to use a variety of foods besides milk, as a one-sided milk diet may be inadequate for total growth and development	T F U	5 4 3 2	:
6. School age children need multiple vitamin pills to ensure good health.	T F U	5 4 3 2	:
7. The term well-balanced when applied to a day's diet often means that all of the food groups in a daily plan are included in amounts recom- mended.	T F U	5 4 3 2	:
8. Chemicals as now used to bleach flour are harmful to human beings.	T F U	5 4 3 2	:

- | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9. Vitamins aid the body in making use of its building and maintenance materials, hence serious vitamin deficiency may affect many parts of the body. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 10. When children have enough food to satisfy their appetites their diets are certain to be nutritionally adequate. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 11. Healthy adults should take food supplements or vitamin pills to ensure having all the nutrients needed for good nutrition. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 12. A good nutritional practice is to eat a wide variety of types of foods from day to day. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 13. Eggs can completely replace milk in the diet so far as nutrients are concerned. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 14. Carbonated beverages are a good food item in the diets of young children. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 15. Citrus fruits include strawberries, raspberries and blueberries. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 16. Skim milk contains about the same amounts of the body building minerals and protein as whole milk. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 17. No reducing diet should contain bread or potatoes. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 18. A meal consisting of sirloin steak, French fries, head lettuce salad and coffee provides at least one-third of all nutrients needed daily by adults . | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 19. Most fat children and adults have a glandular disturbance. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 20. Milk is a food needed mainly for infants and growing children. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 21. Apples that taste sour or tart are generally not good for people. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 22. Apples are an excellent source of Vitamin C. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 23. Foods enriched with Vitamin D help to ensure the normal development of bones and the prevention of rickets. | T | F | U | 5 | 4 | 3 | 2 | 1 |

- | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 24. Gelatin, or Jello, desserts are a good source of protein. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 25. Hard cooked eggs are indigestible. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 26. All people should use a low-fat, low-cholesterol diet to prevent heart disease and strokes. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 27. Cheese is constipating. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 28. A glass of lemonade can be substituted for a glass of orange juice so far as the Vitamin C in the two products is concerned. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 29. Grape juice is an important source of nutrients which guard against anemia. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 30. If a person eats regularly he should be rated as having good food habits. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 31. If a meal is not too starchy or too fat it will be well balanced. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 32. The greater the percentage of polyunsaturated fats in a food the greater the health-giving properties of that food. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 33. The green leafy and yellow vegetables are stressed in daily food plans because they help to ensure meeting the vitamin A needs of the individual. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 34. Healthy, active, young children require some concentrated sweets each day for energy needs. | T | F | U | 5 | 4 | 3 | 2 | 1 |
| 35. Pasteurization destroys much of the food value of milk. | T | F | U | 5 | 4 | 3 | 2 | 1 |

Respondent _____

B. ATTITUDE TOWARD NUTRITION AND EATING HABITS OF PRESCHOOL CHILDREN

We are interested in your judgment of each statement in terms of how well it reflects your attitude. If the statement describes how you feel about your child's nutrition or eating habits, circle the "A" (agree); if the statement does not describe how you feel, circle the "D" (disagree). If you are completely uncertain about the statement, circle "undecided".

After you have made your decision, indicate how certain you are about it. If you are very confident of your decision, circle "5". If you are very doubtful, circle "1". Circle other numbers to indicate degrees of certainty between these extremes. If you have circled "U", do not circle a degree of certainty. A good way to keep these directions in mind is to imagine you were to respond to the items again. How certain are you that you would again respond just as you did this time?

	Agree or Disagree or Undecided			Degree of Certainty				
1. I let the child choose whatever he wants for breakfast.	A	D	U	5	4	3	2	1
2. Children's foods have so many vitamins added that I don't have to bother about nutrition.	A	D	U	5	4	3	2	1
3. I feel my child's nutrition now will be extremely important as he grows older.	A	D	U	5	4	3	2	1
4. As long as the child doesn't pick the same thing constantly, I feel it is all right to let him select his own food.	A	D	U	5	4	3	2	1
5. As long as my child is not sick, I guess I must be feeding him right.	A	D	U	5	4	3	2	1
6. Nutrition is important, and one should not be careless about it.	A	D	U	5	4	3	2	1
7. Even if I give vitamins, I feel that I should be concerned about my child's diet.	A	D	U	5	4	3	2	1
8. Children are more likely to eat well if they select the meat for the meal.	A	D	U	5	4	3	2	1
9. If my child says, "Let's have _____ for lunch," I feel that I should do so.	A	D	U	5	4	3	2	1

- | | | |
|--|-------|-----------|
| 10. I feel that if the child drinks milk,
I don't have to worry about nutrition. | A D U | 5 4 3 2 1 |
| 11. Because the children are fussy about what
they eat, I feel it is necessary to let
them pick what they want for meals. | A D U | 5 4 3 2 1 |
| 12. As long as the doctor doesn't say
anything to me about nutrition, I
don't think I need to worry about it. | A D U | 5 4 3 2 1 |
| 13. I feel that as long as my child is
gaining weight, I don't have to worry
about his nutrition. | A D U | 5 4 3 2 1 |
| 14. I just don't have time to think much about
nutrition. | A D U | 5 4 3 2 1 |
| 15. Nutrition is not so important as long as
my child eats a lot. | A D U | 5 4 3 2 1 |
| 16. I believe a child should be allowed to
choose what he wants for breakfast and
lunch, even if it means a little more
preparation for me. | A D U | 5 4 3 2 1 |
| 17. I am concerned about getting my child to
eat "good" foods throughout the day. | A D U | 5 4 3 2 1 |
| 18. Children should be allowed to eat whatever
they want. | A D U | 5 4 3 2 1 |
| 19. Nutrition is not so important if my child has
plenty of liquids. | A D U | 5 4 3 2 1 |
| 20. Young children don't grow correctly when they
have improper diets. | A D U | 5 4 3 2 1 |
| 21. I believe that a child should not be permitted
to have a diet which is deficient in protein,
minerals and vitamins. | A D U | 5 4 3 2 1 |

C. ATTITUDE TOWARD MEAL PLANNING

What is your attitude toward meal planning? Read each of the following statements. At the right of each statement circle the letter and number which best describe your reaction to it.

The letters and numbers mean the same as in section B.

- | | | |
|---|-------|-----------|
| 1. Planning meals several days at a time makes it
possible to buy food more efficiently. | A D U | 5 4 3 2 1 |
|---|-------|-----------|

- | | | |
|---|-------|-----------|
| 2. The time a homemaker spends planning meals is extremely important. | A D U | 5 4 3 2 1 |
| 3. A homemaker can spend her time more efficiently if she thinks through the order of preparing the foods for a meal. | A D U | 5 4 3 2 1 |
| 4. Planning a meal just before starting to cook is a time saver. | A D U | 5 4 3 2 1 |
| 5. Planning meals a day at a time is better than planning for a longer time period. | A D U | 5 4 3 2 1 |
| 6. Planning meals several days in advance helps a homemaker serve well balanced meals. | A D U | 5 4 3 2 1 |
| 7. Planning meals that are at the same time appealing, quickly prepared and economical is a chore. | A D U | 5 4 3 2 1 |
| 8. Time plans annoy me - I want to feel free to hurry or loiter as I please. | A D U | 5 4 3 2 1 |

D. ATTITUDE TOWARD FOOD PREPARATION

At the right of each statement circle the letter and number that best describes your first reaction to the statement.

Letters and numbers mean the same as in sections B and C.

- | | | |
|---|-------|-----------|
| 1. One of the best ways for a homemaker to get recognition from her friends is to be a good cook. | A D U | 5 4 3 2 1 |
| 2. Food cookery satisfies my yearning to express myself. | A D U | 5 4 3 2 1 |
| 3. Foods I prepare from a recipe taste better than those I make from mixes. | A D U | 5 4 3 2 1 |
| 4. Preparing food three times a day the year around is monotonous. | A D U | 5 4 3 2 : |
| 5. Because my family likes my cooking, I find food preparation a rewarding task. | A D U | 5 4 3 2 : |
| 6. Changing the ingredients in a recipe makes me feel that the final product is more my own. | A D U | 5 4 3 2 1 |
| 7. Cooking does not interest me. | A D U | 5 4 3 2 : |
| 8. A person who is able to prepare many foods well is to be admired. | A D U | 5 4 3 2 : |

- | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|
| 9. Cooking is an important art. | A | D | U | 5 | 4 | 3 | 2 | 1 |
| 10. It is fun to make up my own recipes. | A | D | U | 5 | 4 | 3 | 2 | 1 |
| 11. Cooking takes too much of my time. | A | D | U | 5 | 4 | 3 | 2 | 1 |

APPENDIX C

Table XV.--Anthropometric measurement values of Jardine preschool children.

Child	Nat ^a	Sex	Age	Height cm	Weight lb-oz	Upper Circum- ference cm	Arm Circum- ference cm	skinfold thickness cm
A-8	V	F	5	114.8	48-9	34.5	20.0	17.6
B-3	N	F	4	104.5	39-12	29.7	17.0	12.1
B-4	N	M	3	95.4	30-3	29.7	16.5	12.0
B-10	N	M	3	95.1	32-3	28.2	16.5	10.3
B-24	N	F	3	99.7	35-0	27.9	18.0	14.6
B-30	N	M	4	104.7	33-7	28.3	14.5	6.9
C-23	I	M	3	85.7	25-10	27.0	15.0	10.1
C-29	N	F	5	116.0	46-4	34.7	17.5	11.5
D-4	S	F	2	98.9	28-4	29.0	17.5	10.1
D-5	N	F	4	103.3	40-0	31.0	17.5	13.1
F-1	K	F	4	107.5	36-8	30.1	16.0	10.3
F-2	J	M	3	96.7	32-12	29.5	16.5	10.6
I-7	N	M	5	107.9	40-0	32.7	17.5	10.0
K-27	N	M	2½	94.0	30-2	26.3	15.4	10.1
M-29	G	M	4	96.0	29-14	26.5	15.0	8.0
N-1	J	M	2	83.9	23-0	23.5	14.5	6.8
N-3	Cr	F	5	103.9	43-13	35.5	12.5	14.2
N-9	S	F	4	100.2	30-12	26.8	15.0	8.3
N-30	C	F	4	101.5	40-10	36.0	15.0	14.0
Q-9	Iq	M	2	84.1	27-8	26.2	15.5	8.0
R-4	C	M	5	115.5	45-0	33.7	17.0	8.7
S-3	K	M	5	115.8	48-8	26.2	15.5	12.8
S-4	K	F	4	104.5	37-12	28.6	17.5	11.0
S-10	K	F	4	98.2	34-8	31.5	17.5	12.0
T-4	B	M	2	90.5	33-13	29.7	18.0	11.1
T-23	Tw	M	3	97.5	29-8	25.5	16.0	11.1
V-4	I	F	5	113.2	46-1	33.5	19.0	14.1
V-9	K	M	3	95.5	33-4	29.0	17.0	9.3
W-1	Tw	M	4	97.5	31-12	28.0	16.0	6.8
W-7	T	M	3					
W-10	L	F	3	90-7	35-0	31.8	19.0	10.1
W-23	Vn	M	2	83.8	24-0	23.3	15.0	7.1
W-30	V	F	2	91.7	30-9	30.0	18.0	8.8
X-1	T	M	3	107.1	36-0	27.8	17.5	10.0
X-3	P	M	2					
X-4	L	M	5	105.6	33-10	25.0	15.0	6.8
X-5	N	M	2	97.5	41-12	35.0	19.0	11.1
X-9	Jo	M	3	95.0	35-9	30.1	17.5	10.2
X-10	Iq	F	2	88.4	27-0	26.8	16.5	10.5
Y-3	I	M	4	101.7	35-0	28.0	16.0	9.4
Y-4	N	F	3	100.1	36-6	30.2	17.5	7.8
Y-10	K	M	5	114.6	50-4	34.0	18.0	8.5
Y-29	N	M	3	101.6	42-2	31.5	17.5	7.5
Y-30	I	F	2	92.6	28-4	28.1	17.0	10.1

^a Nationality

B: Brazil
 C: Colombia
 G: Guatemala
 I: Iran
 J: Japan
 K: Korea
 N: Nigeria
 P: Palestine
 S: Sudan
 T: Tunisia
 V: Venezuela

Cr: Costa Rica
 Gr: Greece
 Iq: Iraq
 Jr: Jordan
 Pk: Pakistan
 Tw: Taiwan
 Vn: Vietnam

Table XVI.--Percentage contribution of protein, fat and carbohydrate to total energy intake of children

Child	Protein		Fat		Carbohydrate		Energy
	gm	%	gm	%	gm	%	
A-8	200	16	405	32	648	52	1253
B-3	136	13	315	30	576	57	1030
B-10	208	16	585	46	492	38	1276
B-24	208	19	504	45	408	36	1120
B-30	264	16	666	40	736	44	1659
C-23	144	15	369	39	448	46	958
D-5	68	14	180	38	224	48	470
D-9	136	17	279	35	404	48	800
F-1	300	19	873	55	436	26	1601
F-2	248	19	594	46	472	35	1305
I-7	168	18	261	28	500	54	919
K-27	132	17	288	38	340	45	759
M-29	136	14	252	26	492	60	972
N-1	256	14	963	51	660	35	1881
N-3	200	19	342	32	608	49	1057
N-9	108	15	243	33	404	52	741
N-30	220	12	531	29	1136	59	1845
Q-9	128	15	333	39	412	46	850
R-4	280	18	351	23	932	59	1560
S-3	220	14	486	30	924	56	1603
S-4	232	17	702	51	496	32	1382
S-10	144	15	369	38	460	47	967
T-4	196	12	567	36	872	52	1589
T-23	284	21	513	38	576	41	1346
V-4	176	12	423	29	944	59	1462
V-9	224	18	315	26	704	56	1216
W-1	384	19	819	45	632	36	1810
W-7	256	23	450	40	424	37	1120
W-10	356	20	621	35	840	45	1793
W-23	256	17	414	28	816	55	1489
W-30	288	15	702	38	864	47	1860
X-1	292	21	432	30	748	49	1420
X-3	188	16	360	30	676	54	1205
X-4	280	17	657	40	732	43	1652
X-9	260	19	648	48	444	33	1340
X-11	232	22	369	35	464	43	1052
Y-3	184	17	369	34	560	49	1091
Y-4	136	11	486	38	688	51	1292
Y-10	180	13	306	22	904	65	1386
Y-29	124	13	171	19	640	68	920
Y-30	140	12	261	36	724	52	1170
X-5	92	10	198	22	628	68	912
X-10	288	25	495	42	388	33	1172

Table XVII.--Scores of the mothers on nutrition knowledge and attitude tests

Mother	Nutrition knowledge	Eating habits of preschool child	Nutrition	Meal planning	Food preparatio
A-8	83	-40	69	32	64
B-3	77	-39	80	33	44
B-10	-45	- 8	56	40	47
C-23	55	-32	83	37	19
F-1	22	-16	54	29	26
F-2	-69	-48	-3	11	80
I-7	24	14	15	-13	34
M-29	31	-27	2	8	53
N-30	-22	28	38	-8	31
N-1	67	20	56	28	37
N-3	45	-42	-3	7	30
N-9	14	-37	29	20	44
Q-9	47	- 8	56	24	30
R-4	197	-40	93	48	24
S-3	31	5	48	15	24
S-4	124	- 5	87	29	7
S-10	33	18	50	5	18
T-4	156	- 8	80	40	32
T-23	168	-45	62	48	6
V-4	-32	30	12	-32	23
V-9	33	-26	72	52	49
W-7	-59	- 7	18	-10	40
W-10	-36	28	-2	10	69
W-23	-49	23	48	13	19
W-30	88	-28	88	27	3
X-1	62	-18	80	26	59
X-3	20	-31	71	-8	-2
X-4	36	22	36	8	29
X-9	57	7	72	31	59
X-11	38	-16	70	40	43
Y-3	29	-40	93	-1	41
Y-4	21	-14	40	28	48
Y-10	33	5	45	8	28
Y-29	138	8	20	26	59
Y-30	175	19	90	-19	43

NUTRITIONAL STATUS OF
PRESCHOOL CHILDREN OF INTERNATIONAL STUDENTS
LIVING IN THE JARDINE TERRACE APARTMENTS

by

ORLANDO MARTINEZ CACERES

B. S., Universidad de Pamplona, 1973

AN ABSTRACT OF A MASTER'S THESIS

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MASTER OF SCIENCE

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Factors affecting the nutritional status of 46 preschool children of international students living in the Jardine Terrace Apartments at Kansas State University were investigated. Height, weight, thigh circumference, arm circumference, and triceps skinfold thickness were measured. Three-day dietary records were obtained and food energy and 13 nutrients were calculated and compared to the 1980 RDA. Blood samples were collected and analyzed for hemoglobin and hematocrit. Tests of nutrition knowledge and attitudes toward nutrition, eating habits of the child, meal planning and food preparation were given to the mothers.

In comparison with NCHS height percentile curves, 62% of the children fell in the normal range between the 25th and 75th percentiles, 10% were above the 75th percentile and 12% were below the 25th percentile. According to the NCHS weight curves, 55% of the children were between the 25th and 75th percentiles, 10% between the 75th and 90th percentiles and 35% below the 25th percentile. Two boys were below the 5th percentile for both height and weight. In general, girls were taller and heavier than boys at the same age.

Thigh circumferences were compared to Boston standards which indicated that 50% of the children fell in the normal range, 2% were above the 75th percentile and 48% were below the 25th percentile. When arm circumferences were compared to percentiles found in the U.S. Ten-State Survey, 95% of the children fell between the 85th and 95th percentiles and only 5% were below the 50th percentile. When triceps skinfold measurements were compared to percentiles found in the Ten-State Survey, 26% of the children fell between the 85th and

95th percentiles, 71% between the 15th and 85th percentiles and 3% were below the 15th percentile. In general, girls' measurements for thigh circumference, arm circumference and triceps skinfold thickness were greater than those of the boys.

Mean daily intakes of food energy did not meet the RDA for the age groups studied and only 25% of the individual children's intakes met the RDA for food energy. Mean intakes of protein for all the age groups met the RDA and 97% of the individual children's intakes met the RDA. Boys had greater intakes of calories and protein than girls. However, girls had greater intakes of fat and carbohydrate than boys.

In all but two cases, mean intakes of each of the vitamins for each age group met the RDA. Sixty percent or more of the diets of the individual children met 100% of the RDA for all vitamins except vitamin B₆ (49%) and many of the other diets met at least 67% of the RDA for all vitamins. However, vitamins B₆ and A were below 67% of the RDA in 25 and 19% of the diets, respectively.

Mean intakes of each of the minerals studied for each age group met the RDA in only two cases. Iron, calcium, magnesium and phosphorus were below 67% of the RDA in 57, 42, 42, and 30% of the diets, respectively.

The mean value for hemoglobin was 12.3 gm/100 ml and for hemocrit, 39.5%. None of the children had hemoglobin or hematocrit values that were indicative of anemia.

The test scores of the mothers indicated that their attitude toward nutrition was better than their nutrition knowledge. An

attitude of permissiveness prevailed among the mothers in regard to eating habits of their children. Their attitude toward food preparation was better than their attitude toward meal planning.