

ASSESSMENT OF THE NUTRITIONAL STATUS OF PRE-SCHOOL CHILDREN OF WORKING MOTHERS

by

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(L-85-H.Sc.-169-M)

Thesis

**Submitted to the Punjab Agricultural University
in partial fulfilment of the requirements
for the degree of**

**MASTER OF SCIENCE
IN
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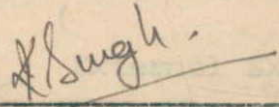
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CERTIFICATE I

This is to certify that this thesis entitled, "Assessment of the Nutritional Status of Pre-School Children of Working Mothers", submitted for the degree of Master of Science in the subject of Foods and Nutrition (Minor Subjects : Biochemistry, and Food Technology), of the Punjab Agricultural University, Ludhiana, is a bonafide research work carried out by Satwinder Kaur (L-85-H.Sc-169-M) under my supervision and that no part of this thesis has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledged.

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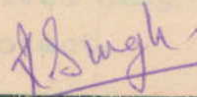

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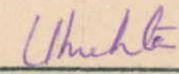
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fulfilment of the requirements for the degree of
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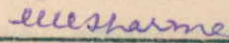


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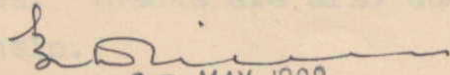


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CHAPTER I

INTRODUCTION

Good nutrition is essential if one is to achieve good health. Every person should supply his or her body with all the essential nutrients needed to keep it in the best possible condition. Not only is good nutrition vital for the normal growth of children but it is also needed to maintain physical and mental fitness throughout their life-span.

Today's children will become the citizens of tomorrow. It is, therefore, of prime importance to take care of their health, for besides being an end in itself it is also a duty of the society to the world of tomorrow. Next to infancy, the most vulnerable period is the pre-school age. Within this period, there is development from babyhood into childhood. During the first five years of life, there is rapid growth (Mishra and Gupta, 1978), which calls for intake of greater amounts of nutrients. It is in this period that the foundation for life time is laid (Devadas et al., 1984).

In the pre-school age, the child is entirely dependent on the mother for food. The significant role of the mother in bringing up the new born is well known. However, there has been a gradual increase in education and employment as shown by comparison between census in 1971 and 1981. Dual stress and conflicting demands in and outside the home have adverse effects on the child's health and nutrition. At the same time, employment may bestow upon the working woman and her family such benefits as a rise in purchasing power and standard of living with consequent improvement in nutritional status (NIN, 1985). With rapid industrialisation and urbanisation, an increasing number of women are seeking gainful employment outside their homes. Working women today constitute about 12 per cent of the total female population in the country and most of them are in the reproductive age period (Thimmayama et al. 1980).

The increased employment of women has led to a demand for convenient and instant foods. This situation has brought about drastic changes in the eating styles of families, thus, affecting their nutritional status. Besides this, the

western influence on the dietary pattern of our people cannot be ignored (Kaur, 1985). The use of carbonated beverages and tea, for example, in day-to-day living has brought changes in food consumption pattern and nutritional status of individuals.

Malnutrition is one of the serious problems among pre-school children in India, the main causes being ignorance, non-availability of food and unequal distribution of food in the family. This leads not only to high rates of mortality and morbidity but also adversely affects physical and mental development of child. Nutritional anaemias, PEM and vitamin deficiencies, especially those of vitamin A, are of common occurrence (Rao, 1978). In Punjab, about 2.4 per cent of the children are suffering from marasmus, anaemia accounts for 17 per cent of the children and vitamin A deficiency for 0.18 per cent of the children. Deficiencies of vitamin B-complex and vitamin C have also been detected in pre-schoolers (CARE, 1974).

Malnutrition of pre-school children has other causes. Food beliefs and prejudices are important social factors which lead to consumption

of restricted diets not only in poor families but also in rich families. Ignorance of the methods of prevention of malnutrition and the folklore and food habits which operate against the use of locally available foods constitute important contributory factors. The solution to the problem lies in the more effective use of locally available and inexpensive foods in proper combination (Rajalakshmi, 1976).

The evaluation of nutritional status of a pre-school child is important for ensuring improved physical and mental development and optimum functional performance. Measurements of heights and weights are important tools in assessing the nutritional status of a population. If properly obtained and interpreted, they would serve as useful indicators in the evaluation of nutritional status (Somerwara and Rao, 1961). Clinical assessment is important for assessing the levels of health of individuals and population as influenced by the diet they consume (Rao et al. 1979).

Thus, efforts must be made at the national level to find a lasting solution to the problem of

malnutrition among pre-schoolers especially because the pre-schoolers in India constitute 15 per cent of the total population as against 7 per cent in the technologically advanced countries of the world (Bhat and Dahiya, 1985).

In view of the above facts, the study on the nutritional status of pre-school children of working mothers has been undertaken with the following objectives :

- 1 To examine the existing dietary practices of pre-school children of working mothers.
- 2 To study the food and nutrient intake of pre-school children and compare with the recommended allowances of ICMR, 1981.
- 3 To assess the nutritional status of pre-school children aged 1-6 years through anthropometric measurements and clinical observation.

CHAPTER II

REVIEW OF LITERATURE

The relevant literature related both directly and indirectly to the present study has been discussed in this chapter under the following headings :

- 2.1 Dietary Surveys on Pre-School Children
- 2.2 Anthropometric Measurements
- 2.3 Clinical Signs and Symptoms Due to Nutritional Deficiency
- 2.4 Biochemical Assessment
- 2.5 Factors Associated With the Nutritional Status.

2.1 Dietary Surveys on Pre-School Children

Metheny et al. (1962) studied the nutrient intake of 87 pre-school children in Columbus and found that 21 per cent of the children had diets meeting 10 per cent or more of the RDA, 61 per cent had diets in which some nutrients were less than 10 per cent of the allowances but all had 67 per cent or more of the allowances.

Garn (1968) studied energy intake of 25 boys

and 26 girls below 6 years of age from South-Western Ohio and found that the calorific value of the diet of the boys exceeded that of girls from 4-6 years of age.

Brown et al. (1970) analysed the nutrient intake of the school children and found that dietary intake of calcium, iron, vitamin A and ascorbic acid was frequently below 2/3rd of the existing recommended dietary allowances.

A study conducted by Park and Lee (1973) on daily food intake of 118 children by 3-day record showed that the intake of meat and fish, beans, milk, fruit, fat and oil was below 50 per cent of the recommended allowances.

The factors affecting the intake of energy and protein by 45 Ugandan pre-school children were studied by Rutishauser (1974). In 1st and 3rd years of life, intake of energy and protein was low. It was found that appetite associated with illness was main factor in restricting intake of energy and protein.

A survey conducted by Standal and Tiangha (1977) on 421 pre-schoolers in Hawaii revealed that

the middle income group children received green and yellow vegetables and butter and fat as often as low income group.

Martin et al. (1977) studied the food intake and family income of 337 families. The overall mean intake of energy and protein, thiamine, riboflavin and vitamin C was satisfactory, whereas that of vitamin A and calcium was 41 and 34 per cent respectively of the values considered adequate. When food intake was related to income, energy intake in lower income group was inadequate.

Alves (1977) studied 2380 families in Sao-Paulo and found that 15.7 per cent of the families had inadequate intake of energy and protein.

Makkar (1978) studied food intake of pre-school children in Habowal Kalan in Ludhiana district. The intake of cereals, pulses, green leafy vegetables, roots and tubers, fruits, milk and milk products, fats and oils, flesh foods, sugar and jaggery and nuts and oilseeds were

131.70 g,	11.13 g,	20.85 g,
12.80 g,	40.75 g,	20.45 g,
126.45 g,	14.66 g,	1.55 g,

23.69 g and 2.75 g, respectively.

Rao et al. (1980) studied nutrient intake of pre-school children which they observed to be significantly related to the intake per consumption unit of family except for iron in rural families. They further reported that it was related to occupation and except in case of vitamin A, to age of child, family income per person and negatively to family size.

Graham et al. (1980) studied the nutrient intake of 130 children and found that the mean daily intakes were 1675 ± 498 kcal, 41 ± 12.1 g protein, 42.1 ± 21.1 g fat, 293 ± 167 mg calcium, 8.9 ± 3.0 mg iron, 0.64 ± 0.07 mg thiamine and 0.96 ± 0.45 mg riboflavin.

The energy intake of well-to-do pre-schoolers in India was studied by Rao et al. (1983). Their diet was adequate in energy and fat and they were fed at short intervals.

Dewey (1983) conducted a study on 149 pre-school children in Mexico and revealed that the diet of the children was adequate with respect to protein foods and grain products but was low in

fruits and vegetables. He also observed that there were no differences in the dietary intake during summer and winter seasons indicating that the difference in levels of fatness was most likely related to seasonal differences in illness frequency.

Pushpamma et al. (1982) conducted a study on 136 pre-schoolers in Andhra Pradesh and reported that the most deficient nutrients were vitamin C, vitamin A, riboflavin, calcium and iron.

Harris et al. (1983) conducted a survey of Bangladeshi children aged under 5 years in London and they reported that infants and children had diets deficient in vitamin D, iron and energy. Protein intake was satisfactory whereas intake of vitamin C and calcium was adequate.

Bai et al. (1984) studied the nutritional profile of Andhra children and observed that children ate adequate amounts of protein but intake of energy was inadequate. Intake of vitamins, namely thiamine, riboflavin and nicotinic acid was almost adequate while that of vitamin A, iron and calcium was deficient.

Nutritional survey conducted on Pakistani and Turkish infants and children aged 8 to 44 months by Uldall et al. (1984) revealed that the energy consumption was adequate but protein and vitamin contents were low. Iron was also deficient in the diets of some children.

Boggio et al. (1984) studied the food intake of 543 French infants for 3 days. Mean energy intake was greater than the recommended amounts for the age range of 6 to 12 months. The mean intake of linoleic acid was least at an average of 8 or 12 months and was less than 2 per cent of the total energy intake.

Dhir (1985) carried out a survey on pre-schoolers in selected localities of Ludhiana and found that intake of calories, protein, calcium, iron, thiamine and riboflavin was 648 ± 213.76 kcal, 34 ± 8.36 g, 869 ± 53.35 mg, 3.9 ± 2.0 mg, 0.98 ± 0.43 mg/1000 kcal, 0.94 ± 0.4 mg/1000 kcal, respectively.

Anne and Begum (1985) studied 90 children aged 3 to 6 years at the University of Agriculture Science Campus School, Bangalore. They found that

protein and energy intake met recommended amounts but iron intake was 50 per cent of the recommended amount.

Kumari et al. (1985) studied nutritional status of pre-school children from 6 to 18 months. The first group of 82 children received additional fortified bread providing 300 kcal and 10 g protein. No supplementary foods were given to second group but their mothers were given nutritional education regarding the energy requirement and the inclusion of cheap and nutritious foods in the diets of their children. All children showed improvements but the same were greater in the second group.

Bhat and Dahiya (1985) studied nutritional status of 200 rural pre-school children of Hissar district, India. Data indicated that breast feeding continued upto 3 years of age and was supplemented with biscuits and khichri. From 3 years onwards, the children were given the usual adult diet including chapaties, cooked vegetables, dhal and milk or butter milk.

Dhir (1985) studied the food intake of pre-school children in the selected localities of

Ludhiana district. The values for urban pre-school children were : 147 ± 9.93 g, 29 ± 4.05 g, 64 ± 25.47 g, 35 ± 6.27 g, 41.3 ± 52.63 g, 21 ± 3.1 g and 23 ± 1.08 g, respectively for cereals, pulses, vegetables, fruits, milk, fats and oils, and sugar and jaggery.

2.2 Anthropometric Measurements

Neumann et al. (1969) studied the anthropometric profile of young rural Punjabi children and found them to be lighter and shorter than their American counterparts (Harvard standards). As the age increased, this difference also increased. When compared to All India standards, they were found to lag only slightly for height and weight. Females were shorter and lighter than males.

Smith and Brown (1970) studied the Honolulu pre-school children and found that boys at each age were larger than girls. Different income levels didnot have any effect on any measurement. The children were shorter for their age when compared to standards of Feh Research Institute in Ohio. No differences were found in the arm circumference.

Choudhary and Ramakrishana (1972) studied pre-school children in Hoogly district of West Bengal. The boys were found to be better than girls in weight, height and arm circumference for the same age group.

Gwynn and Sanjur (1974) conducted a study on 138 children from Colombia aged 10 to 59 months. Out of the 4 anthropometric variables, body weight for age was the most affected by malnutrition, than body weight for height, height for age, or head circumference. Age was not associated significantly with the anthropometric measurements but sex was associated.

Umapathy (1974) conducted a study in the Karnataka State and revealed that the mean heights and weights of children belonging to different socio-economic groups were comparable to those reported for Indians in general.

Choudhary (1975) conducted a survey in Calcutta and revealed that pre-school children were heavier than all Indian standards. They were taller than most of the regional figures. Boys were superior to girls both in height and weight.

Naik et al. (1976) reported that Punjabi pre-school children were taller than their south Indian counterparts. They compared well with ICMR standards but were shorter than the Harvard standards. The average weight of the Punjabi pre-school children was 100.99 per cent of the ICMR standards and 75.3 per cent of the Harvard standards.

Standal and Tiangha (1977) assessed the anthropometric status of Hawaii's 421 pre-school children. There were no significant differences in height, weight, mid-left forearm circumference as triceps skin fold between children from low income and middle income families.

The anthropometric measurements of 2758 school children from Baghdad (Iraq) were studied by Kassira and Abdou (1978) who reported that an average child had a greater triceps skinfold thickness and smaller mid-arm muscle circumference than the local standards.

Anderson (1979) made a comparison of anthropometric measures and nutritional status of pre-schoolers in five developing countries. Body weight

for age and height for age deficits increased with age, whereas body weight for height decreased.

Briley et al. (1979) made anthropometric evaluation of 42 boys and 48 girls of pre-school age. About 50 per cent of the children fell below the 50th percentile, 76 per cent of the boys and 55 per cent of the girls were classified as thin, malnourished or very malnourished.

Plail and Young (1980) studied a group of children under 5 years age and reported that 22.2 per cent had weight above Jelliffe (1966) standards. None of the children were below 80 per cent of Jelliffe standard mean height for age. In both height and weight results, there was a decrease in percentage of children above the means between 18 months and 5 years old when compared with first 18 months of life. Skinfold thickness measurements were consistently below Jelliffe standards.

Power (1982) suggested that there was no significant difference in the anthropometric measurements between the sexes upto 7.5 years. Only 22 per cent of children under 7.5 years were below the 5th percentile for body weight for age

and 18 per cent were under the 5th percentile for height for age.

McDowell and King (1982) carried out a survey on interpretation of arm circumference as an indicator of nutritional status of 1347 children from Zambia. They suggested that arm circumference was about as accurate an indicator as body weight for age or body weight for length.

Monteiro et al. (1984) studied anthropometric measurements on 1359 pre-school children 2 to 6 years old in areas of Sao-Paulo where income was low and compared them with values for children of similar ages from high income areas. The anthropometric measurements were found to be lower.

Dhir (1985) studied the anthropometric measurements of pre-schoolers in selected localities of Ludhiana district. The height, weight, mid-upper arm circumference, triceps skinfold thickness of urban pre-schoolers were 100.27 ± 8.0 cm, $15.19 \text{ cm} \pm 2.26$ kg, 16.14 ± 1.02 cm and 3.72 ± 0.64 cm, respectively.

Bhat and Dahiya (1985) studied the pre-school

children in Gangwa village in Hissar district and revealed that the height in 1-5 year old boys ranged from 69.3 to 85.5 cm while among girls it varied from 70.9 to 80.7 cm. The weight of boys was in the range of 7.4 to 10.2 kg and the corresponding figures for girls were 6.9 and 8.9 kg.

Mishra et al. (1986) studied the growth pattern among Harijan and tribal pre-school children in six clusters in Uttar Pradesh, India. The estimated population means of weights and heights and their respective velocities showed that the initial growth was normal upto six month old. Weight increment in the first six months of life was 2.9 kg and in 1st, 2nd, 3rd, 4th and 5th years of life, the increments were 4.3, 1.4, 1.5, 1.3 and 1.3 kg respectively. There was 8 cm deficit in second half of 1st year and 4.5 cm deficit in the 2nd year of life.

2.3 Clinical Symptoms Due to Nutritional Deficiency

Rao et al. (1969) found that incidence and severity of vitamin A deficiency was higher

among South Indian children with PCM than those found among North Indian children. Vitamin C deficiency was rarely encountered.

Cook et al. (1973) surveyed 1298 pre-school children and reported that there was little evidence of clinical nutritional deficiency.

CARE (1974) conducted a nutrition survey on pre-school children of Punjab and reported that the deficiency of energy was common and about 2.4 per cent were suffering from marasmus, 17 per cent from anaemia, vitamin A deficiency was seen in only 0.18 per cent of children and 0.72 per cent showed mottling of teeth.

A study was conducted on 707 pre-school children of Andhra Pradesh by Rao and Satyanarayana (1974) according to which the prevalence of protein energy malnutrition was highest among Gonds and Chenchus. The signs of vitamin A and vitamin B-complex deficiencies were comparatively less.

Studies on pre-school children ICMR (1974) revealed that the incidence of Kwashiorkor and marasmus was higher in Poona and Calcutta than in

Hyderabad and Bombay. Vitamin A deficiency was prevalent in Hyderabad and Poona. Incidence of deficiency of vitamin A and vitamin B-complex rose with age. Mean protein intake met the recommended allowances. However, daily energy intakes were low.

Devadas et al. (1973) revealed that 34 per cent of the pre-school children were anemic. Conjunctival xerosis and bitot's spots were the other prevalent deficiency/symptoms.

Burgess et al. (1975) studied nutritional status of children aged 0-5 years and concluded that there was high prevalence of protein energy malnutrition.

Nutritional survey was conducted on pre-school children of Bombay, Calcutta, Hyderabad, New Delhi, Poona and Vellore by ICMR (1977). The deficiency signs commonly observed among children in all six areas were protein-energy malnutrition, ocular manifestation of vitamin A deficiency and oral lesions due to B-complex deficiency.

Gupta et al. (1978) conducted a clinical study of 1235 pre-school children from rural and urban areas of Western Rajasthan and reported the

incidence of protein-energy malnutrition in 11.52 per cent, night blindness in 2.9 per cent, Bitot's spots in 2.2 per cent and corneal and conjunctival xerosis in 1.13 per cent and 1.29 per cent. The incidence of rickets was 2.6 per cent.

Taneja et al. (1978) studied the nutritional deficiency symptoms of 513 children. The deficiencies of B-vitamin occurred as angular stomatitis, glossitis and cheilosis and those of vitamin A and necrosis. Three children had Bitot's spots. Anaemia was present in 19 children only.

Indian Council of Medical Research (1984) surveyed the different states of India and found that anaemias, B-complex, ascorbic acid, vitamin A deficiency symptoms were common among children.

Bhat and Dahiya (1985) observed in 200 children 1 to 5 years old of a rural village in Hissar district, India, that about 40 per cent of children were deficient in vitamin A and about 15 per cent had signs of severe PEM.

Anne and Begum (1985) conducted a nutritional survey of 90 children aged 3 to 6 years at the

University of Agriculture Science Campus School, Bangalore, India. Anaemia was present in 16 per cent of children and 17 per cent had other signs of nutritional deficiency.

Sastri and Rao (1986) conducted a study in 9 Indian States from 1975 to 1980. Although the extent of clinical malnutrition in terms of signs and symptoms of nutritional deficiency did not show any consistent trend, the growth profile of pre-school children showed a definite improvement during the same period.

2.4 Biochemical Assessment

Devadas et al. (1973) conducted a study on pre-school children in two villages of Coimbatore. They found that 80 per cent children were anemic and 50 per cent of the 35 children had haemoglobin levels below 8.99/100 ml of blood.

Makkar (1978) conducted a survey on pre-schoolers of Haibowal Kalan in Ludhiana district of Punjab and revealed that their average haemoglobin content was 7.81 ± 0.85 g/100 ml.

Gupta et al. (1979) conducted a survey on haemoglobin levels of 352 pre-school children in rural and urban areas of western Rajasthan. They reported that 73 per cent had haemoglobin values below 10.88 g/100 ml, 40 per cent of those with haemoglobin values below 7.88 g/100 ml were from lower socio-economic level.

Wood and Gans (1984) observed 266 children in several villages of Western Samoa and reported that 60 per cent had lower values for haemoglobin.

Bhat and Dahiya (1985) revealed that haemoglobin level of one to five year old boys and girls ranged from 8.5 to 10.0 g/100 ml and 8.7 to 10.0 g/100 ml respectively.

2.5 Factors Associated With Nutritional Status

Rao and Satyanarayana (1970) studied the nutritional status of 1350 pre-school children in Andhra Pradesh in India. The dietary intake and growth status among pre-schoolers varied according to the socio-economic groups being higher in those from higher income group.

Grewal et al. (1973) studied 89 children 6 to

36 months old in rural Madhya Pradesh and found that children with better nutritional status came from families of high income, land ownerships, non-working mothers and a joint family structure. Availability of food and maternal care were closely related to nutritional status.

Vijaylakshmi et al. (1975) studied the nutritional background of selected pre-school children and found the causes of malnutrition to be low nutrient intake, poor economic conditions, infection, poor weaning practices and lack of knowledge of proper nutrition.

Rawson and Valverde (1976) surveyed the etiology of malnutrition among pre-schoolers of Costa Rica. They found that households with access to less than 2 manzanas of land usually have fathers working as day labourers and working mothers. All these factors affect negatively the nutritional status of children.

Dhamija et al. (1976) studied the physical growth of pre-school children. Children from the highest socio-economic group were heavier and taller than those from other groups.

Caliendo et al. (1977) studied a sample of 113 pre-schoolers. Path analysis indicated that the variables exerting predictive influences on dietary quality included sex, ordinal position in the family and mother's employment status, education and nutritional knowledge.

Mancebo and Onate (1979) studied the nutritional behaviour of mothers of pre-school children and the nutritional status of their pre-school children. There was found to be no significant relation between the nutritional status of pre-schoolers and their parents income. Incidence of normally nourished children increased with nutritional knowledge of mothers.

Devadas et al. (1980) studied the influence of family income and parents education on nutritional status. They observed that intake of foods except cereals and vegetables increased with income but not upto the recommended allowances.

Ito et al. (1980) observed that children of working mothers in nuclear families had a high incidence of trouble free weaning and their meal was planned for children but they had highest

incidence of food preferences and the lowest of regular breakfast eating children.

Thimmayamma et al. (1980) studied infant feeding practices of working mothers in an urban area. Working mothers found it difficult to work outside their homes and at the same time care for their infants because of several problems. They preferred joint families for better child care. Majority of the mothers wanted well maintained creches, an increase in number and duration of breaks and option for part-time jobs to help them in giving proper care to the child.

Bhargava et al. (1980) conducted a longitudinal study of physical growth from birth to six years in children with birth weight of 2500 g or more. Boys generally had a better growth pattern than girls.

Stetler et al. (1980) collected data for 6120 infants from 6 to 72 months old of Togo. Incidence of both types of undernutrition was significantly higher in northern rural areas than urban areas. Togo pre-school children of high socio-economic status had a significantly

higher nutrition status.

Suman (1980) studied the food consumption pattern of pre-schoolers from parts of Hissar. Family income affected intakes of protein, energy, calcium. Children of better educated parents had higher nutrient intakes. Children of families of higher income were heavier and taller.

Munz and Leitzmann (1982) studied the influence of socio-economic status weaning practices and number of children on the nutritional status. Nutritional state of the children was lower when there were many children in the family and the child was weaned early, even from families of good nutritional status.

Glassauer and Leitzman (1982) studied 84 pre-school children in Mar Rim District and Chiang Mai Province of Thailand and found no close relation between the nutritional status of pre-school children and nutritional knowledge of their mothers. Family factors mainly socio-economic seemed to have more effect on nutritional status.

Choudhary and Rao (1983) studied the

nutritional status of pre-school children and associated factors. They found that most of the measurements of the nutritional state were closely related to educational levels of parents, income per caput of parents and occupation of parents.

Corpus and Inciong (1981) reported that there was no significant relation between the nutritional state of pre-school children and factors like type of housing, child's health index, income per caput, dietary practice, number of pre-school children, number of years of schooling of mother, knowledge of mothers etc.

Kumari et al. (1985) studied implications of nutritional education versus food supplementation in pre-school children. All children showed improvements, improvements being greater in groups given nutrition education.

Choudhary et al. (1986) studied nutritional status of children of working mothers. Simple as well as composite anthropometry among 200 pre-school Indian children showed that those whose mothers were working had a higher prevalence of malnutrition than those of non-working mothers.

The children of working mothers in nuclear families had significantly worse nutritional state than those from joint families. This difference was not significant for non-working mothers.

A study was conducted by Vobecky and Vobecky (1986) on 518 children of 3 years old in Sherbooke, Canada. Children from families with a socio-economic score above 70 had a significantly higher intake of vitamin A, vitamin E, vitamin B-12, Folate, riboflavin and iron than children from families with a lower score. Family income, fathers profession and maternal education had the most important overall influence on eating habits.

1.4 Pre-testing of Questionnaire

1.5 Standardization of the Weights of Cooked Food

1.6 Collection of Data

1.7 Calculation of Nutritive Value of Diets

1.8 Anthropometric Measurements

1.9 Clinical Assessment

1.10 Haemoglobin Assay

1.11 Statistical Analysis

CHAPTER III

MATERIALS AND METHODS

The objective of the present study was to investigate the ~~nutritional~~ status of pre-school children aged 1-6 years of working mothers belonging to the middle-income group of Ludhiana city. The methods and methodology used for the purpose have been discussed under the following headings :

- 3.1 Locale of the Study
- 3.2 Selection of Subjects
- 3.3 Developing the Questionnaire
for Nutritional Survey
- 3.4 Pre-testing of Questionnaire
- 3.5 Standardisation of the Weights
of Cooked Food
- 3.6 Collection of Data
- 3.7 Calculation of Nutritive Value
of Diets
- 3.8 Anthropometric Measurements
- 3.9 Clinical Assessment
- 3.10 Haemoglobin ~~Records~~
- 3.11 Statistical Analysis

3.1 Locale of Study

Model Town, Shastri Nagar, Maya Nagar, Power Colony (Sarabha Nagar), Bhai Randhir Singh Nagar, Housing Board Colony and Gurdev Nagar areas of Ludhiana city were selected for the study. This selection was due to proximity of these areas to Punjab Agricultural University, the investigator's place of work. Furthermore, the investigator being well acquainted with the people of these areas, it was possible to get the necessary and reliable information.

3.2 Selection of Subjects

The sample size for the study was 75 pre-school children of working mothers belonging to middle income group (per capita income Rs 300 to Rs 700). The sample was selected from the areas mentioned earlier proportionally by simple random sampling technique.

3.3 Developing the Questionnaire for the Nutritional Survey

The questionnaire-cum-recall method was used for the survey. A questionnaire was formulated

to collect relevant information from the respondents. It consisted of the following parts :

3.3.1 General Information : This included information regarding the family size, type of family, age, sex, educational level and occupation of all family members, total income from all sources, information regarding likes/dislikes and food habits of the pre-schoolers and information regarding the working mothers.

3.3.2 Anthropometric Measurements : This part was related to the measurements of different parts of body like weight, height, arm circumference, head circumference, chest circumference and skinfold thickness.

3.3.3 Clinical Observation : This part of the questionnaire comprised a list of deficiency symptoms belonging to the first category related directly to specific nutrient deficiencies. The classified list of signs as adapted from WHO Expert Committee (1963) was used for the purpose.

3.3.4 Dietary Information : The information regarding food consumption was collected by questionnaire-cum-24 hour-recall method for three days. Food habits and food fads and falacies were also recorded.

3.4 Pre-testing of Questionnaire

Ten pre-school children of working mothers from middle socio-economic group were selected for this purpose. The required modifications were made in the questionnaire on the basis of the results. The pre-testing sample was excluded from final study sample.

3.5 Standardising the Weights of Cooked Foods

A list of foods consumed by the pre-school children was prepared on the basis of pre-testing results. Known amounts of cereals, pulses and legumes were cooked to different consistencies (thin, medium, thick) in the laboratory. The cooked amounts were measured in steel bowls and weighed in grams. Three katories of different sizes were standardised for the survey. The

cooked foods were weighed in each of the katories and hence the raw amounts used per katori could be calculated. While conducting the survey, the amount of various cooked foods consumed by the pre-school children were recorded in terms of the standardised katories. The cooked food items were quantitated in terms of raw foods to facilitate the calculation of nutritive values from Food Composition Tables (Gopalan, 1981). In case of chapaties and paranthas, both plain and stuffed, three sizes were standardised, i.e., small, medium and large. Fruits too were standardised accordingly. Milk, beverages and fruit juices were standardised in two steel tumblers of different sizes.

3.6 Collection of Data

The data was collected with the help of the mother of the pre-school child, after explaining to her the purpose of the study and usefulness of the data collected. She was also informed that reliable data could only be obtained with her full cooperation. Personal characteristics, such as occupation, timings of job, income from all sources, family size, educational level and food habits were also collected. The food intakes for

different meals by the pre-school child were recorded with the help of the standardised utensils. THE survey WAS conducted from March to May, 1987.

3.7 Calculation of Nutritive Value of Diets

The amount of each food consumed by the pre-schooler during three days was noted. The nutritive value of foods was calculated from the Food Composition Tables of Gopalan et al. (1981) on raw weight basis. The calculated values were compared with the Recommended Dietary Allowances (ICMR, 1981).

3.8 Anthropometric Measurements

The anthropometric measurements were taken using the standard methods (Jelliffe, 1966) and have been given below :

3.8.1 Height (cm) : The measurement of height was taken with the help of vertical rod with head piece. The subject was asked to stand erect, without shoes, with feet parallel and with heels, buttocks, shoulders and back of head touching the upright rod. The head was held comfortably erect

and arms were hanging on the sides. The head piece was lowered, crushing the hair and making contact with the top of the head. The reading was recorded to the nearest 0.1 cm. The heights of the subjects were compared with the average values given by ICMR (1984) and Harvard standards - Stuart and Stevenson (1959).

3.8.2 Weight (kg) : The body weights of subjects were recorded to the nearest 0.5 kg using the salter's spring balance. The respondents were made to stand erect on the balance after removing the shoes and extra clothing. Weights of the respondents were compared with the average values given by ICMR (1984) and Harvard standards - Stuart and Stevenson (1959).

3.8.3 Arm Circumference (cm) : The left arm was measured while hanging freely at its mid-point. The arm circumference was measured to the nearest 0.1 cm with a flexible, non-stretch fibre-glass tape which was placed gently, but firmly, round the limb to avoid compression of soft tissue. It was compared with standards given by Wolanski (1964).

3.8.4 Head Circumference (cm) : The head circumference was measured by placing the flexible fibre glass tape firmly round the frontal bone just superior to the supraorbital ridges passing it round the head at the same level on each side and laying it over the maximum proximal prominence at the back so as to get the maximum circumference. Measurement was made to the nearest 0.1 cm and then compared with the average values given by ICMR (1984).

3.8.5 Chest Circumference (cm) : A narrow, flexible, non-stretch tape was used and measurement was made at the nipple line. These were compared with the average values given by ICMR (1984).

3.8.6 Triceps Skinfold (mm) : The Harpenden skinfold calliper was used to measure the triceps skinfold thickness. The measurement was taken half-way down the left arm between the top of acromion process of scapula and olecranon process of the vena. Measurement was made while the arm was hanging freely at the side. The skinfold parallel to the long axis was picked up between the thumb and forefinger of left hand and was

pinched away from the underlying muscle. The callipers were applied to the fold little below fingers and reading noted to nearest 0.1 mm. The skinfold measurements were compared with standards given by Hammond (1955).

3.9 Clinical Assessment

Clinical assessment was done by comparing the symptoms, if present in the subject, with the descriptive list of clinical signs based on 1963 report of WHO Expert Committee on Medical Assessment of Nutritional Status. The help of medical expert was taken in case of doubt.

3.10 Haemoglobin Records

Since most of the mothers were reluctant to give blood sample of the child, the haemoglobin levels of the subjects were taken from their medical records. These values were compared with WHO Standards (WHO, 1972). It was taken care that the records were only 2-4 months old.

3.11 Statistical Analysis of Data

In order to test the differences between the average daily intakes of subjects and the

recommended daily allowances (ICMR, 1981), the t-test was applied. Here the statistic 't' is defined as :

$$t = \frac{\bar{X} - u}{\sqrt{S^2/n}}$$

Where,

$\bar{X}$ = Sample mean

u = Mean of the parent normal population
from which sample has been taken

$$S^2 = \frac{1}{n-1} \left[\sum_{i=1}^n x_i^2 - \frac{(\sum_{i=1}^n x_i)^2}{n} \right]$$

is an unbiased estimate of the

population variance

n = Sample size

The calculated value of 't' was compared with the table value of 't' at 5 per cent level of significance. If calculated 't' is greater than tabulated 't', then null hypothesis is rejected.

CHAPTER IV

RESULTS AND DISCUSSION

The results of the present study have been discussed in this chapter under the following headings :

- 1 General Information
- 2 Food Intake
- 3 Nutrient Intake
- 4 Anthropometric Measurements
- 5 Clinical Assessment
- 6 Haemoglobin Records

4.1. General Information

Seventy-five pre-school children of working mothers were selected from different areas of Ludhiana city. The distribution of the subjects according to age and sex is given in Table 4.1. The information obtained on the different aspects has been discussed below.

Table 4.1 Distribution of subjects
according to age and sex

S. No.	Age group	Sex	No. of children	Percentage of children
1	1-3	Boys	18	24.00
		Girls	19	25.33
2	4-6	Boys	19	25.33
		Girls	19	25.33

4.1.1 Distribution of Parents According to Their Educational Level

It has been reported that education tends to increase the earning power and helps in proper selection of food items (Justice et al. 1974). The data obtained in the present study showed that 10.66 per cent of the fathers were educated upto matriculation, whereas in case of mothers, the figure was 14.66 per cent. Fifty-three per cent fathers had received education upto graduation. Among the mothers, 61.33 per cent were graduates. The percentage of postgraduates among fathers and mothers was 36 per cent and 24 per cent respectively. The above data is tabulated in

Table 4.2.

Table 4.2 Distribution of parents according to educational level

Educational level	Fathers	Mothers	Total
Upto Matriculate	8* (10.66)	11 (14.66)	19
Graduate	40 (53.33)	46 (61.33)	86
Postgraduate	27 (36.00)	18 (24.00)	45
Total	75	75	-

*Figures in the parentheses represent percentages.

4.1.2 Distribution of Parents According to Occupation :

Occupation of the parents was studied under two broad categories, viz. service (school teacher, college, University teacher, office going) and business. Most of the parents belonged to the former, the figures for fathers and mothers being 93.33 per cent and 98.66 per cent respectively. The second category included 6.66 per cent men and 1.33 per cent women. The

data is given in Table 4.3.

Table 4.3 Distribution of parents according to occupations

Occupation	Fathers	Mothers
Service	70 (93.33)	74 (98.66)
Business	5 (6.66)	1 (1.33)

Figures in the parentheses represent percentages.

4.1.3 Distribution of Working Mothers According to Occupation

All the respondents had a full time job. Majority of the working mothers were school teachers, i.e., 61.33 per cent. A very small number constituting 2.66 per cent of the mothers were college or University teachers. Thirty-two per cent were working in various offices. Three of the respondents, i.e., 4 per cent belonged to the "any other" category (business, creche incharge, attendant). The data is given in Table 4.4.

Table 4.4 Distribution of working mothers according to occupation

Occupation	No. of mothers
School teacher	46 (61.33)
College/University teacher	2 (2.66)
Office going	24 (32.00)
Any other (business, creche incharge, attendant)	3 (4.00)

Figures in the parentheses represent percentage distribution of working mothers according to occupation.

4.1.4 Distribution of Children According to Family Size, Type of Family and Monthly Income (Table 4.5)

(a) Family Size : The children were divided according to the size of family into two groups, having 3-5 members and 6-7 members. In the age group of 1-3 years, 14.66 per cent boys and 21.30 per cent girls belonged to the first category (3-5 members), whereas 9.33 per cent boys and 5.33 per cent girls belonged to second category (6-7 members).

Table 4.5 Distribution of subjects according to the type of family, size, monthly income

S. Factors No.	Number of children					
	Boys			Girls		
	1-3 years	4-6 years	1-3 years	4-6 years	1-3 years	4-6 years
1 <u>Family size</u>						
3-5 members	11 (14.66)	13 (17.33)	15 (21.30)	16 (21.30)	26	29
6-7 members	7 (9.33)	6 (8.00)	4 (5.33)	3 (4.00)	11	9
2 <u>Type of family</u>						
Nuclear	5 (6.66)	12 (16.00)	9 (12.00)	11 (14.66)	14	23
Joint	13 (17.33)	7 (9.33)	10 (13.33)	8 (10.60)	23	15
3 <u>Monthly income (Rs)</u> <u>(Per caput)</u>						
300-500	2 (3.00)	3 (4.00)	4 (5.33)	6 (8.00)	6	9
500-700	16 (21.33)	16 (21.33)	15 (20.00)	13 (17.33)	31	29

Figures in the parentheses represent per cent distribution

In the age group of 4 to 6 years, 17.33 per cent boys and 21.30 per cent girls were from first category and 8.0 per cent boys and 4.0 per cent girls from second category.

(b) Type of Family : The children were divided according to the type of family they were from, i.e., whether nuclear or joint. In the 1 to 3 years age group, 6.66 per cent boys and 12.0 per cent girls belonged to nuclear families and 17.33 per cent boys and 13.33 per cent girls from joint families.

In the 4 to 6 years age group, 16.00 per cent boys and 14.66 per cent girls belonged to nuclear families and 9.33 per cent boys and 10.60 per cent girls belonged to joint families.

(c) Monthly Income : The subjects were selected from middle income group families (having an income of Rs 300 to 700 per capita). The distribution was done according to two categories, viz., Rs 300-500 and Rs 500-700.

Among boys aged 1 to 3 years, 3.00 per cent belonged to the first category, 21.33 per cent to the second category. The figures for 1 to 3 year

old girls were 5.33 per cent and 20.00 per cent respectively.

For boys from 4 to 6 years age group, the figures were 4.00 per cent and 21.33 per cent respectively. For the girls of this age group, the figures were 8.00 per cent and 17.33 per cent respectively.

Since both parents were working, 80.00 per cent children belonged to the second category (Rs 500-700 per capita).

Table 4.5 Distribution of subjects according to

4.1.5 Distribution of Subjects According to their Food Habits :

Food habits of the family influence profoundly the habits of the children born into the family besides influencing the total food intake of an individual. Cultural, social, personal and situational factors that motivate or encourage people to eat certain foods are inter-twined with food habits (Dickins, 1965). The respondents were divided into three categories according to their food habits, i.e., whether they were vegetarian, non-vegetarian or ova-vegetarian. The data showed that of the boys

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in the age group 1 to 3 years, 10.66 per cent were non-vegetarian, 10.66 per cent vegetarian and 2.66 per cent ovatarian. Among the girls, the figures were 12.00 per cent each in the vegetarian and the non-vegetarian category and 1.33 per cent in ovatarian category. Same was the case in boys of 4 to 6 years age group, whereas among girls from 4 to 6 years old category, 9.33 per cent were vegetarian, 12.00 per cent non-vegetarian and 2.66 per cent ovatarian. The data regarding food habits is presented in Table 4.6.

Table 4.6 Distribution of subjects according to their food habits

Food habits	Age groups (Years)			
	1-3		4-6	
	Boys	Girls	Boys	Girls
Vegetarian	8 (10.66)	9 (12.00)	9 (12.00)	7 (9.33)
Non-vegetarian	8 (10.66)	9 (12.00)	9 (12.00)	9 (12.00)
Ovatarian	2 (2.66)	1 (1.33)	1 (1.33)	2 (2.66)

Figures in the parentheses represent the percentage number of children.

Information on Immunization of Child : Immunization is the process by which immunity is produced in a person, animal or plant. It is defined as the ability of the body to recognise, destroy and eliminate antigenic materials foreign to its own. Earlier, some five million children were dying each year and another four million were disabled by childhood diseases, almost all in developing countries. In just over a decade, however, the picture has changed. India today has immunised 65 per cent of 1-year old against tuberculosis, 51 per cent against DPT and 37 per cent against polio (Sehat, 1987). All the children had been immunised according to the immunization schedule, showing thereby that most parents today are aware of the necessity and importance of immunization. By the age of three years, all children had been given DPT (diphtheria, pertussis, tetanus), polio, BCG and measles vaccinations. By the age of six years, typhoid vaccine was given to all children. All mothers had taken tetanus toxoid vaccine during the period of pregnancy.

4.1.6 Information on Illness of Child : The growth of the child on a sound basis is a necessary

pre-condition for a prosperous future. To ensure their full physical, mental and social development, adequate services have to be provided to the children both before and after birth as well as through the period of growth.

The data concerning the occurrence of illness among children was based on "multiple response". The illness pattern among pre-schoolers of working mothers indicated that a maximum number of children suffered from common cold and cough, the figures being 44 per cent and 45.33 per cent respectively. Some of the foods avoided were curds, lassi, citrus fruits, pickles fried foods, rice, tamarind, cold drinks and some foods. The occurrence of cold and cough was mainly due to seasonal variation or else some infection.

Fever accompanied cold and cough in most children. Forty per cent of the children had fever, the main reasons being a sudden change in the temperature of the surroundings or due to seasonal variations. The foods avoided during this period included fried foods, cold drinks, sour foods and pickles.

Twenty per cent of the children suffered from diarrhoea and dysentery. The main reasons were indigestion, unhygienic conditions or some sort of infection. The foods not fed to the subjects included fried foods, pickles, spicy foods and milk.

Seven per cent pre-school children suffered from measles, 8 per cent from mumps and 5 per cent from chicken-pox prior to the present study. Two children had suffered from mild infective hepatitis at the time of birth. No children showed signs of tuberculosis. During the onset of the above mentioned diseases, the physician was consulted with regard to the foods to be given to the child. Pre-school children found to be suffering from any of the above illness during the period of study were excluded from the sample.

4.2 Food Intake

The frequency and consumption of various foods by pre-schoolers is presented in Tables 4.7 and 4.8 and described below.

4.2.1 Cereals : Wheat was more frequently consumed,

Table 4.7 Daily food intake by the children (1-3 years)

Subjects	Food groups (g)										
	Cereals	Pulses	Green leafy veg.	Roots & tubers	Other veg. & fruits	Milk & milk produ-cts	Sugar & jaggery	Fats & oils	Meat & fish	Eggs	
Girls	Mean ± SD	104.73 +20.58	23.68 +8.97	8.15 +3.41	12.78 +3.27	48.68 +21.97	550.00 +134.37	30.52 +8.90	16.31 +4.02	1.28 +0.60	14.91 +9.10
Boys	"	113.05 +24.74	24.72 +5.27	15.00 +5.77	14.44 +4.50	33.61 +6.81	541.66 +174.26	27.22 +6.23	15.55 +3.79	1.36 +0.89	20.36 +10.40
RDA		175.00	35.00	40.00	10.00	20.00	300.00	30.00	15.00	— 30	—
T-value (Girls)	-14.88*	-8.26*	-40.80*	3.69*	8.74*	8.11*	0.25NS	0.79NS	-	-	-
(Boys)	-10.62*	-8.29*	-18.93*	4.18*	8.50*	5.88*	-1.90NS	0.61NS	-	-	-

*Significant at 5 per cent level.

NS : Non-significant

RDA: (Recommended Dietary Allowances, ICMR, 1981)

Table 4.8 Daily food intake by the children (4-6 years)

Subjects	Food groups (g)										
		Cereals	Pulses	Green leafy veg.	Roots & tubers	Other veg. & fruits	Milk & milk produ-cts	Sugar & jaggery	Fats & oils	Meat & fish	Eggs
Girls	Mean ± S.D	190.52 +41.36	26.84 +6.05	17.26 +6.46	36.84 +9.45	105.26 +30.70	315.78 +68.82	33.42 +5.01	23.42 +4.72	6.05 +3.01	21.05 +12.21
Boys		199.73 +33.51	22.36 +4.52	16.11 +4.39	36.31 +9.10	128.94 +20.85	413.15 +131.06	27.63 +5.61	25.78 +4.17	6.10 +3.99	18.42 +10.10
RDA		270.00	35.00	50.00	30.00	50.00	250.00	40.00	25.00	—	30
T-value (Girls)		-7.47*	-9.15*	-22.12*	2.92*	9.94*	10.33*	-10.75*	-0.72NS	—	—
(Boys)		-7.25*	-12.27*	-32.90*	3.03*	16.51*	5.42*	-9.60*	0.47NS	—	—

*Significant at 5 per cent level.

NS : Non-significant

RDA : (Recommended Dietary Allowances, ICMR, 1981)

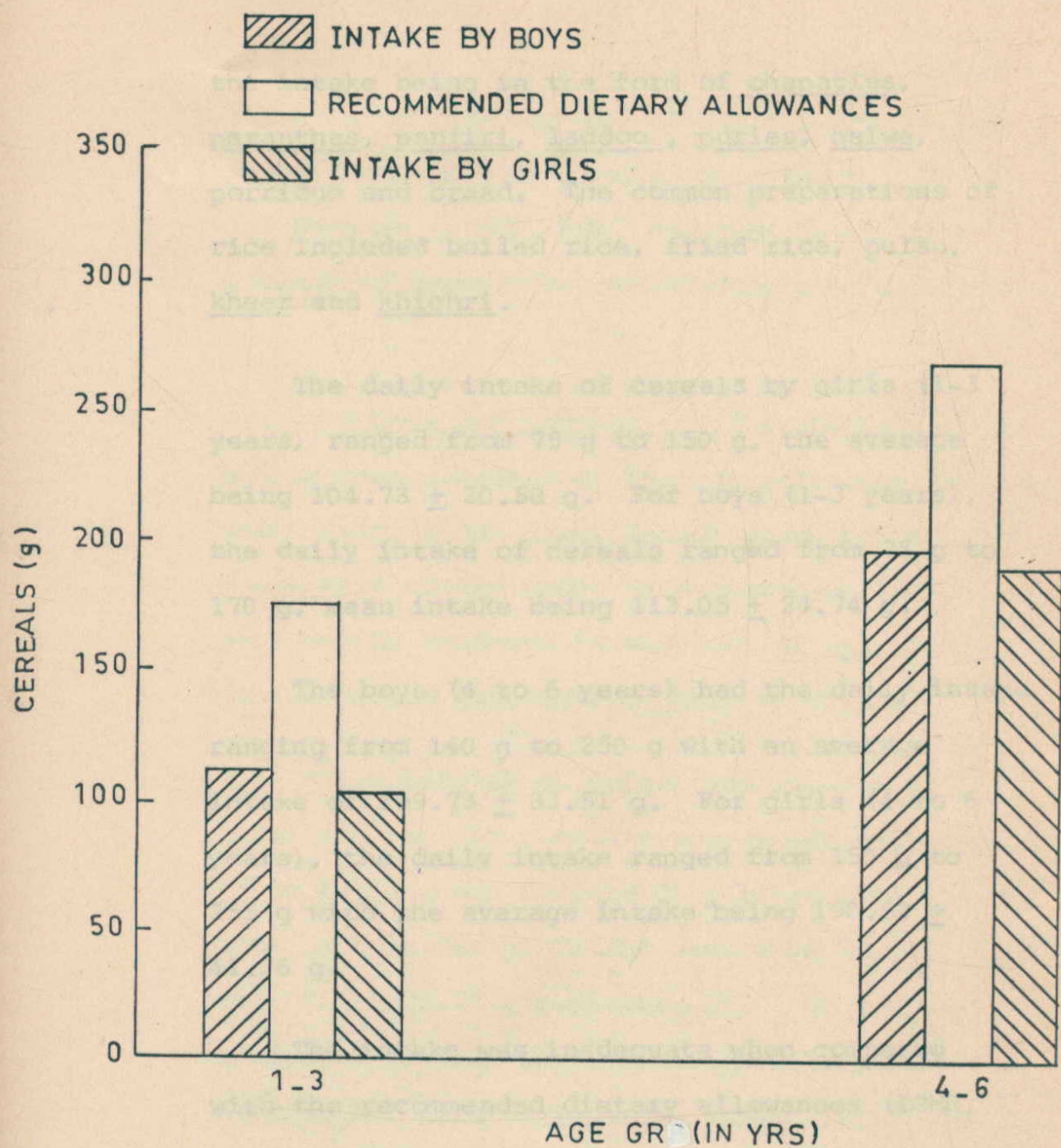


Fig. 1. INTAKE OF CEREALS BY PRE-SCHOOL CHILDREN

the intake being in the form of chapaties, paranthas, panjiri, laddoo, puries, halwa, porridge and bread. The common preparations of rice included boiled rice, fried rice, pulao, kheer and khichri.

The daily intake of cereals by girls (1-3 years) ranged from 75 g to 150 g, the average being 104.73 ± 20.58 g. For boys (1-3 years), the daily intake of cereals ranged from 75 g to 170 g, mean intake being 113.05 ± 24.74 g.

The boys (4 to 6 years) had the daily intake ranging from 140 g to 250 g with an average intake of 199.73 ± 33.51 g. For girls (4 to 6 years), the daily intake ranged from 150 g to 255 g with the average intake being 190.52 ± 41.36 g.

The intake was inadequate when compared with the recommended dietary allowances (ICMR, 1981) in both the age groups. Significant differences were observed in both cases. Rao et al. (1983) reported inadequate intakes of cereals by pre-schoolers in India. The results of the present study are also in line with those

of Dhir (1985) and Kaur (1986) who found the intake of cereals by pre-school children to be lower than the recommended allowances. Geetha and Devadas (1986), too, reported inadequate intakes of cereals by pre-schoolers in Coimbatore.

4.2.2 Pulses and Legumes : The common pulses and legumes consumed by the subjects were lentils, green gram, black gram, bengal gram and rajmah. These were cooked whole or dehusked split and were mainly consumed in the form of dals, the consistencies ranging from thin to thick.

Daily intakes of pulses and legumes by the girls and boys of 1 to 3 years in age ranged from 15 to to 36 g and 13 g to 30 g respectively. The mean intakes for girls and boys were 23.68 ± 5.97 g and 24.72 ± 5.27 g respectively. The average intakes of pulses and legumes were less than the recommended daily allowances (ICMR, 1981) both for boys and girls, the differences being significant in both cases.

Fig. 2. INTAKE OF PULSES AND LEGUMES BY PRESCHOOL CHILDREN

The daily intake of pulses and legumes by the boys (4 to 6 years) ranged from 18 g to 42 g, mean

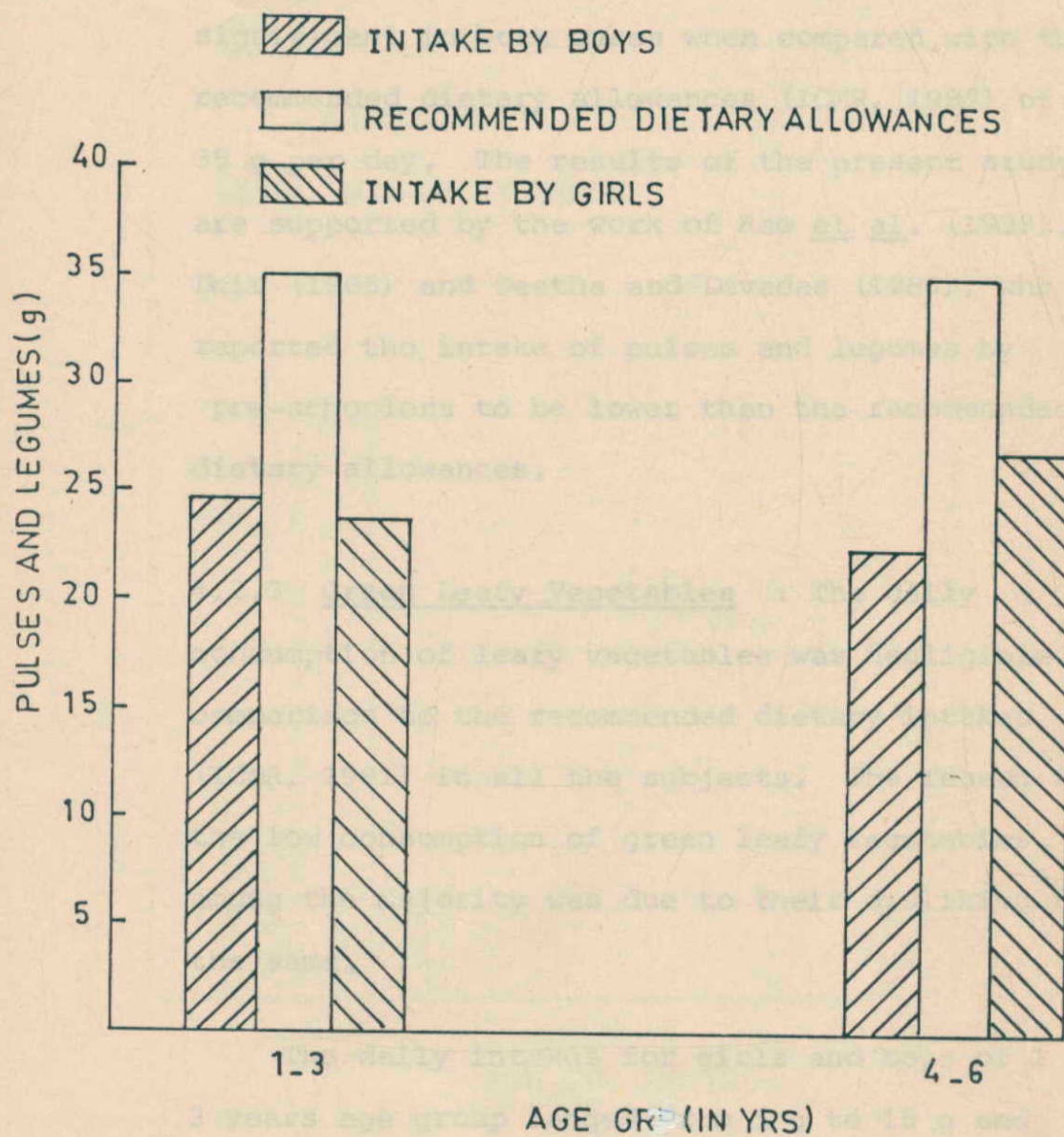


Fig. 2. INTAKE OF PULSES AND LEGUMES BY PRE-SCHOOL CHILDREN

intake being 22.36 ± 4.52 g. For girls, the intake ranged from 15 g to 39 g with the average intake of 26.84 ± 6.05 g. The differences were significant in both cases when compared with the recommended dietary allowances (ICMR, 1987) of 35 g per day. The results of the present study are supported by the work of Rao *et al.* (1983), Dhir (1985) and Geetha and Devadas (1986), who reported the intake of pulses and legumes by pre-schoolers to be lower than the recommended dietary allowances.

4.2.3 Green Leafy Vegetables : The daily consumption of leafy vegetables was negligible in comparison to the recommended dietary intakes (ICMR, 1981) in all the subjects. The reason for the low consumption of green leafy vegetables among the majority was due to their disliking for the same.

The daily intakes for girls and boys of 1 to 3 years age group ranged from 5 g to 15 g and 10 g to 25 g respectively. The mean intakes for girls and boys were 8.15 ± 3.41 g and 15.00 ± 5.77 g respectively.

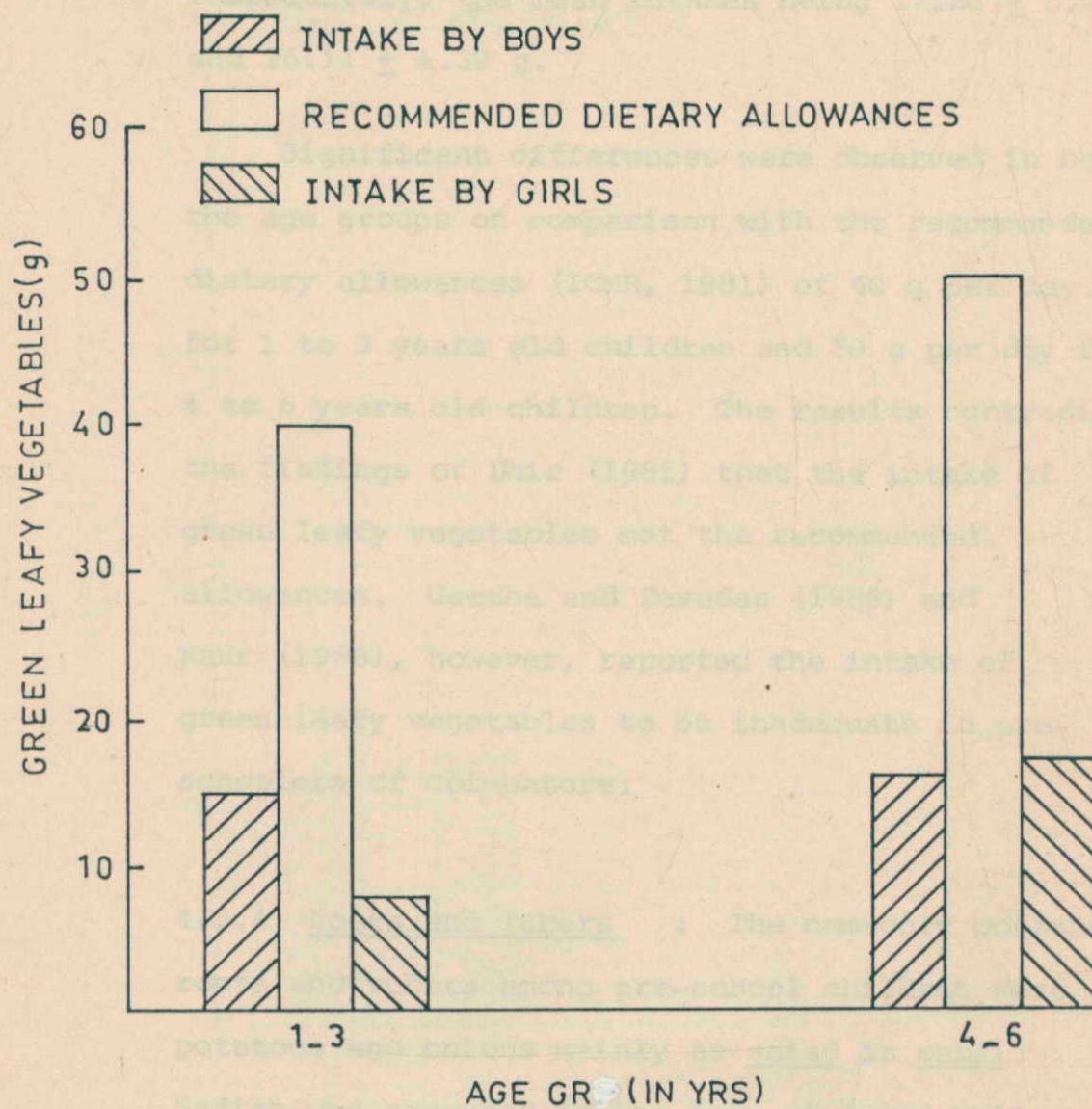


Fig. 3. INTAKE OF GREEN LEAFY VEGETABLES BY PRE-SCHOOL CHILDREN

For girls and boys (4 to 6 years), the daily intakes ranged from 8 g to 30 g and 5 g to 20 g respectively, the mean intakes being 17.26 ± 6.46 g and 16.11 ± 4.39 g.

Significant differences were observed in both the age groups on comparison with the recommended dietary allowances (ICMR, 1981) of 40 g per day for 1 to 3 years old children and 50 g per day for 4 to 6 years old children. The results contradict the findings of Dhir (1985) that the intake of green leafy vegetables met the recommended allowances. Geetha and Devadas (1986) and Kaur (1986), however, reported the intake of green leafy vegetables to be inadequate in pre-schoolers of Coimbatore.

4.2.4 Roots and Tubers : The commonly consumed roots and tubers among pre-school children were potatoes and onions mainly as salad or sabzi. Radish was consumed in the form of salad while carrots were consumed both as salad and in the form of gajrela (halwa).

The daily intakes for girls and boys from 1 to 3 years ranged from 10 to 20 g and 10 to 25 g,

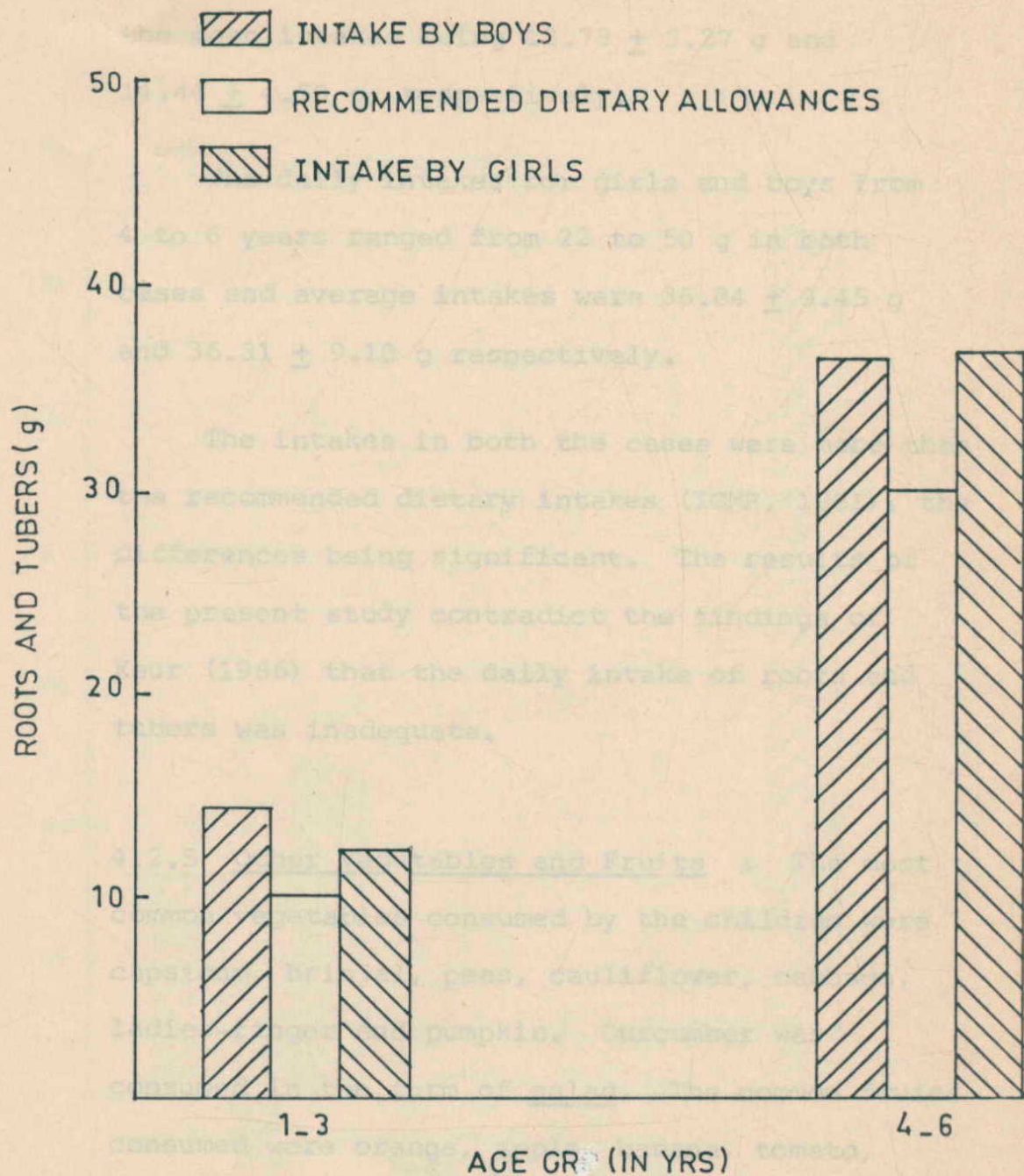


Fig. 4. INTAKE OF ROOTS AND TUBERS BY PRE-SCHOOL CHILDREN

the mean intakes being 12.78 ± 3.27 g and 14.44 ± 4.50 g, respectively.

The daily intakes for girls and boys from 4 to 6 years ranged from 22 to 50 g in both cases and average intakes were 36.84 ± 9.45 g and 36.31 ± 9.10 g respectively.

The intakes in both the cases were more than the recommended dietary intakes (ICMR, 1981), the differences being significant. The results of the present study contradict the findings of Kaur (1986) that the daily intake of roots and tubers was inadequate.

4.2.5 Other Vegetables and Fruits : The most common vegetables consumed by the children were capsicum, brinjal, peas, cauliflower, cabbage, ladies-finger and pumpkin. Curcumber was consumed in the form of salad. The common fruits consumed were orange, apple, banana, tomato, grapes and lemon. Intake in the form of juices and soups was common.

The daily intakes for girls and boys (1 to 3 years) ranged from 35 to 82 g and 31 to 75 g with

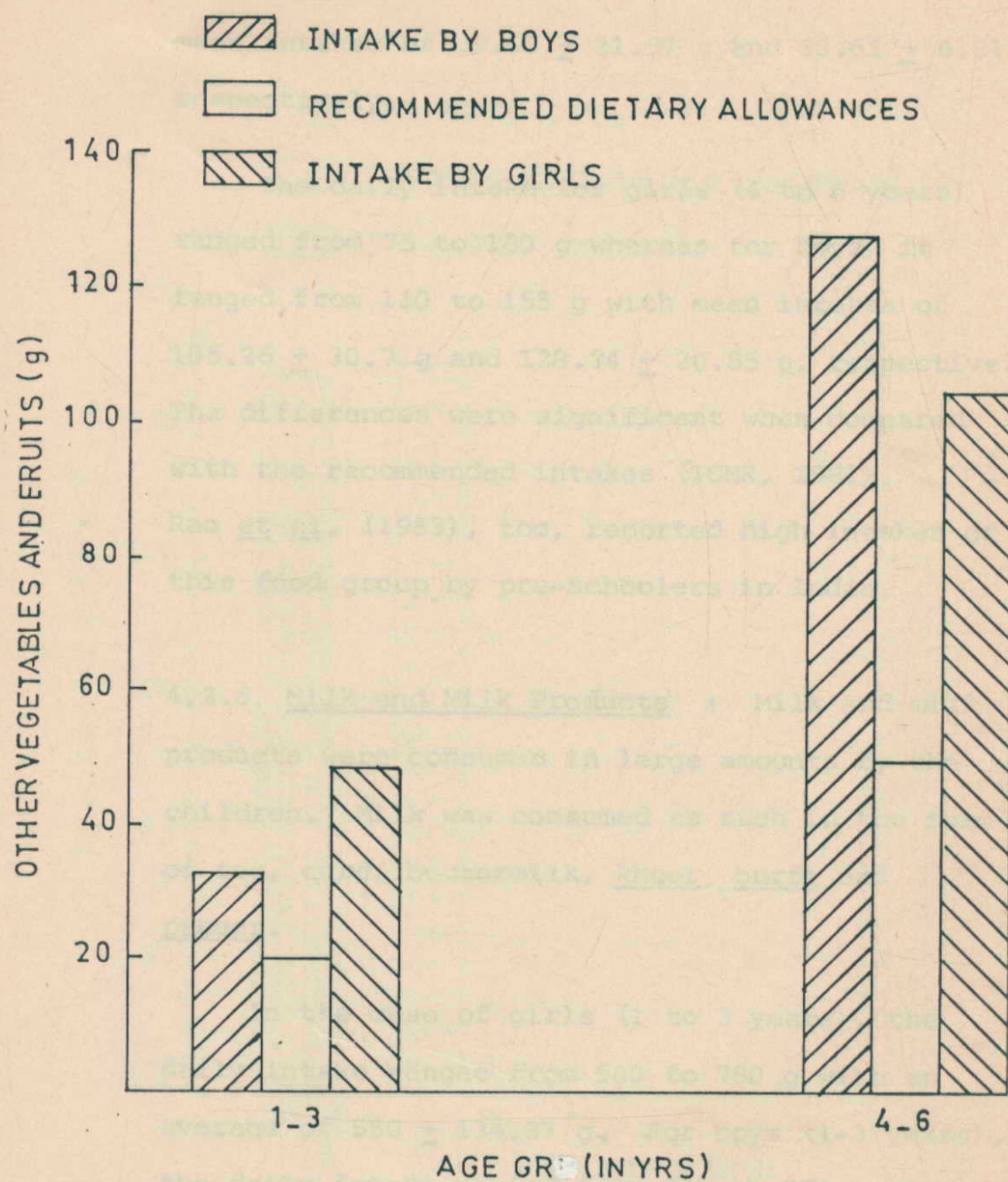


Fig.5. INTAKE OF OTHER VEGETABLES AND FRUITS BY PRE-SCHOOL CHILDREN

mean intakes of 18.68 ± 21.97 g and 33.61 ± 6.81 g respectively.

The daily intake for girls (4 to 6 years) ranged from 75 to 180 g whereas for boys, it ranged from 110 to 155 g with mean intakes of 105.26 ± 30.7 g and 128.94 ± 20.85 g, respectively. The differences were significant when compared with the recommended intakes (ICMR, 1981). Rao et al. (1983), too, reported high intakes of this food group by pre-schoolers in India.

4.2.6 Milk and Milk Products : Milk and milk products were consumed in large amounts by the children. Milk was consumed as such in the form of tea, curd, buttermilk, kheer, burfi and paneer.

In the case of girls (1 to 3 years), the daily intake ranged from 500 to 780 g with an average of 550 ± 134.37 g. For boys (1-3 years), the daily intake ranged from 200 to 750 g with average intake of 541.66 ± 174.26 g.

For girls and boys (4 to 6 years), the daily intakes ranged from 250 to 400 g and 300 to 650 g

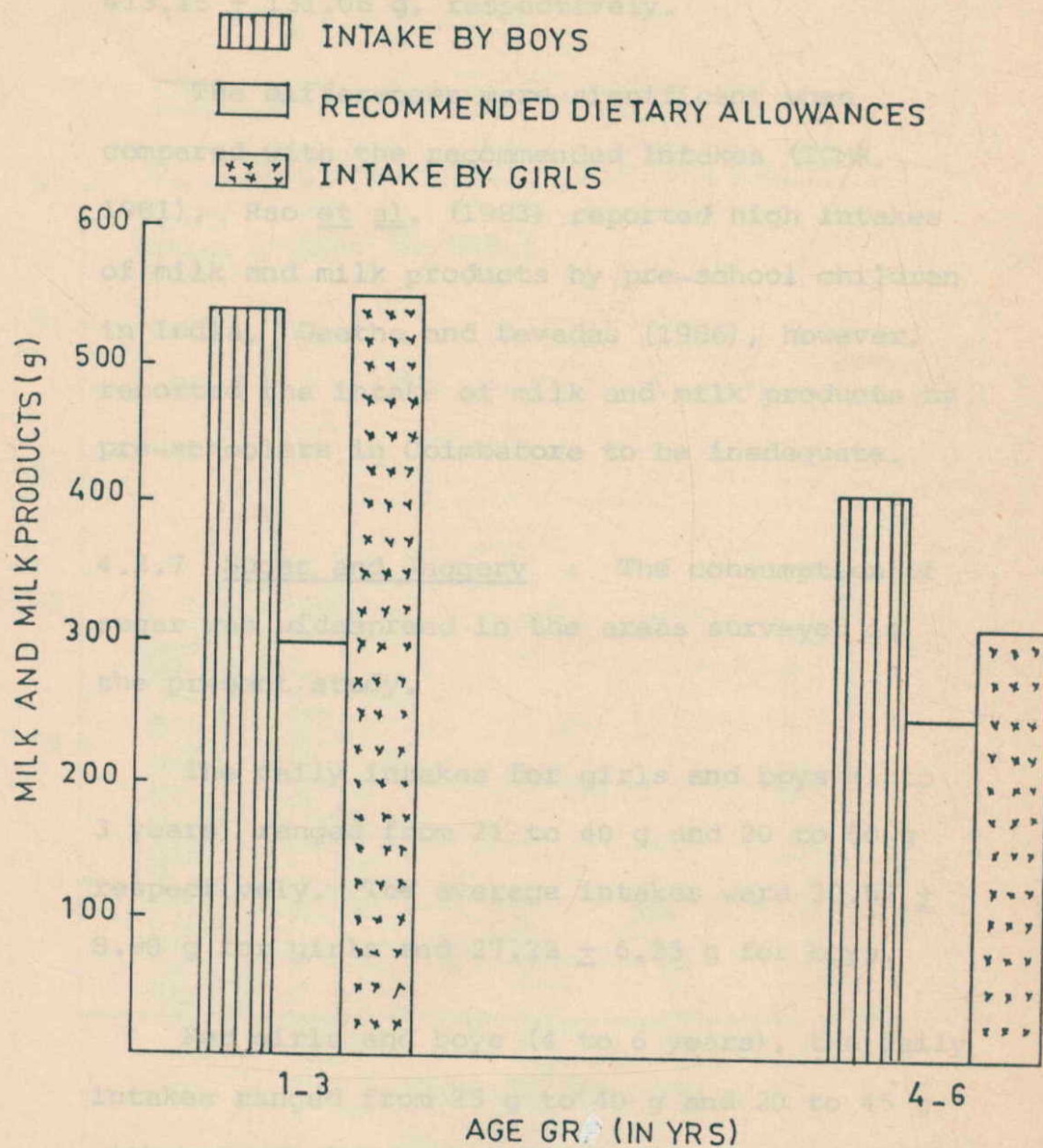


Fig. 6 INTAKE OF MILK AND MILK PRODUCTS BY PRE-SCHOOL CHILDREN

with average intakes of 315.78 ± 68.82 g and 413.15 ± 131.06 g, respectively.

The differences were significant when compared with the recommended intakes (ICMR, 1981). Rao et al. (1983) reported high intakes of milk and milk products by pre-school children in India. Geetha and Devadas (1986), however, reported the intake of milk and milk products by pre-schoolers in Coimbatore to be inadequate.

4.2.7 Sugar and Jaggery : The consumption of sugar was widespread in the areas surveyed in the present study.

The daily intakes for girls and boys (1 to 3 years) ranged from 21 to 40 g and 20 to 50 g respectively. The average intakes were 30.52 ± 8.90 g for girls and 27.22 ± 6.23 g for boys.

For girls and boys (4 to 6 years), the daily intakes ranged from 25 g to 40 g and 20 to 45 g with average intakes of 33.42 ± 5.01 g and 27.63 ± 5.61 g, respectively.

The differences were non-significant in case of 1 to 3 years age group but significant

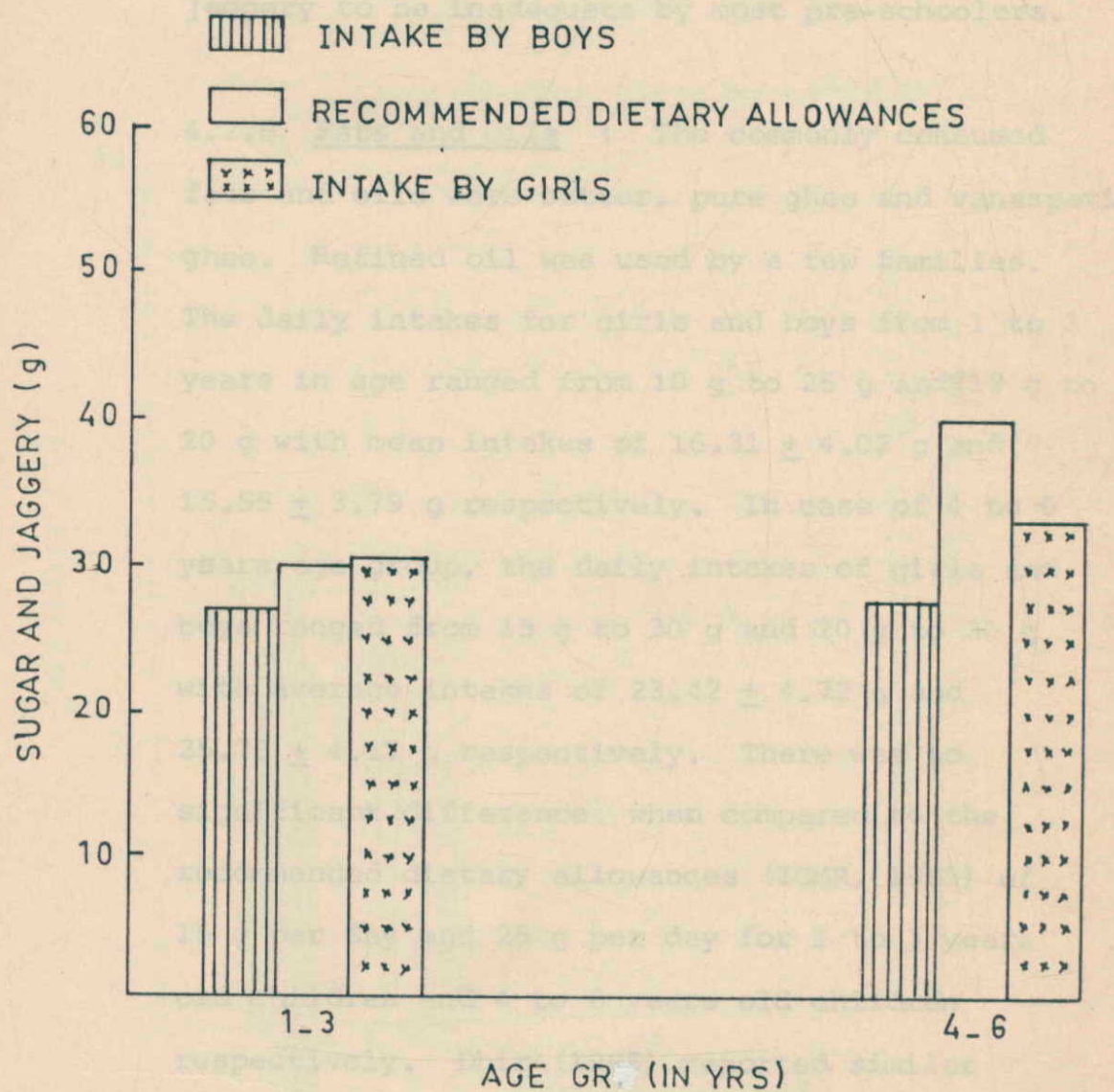


Fig.7. INTAKE OF SUGAR AND JAGGERY BY PRE-SCHOOL CHILDREN

in case of 4 to 6 years age group. Geetha and Devadas (1986) reported the intake of sugar and jaggery to be inadequate by most pre-schoolers.

4.2.8 Fats and Oils : The commonly consumed fats and oils were butter, pure ghee and vanaspati ghee. Refined oil was used by a few families. The daily intakes for girls and boys from 1 to 3 years in age ranged from 10 g to 25 g and 12 g to 20 g with mean intakes of 16.31 ± 4.02 g and 15.55 ± 3.79 g respectively. In case of 4 to 6 years age group, the daily intakes of girls and boys ranged from 15 g to 30 g and 20 g to 30 g with average intakes of 23.42 ± 4.72 g and 25.78 ± 4.17 g respectively. There was no significant difference when compared to the recommended dietary allowances (ICMR, 1981) of 15 g per day and 25 g per day for 1 to 3 years old children and 4 to 6 years old children respectively. Dhir (1985) reported similar results in pre-schoolers of Ludhiana. However, Geetha and Devadas (1986) reported an inadequate intake of this food group by pre-schoolers of Coimbatore.

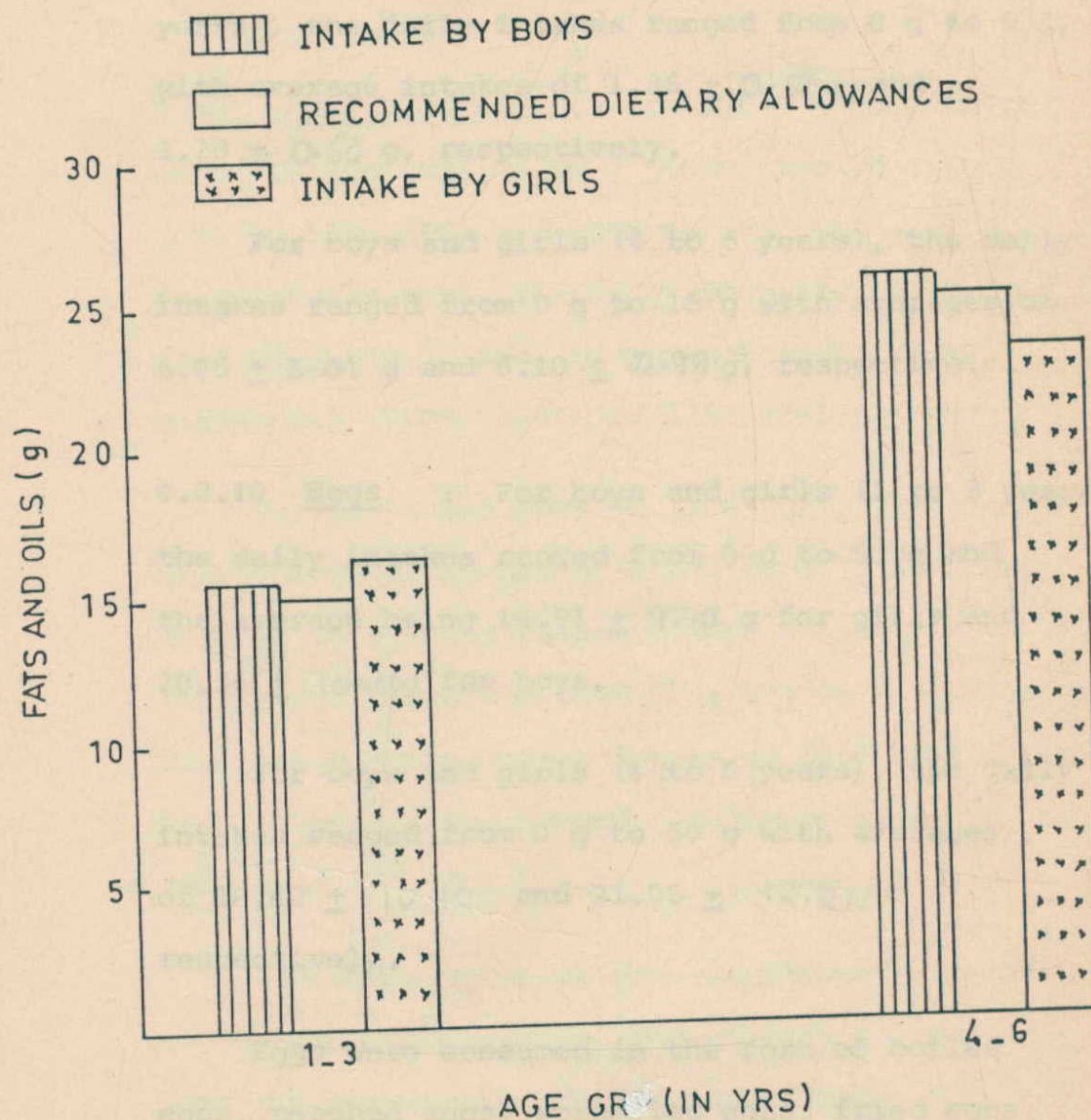


Fig. 8. INTAKE OF FATS AND OILS BY PRE-SCHOOL CHILDREN

4.2.9 Meat and Fish : Meat was more frequently consumed mainly as soup or in the form of meat-curry. For girls and boys (1 to 3 years), the daily intakes ranged from 0 g to 5 g, with average intakes of 1.36 ± 0.52 g and 1.28 ± 0.60 g, respectively.

For boys and girls (4 to 6 years), the daily intakes ranged from 0 g to 15 g with averages of 6.05 ± 3.01 g and 6.10 ± 2.99 g, respectively.

4.2.10 Eggs : For boys and girls (1 to 3 years) the daily intakes ranged from 0 g to 50 g and the average being 14.91 ± 9.10 g for girls and 20.36 ± 10.40 g for boys.

For boys and girls (4 to 6 years), the daily intakes ranged from 0 g to 50 g with averages of 18.42 ± 10.10 and 21.05 ± 12.21 respectively.

Eggs were consumed in the form of boiled eggs, poached eggs, scrambled eggs, fried eggs, omelettes, bhurji. Some children were given egg nog. The consumption of boys was found to be more than girls.

4.3 Nutrient Intakes

The nutrient intake of pre-school children has been tabulated in Tables 4.9 and 4.10.

4.3.1 Energy Intake : The daily energy intakes of girls and boys (1 to 3 years) ranged from 1050 to 1510 kcal and 1019 to 1550 kcal. The mean intakes were 1242.68 ± 145.81 kcal and 1294.73 ± 170.17 kcal as against recommended allowances (ICMR, 1981) of 1220 kcal per day.

For girls and boys (4 to 6 years), the daily energy intakes ranged from 993 to 1779 kcal and 1050 to 1809 kcals respectively. The average intake for girls was 1549.47 ± 253.46 kcal whereas the boys had an average intake of 1602.68 ± 217.44 kcal as against recommended allowances of 1720 kcal per day.

The difference was non-significant in both cases, when the average intakes were compared with the recommended dietary allowances (RDA, ICMR, 1981). The results of Rao et al. (1983) support those of the present study. The findings of Bai et al. (1984) and Dhir (1985)

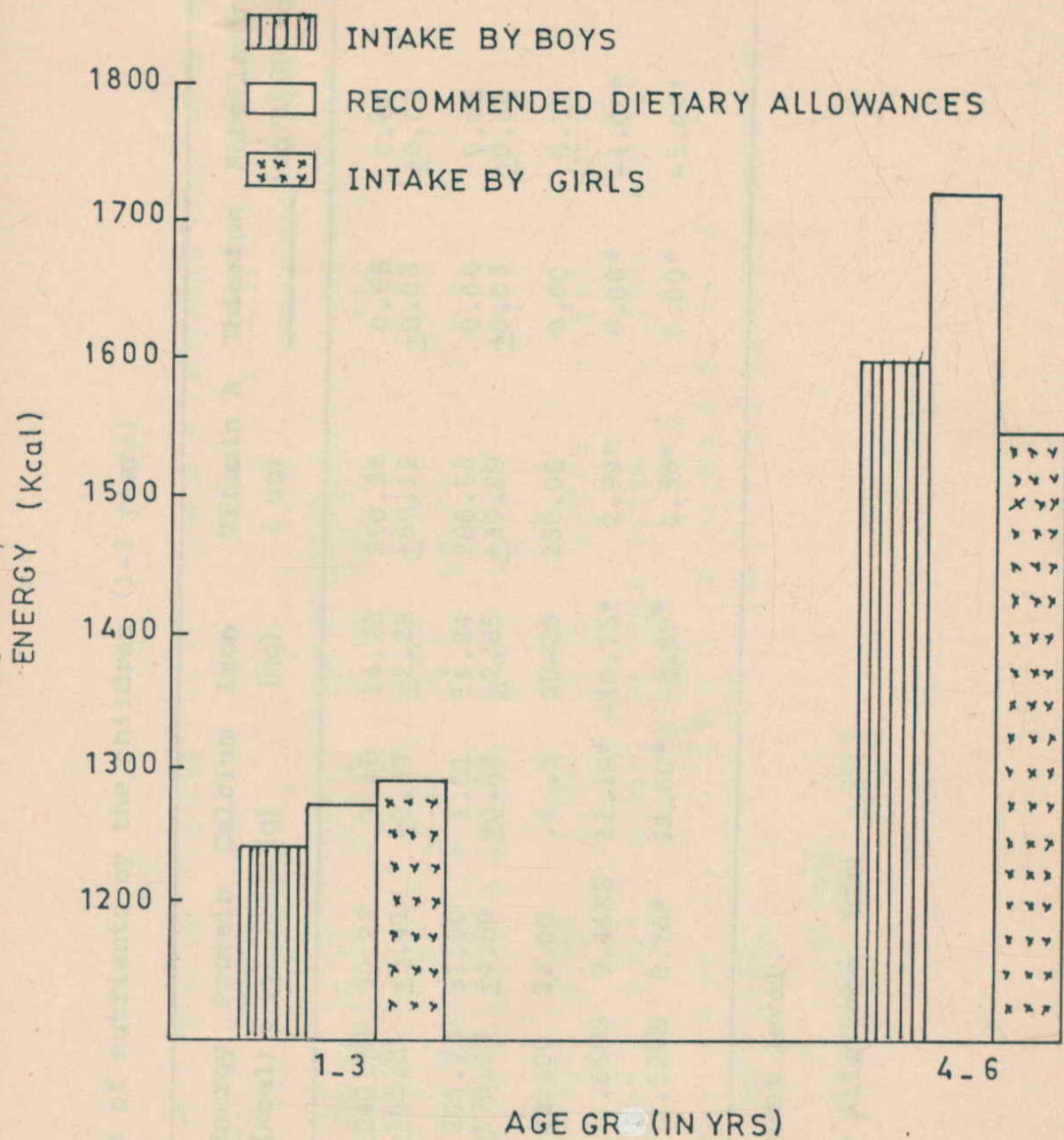


Fig.9. ENERGY INTAKE BY PRE-SCHOOL CHILDREN

Table 4.9 Daily intake of nutrients by the children (1-3 years)

Subjects	Energy		Protein		Calcium		Iron		Vitamin A		Thiamine		Riboflavin		Niacin	
	(kcal)	(g)	(g)	(g)	(mg)	(ug)	(mg)	(ug)	(mg/1000 kcal)	(mg/1000 kcal)	(mg/1000 kcal)	(mg/1000 kcal)	(mg/1000 kcal)	(mg/1000 kcal)	(mg/1000 kcal)	(mg/1000 kcal)
Girls	Mean	1242.68	30.22	1.40	14.23	290.26	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	5.13	5.13
	± S.D.	±145.81	±5.41	±0.37	±2.28	±58.12	±0.03	±0.03	±0.03	±0.03	±0.03	±0.03	±0.03	±0.03	±0.91	±0.91
Boys	Mean	1294.73	31.00	1.51	14.34	286.50	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	5.52	5.52
	± S.D.	±170.17	±4.89	±0.44	±2.85	±39.89	±0.03	±0.03	±0.03	±0.03	±0.03	±0.03	±0.03	±0.03	±0.96	±0.96
RDA	1210.00	22.00	4.5	20-25	250.00	2.99*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	8.00	8.00
T-value (Girls)	0.66NS	9.44NS	12.19*	-10.75*	2.99*	2.99*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	-14.35*	-14.35*
(Boys)	1.52NS	6.76*	11.60*	-8.69*	4.56*	4.56*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	6.00*	-19.14*	-19.14*

*Significant at 5 per cent level.

NS : Non-significant

RDA : (Recommended Dietary Allowance, ICMR, 1981)

Table 4.10 Daily intake of nutrients by the children (4-6 years)

Subjects	Energy (kcal)	Protein (g)	Calcium (g)	Iron (mg)	Vitamin A (ug)	Thiamine (mg/1000 kcal)	Riboflavin (mg/1000 kcal)	Niacin (mg/1000 kcal)
Girls	1549.47 +253.46 ±10.31	38.68 ±10.31	0.89 ±0.33	18.75 ±4.95	329.21 ±67.90	0.79 ±0.15	0.86 ±0.33	7.50 ±0.90
Boys	1602.68 +217.44 ±10.67	38.00 ±10.67	0.93 ±0.34	20.28 ±5.66	345.00 ±70.20	0.81 ±0.23	0.86 ±0.34	6.94 ±1.51
RDA	1720.00	29.40	0.4-0.5	20-25	300.00	0.90	1.00	11.00
T-values (Girls)	-2.07NS	8.36*	6.28*	-3.31*	0.94NS	-3.66*	-2.00NS	-17.50*
(Boys)	-0.32NS	3.52*	6.85*	-1.72NS	1.40NS	-2.25NS	-2.00NS	-11.94*

*Significant at 5 per cent level.

NS : Non-significant

RDA: (Recommended Dietary Allowances ICMR, 1981)

however, contradict those of the present study. They reported that the pre-school children were not getting adequate calories. Anne and Begum (1985), too, reported that the pre-schoolers of Bangalore were getting adequate energy from their diets.

4.3.2 Protein Intake : Protein intake of girls and boys (1 to 3 years) ranged from 17 g to 33 g and 15 g to 38 g respectively. The mean daily intake for girls was 30.22 ± 5.41 g and for boys 31.0 ± 4.89 g as against the RDA of 22 g per day. The difference was significant in both cases, when compared to the RDA (ICMR, 1981).

The daily protein intakes for girls and boys (4 to 6 years) varied from 25 to 57 g and 22 to 58 g, respectively. The average daily intakes were 38.68 ± 10.31 g for girls and 38 ± 10.67 g for boys which were more than the RDA (ICMR, 1981) of 29.4 g per day, the difference being significant.

Fig 10. PROTEIN INTAKE BY PRE-SCHOOL CHILDREN

Protein intake was high among pre-schoolers due to the high consumption of milk and milk products. These results are in line with those of

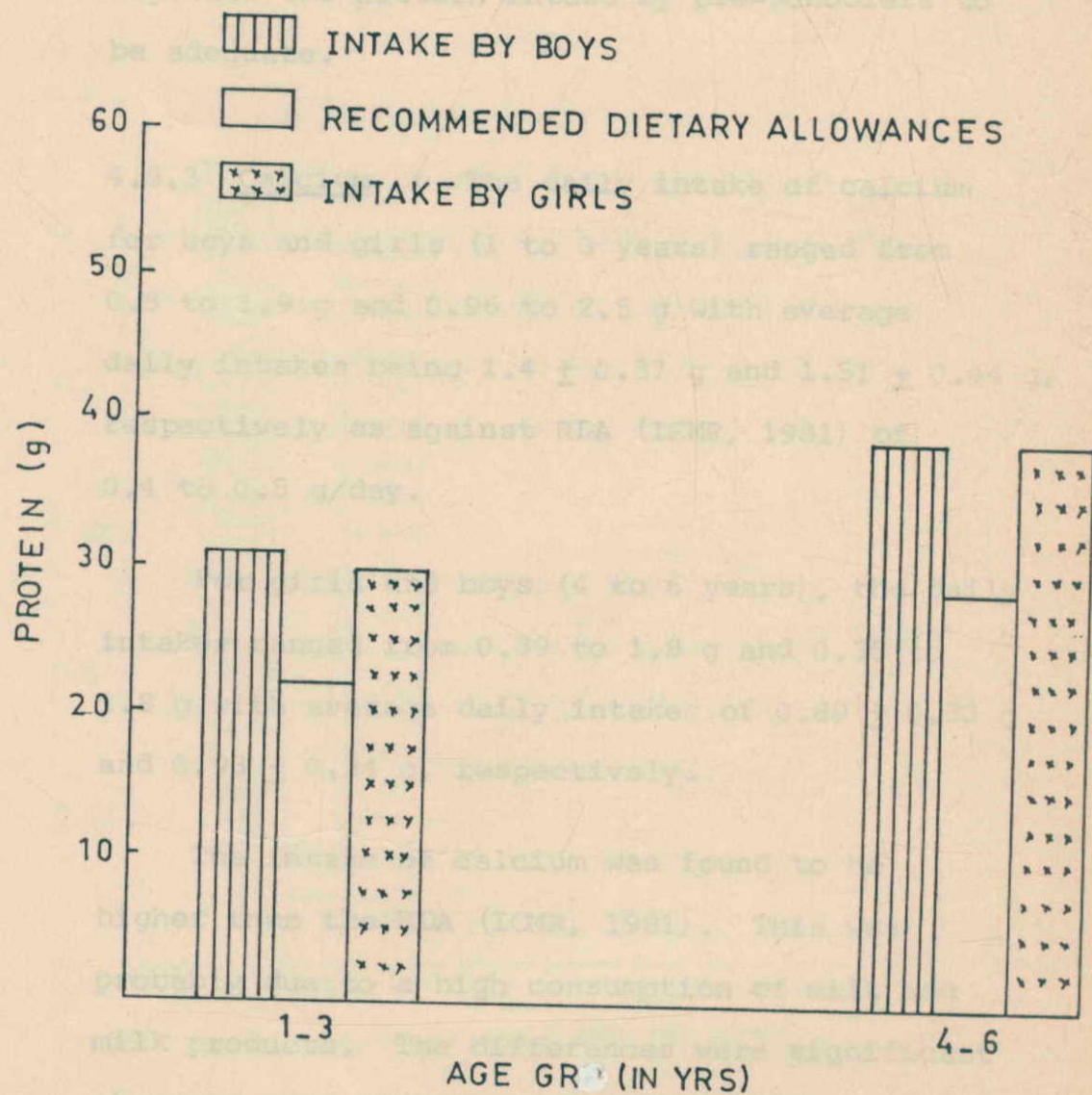


Fig.10. PROTEIN INTAKE BY PRE-SCHOOL CHILDREN

Rao et al. (1983), and Dhir (1985) who reported that protein intake was adequate among pre-school children. Anne and Begum (1985) also reported the protein intake by pre-schoolers to be adequate.

4.3.3 Calcium : The daily intake of calcium for boys and girls (1 to 3 years) ranged from 0.8 to 1.9 g and 0.96 to 2.5 g with average daily intakes being 1.4 ± 0.37 g and 1.51 ± 0.44 g, respectively as against RDA (ICMR, 1981) of 0.4 to 0.5 g/day.

For girls and boys (4 to 6 years), the daily intakes ranged from 0.39 to 1.8 g and 0.35 to 1.8 g with average daily intakes of 0.89 ± 0.33 g and 0.93 ± 0.34 g, respectively.

The intake of calcium was found to be higher than the RDA (ICMR, 1981). This was probably due to a high consumption of milk and milk products. The differences were significant when compared with the RDA (ICMR, 1981). Leung et al. (1984) reported the intake of calcium by pre-schoolers to be 1.6 g. High intakes of calcium by pre-schoolers have also been

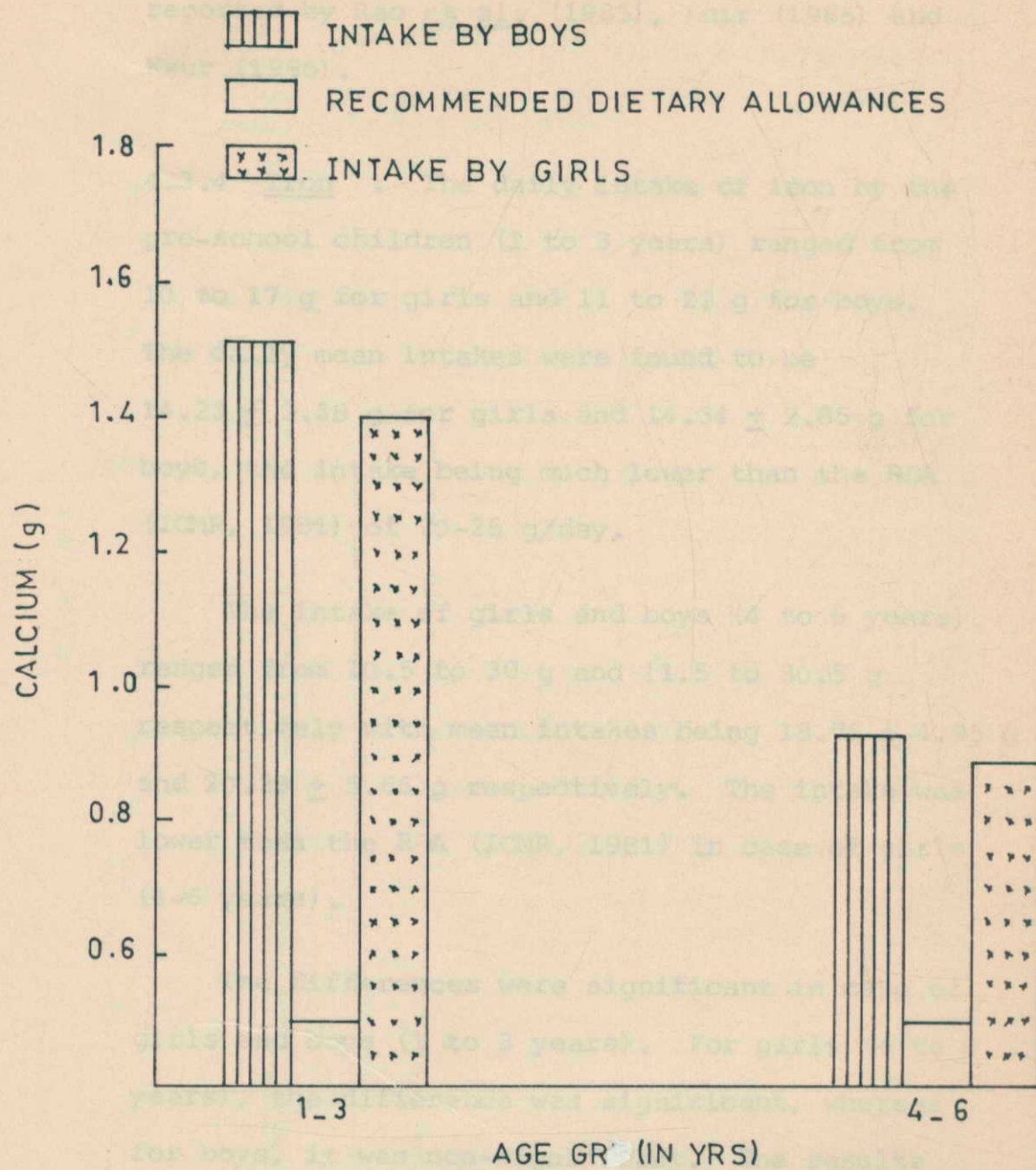


Fig.11 CALCIUM INTAKE BY PRE-SCHOOL CHILDREN

reported by Rao et al. (1985), Jain (1985) and Kaur (1986).

4.3.4 Iron : The daily intake of iron by the pre-school children (1 to 3 years) ranged from 10 to 17 g for girls and 11 to 21 g for boys. The daily mean intakes were found to be 14.23 ± 2.28 g for girls and 14.34 ± 2.85 g for boys, the intake being much lower than the RDA (ICMR, 1981) of 20-25 g/day.

The intake of girls and boys (4 to 6 years) ranged from 10.5 to 30 g and 11.5 to 30.5 g respectively with mean intakes being 18.75 ± 4.95 g and 20.28 ± 5.66 g respectively. The intake was lower than the RDA (ICMR, 1981) in case of girls (4-6 years).

The differences were significant in case of girls and boys (1 to 3 years). For girls (4 to 6 years), the difference was significant, whereas for boys, it was non-significant. The results are supported by the findings of Pushpamma et al. (1983) who reported that iron was among the deficient nutrients. Graham et al. (1980) reported the intake of iron by pre-schoolers to

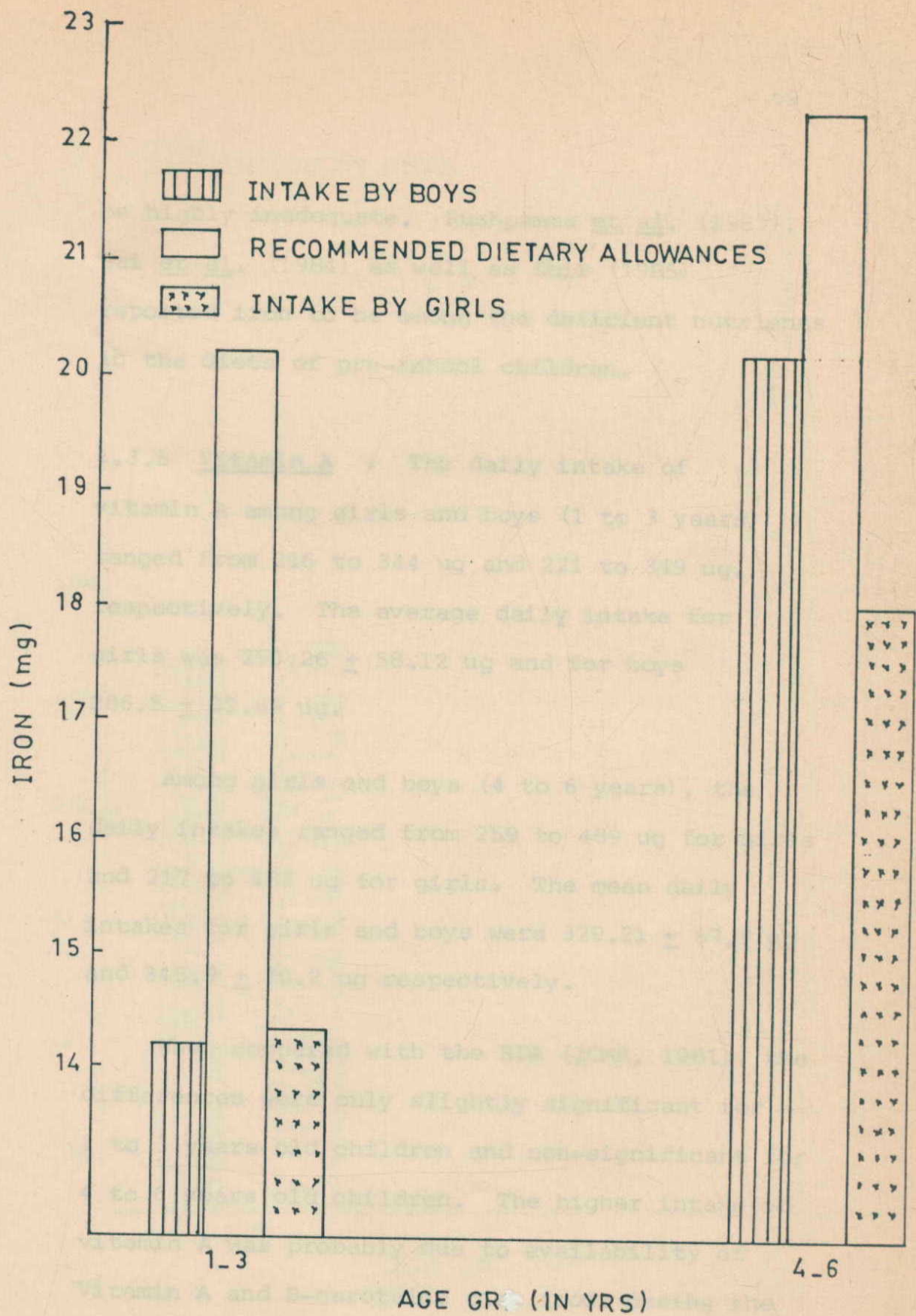


Fig.12. IRON INTAKE BY PRE-SCHOOL CHILDREN

be highly inadequate. Pushpamma et al. (1983), Bai et al. (1984) as well as Dhir (1985) reported iron to be among the deficient nutrients in the diets of pre-school children.

4.3.5 Vitamin A : The daily intake of vitamin A among girls and boys (1 to 3 years) ranged from 216 to 344 ug and 221 to 349 ug, respectively. The average daily intake for girls was 290.26 ± 58.12 ug and for boys 286.5 ± 39.89 ug.

Among girls and boys (4 to 6 years), the daily intakes ranged from 259 to 489 ug for girls and 217 to 483 ug for girls. The mean daily intakes for girls and boys were 329.21 ± 67.9 ug and 345.9 ± 70.2 ug respectively.

When compared with the RDA (ICMR, 1981), the differences were only slightly significant for 1 to 3 years old children and non-significant for 4 to 6 years old children. The higher intake of vitamin A was probably due to availability of Vitamin A and B-carotene rich foods during the period of survey. Another reason could be the high intake of milk and its products and other

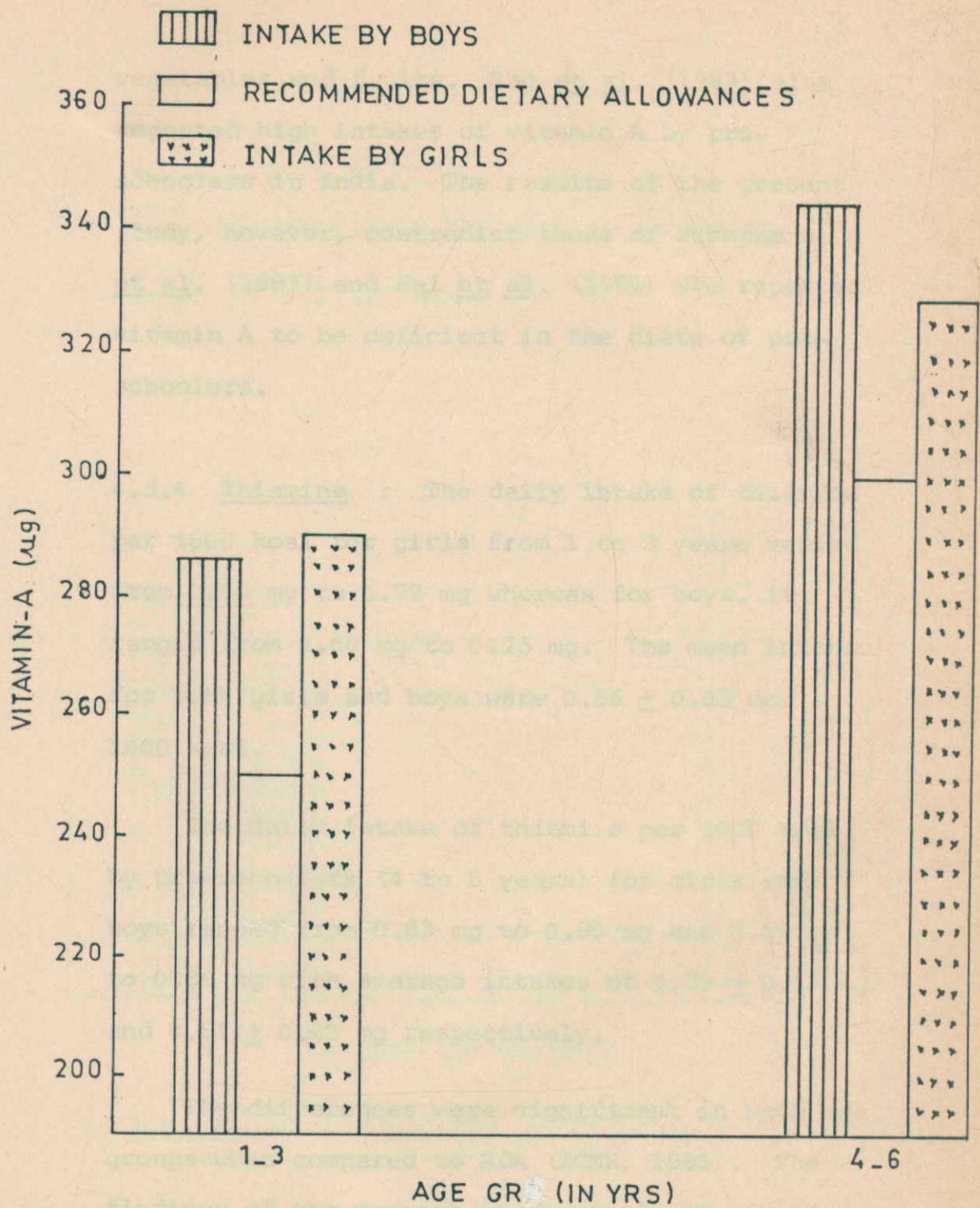


Fig. 13. VITAMIN-A INTAKE BY PRE-SCHOOL CHILDREN

vegetables and fruits. Rao et al. (1983) also reported high intakes of vitamin A by pre-schoolers in India. The results of the present study, however, contradict those of Pushpamma et al. (1983) and Bai et al. (1984) who reported vitamin A to be deficient in the diets of pre-schoolers.

4.3.6 Thiamine : The daily intake of thiamine per 1000 kcal for girls from 1 to 3 years varied from 0.60 mg to 0.72 mg whereas for boys, it ranged from 0.60 mg to 0.75 mg. The mean intakes for both girls and boys were 0.66 ± 0.03 mg/1000 kcal.

The daily intake of thiamine per 1000 kcal by pre-schoolers (4 to 6 years) for girls and boys ranged from 0.63 mg to 0.86 mg and 0.61 mg to 0.89 mg with average intakes of 0.79 ± 0.15 mg and 0.81 ± 0.23 mg respectively.

The differences were significant in both age groups when compared to RDA (ICMR, 1981). The findings of the present study are in line with those of Graham et al. (1980), Rao et al. (1983) and Aujla et al. (1985) who also reported the

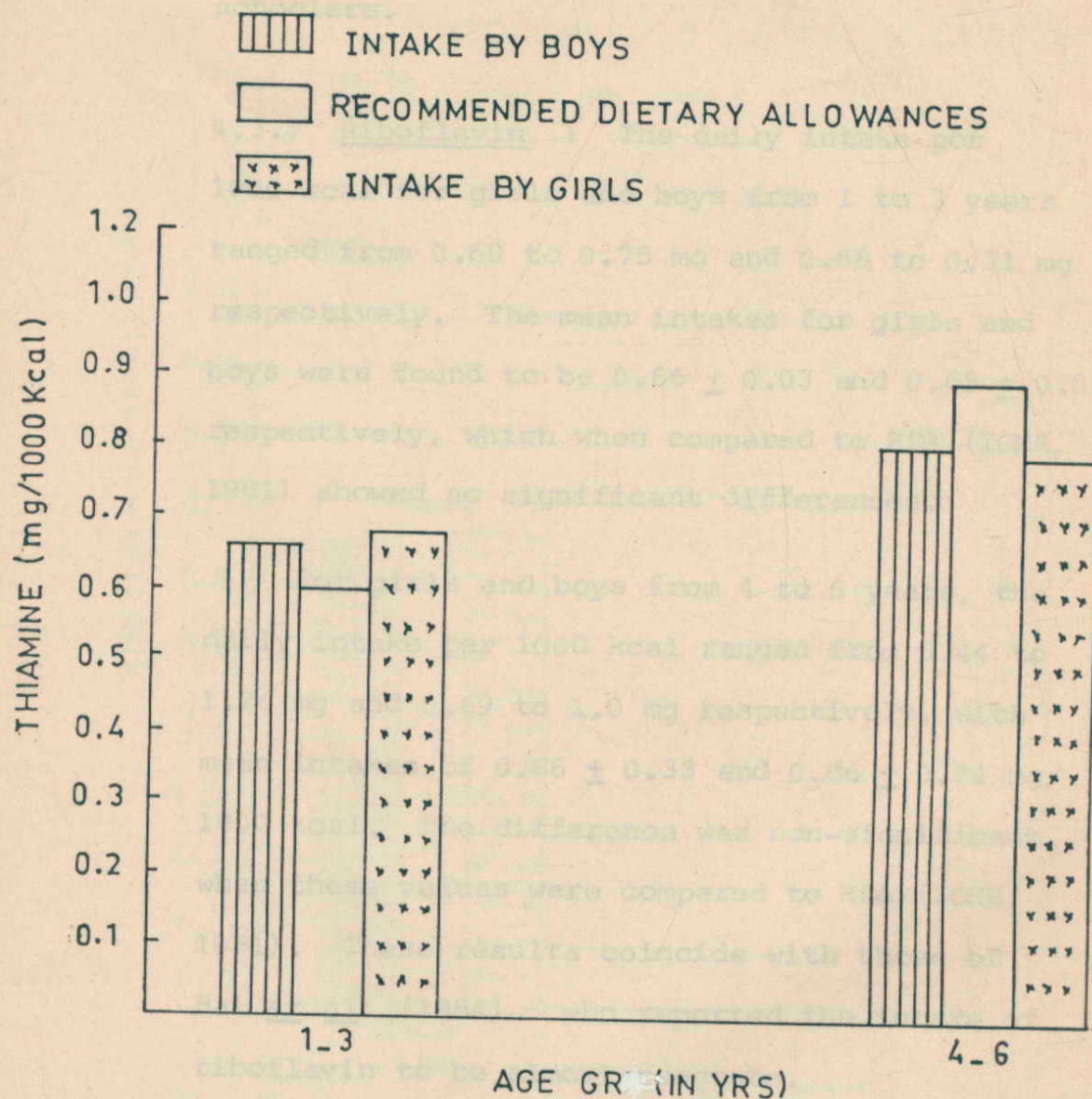


Fig. 14. THIAMINE INTAKE BY PRE-SCHOOL CHILDREN

intake of thiamine was adequate among the pre-schoolers.

4.3.7 Riboflavin : The daily intake per 1000 kcal for girls and boys from 1 to 3 years ranged from 0.60 to 0.75 mg and 0.66 to 0.71 mg respectively. The mean intakes for girls and boys were found to be 0.66 ± 0.03 and 0.65 ± 0.06 mg respectively, which when compared to RDA (ICMR, 1981) showed no significant differences.

For girls and boys from 4 to 6 years, the daily intake per 1000 kcal ranged from 0.44 to 1.26 mg and 0.69 to 1.0 mg respectively, with mean intakes of 0.86 ± 0.33 and 0.86 ± 0.34 mg/1000 kcal. The difference was non-significant when these values were compared to RDA (ICMR, 1981). These results coincide with those of Bai et al. (1984) who reported the intake of riboflavin to be almost adequate.

4.3.8 Niacin : The daily intakes for girls and boys (1 to 3 years) varied from 4.0 to 7.5 mg and 4.0 to 7.2 mg. The average intakes were found to be 5.13 ± 0.91 and 5.52 ± 0.96 respectively.

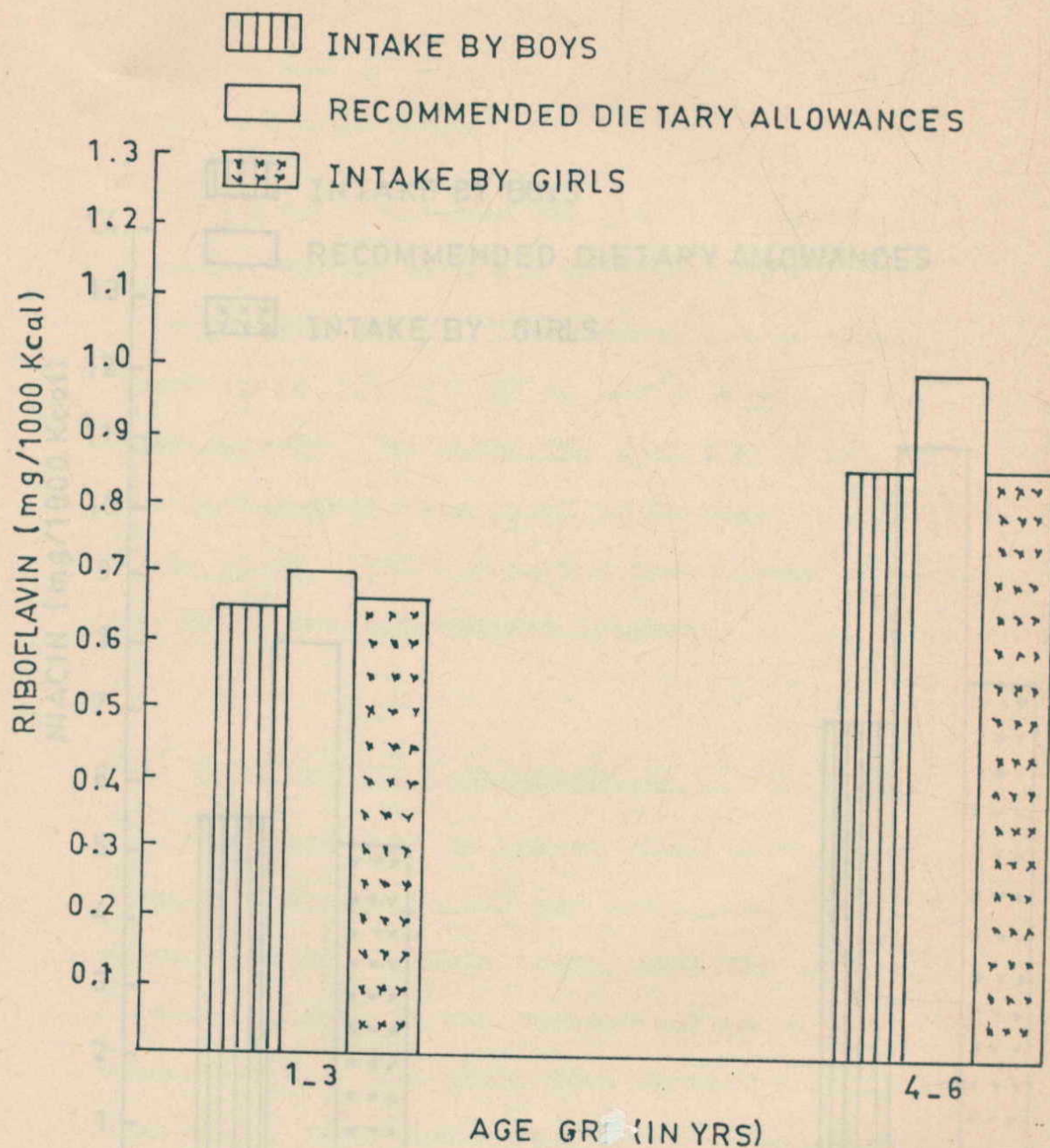


Fig.15. RIBOFLAVIN INTAKE BY PRE-SCHOOL CHILDREN

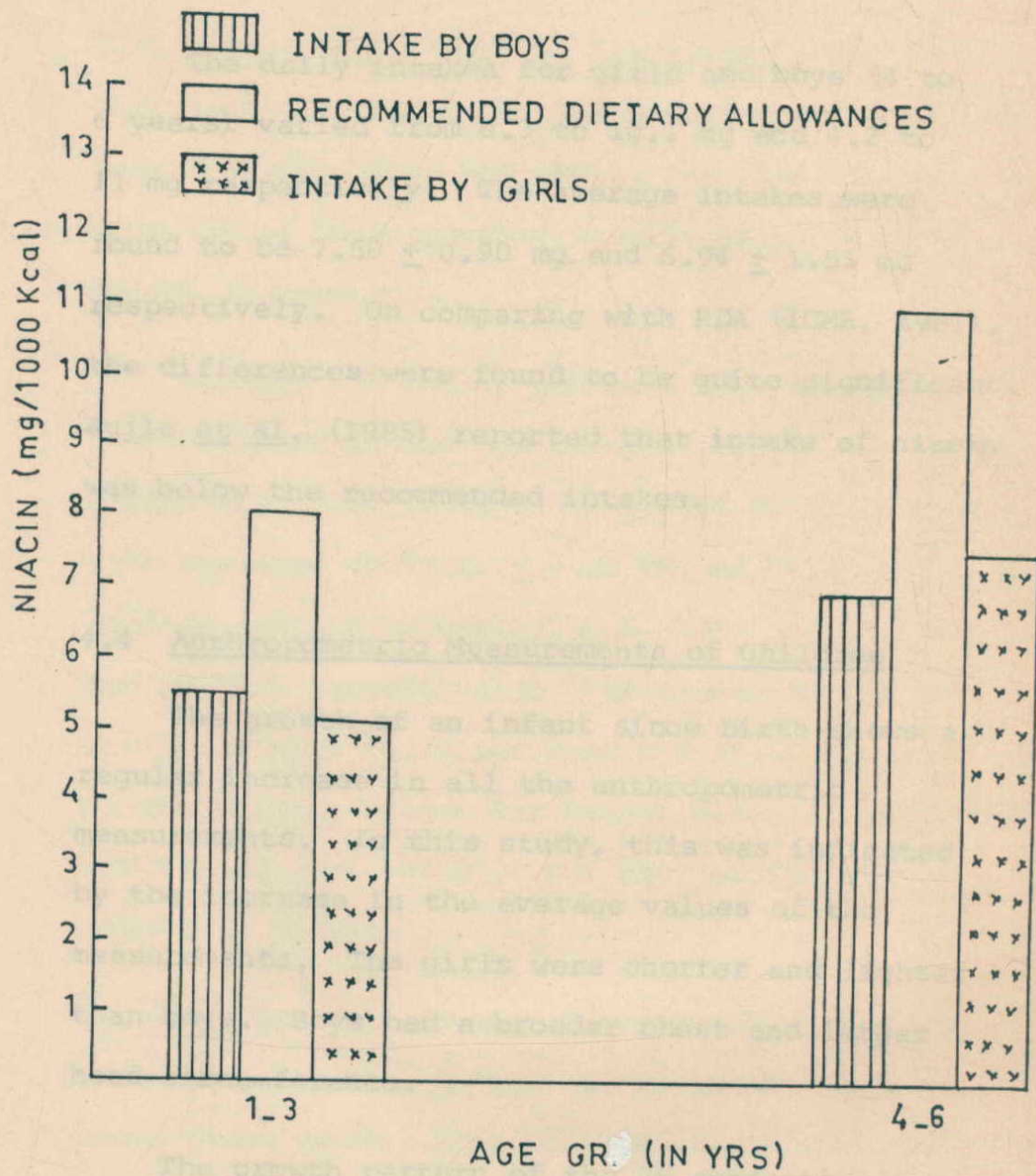


Fig.16. NIACIN INTAKE BY PRE-SCHOOL CHILDREN

The differences, when the intakes were compared with the RDA (ICMR, 1981), were significant for girls and boys both.

The daily intakes for girls and boys (4 to 6 years) varied from 6.3 to 10.1 mg and 4.2 to 11 mg respectively. The average intakes were found to be 7.50 ± 0.90 mg and 6.94 ± 1.51 mg respectively. On comparing with RDA (ICMR, 1981), the differences were found to be quite significant. Aujla et al. (1985) reported that intake of niacin was below the recommended intakes.

4.4 Anthropometric Measurements of Children

The growth of an infant since birth shows a regular increase in all the anthropometric measurements. In this study, this was indicated by the increase in the average values of the measurements. The girls were shorter and lighter than boys. Boys had a broader chest and larger head-circumference.

The growth pattern of the 75 subjects was studied after grouping them into five groups according to age and sex. The data on the

anthropometric measurements of the children are given in Tables 4.11 to 4.16.

4.4.1 Standing Height : The height of an individual is made up of the sum of four components : legs, pelvis, spine and skull. In field nutritional anthropology usually only the total height is measured.

Heights for twelve per cent boys and girls each, falling in the age group of one to two years ranged from 71.5 cm to 82 cm and 70 cm to 85 cm with averages of 79.33 ± 4.39 cm and 79.25 ± 3.51 cm against average values by ICMR (1984) of 82.4 cm and 80.5 cm respectively. The values for boys and girls were 95.27 per cent and 98.44 per cent of the average values for Punjab State (ICMR, 1984) and 98 per cent and 97.8 per cent of the Harvard standards (1959).

Heights of 9.33 per cent boys and 10.66 per cent girls falling in the age group of two to three years ranged from 83.50 to 94 cm and 85 to 91.4 cm with averages of 89.58 ± 3.58 cm and 87.23 ± 2.10 cm against average values by ICMR (1984) of 90.1 cm and 87.4 cm respectively.

Table 4.11 Heights of pre-school children (1-6 years)

Age (Yrs)	Boys					Girls						
	Number	Height (cm)	*Reference values	%age of standards	Harvard standards ds	Height (cm)	*Reference values	%age of standards ds	Harvard standards ds	%age of standards rds		
1-2	9 (12.00)	79.33 +4.39	82.40 +4.88	96.27	80.9	98.0	9 (12.00)	79.25 +3.51	80.50 +6.87	98.44	80.9	97.8
2-3	7 (9.33)	89.58 +3.58	90.10 +6.36	99.42	91.5	97.8	8 (10.66)	87.23 +2.10	87.40 +7.99	99.80	91.5	95.3
3-4	6 (8.00)	96.05 +0.65	96.30 +7.68	99.74	96.6	99.3	11 (14.66)	92.50 +6.58	93.20 +6.58	99.24	96.6	95.7
4-5	9 (12.00)	101.26 +1.67	102.50 +8.54	98.79	106.2	95.2	4 (5.33)	101.77 +0.85	102.60 +6.95	99.19	106.2	95.7
5-6	6 (8.00)	109.83 +1.51	110.60 +6.66	99.30	116.7	94.11	6 (8.00)	108.00 +1.84	109.20 +6.95	98.90	116.7	92.54

* Average values as given by ICMR (1984).

Figures in parentheses represent percentage of children.

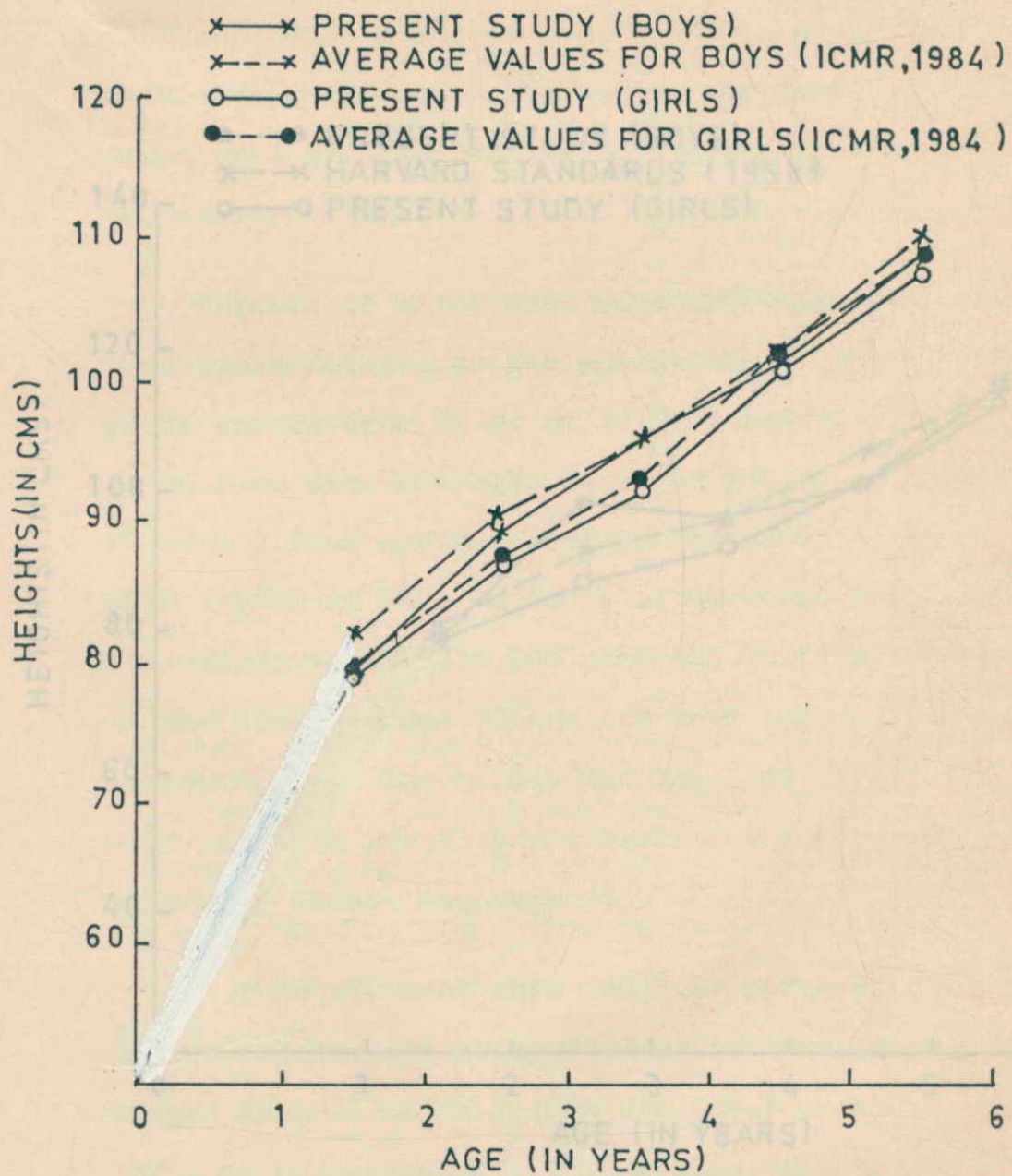


Fig.17. HEIGHTS OF PRE-SCHOOL CHILDREN

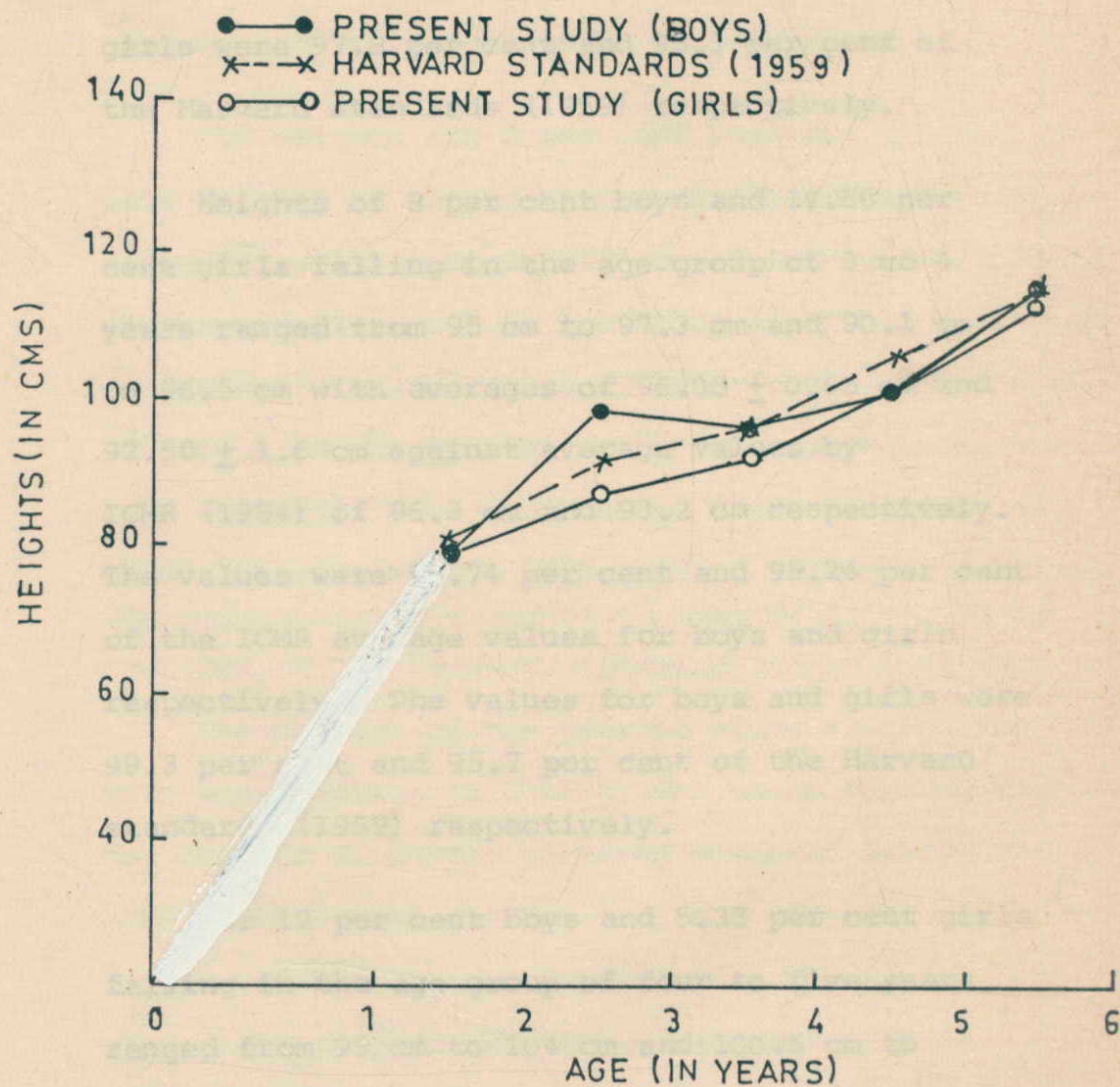


Fig.17.a. HEIGHTS OF PRE-SCHOOL CHILDREN

The values for boys and girls were 99.42 per cent and 99.80 per cent of the ICMR average values respectively. The values for boys and girls were 97.8 per cent and 95.3 per cent of the Harvard standards (1959) respectively.

Heights of 8 per cent boys and 14.66 per cent girls falling in the age group of 3 to 4 years ranged from 95 cm to 97.3 cm and 90.1 cm to 96.5 cm with averages of 96.05 ± 0.65 cm and 92.50 ± 1.6 cm against average values by ICMR (1984) of 96.3 cm and 93.2 cm respectively. The values were 99.74 per cent and 99.24 per cent of the ICMR average values for boys and girls respectively. The values for boys and girls were 99.3 per cent and 95.7 per cent of the Harvard standards (1959) respectively.

For 12 per cent boys and 5.33 per cent girls falling in the age group of four to five years ranged from 99 cm to 104 cm and 100.5 cm to 102.6 cm respectively. The average heights for boys and girls were 101.26 ± 1.67 and 101.77 ± 0.85 cm as against average values by ICMR (1984) of 102.5 ± 8.54 cm and 102.6 ± 6.96 cm respectively. The values were 98.79 per cent and

99.19 per cent of the ICMR value for boys and girls respectively. The values for boys and girls were 95.2 per cent and 95.7 per cent of the Harvard standards (1959) respectively.

The heights for 8 per cent boys and girls each falling in the age group of five to six years varied from 106.5 cm to 111 cm and 105 cm to 110.5 cm with averages of 109.83 ± 1.51 cm and 108.0 ± 1.84 cm as against average values by ICMR (1984) of 110.6 cm and 109.2 cm respectively. The average heights for boys and girls were found to be 99.30 per cent and 98.90 per cent of the ICMR average values respectively. The values for boys and girls were 94.11 and 92.54 per cent of the Harvard standards respectively.

The results of the present study are in line with the findings of Dhir (1985) according to which the heights of Punjab children compared well with ICMR average values. However, the average heights of pre-schoolers (1 to 6 years), in the present study, were higher than those reported by Bhat and Dahiya (1985). Banik (1982) reported that the pre-schoolers in India were as tall as than American counterparts which supports the findings of the present study.

4.4.2 Weight : Weight is the anthropometric measurement most in use. Its potential value is appreciated both by health personnels and parents as it provides an index of actual growth and of growth failure.

For 12 per cent boys and girls each in the age group 1 to 2 years, the weights ranged from 8 kg to 11.5 kg and 7.5 kg to 11.0 kg with averages of 10.0 ± 1.0 kg and 9.61 ± 1.17 kg as against ICMR average values of 10.3 kg and 9.6 kg respectively. The values were found to be 97.08 per cent and 100 per cent for boys and girls respectively. The values were found to be 90.00 per cent and 86.4 per cent of the Harvard standards (1959) for boys and girls respectively.

For 9.33 per cent boys and 10.66 per cent girls, falling in the age group of two to three years, the weights ranged from 10.5 kg to 14 kg and 9.5 kg to 12 kg respectively. The average weights for boys and girls were 12.14 ± 1.18 kg and 10.8 ± 0.77 kg as against ICMR standards (1984) of 12.5 kg and 11.4 kg respectively. The values were 96.8 per cent and 94.7 per cent of the ICMR average values for boys and girls respectively.

Table 4.12 Weights of pre-school children (1-6 years)

Age (Yrs)	Boys					Girls				
	Number	Weight (kg)	*Reference values	%age of standards	Harvard standards	%age of standards	Number	Weight (kg)	*Reference values	%age of standards
1-2	9 (12.00)	10.00 ±1.00	10.30 ±1.55	97.08	11.1	90.0	9 (12.00)	9.61 ±1.74	9.60 ±1.74	100.00
2-3	7 (9.33)	12.14 ±1.18	12.50 ±2.14	96.80	13.4	90.2	8 (10.66)	10.80 ±0.77	11.40 ±2.11	94.70
3-4	6 (8.00)	13.91 ±1.04	14.00 ±2.21	99.20	15.5	89.6	11 (14.66)	12.25 ±0.73	12.80 ±2.15	95.70
4-5	9 (12.00)	14.98 ±0.51	15.40 ±2.46	97.27	17.4	85.6	4 (5.33)	15.00 ±0.35	15.10 ±2.43	99.33
5-6	6 (8.00)	17.00 ±0.53	17.40 ±2.57	97.70	21.3	72.0	6 (8.00)	16.25 ±0.75	16.90 ±2.51	96.15
										21.5
										75.61

*Average values as given by ICMR (1984).

Figures in parentheses represent percentage of children.

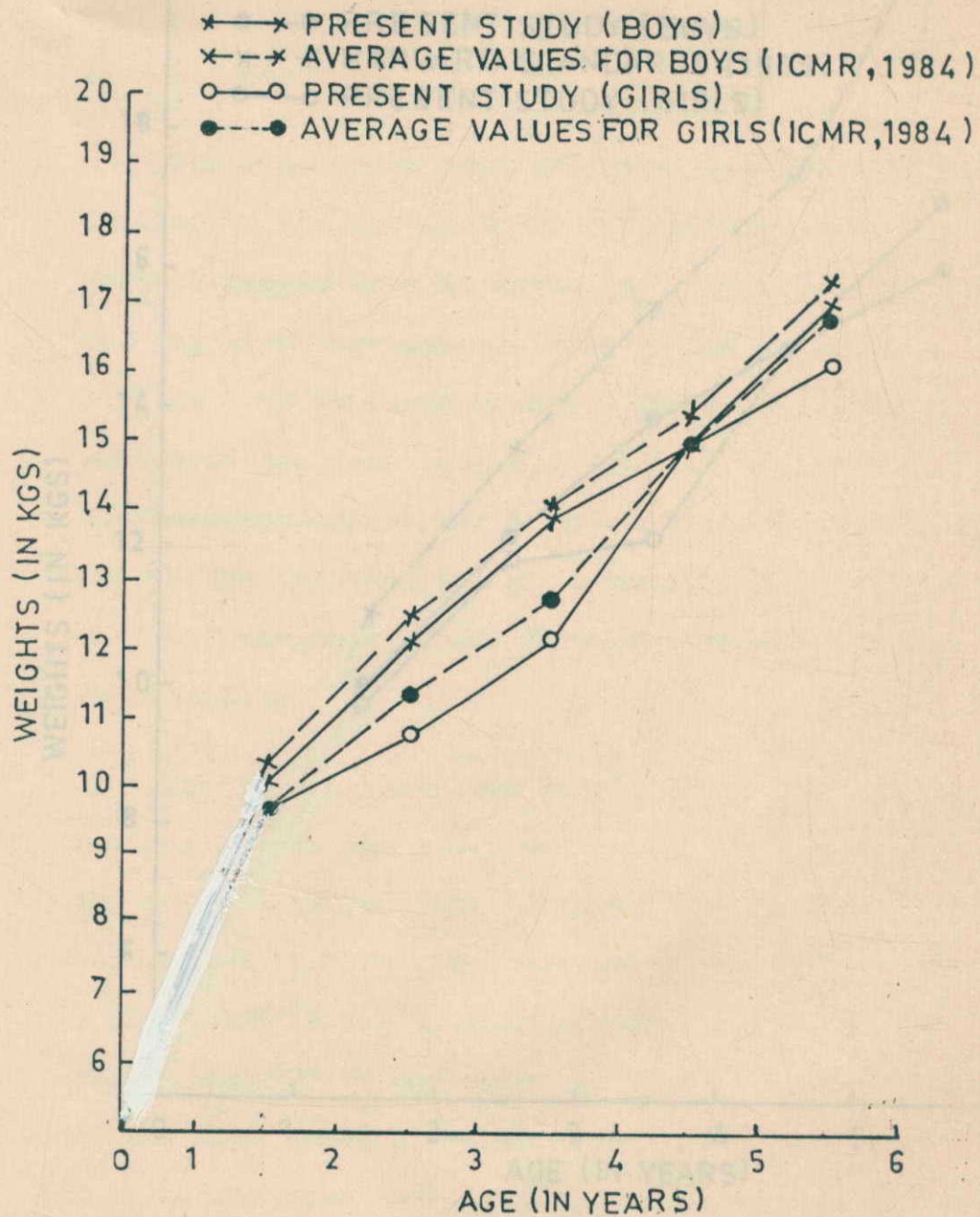


Fig.18. WEIGHTS OF PRE-SCHOOL CHILDREN

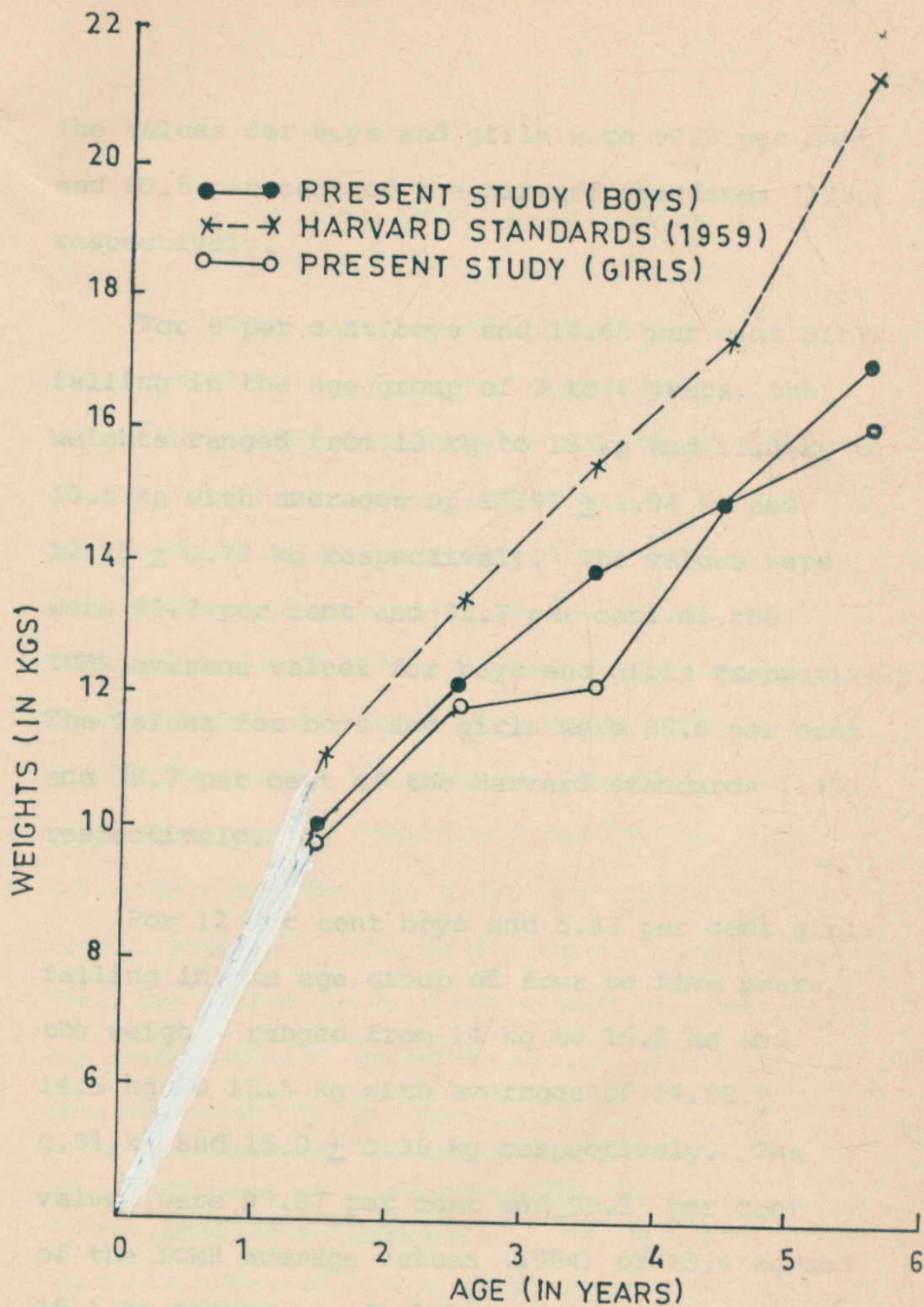


Fig.18.a. WEIGHTS OF PRE-SCHOOL CHILDREN

The values for boys and girls were 90.2 per cent and 80.5 per cent of the Harvard standards (1959) respectively.

For 8 per cent boys and 14.66 per cent girls falling in the age group of 3 to 4 years, the weights ranged from 13 kg to 15 kg and 11.0 kg to 13.5 kg with averages of 13.91 ± 1.04 kg and 12.25 ± 0.73 kg respectively. The values were 99.2 per cent and 95.7 per cent of the ICMR average values for boys and girls respectively. The values for boys and girls were 89.6 per cent and 78.7 per cent of the Harvard standards (1959) respectively.

For 12 per cent boys and 5.33 per cent girls falling in the age group of four to five years, the weights ranged from 14 kg to 15.5 kg and 14.5 kg to 15.5 kg with averages of 14.98 ± 0.51 kg and 15.0 ± 0.35 kg respectively. The values were 97.27 per cent and 99.3 per cent of the ICMR average values (1984) of 15.4 kg and 15.1 kg for boys and girls and 85.6 per cent and 86.2 per cent of the Harvard standards (1959) respectively. The results agree to those of Dhir (1985) who concluded that the weight of urban

pre-schoolers averaged to 15.19 ± 2.26 kg.

For 8 per cent boys and girls each in the age group of 5 to 6 years, the weights ranged from 16.5 kg to 18.5 kg and 15.0 to 17.0 kg with averages of 17.0 ± 0.53 kg and 16.25 ± 0.75 kg as against ICMR average values (1984) of 17.4 kg and 16.9 kg respectively. The values were 97.7 per cent and 96.15 per cent of the ICMR average values for boys and girls respectively. Bhat and Dahiya (1985) also concluded that the weights of pre-schoolers from 1 to 6 years compared well with ICMR values. Geetha and Devadas (1986) however, reported that the pre-schoolers in Coimbatore had weights below the ICMR standards. In his studies, Banik (1982) came to the conclusion that the Indian pre-schoolers were as heavy as American children of corresponding ages which is contradictory to the results of the present study in which the weights of boys and girls were 79.10 and 75.61 per cent of Harvard standards.

4.4.3 Head Circumference : The measurement of head circumference is a standard procedure in paediatric practice, usually to detect pathological conditions accompanied by a large head or one of increasing size e.g., hydrocephalus or microcephaly.

For 12 per cent boys and girls each, falling in the age group of 1 to 2 years, the head circumference ranged from 44 cm to 48.5 cm and 41.5 cm to 48.5 cm respectively. The average for boys was 46.0 ± 1.1 cm and that for girls 44.6 ± 2.37 cm as against ICMR average values of 47.1 ± 1.48 cm and 45.8 ± 1.97 cm respectively. The values were 97.66 per cent and 97.37 per cent of the ICMR average values, respectively.

Head circumference values for 9.33 per cent boys and 10.66 per cent girls falling in the age group of two to three years ranged from 45.5 cm to 49.1 cm and 44 to 48.7 cm respectively with averages of 47.37 ± 1.19 cm and 46.17 ± 1.13 cm as against ICMR average values (1984) of 48.2 cm and 46.7 cm. The values were 98.13 per cent and 98.71 per cent of the ICMR average values for boys and girls respectively.

For 8 per cent boys and 14.66 per cent girls falling in the age group of 3 to 4 years, the values ranged from 45.5 cm to 50.8 cm and 45 cm to 50.0 cm respectively. The averages were 48.38 ± 1.73 cm and 47.4 ± 1.52 cm as against ICMR average values of 49.0 cm and 47.5 cm for

Table 4.13 Head circumference of pre-school children (1-6 years)

Age (Yrs)	Boys			Girls		
	Number	Head circum- ference (cm)	*Reference values %age of standards	Number	Head circum- ference (cm)	*Reference values %age of standards
1-2	9 (12.00)	46.00 +1.10	47.10 +1.48	9 (12.00)	44.60 +2.37	45.30 +1.97
2-3	7 (9.33)	47.37 +1.19	48.20 +1.98	8 (10.66)	46.17 +1.13	46.70 +2.09
3-4	6 (8.00)	48.38 +1.73	49.00 +1.88	11 (14.66)	47.40 +1.52	47.50 +1.49
4-5	9 (12.00)	48.60 +0.88	49.20 + 2.02	4 (5.33)	48.40 +0.55	48.60 +1.80
5-6	6 (8.00)	49.08 +1.76	50.00 +1.55	6 (8.00)	49.33 +0.98	49.10 +1.60

*Average values as given by ICMR (1984).

Figures in the parentheses represent percentage of children.

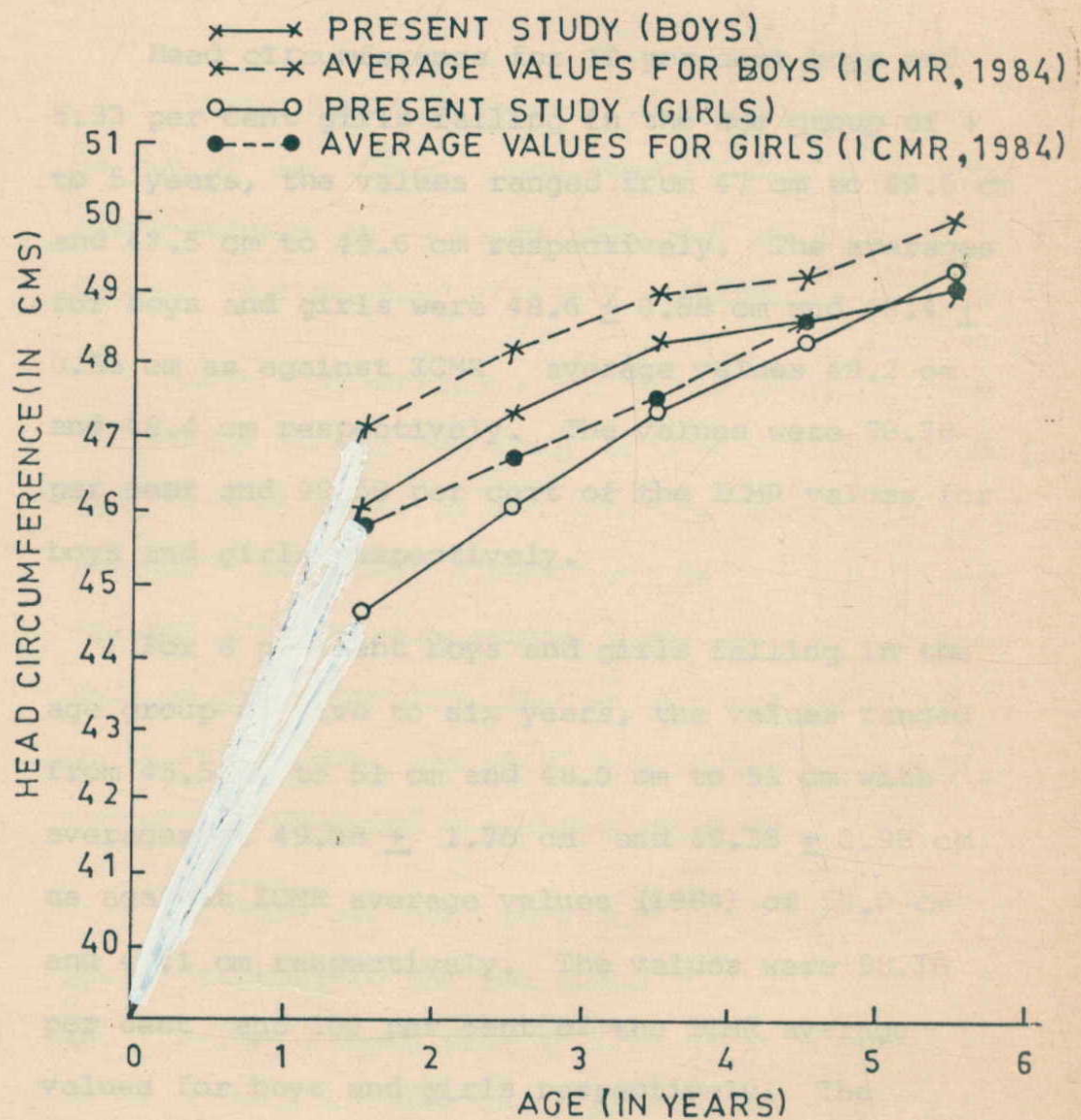


Fig.19. HEAD CIRCUMFERENCE OF PRE-SCHOOL CHILDREN

boys and girls respectively. The values were 98.57 per cent and 99.78 per cent of the ICMR average values for boys and girls respectively.

Head circumference for 12 per cent boys and 5.33 per cent girls falling in the age group of 4 to 5 years, the values ranged from 47 cm to 49.5 cm and 47.5 cm to 49.6 cm respectively. The averages for boys and girls were 48.6 ± 0.88 cm and 48.4 ± 0.55 cm as against ICMR average values 49.2 cm and 48.4 cm respectively. The values were 98.78 per cent and 99.58 per cent of the ICMR values for boys and girls respectively.

For 8 per cent boys and girls falling in the age group of five to six years, the values ranged from 45.5 cm to 51 cm and 48.0 cm to 51 cm with averages of 49.08 ± 1.76 cm and 49.33 ± 0.98 cm as against ICMR average values (1984) of 50.0 cm and 49.1 cm respectively. The values were 98.16 per cent and 100 per cent of the ICMR average values for boys and girls respectively. The results of the present study are in line with the findings of Behera et al., who reported the head circumference of pre-schoolers in Orissa to be 100.74 per cent of the ICMR average values.

Bhat and Dahiya (1985) also reported that the head circumference of pre-schoolers compared well with ICMR values.

4.4.4 Chest Circumference : Chest circumference is one of the linear measurements. The chest/head circumference ratio is an indicator of protein-caloric malnutrition of early childhood.

Chest circumference for 12 per cent boys and girls each in the age group of 1 to 2 years, ranged from 44.5 cm to 47 cm and 42 cm to 48 cm with averages of 45.6 ± 0.84 cm and 44.6 ± 2.37 cm as against ICMR average values (1984) of 46.7 cm and 45.2 cm respectively. The values were found to be 97.64 per cent and 98.67 per cent of the ICMR values for boys and girls respectively.

For 9.33 per cent boys and 10.66 per cent girls, falling in the age group of 2 to 3 years, the values ranged from 45.5 cm to 49.5 cm and 44 cm to 49.0 cm with averages of 47.1 ± 1.24 cm and 46.6 ± 1.52 cm as against ICMR average values of 49.0 ± 2.76 cm and 47.4 ± 2.86 cm respectively. The values were 96.12 per cent and 98.31 per cent of the ICMR average values respectively.

Table 4.14 Chest circumference of pre-school children (1-6 years)

Age (Yrs)	Boys				Girls			
	Number	Chest circum- ference (cm)	*Reference values	%age of standards	Number	Chest circum- ference (cm)	*Reference values	%age of standards
1-2	9 (12.00)	45.60 +0.84	46.76 +2.25	97.64	9 (12.00)	44.60 +2.37	45.20 +2.79	98.67
2-3	7 (9.33)	47.10 +1.24	49.00 +2.76	96.12	8 (10.66)	46.60 +1.52	47.40 +2.86	98.31
3-4	6 (8.00)	49.40 +1.27	50.00 +2.64	98.80	11 (14.66)	48.10 +1.33	48.60 +2.69	98.97
4-5	9 (12.00)	50.70 +0.78	51.30 +3.43	98.83	4 (5.33)	50.50 +0.57	50.90 +2.72	99.21
5-6	6 (8.00)	52.60 +1.24	53.50 +3.00	98.31	6 (8.00)	51.90 +0.82	52.70 +2.98	98.48

*Average values as given by ICMR (1984).

Figures in the parentheses represent percentage of children.

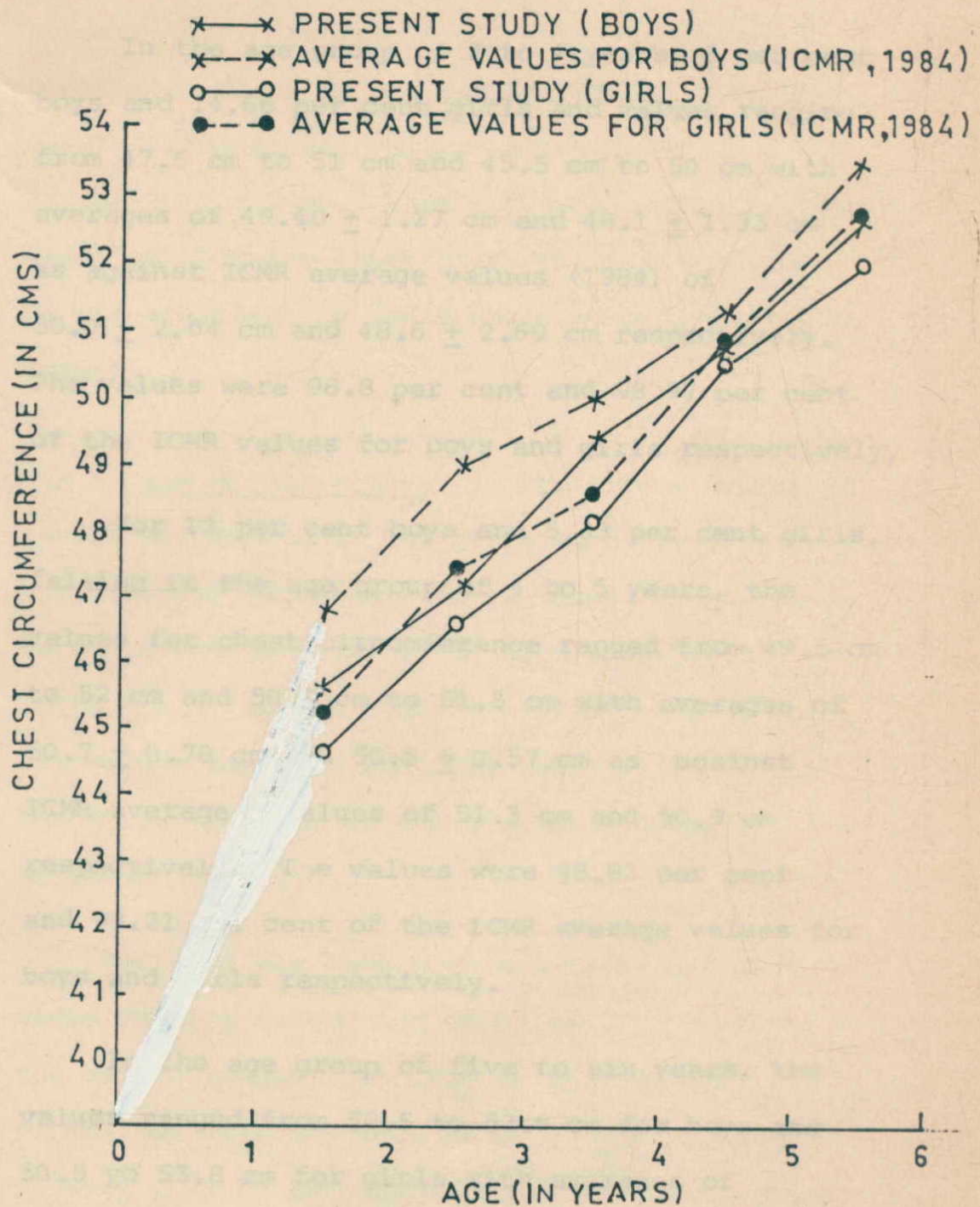


Fig. 20. CHEST CIRCUMFERENCE OF PRE-SCHOOL CHILDREN

In the age group of 3 to 4 years, 8 per cent boys and 14.66 per cent girls and values ranging from 47.5 cm to 51 cm and 45.5 cm to 50 cm with averages of 49.40 ± 1.27 cm and 48.1 ± 1.33 cm as against ICMR average values (1984) of 50.0 ± 2.64 cm and 48.6 ± 2.69 cm respectively. The values were 98.8 per cent and 98.97 per cent of the ICMR values for boys and girls respectively.

For 12 per cent boys and 5.33 per cent girls, falling in the age group of 4 to 5 years, the values for chest circumference ranged from 49.5 cm to 52 cm and 50.0 cm to 51.5 cm with averages of 50.7 ± 0.78 cm and 50.5 ± 0.57 cm as against ICMR average values of 51.3 cm and 50.9 cm respectively. The values were 98.83 per cent and 99.21 per cent of the ICMR average values for boys and girls respectively.

In the age group of five to six years, the values ranged from 50.5 to 53.6 cm for boys and 50.5 to 53.8 cm for girls with averages of 52.6 ± 1.24 cm and 51.9 ± 0.82 cm as against ICMR average values (1984) of 53.5 cm and 52.7 cm respectively. The values were 98.31 and 98.48 per cent of the ICMR average values for boys and girls

respectively. Behera et al. (1982) reported similar findings to the present study, i.e., the chest circumference values were 101.59 per cent of the ICMR values. Bhat and Dahiya (1985) also reported that the chest circumference values of pre-schoolers in India compared well with ICMR values.

4.4.5 Arm Circumference : Arm circumference of twelve per cent boys and girls each, falling in the age group of one to two years ranged from 14.5 cm to 17 cm and 13 cm to 17 cm with averages of 15.83 ± 0.91 cm and 15.16 ± 1.29 cm respectively. The values for boys and girls were 97.1 per cent and 95.34 per cent of the standards given by Wolanski (1964).

For 9.33 per cent boys and 10.66 per cent girls falling in the age group of 2 to 3 years, the values ranged from 14.5 to 17.5 cm and 14.5 to 16.7 cm with averages of 15.67 ± 0.92 cm and 15.35 ± 0.73 cm respectively. These values were 96.7 per cent and 96.54 per cent of the standards by Wolanski (1964).

Table 4.15 Arm circumference of pre-school children (1-6 years)

Age (Yrs)	Boys			Girls		
	Number	Arm circum- ference (cm)	%age of standards	Number	Arm circum- ference (cm)	%age of standards
1-2	9 (12.00)	15.83 ± 0.91	97.10	9 (12.00)	15.16 ± 1.29	95.34
2-3	7 (9.33)	15.67 ± 0.92	96.70	8 (10.66)	15.35 ± 0.73	96.54
3-4	6 (8.00)	16.58 ± 0.44	98.10	11 (14.66)	16.22 ± 0.61	95.97
4-5	9 (12.00)	16.22 ± 0.82	98.41	4 (5.33)	16.00 ± 0.70	94.67
5-6	6 (8.00)	16.80 ± 0.70	97.10	6 (8.00)	16.86 ± 0.59	97.40

*From Wolanski (personal communication, 1964).

Figures in parentheses represent percentage of children.

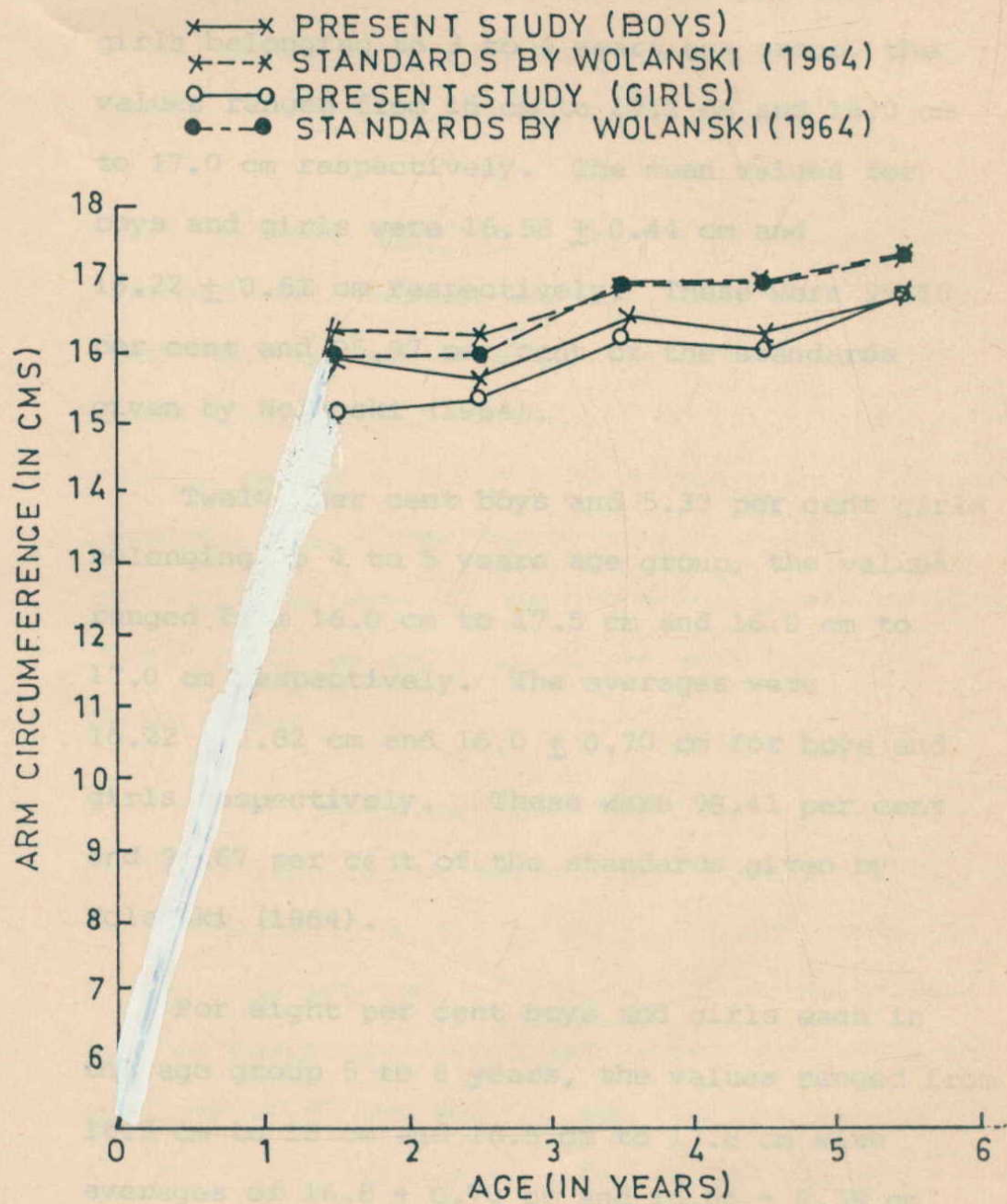


Fig. 21. ARM CIRCUMFERENCE OF PRE-SCHOOL CHILDREN

For 8 per cent boys and 14.66 per cent girls belonging to 3 to 4 years age group, the values ranged from 16 cm to 17.2 cm and 16.0 cm to 17.0 cm respectively. The mean values for boys and girls were 16.58 ± 0.44 cm and 16.22 ± 0.61 cm respectively. These were 98.10 per cent and 95.97 per cent of the standards given by Wolanski (1964).

Twelve per cent boys and 5.33 per cent girls belonging to 4 to 5 years age group, the values ranged from 16.0 cm to 17.5 cm and 16.0 cm to 17.0 cm respectively. The averages were 16.22 ± 0.82 cm and 16.0 ± 0.70 cm for boys and girls respectively. These were 98.41 per cent and 94.67 per cent of the standards given by Wolanski (1964).

For eight per cent boys and girls each in the age group 5 to 6 years, the values ranged from 16.3 cm to 18 cm and 16.5 cm to 17.8 cm with averages of 16.8 ± 0.70 cm and 16.86 ± 0.59 cm respectively. The average values were 97.1 per cent and 97.4 per cent of the standards by Wolanski (1964).

According to Dhir (1985), the arm circumference values of urban pre-schoolers were slightly less than the standard values.

4.4.6 Triceps Skinfold : Among twelve per cent boys and girls each in the age group of 1 to 2 years, the triceps skinfold measurements ranged from 8.2 mm to 10.5 mm and 9.7 mm to 10.2 mm, with average values of 9.7 ± 0.71 mm and 9.95 ± 0.14 mm respectively. These values were 97.0 per cent and 98.51 per cent of the standard values (Hammond, 1955a) of 10 mm and 10.1 mm for boys and girls respectively.

For 9.33 per cent boys and 10.66 per cent girls falling in the age group of 2 to 3 years, the values ranged from 8.5 mm to 9.3 mm and 9.0 mm to 9.7 mm with averages of 8.98 ± 0.23 mm and 9.28 ± 0.26 mm respectively. These values were 96.55 per cent and 95.67 per cent of the standard values (HAMMOND, 1955) for boys and girls, i.e., 9.3 mm and 9.7 mm respectively.

In the age group of 3 to 4 years, 8 per cent boys and 14.66 per cent girls had values ranging from 8.9 mm to 9.5 mm and 9.5 mm to 10.5 mm with

Table 4.16 Triceps skinfold of pre-school children (1-6 years)

Age (Yrs)	Boys				Girls			
	Number	Triceps skinfold (mm)	*Reference standards	%age of standards	Number	Triceps skinfold (mm)	*Reference standards	%age of standards
1-2	9 (12.00)	9.70 ± 0.71	10.00	97.00	9 (12.00)	9.95 ± 0.14	10.10	98.51
2-3	7 (9.33)	8.98 ± 0.23	9.30	96.55	8 (10.66)	9.28 ± 0.26	9.70	95.67
3-4	6 (8.00)	9.06 ± 0.22	9.30	97.41	11 (14.66)	9.96 ± 0.27	10.20	97.64
4-5	9 (12.00)	8.78 ± 0.54	9.10	96.48	4 (5.33)	8.97 ± 0.35	9.40	95.54
5-6	6 (8.00)	7.98 ± 0.23	8.20	97.31	6 (8.00)	9.31 ± 0.24	9.60	96.97

*Adapted from Hammond (1955).
 Figures in parentheses represent percentages.

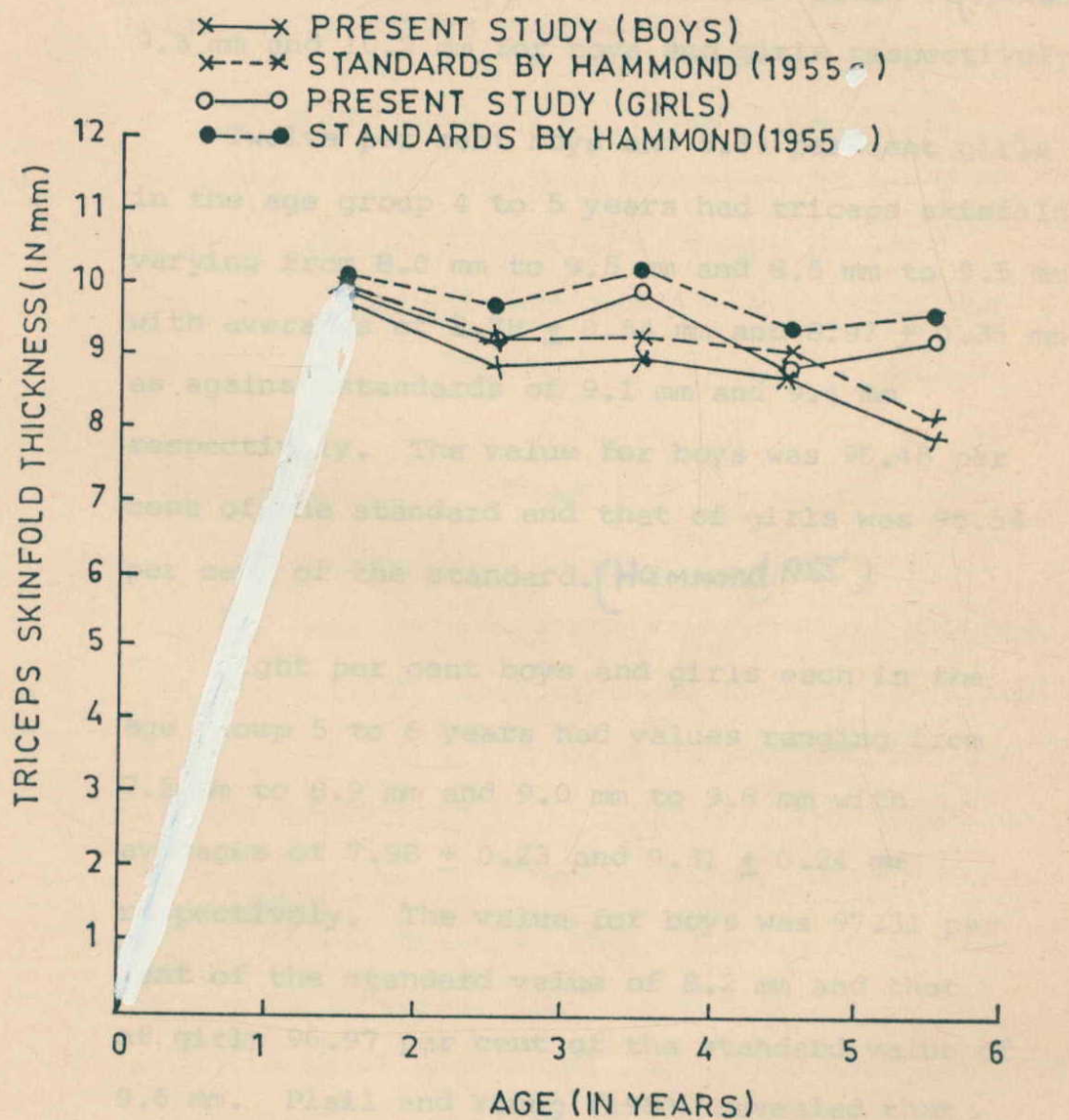


Fig.22. TRICEPS SKINFOLD OF PRE-SCHOOL CHILDREN

averages of 9.06 ± 0.22 mm and 9.96 ± 0.27 mm respectively. These values were 97.41 per cent and 97.64 per cent of the standard values of (Hammond 1955) of 9.3 mm and 10.2 mm for boys and girls respectively.

Twelve per cent boys and 5.33 per cent girls in the age group 4 to 5 years had triceps skinfold varying from 8.0 mm to 9.5 mm and 8.5 mm to 9.5 mm with averages of 8.78 ± 0.54 mm and 8.97 ± 0.35 mm as against standards of 9.1 mm and 9.4 mm respectively. The value for boys was 96.48 per cent of the standard and that of girls was 95.54 per cent of the standard. (Hammond 1955)

Eight per cent boys and girls each in the age group 5 to 6 years had values ranging from 7.5 mm to 8.9 mm and 9.0 mm to 9.6 mm with averages of 7.98 ± 0.23 and 9.31 ± 0.24 mm respectively. The value for boys was 97.31 per cent of the standard value of 8.2 mm and that of girls 96.97 per cent of the standard value of 9.6 mm. Plail and Young (1980) revealed that skinfold thickness was consistently below the Jelliffe standards. Sood and Kapil (1984) also reported the triceps skinfold of pre-schoolers to be slightly lower than the Hammond standards.

4.5 Clinical Assessment

Although no clear-cut nutritional deficiencies were present in the seventy-five pre-school children surveyed in the present study, a few signs and symptoms were observed.

Pale conjunctiva was observed in three children. There was only one case of mottled enamel. Dental caries were present in 11 children. Two children had bow legs while one child had knock knees.

4.6 Haemoglobin Records

The haemoglobin level (g/100 ml) of 49 children was recorded from their medical records. The haemoglobin level of these children averaged to 10.34 ± 0.70 g/100 ml as compared to WHO standard (1972) of 11.0 g/100 ml. The value was 94 per cent of the standard value. Bhat and Dahiya (1985) revealed that haemoglobin levels of one to five year old boys and girls ranged from 8.5 to 10.0 g/100 ml and 8.7 to 10.0 g/100 ml respectively. These results coincide with those of the present study. The results of the present study were contradictory to those of Jansen (1985) who concluded that in most of the pre-school children, the haemoglobin level was more than 11.0 g/100 ml.

CHAPTER V

SUMMARY

- 1 The nutritional status of pre-school children of working mothers was assessed using dietary survey, biochemical assessment and anthropometric measurements. Besides this, general information, viz., type of family, family income, size of family, education and occupation of family members of the subjects, information regarding illness and immunization was also collected.
- 2 Seventy-five pre-school children of working mothers belonging to middle income group families residing in Gurdev Nagar, Model Town, Shastri Nagar, Bhai Randhir Singh Nagar, Maya Nagar, Power Colony and Housing Board Colony of Ludhiana were selected proportionally using simple random sampling.
- 3 The detailed record of the food intake for three days [redacted] (by 24 hour-recall method), anthropometric measurements, nutritional deficiency symptoms, information regarding the illness of the child and

immunization of the child was recorded. The nutrient intake by the pre-schoolers was calculated with the help of Food Composition Tables (Gopalan et al 1981). The food and nutrient intake was compared with the Recommended Dietary Allowances (ICMR, 1981). Clinical observations were made according to the classified list of signs suggested by Expert Committee of WHO (1968).

- 4 The average intake of cereals, pulses and legumes, green leafy vegetables, roots and tubers, other vegetables and fruits, milk and milk products, sugar and jaggery, fats and oils, meat and fish and eggs by girls of the age group 1 to 3 years was 104.70 ± 20.58 g, 23.68 ± 5.97 g, 8.15 ± 3.41 g, 12.78 ± 3.27 g, 48.68 ± 21.97 g, 550 ± 134.37 g, 30.52 ± 8.9 g, 16.31 ± 4.02 g, 1.28 ± 0.60 g, 14.91 ± 4.10 g, while that of boys of the same age group was 113.05 ± 24.7 g, 24.72 ± 5.27 g, 15.0 ± 5.77 g, 14.44 ± 4.5 g, 33.61 ± 6.81 g, 541.66 ± 174.26 g, 27.22 ± 6.23 g, 15.55 ± 3.79 g, 1.36 ± 0.52 g and 20.36 ± 10.40 g respectively. The average intake of the above mentioned food groups, by girls of the age group of 4 to 6 years was

190.52 ± 41.30 g, 26.84 ± 6.05 g, 17.26 ± 6.46 g,
 36.84 ± 9.45 g, 105.26 ± 30.7 g, 315.78 ± 68.82 g,
 33.42 ± 5.01 g, 23.42 ± 4.72 g, 6.05 ± 3.01 g
 21.05 ± 12.21 g, and that of boys was
 199.73 ± 33.51 g, 22.36 ± 4.52 g, 16.11 ± 4.39 g,
 36.31 ± 9.10 g, 128.94 ± 70.85 g, 413.15 ± 131.06 g,
 27.63 ± 5.61 g, 25.78 ± 4.17 g, 6.10 ± 0.99 g
 and 18.42 ± 10.10 g, respectively.

- 5 The intake of cereals, pulses and legumes, and green leafy vegetables was inadequate while that of roots and tubers, other vegetables and fruits, milk and milk products was more than the recommended allowances in both age groups, i.e., 1 to 3 years and 4 to 6 years. The intake of sugar and jaggery was more than adequate in girls from 1 to 3 years, nearly adequate in case of boys from 1 to 3 years and inadequate in both boys and girls from 4 to 6 years. The intake of fats and oils was nearly adequate in both the age groups.

- 6 The average intake of energy and protein by girls and boys of the age group of 1 to 3 years was 1242.68 ± 145.81 kcal, 30.22 ± 5.41 g, 1294.73 ± 170.17 kcal and 31.0 ± 4.89 g, while

that of girls and boys of the age group of 4 to 6 years was 1549.47 ± 253.46 kcal, 38.68 ± 10.31 g, 1602.68 ± 217.44 kcal and 38.0 ± 10.67 g respectively. The average intake of calcium and iron by girls and boys of the age group of 1 to 3 years was 1.4 ± 0.37 g, 14.23 ± 2.28 mg, 1.51 ± 0.4 g and 14.34 ± 2.85 mg while that of girls and boys of the age group of 4 to 6 years, it was 0.89 ± 0.33 g, 18.75 ± 4.95 mg, 0.93 ± 0.34 g, 20.28 ± 5.66 mg respectively. The average intake of vitamin A, thiamine, riboflavin and niacin by girls and boys of the age group of 1 to 3 years was 290.26 ± 58.12 ug, 0.68 ± 0.03 mg/1000 kcal, 0.66 ± 0.03 mg/1000 kcal, 5.13 ± 0.91 mg/1000 kcal and 286.5 ± 39.89 ug, 0.66 ± 0.03 mg/1000 kcal, 0.65 ± 0.06 mg/1000 kcal and 5.52 ± 0.96 mg/1000 kcal respectively. The average intake of vitamin A, thiamine, riboflavin and niacin by girls and boys of the age group of 4 to 6 years was 329.21 ± 67.9 ug, 0.79 ± 0.15 mg/1000 kcal, 0.86 ± 0.33 mg/1000 kcal, 7.50 ± 0.90 mg/1000 kcal and 345.0 ± 70.20 ug, 0.81 ± 0.23 mg/1000 kcal, 0.86 ± 0.34 mg/1000 kcal and 6.94 ± 1.51 mg/1000 kcal respectively.

- 7 In the age group of 1 to 3 years, the intake of energy was adequate, protein, calcium, vitamin A and thiamine was more than adequate, riboflavin was almost adequate and iron and niacin was inadequate. In the age group of 4 to 6 years, the intake of protein, calcium and vitamin A was more than adequate, energy, thiamine and riboflavin was nearly adequate, while iron and niacin was inadequate.
- 8 The average height, weight, head circumference, chest circumference, arm circumference and triceps skinfold of girls in the age group of 1 to 2 years was 79.25 ± 3.51 cm, 9.61 ± 1.17 kg, 44.6 ± 2.37 cm, 44.6 ± 2.37 cm, 15.16 ± 1.29 cm and 9.95 ± 0.14 mm respectively and for boys, the values were 79.33 ± 4.39 cm, 10.0 ± 1.0 ug, 46.0 ± 1.40 cm, 45.6 ± 0.84 cm, 15.83 ± 0.91 cm and 0.7 ± 0.71 cm.
- 9 The average height, weight, head circumference, chest circumference, arm circumference and triceps skinfold of boys in the age group of 2 to 3 years were 89.58 ± 3.58 cm, 12.14 ± 1.18 kg, 47.37 ± 1.19 cm, 47.1 ± 1.24 cm,

15.61 $\pm$ 0.92 cm and 8.98 $\pm$ 0.23 mm respectively. The values for girls were 87.23 $\pm$ 2.10 cm, 10.8 $\pm$ 0.77 kg, 46.17 $\pm$ 1.13 cm, 46.6 $\pm$ 1.52 cm, 15.35 $\pm$ 0.73 cm and 9.28 $\pm$ 0.26 mm, respectively.

- 10 The average height, weight, head circumference, chest circumference, arm circumference and triceps skinfold measurements of boys in the age group of 3 to 4 years were 96.05 $\pm$ 0.65 cm, 13.91 $\pm$ 1.04 kg, 48.38 $\pm$ 1.73 cm, 49.41 $\pm$ 1.17 cm, 16.58 $\pm$ 0.44 cm and 9.06 $\pm$ 0.22 mm, whereas the values of these measures for girls were 92.5 $\pm$ 1.60 cm, 12.25 $\pm$ 0.73 kg, 47.4 $\pm$ 1.52 cm, 48.1 $\pm$ 1.33 cm, 16.22 $\pm$ 0.61 cm and 9.96 $\pm$ 0.27 mm respectively.
- 11 The average height, weight, head, chest and arm circumference and triceps skinfold measurements of boys in the age group of 4 to 5 years were 101 $\pm$ 1.67 cm, 14.98 $\pm$ 0.51 kg, 48.6 $\pm$ 0.88, 50.7 $\pm$ 0.78 cm, 16.22 $\pm$ 0.82 cm and 8.78 $\pm$ 0.54 mm, whereas in the case of girls, these values were 101.77 $\pm$ 0.85 cm, 15.0 $\pm$ 0.35 kg, 48.4 $\pm$ 0.55 cm, 50.5 $\pm$ 0.57 cm, 16.0 $\pm$ 0.70 cm and 8.97 $\pm$ 0.35 cm respectively.

- 12 The average height, weight, head circumference, chest circumference, arm circumference and triceps skinfold of boys in the age group of 5 to 6 years were 110.6 ± 6.66 cm, 17.0 ± 0.53 cm, 49.08 ± 1.76 cm, 52.6 ± 1.24 cm, 16.8 ± 0.70 cm and 7.98 ± 0.23 mm. The values for girls were 108.0 ± 1.84 cm, 16.25 ± 0.75 cm, 49.33 ± 0.98 cm, 51.9 ± 0.82 cm, 16.86 ± 0.59 cm and 9.31 ± 0.24 mm respectively.
- 13 The average haemoglobin level (g/100 ml) of the pre-school children (1 to 6 years) was 10.34 ± 0.70 g/1000 ml.
- 14 No clear-cut clinical signs and symptoms were observed on the subjects of the present study.
- 15 All the subjects had been immunized according to the immunization schedule.

The following conclusions can be drawn from the results of the present study :

- 1 Cereals, pulses and legumes and green leafy vegetables were inadequate, whereas roots and tubers, other vegetables and fruits, milk and milk products were more than adequate in the

diets of pre-school children of both the age groups, i.e., 1-3 years and 4-6 years. The intake of sugar and jaggery was more than adequate in girls from 1 to 3 years, nearly adequate in boys from 1 to 3 years and inadequate in girls and boys from 4 to 6 years. Fats and oils were nearly adequate in both the age groups.

- 2 Energy was adequate, protein, calcium, vitamin A and thiamine was more than adequate, riboflavin was almost adequate and niacin and iron were inadequate in the diets of pre-schoolers aged 1 to 3 years. The intake of protein, calcium and vitamin A was more than adequate, energy, riboflavin and thiamine nearly adequate while iron and niacin was inadequate in the age group of 4 to 6 years.
- 3 The anthropometric measures height, weight, head and chest circumference compared well with the average values by ICMR (1984) for the State of Punjab. Heights compared well, whereas weights did not compare well with Harvard (1959) standards. Arm circumference and triceps skinfold were slightly less than the standards in the form of data or even in the form of colourful plates.

suggested by Wolanski (1964) and Hammond (1955a) respectively. Girls were shorter and lighter and had smaller arm circumference and a greater triceps skinfold thickness than boys. Boys had a broader chest and a larger head circumference.

- 4 Haemoglobin level (g/100 ml) among pre-schoolers was below the standards (WHO, 1972).
- 5 No clear-cut clinical signs and symptoms were observed among pre-school children.
- 6 All children had been immunized according to the immunization scheme.

Keeping in view the results of the present study, it can be suggested that :

- 1 To compensate the inadequacy of cereals, pulses, green leafy vegetables in the diets of the pre-schoolers, these foods can be prepared for the children in attractive combinations. Since children dislike having green leafy vegetables, these can be given to the child in the form of soups, in combination with cereals in the form of parantha or stuffed puri, with pulses in the form of dals or even in the form of colourful salads.

- 2 A working mother may find it difficult to prepare special dishes for her children. By using little trick and intelligence, she can serve the same dishes to the child in an attractive way.
- 3 Repetition should be avoided as the child would hate to have foods which he dislikes every day in the same form.
- 4 Convenient and nutritious foods can be included in the diet.

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APPENDIX I

NUTRITIONAL SURVEY OF PRE-SCHOOL CHILDREN OF WORKING MOTHERS (MIG)

I GENERAL INFORMATION

- 1 Informant's name :
- 2 Informant's address :
- 3 Informant's relation
with the child :
- 4 Caste of the family :
- 5 Religion of the family :
- 6 Type of family : Nuclear/Joint
- 7 Composition of family :

S. No.	Name of family members	Relation to the child	Sex	Age in yrs & months	Educa- tion	Occu- pation	In- come
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- i.
- ii.
- iii.
- iv.
- v

- 8 Any other source of income :
- 9(a) Any still birth/abortion/
death of the child after
birth
- (b) Birth order in above case :
- 10 Duration of the experiment : From ____ to ____

II INFORMATION ABOUT THE CHILD

- 1 (a) Name :
- (b) Age group : 1-3 yrs _____ 4-6 yrs _____
- (c) Date of birth :
- (d) Sex :
- (e) Birth order :

- 2 Has the child been given the following vaccines ?

<u>Vaccine</u>	<u>Yes/No</u>	<u>When</u>
(a) Small-pox		
(b) B.C.G.		
(c) Triple antigen		
(d) Polio		
(e) Measles		
(f) Typhoid		
(g) Tetanus		
(h) D.P.T.		

- 3 Any tonic/medicine/appetizer being given to child
(Please specify) :

III INFORMATION ABOUT MOTHER

- 1 Type of employment (Please tick mark ☒)
School Teacher/College/University Teacher/
Office Going/Any other
- 2 Timings of job : (a) Full time/Part Time
(b) Timings : From _____ to _____

3 Whether the child is left at home : Yes/No

4 If yes, who looks after the child (Please specify) :

Grandmother/Servant/Relative/Any other

5 If no, where is the child left ?

6. Had she taken Tetanus toxoid Vaccine during pregnancy? (yes/no)

IV FOOD HABITS

1 Vegetarian/Non-vegetarian/Ova-vegetarian

2 Food fads and falacies, taboos and food habits

Reasons

3 Child's likes and dislikes :

(a)

(b)

(c)

V INFORMATION ON ILLNESS OF CHILD

S. No.	Type of illness	Time of illness	Foods avoided	Reasons
1	Cold			
2	Cough			
3	Fever			
4	Dysentery			
5	Measles			
6	Mumps			
7	Chicken-pox			
8	T.B.			

- 9 Infective Hepatitis
- 10 Any other

Present and past history of serious illness
of any family member :

VI INFORMATION ON ANTHROPOMETRY

- 1 Height (cm) :
- 2 Weight (kg) :
- 3 Head circumference (cm) :
- 4 Chest circumference (cm) :
- 5 Arm circumference (cm) :
6. Triceps skinfold (mm) :

VII CLINICAL EXAMINATION

- 1 Hair
 - i. Sparse :
 - ii. Discoloured :
 - iii. Easily plucked :
- 2 Face
 - i. Moon face :
 - ii. Naso labial dyssebacea :
- 3 Eyes
 - i. Pale conjunctiva :
 - ii. Conjunctival xerosis :
 - iii. Night blindness :
 - iv. Bitot's spots :

11 4 Lips

- i. Angular stomatitis :
- ii. Cheilosis :

5 Tongue

- i. Scarlet and raw :
- ii. Magenta :
- iii. Atrophic papillae :
- iv. Hypertrophic papillae :

6 Gums

- i. Spongy :
- ii. Bleeding :

7 Skin

- i. Follicular hyperkeratosis :
- ii. Pigmentation :

8 Teeth

- i. Mottled enamel :
- ii. Dental caries :

9 Nails

- i. Koilonychia :

10 Protein Energy Malnutrition

- i. Marasmus :
- ii. Kwashiorkor :
- iii. Marasmic kwashiorkor :

11 Skeletal System

- i. Knock knees and bow legs :
- ii. Beading of ribs :
- iii. Pigeon chest :

12 Any other

- i. Iodine deficiency disorder :
- ii. Leprosy
- iii. Pellagra

13 Biochemical

Haemoglobin level :

VIII DIETARY INFORMATION

Name of child :
Code No. :
Date of survey :

S No.	Day	Timings	Menu	Ingredients used	Household measurements	Exact measurements
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