Availability of Nutrients and Calories from the Nutritious Meal Programme and Height and Weight of the Children

BY

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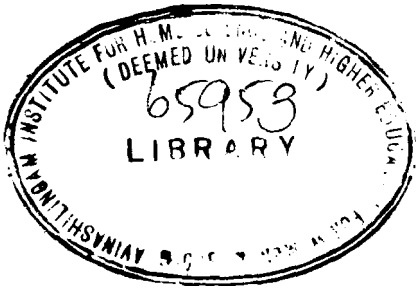

A Dissertation Submitted to the Bharathiyar University in Partial Fulfilment of the Requirements for the Degree of Master of Science through Sri Avinashilingam Home Science College for Women, Coimbatore.

MAY 1985

Acknowledgement

ACKNOWLEDGEMENT

The author records her deep sense of gratitude to Dr. (Mrs.) Rajammal P. Devadas, M.A., M.Sc., Ph.D., (Ohio State) D.Sc., (Madras) Dean, Post-Graduate Studies, Sri Avinashilingam Home Science College for Women, Coimbatore, for her dynamic guidance, constructive suggestions and continuous encouragement rendered throughout the study.

The investigator expresses her sincere and heartfelt thanks to Dr. (Mrs.) S. Premakumari, M.Sc., M.Phil., Ph.D., Dip. in Ed., (Madras) Professor of Foods and Nutrition, Sri Avinashilingam Home Science College for Women (Autonomous) Coimbatore for her help and encouragement and untiring patience extended throughout the study.

The author is extremely grateful to Dr. (Mrs.) Lakshmi Santa Rajagopal, M.S., (Tennessee) Ph.D., (Madras) Principal, Sri Avinashilingam Home Science College for Women, Coimbatore for making available all the amenities to carry out this study.

The investigator is highly obliged with a deep sense of gratitude to Dr. (Mrs.) Usha Chandrasekhar, M.Sc., Ph.D., (Purdue), Head of the Department of Foods and Nutrition, for her valuable advice and interest shown in the conduct of this study.

The author expresses a special word of thanks to the District Educational Officer, Headmasters of the schools, parents and all the participants of this study for their good response and co-operation rendered in this investigation without whom the study would not have been carried out successfully.

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Introduction

I INTRODUCTION

Good food adequate in quantity and quality, is essential for good nutrition which will in turn, stimulate and maintain the growth and health of the children. As Devadas (1975) points out the welfare of a nation rests on the health of its people, particularly, the children. Good health is the most precious endowment, parents and communities confer on their children.

According to the 1981 census estimates in India, children up to 14 years of age constitute 255 millions. This is 35 per cent of the total population. The population of Tamil Nadu works out to be 48.2 millions. Children between two to five years age group constitute 4.21 millions and children in the age group of five to ten, 6.37 millions. Thus children in the age group of two to ten constitute 10.58 millions.

According to Gravioto (1981), malnutrition at the community level is a man-made disorder, characteristic of the under privileged segments of the society. Malnutrition in infants and young children is a serious problem and an important cause of ill health and high childhood mortality in India. (Indian Council of Medical Research (ICMR), 1980).

As Soman (1982) and Devadas (1982) warn, malnutrition has been considered as the most important single problem contributing to higher mortality and morbidity among the people of the developing countries. While malnutrition affects the people of

all ages, children are the worst sufferers from its ravages. It is estimated that as many as one million children die in India every year as a result of severe malnutrition. About one fourth of the population in the developing countries are undernourished.

Devadas (1973) and Arya (1981) stress that protein energy malnutrition is a serious nutritional disability affecting both physical growth and brain development. Cravioto and Delicardo (1973) explain that malnutrition results in poor school performance and low aspiration to higher education. Therefore only 40 per cent of the pupils entering the primary schools reach the fourth grade, which is the minimum to achieve lasting literacy. Since it is evident that malnutrition among school children leads to marked physical and mental growth retardation in children who are the nation's biggest investment, equal importance or perhaps more importance should be given to the children of school going age, when compared to the pre-school age (Vyikantia and Sastri, 1971; Swaminathan, 1971 and Eswaran et al, 1974).

The causes of malnutrition are, low socio-economic status, ignorance, superstitious beliefs, harmful traditions and faulty practices, non availability of food, improper selection of food

and cooking practices, parental illiteracy, large family size and inequitable distribution of foods among the family members (Devadas et al , 1977).

Absence of policies and appropriate programmes to tackle the nutrition problems is a serious handicap of the under privileged(Dharmalingam and Dutt, 1983). Therefore this complex problem should be tackled immediately with proper policy and programme implementation.

In order to root out malnutrition among children, numerous supplementary feeding programmes are in operation under the auspies of the Central and State Governments and voluntary agencies (Devadas et al. 1977). Some of the programmes which were in operation in Tamil Nadu were the Special Nutrition Programme, Applied Nutrition Programme, Family and Child Welfare Programme, Child Feeding through Balwadies, and Mid-day Meals Programme (Kothari, 1973).

However these programme operated in isolation from each other. As Devadas (1983) points out there was no uniformity either in their operation or in their evaluation. Those programmes were sponsored by the different departments of the Government as well as voluntary agencies. It was strongly felt that all the feeding programmes should be brought under one umbrella

in order to ensure uniformity which would facilitate proper evaluation and improvement in future. Under these circumstances, the Honourable Chief Minister of Tamil Nadu, Dr. Thiru M.G. Ramachandran launched a unique nutritious meal programme for children in the state on July first, 1982 in all the pre-schools and primary schools in the rural areas and extended to all the pre-schools and primary schools in the cities and towns on September 15, 1982. There after, on September 15, 1984 the programme was extended to the high schools also, all over Tamil Nadu, with the main objective of improving the nutritional status of the children, 2+ to 14+ years of age, thereby enabling them to study well and become strong citizens (Devadas, 1983). All the different types of feeding programmes in the state were thus brought under one umbrella when this scheme was introduced. It is highly commendable that the State Government has allotted a large sum of money, nearly 160 crores of rupees for this tremendous programme, and it is imperative to watch the impact of this new venture.

Devadas (1983) has pointed out that the new programme has proved to be a great success in terms of the nutritional status, nutrition knowledge and vocabulary and cognitive development of the children. However studies are necessary to assess the availability of nutrients from the nutritious meal. Hence this

study was designed to assess the availability of calories and nutrients: namely, protein, calcium, phosphorus and iron from the meal supplied to the primary school children and also measure the outcomes of the programme in terms of the heights and weights of the children recorded over a period of four months in a few selected schools in and around Coimbatore city.

Review of Literature

II REVIEW OF LITERATURE

The literature pertaining to the present investigation entitled "Availability of nutrients and calories from the Nutritious Meal Programme and Height and Weight of the Children" is presented under the following headings:

A. Nutritional picture of the school going children in India

B. Role of supplementary feeding programmes in India

C. Operation of the Honourable Chief Minister's Nutritious Meal Programme in Tamil Nadu

D. Evaluation of the feeding programmes and

E. Intake and availability of nutrients from diets.

A. Nutritional picture of the school going children in India:

Nutritional well being of a community or nation is an important determinant of its health status (FAO, 1976 and Krishnamoorthy, 1980). Malnutrition is widely prevalent in India particularly among the children of the low socio economic groups. About 15 to 20 per cent of the population in India are not able to obtain their nutritional requirements (Sukhatme, 1982). It is found that as many as 20 per cent of the children of five to twelve years age group often show one or more signs of deficiency diseases. It is therefore important that these children receive adequate food of good quality (Haque, 1981).

Protein energy Malnutrition in early childhood is a major health problem (NIN, 1981). Severe forms of protein energy malnutrition and even moderate and mild grade when prolonged, result in adverse impact on physical growth and mental development of the survivors often on a permanent basis (Gopalan, 1976; Berg, 1981 and Ramalingaswamy, 1981).

Iron deficiency anaemia reduces the physical capacity, increases susceptibility to infection and decreases the learning ability of children (Basta, 1977). Twenty per cent of the children in India suffer due to malnutrition, vitamin A deficiency, rickets, pellagra and goitre (Bhosale et al, 1982).

Kallen (1973) defines malnutrition as a condition resulting due to lack of sufficient quantity or quality of nutrients to maintain the body system at some difinable level of functioning. Alice and Bogert (1974) gave a more precise statement for malnutrition as it is defined as a stabe in which either the food intake is inadequate in some respect to meet the body needs or in which physiological and environmental conditions are such that the body is unable to utilise sufficient energy to provide for its proper growth, maintenance and repairs and such deficiency is more likely to occur in youth.

Country wide nutrition surveys carried on a large number of pre-school children showed that for 90 per cent, the heights

and weights were below the tenth percentile values of American children of corresponding ages. When classified according to weight deficit for age, 17 per cent children were suffering from grade III malnutrition and 65 per cent children from grade I and II malnutrition (Gopalan, 1973).

In India children up to fourteen years of age number 250 million and constitutes 38 per cent of the total population. Among these two to three per cent of children suffer from severe malnutrition, while 60 to 70 per cent suffer from mild and moderate degree malnutrition presenting varying degrees of growth retardation (ICMR, 1980). Omen (1980) remarks that 75 per cent of child population can be considered as not healthy due to major or mild illness. Devadas (1973) and Eswaran (1976) state that malnutrition is at the base of blindness among children. Vitamin A deficiency is the major cause of preventable blindness in India, nearly 78 per cent of children below five years and about ten per cent of children of school age develop ocular signs of vitamin A deficiency (Hari Mohan, 1982).

In predominantly agricultural countries like India, the main obstacles against procuring even minimum nutritional requirements seems to be poverty and the consequent low standard of living, illiteracy, low production, shortage of food, increasing population, unemployment all accentuate the problem and result in

widely prevalent malnutrition (Devadas, 1957 and Swaminathan, 1980). Rajalakshmi (1976) states that ignorance is an important contributing factor for malnutrition. Rao (1983) states that the educational level of mother and father in order are more effective and correlated with better nutritional status of children. Srikantia (1973) finds that the primary bottle neck in the dietaries of children belonging to poor income groups is calories and not protein.

Severe malnutrition is accompanied by alteration in behaviour such as reduced motor activity, apathy, irritability and loss of interest in social environment. It not only leads to increased susceptibility to disease or to impaired growth, but also has lasting consequences on the brain and mental functions (WHO, 1974). Malnutrition can be visualised as an "ice berg" that decreases in size and composition according to the degree of evaluation of society from poor traditional to effluent modern ways of life (Leonardonate, 1980).

Biological consequences of malnutrition result in seriously handicapped human resources and there by making difficult to achieve the socio economic development of community (Agarwal et al 1982).

B. Role of supplementary feeding programme in India:

One of the most effective means of combating malnutrition is to provide a nutritious meal or a balanced food supplement prepared with inexpensive local foods to the target groups to ensure their proper nourishment (Devadas, 1984). Mortality among infants and young children could be reduced by intervention programmes which improve the nutritional status. On physiological and humanitarian grounds, supplementary feeding programmes therefore seem to be necessary (Nutrition Reviews; 1985). Sen (1984) states that a number of nutrition intervention programmes have been launched in developing countries to combat with widespread malnutrition among vulnerable sections of society especially children and expectant and nursing mothers. The successful implementation of any nutrition programme is dependant on several variables.

- appropriate selection of the target group,
- effective delivery system,
- proper utilization of services,
- adequate community participation
- close supervision and
- monitoring and evaluation.

Chen (1982) points out that atleast the role of nutrition may be

in ameliorating the debilitating effects of infection or phrased another way, facilitating the recovery from infection and fostering "catch up growth" between periods of infection.

Supplementary feeding schemes are the most commonly undertaken intervention for combating malnutrition(Choudhry, 1983). In India it includes Applied Nutrition Programme, Mid-day Meal Programme for school children, Special Nutrition Programme and Vitamin A Prophylaxis Programme, Anemia Prophylaxis Programme, Integrated Child Development Services (ICDS), Food for Work Programme etc. (Suraj and Gupta, 1983).

C. Operation of the Honourable Chief Minister's Nutritious Meal Programme (CMNMP)

The CMNMP is a major socio-economic measure aimed at establishing a hungerless egalitarian society through promoting the healthy growth of young children by nourishing not only their bodies but also their minds as well. For Thiru M.G. Ramachandran, the Chief Minister of Tamil Nadu, hunger and poverty are no mere theoretical possibilities of abstract dangers. Rather they were a recurring reality and aweful affliction in his life at an impressionable age. This is the genesis of this programme, which, for its nobility of conception, firmness of conviction daringness of design and smoothness of execution has won the

hearts and minds of the masses and generated a ground full of good will and spontaneous enthusiasm within weeks of its launching (Devadas, 1983).

On 1st July 1982, Tamil Nadu introduced this scheme of historic significance for providing a nutritious free meal to lakhs of poor children in the age group of 2 to 10 years. This scheme which provides one third of the daily requirement of calories and the nutrients, has improved attendance in the school and cultivated good food habits besides imparting nutrition and health education through pre-school education. Thus 69 lakhs children living below the poverty line received atleast one square meal a day. (Social Welfare, 1982)

The programme benefits over 8.5 million children in the 2+ to 14+ age group. At the time of start, 16.930 lakhs pre-school children were fed in the OWCS and 38.15 lakhs of school going children in 36,000 primary schools including the schools under the Adidravidar and Backward Class departments. At present, 27,897 OWCS and 34,084 school feeding centres and 8925 High School feeding centres are operating the programme benefitting a total of 2.5 million pre-school children, 4 million school going children and 2 million High School Children totalling 8.5 millions.

It was stipulated by the Government, after consultation with a panel of nutrition experts, that for the under fives, the mid-day meal should comprise rice 80 gm, oil 7 gm, dhal 10 gm, green leafy vegetables 25 gm and other vegetables 25 gm per child per day. The cost of the meal has been fixed at 44 paise per child/day for all the 365 days in the year. The food is cooked as a mixed rice preparation in the centre and served hot. The requirements of food commodities for each centre are supplied at the feeding centre by the Tamil Nadu Civil Supplies Corporation or the Co-operatives. The supply is done once in a fortnight.

The vegetables and the fuel are purchased by the CWO weekly or more frequently. A permanent advance of Rs.50/- week for this purpose to be recouped from the Block Development Office every week, with proper vouchers within the over all sanction of this items has been sanctioned to the CWO.

This scheme has generated gainful employment for some 14,700 women, mostly widows and destitutes. This scheme has had a tremendous impact on the enrolment of children in primary schools. An additional 2.63 lakh children in the 6.11 year age group had been enrolled in standards 1 to 5 within 10 weeks of its inception, against target of an additional 1,00,000 children in this age group set up by the Planning Commission for the year 1982-1983.

D. Evaluation of the feeding programme:

Prahilad Rao (1983) defines evaluation as a process of measuring progress towards a pre-set objective or goals .

The essential pre-requisites of evaluation are:

1. A clear cut statement of measurable objectives and the strategy employed for achieving them in unambiguous terms.

2. Knowledge of base line status of target group in terms of indications used to measure the change.

3. Availability and identification of appropriate instruments and indications of change and

4. Feasible frame work for evaluation.

The assessment of nutritional deficiencies depend on physical examination. It should be supplemented by nutritional anthropometry consisting of accurate growth and skinfold measurements (Panchary, 1982).

Greaves and Berry (1982) report that anthropometric measurements properly taken and properly evaluated represent a useful basis for the assessment of nutritional status. The nutrient contribution of the diet of the females is directly dependant on the food habits. This in turn is reflected in their nutritional status. Nutritional status is the out come of interactions of education,

culture, customs, traditions and the purchasing power (Ramesh Puri et al, 1984).

Height is a very reliable measure of the growth phenomenon. The child's height curve is an excellent record of previous development and graphic evidence of his entire growth history (1982). As opposed to weight which is subject to rapid and radical variation, height is a very stable measurement which cannot decrease (Chamdeck, 1984). Unlike weight, height once gained cannot be lost and it is believed that it is relatively less affected by acute and short episodes of malnutrition, but affected by chronic malnutrition of some duration (NIN, 1979). Crispin et al,(1968) report that physical measurements are related to nutrient intake. WHO (1963) points out that clinical investigations are based on examination of the sliva, masculature and state of the bones and teeth.

Usha and Devadas (1964) state that diet surveys serve as important guidelines to know the existing problems with regard to food intake of individuals and groups and the ways and means of improving them.

E. Intake and availability of nutrients from diets:

Calories:

FAO (1963) has estimated that there is a gap of ten per cent to be found between the average calorie supply and requirement of

the poorer sections in the Far East. Radha Krishna Rao (1967) recommends that children must derive 13 to 15 per cent of total calories from protein, 15 to 20 per cent from fat and 65 to 70 per cent from carbohydrates.

It was reported (Ann. Rep. 1981) that energy intakes of urban children from well-to-do families correspond closely to the currently recommended levels of the ICMR, while in pre-school children from low income families the average energy deficit is about 30 per cent (NNMB Rep, 75 - 80). It is often suggested that the low energy intakes of rural poor children may be due to the low calorie density of their diets. Low calorie density of diets due to low fat intake appeams to be one of the reasons for the inadequate energy intakes of rural poor children.

Proteins:

Patwardhan et al (1950) state that urinary nitrogen excretion fall between 66 and 160 mg per day per kg with an average of 114 mg. Pasricha (1965) conducted nitrogen balance in adult. Indian women and found that the urinary nitrogen excretion generally decreased rapidly after the low protein diet was instituted and stabilised in three or four days.

Hortsman (1972) and Travers and Compbell (1974) and Marberell et al (1980) indicated that whenever an individual

trains to develop strength and power, the daily intake of protein must be increased from an approximate normal value of 70 to 90 gm per day.

Studies conducted by Devadas et al (1973) on the nitrogen retention in pre-school children fed with vegetable protein mixture supplements proved that the nitrogen retention from the supplemented diet was significantly greater than that from basal diet. The apparant digestability of the basal and supplemented diet was found to be 75 and 85 per cent respectively.

Calcium and Phosphorus:

Basu et al (1939) report that for Indians 0.388 gm of calcium and 1.0 g of phosphorus may be considered as maintenance requirement. Sathe et al (1952) observed that milling of rice to remove the outer layers to the extent of four per cent of its weight improve the retention of calcium. Calcium requirement of children can be calculated on the basis of the amount of calcium secretion during the period of growth. Children need calcium not only for up keep but also for growth of their bones. There is increased storage and use of calcium by the growing body. (Martin, 1970)

Iron:

The single most important cause for the wide spread iron deficiency anaemia in India is inadequate iron intake in the

habitual diets, coupled with poor bioavailability of dietary iron. Iron absorption from diets based on cereals, millets and pulses has been reported not to exceed three to five per cent (Nutrition review; 1984).

De (1950) has found a progressive increase in positive iron balance with increasing iron intake on typical rice and wheat based dietaries and has observe that when the intake exceeds 35 mg/day the balance stabilised itself between 8 and 9 mg/day. Balance studies with girls and women summerised by Joseph (1958) showed the average absorption of iron to be, 3 to 40 per cent. Average iron absorption from mixed diet is about 10 per cent (White et al, 1971). Iron absorption from rice based diets was determined in sixty apparently well nourished subjects belonging to the laboratory staff. Labelled $FeSO_4$ containing 5 mg of iron was mixed with a rice based lunch and retension was determined by whole body counting. The mean absorption of iron in these subjects was found to be 5.5 per cent of the administered dose. (Ann. Rep. 1975).

The most suitable method for determining the bioavailability of iron from diets is to measure iron absorption in human beings using extrinsic tag technique-using radio traces (Bjorn - Rasmissen et al, 1976). Studies using dual radio iron tag to measure non-haem iron absorption from foods simultaneously in

human subjects have also been conducted by Cook et al (1972) and Layrisse et al (1973).

An alternate animal model to determine iron availability from human diets has recently been proposed by Narasinga Rao et al (1977). While these invitro methods are accurate these are however time consuming and expensive for screening large number of food materials.

Experimental Procedure

III EXPERIMENTAL PROCEDURE

The experimental procedure for this investigation, entitled, "Availability of nutrients and calories from the Nutritious Meal Programme and Height and Weight of Children" are presented under the following headings.

A. Selection of schools

B. Selection of subjects

C. Conducting the socio economic survey

D. Assessment of the availability of nutrients in children and

E. Assessment of the nutritional status of the children through

1. Anthropometric measurements
2. Clinical assessment and
3. Bio-chemical analysis

1. Selection of schools:

For carrying out the present study three primary schools, where the Honourable Chief Ministers' Nutritious Meal Programme was in operation were selected. Of the three schools two were rural schools and the third was an urban school. The three schools selected were

1. Sri Avinashilingam Basic School - Urban School
2. Ramanathapuram Elementary School and
3. Thaliyur Elementary School - Rural Schools.

These schools were selected for their nearness to the college and the willingness of the Headmastem, teachers and parents to cooperate in the study.

B. Selection of the children:

In all the three primary schools put together 310 children of age 6 to 9 years were participating in the feeding programme. Of these 310 children, 200 children who were the regular participants of the programme were selected for the study (Group E) based on the following factors:

1. All were participating in the programme from its start.
2. All were regular for the school and
3. Houses of the beneficiaries were nearby, enabling the investigator to collect the required data from their parents.

Apart from these, 60 children who were not participating in the programme were chosen as the control group (Group C) for comparison purposes.

The details of the subjects selected and their age wise distribution are presented in Tables I and II.

TABLE - I SEX WISE DISTRIBUTION OF THE CHILDREN

S.No.	Name of the school	Experimental group (E)			Control group(C)		
		Male	Female	Total	Male	Female	Total
1.	Sri Avinashilingam Elementary School, Coimbatore (120)	44	17	61	8	12	20
2.	Thaliyur Elementary School, Thaliyur (70)	31	30	61	9	11	20
3.	Ramanathapuram Elementary School, Ramanathapuram (120)	45	33	78	10	10	20
	Total	120	80	200	27	33	60

TABLE - II AGE WISE DISTRIBUTION OF THE CHILDREN

Age in years	Group	Male	Female	Total
6	E	27	17	44
	C	5	10	15
7	E	46	15	61
	C	8	9	17
8	E	28	26	54
	C	7	8	15
9	E	26	20	41
	C	7	6	13

E - Experimental

C - Control

C. Conducting the socio-economic survey in the families:

A simple socio-economic survey was conducted in randomly selected 40 and 20 families of the experimental and control children respectively. In the urban school alone, a questionnaire was evolved and used for this purpose (Appendix - A). The investigator visited all the families and the data was collected from the mothers. This survey was carried out in the urban school alone mainly to facilitate selection of the children of six to eight years old for assessing the availability of nutrients.

D. Assessment of the availability of nutrients in children:

In the present investigation, utilisation of protein, calcium, phosphorus, iron and calories was studied on a selected group of five experimental and five control children. These children were selected from Sri Avinashilingam Elementary School for its convenience to carry out the balance study. They were selected from the group for whom the socio economic survey was carried out. They belonged to the same socio economic status. The houses of the children were very near to the college and the children and their parents were willing to co-operate in this study.

1. Preparation for the metabolic study:

For the metabolic study to be conducted 10 children were selected, five from the experimental group and five from the control

group. The subjects and their mothers were oriented about the procedures involved in the conduct of the study and what was required of them. Each subject was provided with containers to urinate and defaecate. They were instructed well to collect the whole day's urine and faeces.

2. Collection and preservation of samples:

The metabolic study was carried out for a period of six days, with three days of adjustment and three days of collection periods. For food weightment a double beam balance was used to record weight accurately up to one gram. After weighing each item of the diet consumed by the child, one tenth equivalent of the food consumed was weighed separately and collected for the whole day from early morning to night on all the six days. The total weight of the collected food was homogenised in the laboratory for each subject separately, 10 ml of the 6N HCl was added to the samples as the preservative and stored in the refrigerator. This was done for three days of the collection period. At the end of the three days the food samples were pooled and stored.

The urine and faeces excreted by the children were collected for six days. The first three days samples were discarded and the later three days samples were taken for analysis. One tenth

of the homogenised samples were preserved with 1.0 ml of toluene in the case of urine and/0 ml of 9N HCl in the case of faeces. At the end of three days the faeces and urine samples of each subject was pooled separately and used for further analysis. Charcoal tablets were used to identify the faeces of the three days of collection period.

3. Analysis of the samples:

The sample of food, faeces and urine were analysed for their nitrogen, calcium, iron, phosphorus and calories and calculated the total intake and excretion. The balance or retension for each nutrient was then calculated.

The nitrogen content of food faeces and urine was estimated by Micro Kjeldahl's method (NIN, 1971). The food and faeces were ashed and the ash was dissolved in concentrated HCl and made up to 100 ml with distilled H_2O. The ash solution as well as the urine samples were used for the estimation of minerals (NIN, 1971).

Calcium was precipated as calcium oxalate and titrated against permanganate. Phosphorus was estimated by the method of Fiske and Subba Rao (1925). Iron was determined colorimetrically making use of the fact that ferric iron gives a blood red colour with thiocyanate. Calories was estimated by using bomb calorimeter.

B. Assessment of the nutritional status of the children:

1. Anthropometric measurements
2. Clinical assessment and
3. Bio-chemical analysis

1. Anthropometric measurements:

Anthropometry was used in the present investigation since it provides a very convenient tool for monitoring the nutritional status of the population. Anthropometric data taken among children, in particular provide information on their growth, development and nutritional status (Magbitang et al, 1983).

The measurements namely height and weight of all the experimental and the control children were taken initially as well as finally, that is at the end of the four months. The age was recorded as given in the school records.

a. Height:

A non-stretchable fibre glass tape was used for height measurement. It was fixed vertically on a wall and the subjects were made to stand on the floor with the feet parallel and with bultocks, shoulders and back of the head touching the wall. The head was held comfortably with the arm hanging at the sides in a natural manner. A wooden scale was placed gently over the head perpendicular to the wall and the height was measured from the tape correct to 0.1 cm (Jelliffe, 1966).

2. Weight:

A bathroom weighing balance was used for this purpose. The subjects were made to stand on the centre of the platform without touching or holding on to any object. The weight was measured correct to 0.1 kg. The subject was wearing minimum clothing. The accuracy of the balance was checked after every five measurements, using a standard weight. (Jelliffe, 1966)

3. Clinical assessment:

FAO (1970) states that clinical examination is the most essential part of all the nutrition surveys, since the ultimate objective is to assess the levels of health of individuals and population groups as influence by the diet they consume.

The clinical assessment was carried out on all the experimental and control subjects in this investigation, both initially and finally at the end of four months. A schedule was specially evolved for this purpose and it was administered (Appendix - B).

4. Bio-chemical analysis:

Haemoglobin estimation was done with finger prick samples of blood for 25 and 20 children of experimental and control groups respectively, by the modified cyanmethaemoglobin method. Haemoglobin was estimated from the finger prick blood samples colorimetrically using Drabkin's reagent as per the procedure of Varley (1964).

The data thus collected were processed to determine the utilisation of nutrients from the Nutrition Meal Programme and the nutritional status of the children.

Results and Discussion

IV RESULTS AND DISCUSSION

The results of this investigation entitled "Availability of nutrients and calories from the Nutritious Meal Programme and height and weight of children" is discussed under the following heads:

A. Socio-economic back ground of the children

B. Availability of nutrients from the diets and

C. Nutritional status of children

A. Socio-economic back ground of the children:

The socio-economic background of the families of 40 children in the experimental group and 20 children in the control group of the urban school alone, assessed by administering a simple questionnaire is presented below.

1. Caste, community and type:

The caste, community and the type of the families studied is presented in Table - III.

TABLE III

CASTE, COMMUNITY AND TYPE OF THE FAMILIES STUDIED

S.No.	Details	Percentage of families	
		Group E	Group C
	Caste		
1.	Chettiyar	15.0	25.0
2.	Boyar	12.5	NIL
3.	Gounder	12.5	15.0
4.	Naidu	10.0	10.0
5.	Muslim	10.0	10.0
6.	Christian	7.5	12.0
7.	Mudhaliyar	7.5	8.0
8.	Pillai	7.5	10.0
9.	Adidravida	7.5	NIL
10.	Yadavas	5.0	NIL
11.	Nadar	5.0	10.0
	TOTAL	100.0	100.0
	Community		
1.	Backward community	62.5	70.0
2.	Scheduled caste	7.5	NIL
3.	Forward community	30.0	30.0
	TOTAL	100.0	100.0
	Type		
1.	Nuclear	87.5	75.0
2.	Joint	12.5	25.0
		100.0	100.0

It was found out that in both the groups studied people from different castes were distributed. However a majority of them, about 70 per cent in the experimental group and in the control group belonged to either backward or scheduled caste while the remaining few belonged to forward community.

Nuclear families predominated in both the groups (87.5 per cent in the experimental and 75.0 per cent in the control group) while 12.5 and 25.0 per cent of the families in group E and C respectively belonged to joint families.

2. Occupation of the parents:

The occupational status of the parents is presented in Table IV.

TABLE IV

OCCUPATION OF THE PARENTS

S.No.	Occupation	Percentage of parents in	
		Group E	Group C
1.	Coolies	25.0	15.0
2.	Mill worker	20.0	25.0
3.	Employed in workshops	15.0	10.0
4.	Clerical job	15.0	25.0
5.	Others	25.0	25.0
		100.0	100.0

It was clear that more number of families in the experimental group (25.0 per cent) were coolies while only 15.0 per cent of the parents were coolies in the control group. In the control group more numbers (25.0 per cent) were engaged as clerks. In both the groups, more than 15 per cent of parents were mill workers. In both the groups 25 per cent of the parents were drivers, tailors, barbers, electricians, etc.

3. Education of parents studied:

The educational level of parents in the two groups is presented in Table V.

TABLE V

EDUCATIONAL LEVEL OF THE PARENTS

S.No.	Educational level	Percentage of parents in			
		Father Group		Mother Group	
		E	C	E	C
1.	Primary school	27.5	30.0	25.0	25.0
2.	Middle school	27.5	40.0	20.0	40.0
3.	High school	20.0	20.0	5.0	15.0
4.	Illiterate	25.0	10.0	50.0	20.0
	TOTAL	100.0	100.0	100.0	100.0

Among the 40 families of the experimental group only 25 per cent were illiterate while in the control group 10.0 per cent were illiterate in the case of fathers. In both the groups, 20 per cent of the fathers were educated upto high school. In the case of mothers only 20 per cent were illiterate in the control group while 50 per cent were illiterate in the experimental group. Only 5 and 15 per cent were educated up to high schools in the case of mothers in the experimental and control groups respectively. It was surprising that none of the parents were educated upto college level in both the groups studied.

4. Income level of families:

The monthly income level of the families studied in two groups is presented in Table VI.

TABLE VI

MONTHLY INCOME LEVEL OF THE FAMILIES STUDIED

S.No.	Income level in rupees	Percentage of families	
		Group E	Group C
1.	1 - 200	12.5	5.0
2.	201 - 400	50.0	45.0
3.	401 - 600	25.0	30.0
4.	601 and above	12.5	20.0
		100.0	100.0

The families in the two groups were from slightly different socio-economic back grounds. It was noted that 62.5 per cent of families in the experimental group and 50 per cent of families in the control group had a meagre monthly income below Rs.400/- per month. Only 12.5 per cent of families in the experimental group and 20 per cent of families in the control group had a monthly income of above Rs.601/-.

It was observed that the socio-economic background of all the families studied was poor. However, the control families stood slightly better than the experimental families in terms of the monthly income.

B. Availability of nutrients from the diet:

The results of the three day balance study on calories and other nutrients is discussed under the following headings.

1. Availability of calories
2. Availability of nitrogen
3. Availability of calcium
4. Availability of phosphorus and
5. Availability of iron

1. Availability of calories:

Table VII presents the availability of calories from the diets consumed by the two groups of children. The individual values are presented in Appendix C.

TABLE VII

MEAN AVAILABILITY OF CALORIES IN TWO GROUPS OF CHILDREN STUDIED

Group	Calories intake K.cal/day	Excretion of calories in faeces K.cal/day	Calories retained K.cal/day	Digestible energy per cent
Experimental	1560.08	330.24	1229.87	78.8 ± 2.3
Control	1215.79	341.95	873.81	71.9 ± 1.5

't' value on comparison between the groups E and C = 4.97 (Significant at one per cent level)

*Digestible energy per cent = dietary/K.cal (bomb) - faecal k.cal (bomb)/dietary k. cal X 100.

The mean calorie intake of the experimental children was found to be 1560 while that of the control children was found to be 1216. When compared with the ICMR (1981) recommended allowance of 2050 k.cal all the children were consuming inadequate calories only.

The total faecal excretion of calories in children in groups E and C were recorded to be 330 and 342 respectively. The digestible energy percentage was found to be 78.8 and 71.9 per

cent for the groups E and C respectively. The findings showed that when the nutrition meal was consumed by the children the availability of energy was increased significantly at one per cent level.

2. Availability of nitrogen:

Table VIII presents the findings of the balance study regarding the availability of nitrogen with the individual values in Appendix C.

TABLE VIII

MEAN INTAKE, EXCRETION AND RETENTION OF NITROGEN IN CHILDREN

Group	N intake g/day	Excretion of nitrogen g / day			Apparent N retention g/day	Percentage retention
		Urine	Faeces	Total		
Experimental	7.87	2.480	0.232	2.712	5.117	65.64 ± 7.8
Control	5.17	1.912	0.097	2.009	3.166	61.29 ± 2.5

't' value on comparison between the groups E and C = 1.06

The mean nitrogen intake of the experimental children was found to be 7.8 while that of the control children was found to be 5.17 g. When compared with the ICMR (1981) recommended allowances, all the children consumed greater quantities of protein than the requirement. However, since the diets were highly deficient in calories a considerable portion of the protein would be utilised for energy purposes. The urinary excretion of nitrogen was greater than the faecal nitrogen in both the groups. The apparent nitrogen retention in the experimental group was 5.117 g while that of the control group was 3.166 g with the

percentages being 65.64 and 61.28 in groups E and C respectively. However the difference between the two groups was not statistically significant.

3. Availability of calcium

The results of the calcium balance study are presented in Table IX with the individual values in Appendix C.

TABLE IX

MEAN INTAKE, EXCRETION AND RETENTION OF CALCIUM IN CHILDREN

Group	Calcium intake mg/day	Excretion of calcium mg/day			Calcium retention mg/day	Percentage retention
		Urine	Faeces	Total		
Experimental	334.82	107.19	201.40	288.60	25.93	7.78 ± 0.97
Control	248.53	86.03	146.47	237.91	15.62	6.29 ± 0.33

't' value on comparison between the groups E and C = 2.91 (Significant at one per cent level)

The mean daily intake of calcium in the experimental children was 334.8 mg where as the intake of the control children was found to be only 248.5 mg. The intake of all the children was deficient when compared with the ICMR recommendation of 0.4 to 0.5 g for this age group. Similar deficient intakes have been

reported by Devadas (1983). The mean faecal excretion in groups B and C was 201.4 and 146.5 mg respectively, recording an absorption of 39.9 and 41.0 percentages.

The mean retention of calcium in group A was 25.93 mg (7.8 per cent) and in group B was 15.6 mg (6.3 per cent) revealing that the consumption of nutrition meal has improved the availability of calcium in children to a significant extent (P 0.01).

4. Availability of phosphorus:

Table X presents the results of the phosphorus balance carried out on the selected experimental and control children, with the individual values in Appendix -C.

TABLE X

MEAN INTAKE, EXCRETION AND RETENTION OF PHOSPHORUS IN CHILDREN

Group	P intake mg/day	Excretion of phosphorus mg/day			Apparent 'P' retention mg/day	Percentage retention
		Urine	Faeces	Total		
Experimental	351.67	119.60	200.40	320.00	56.79	9.088 ± 1.84
Control	262.06	108.10	135.20	243.30	18.76	7.170 ± 0.44

't' value on comparison between the groups B and C = 2.02 (Significant at one per cent level)

It was observed that the experimental and the control children consumed 351.7 and 262.1 mg respectively of phosphorus. The total excretion of phosphorus ranged from 283 to 340mg in the experimental children and 232 to 263 mg in the control children. The mean retention of phosphorus was worked out to be 56.8 mg in the experimental group and 18.8 mg in the control group. The percentage retention of phosphorus in the experimental children (9.09) was found to be significantly greater than that of the control children (7.17) at one per cent level.

5. Availability of iron:

Table XI presents the availability of iron to children from the school lunch in comparison with the control children, with the individual values in Appendix C.

TABLE XI

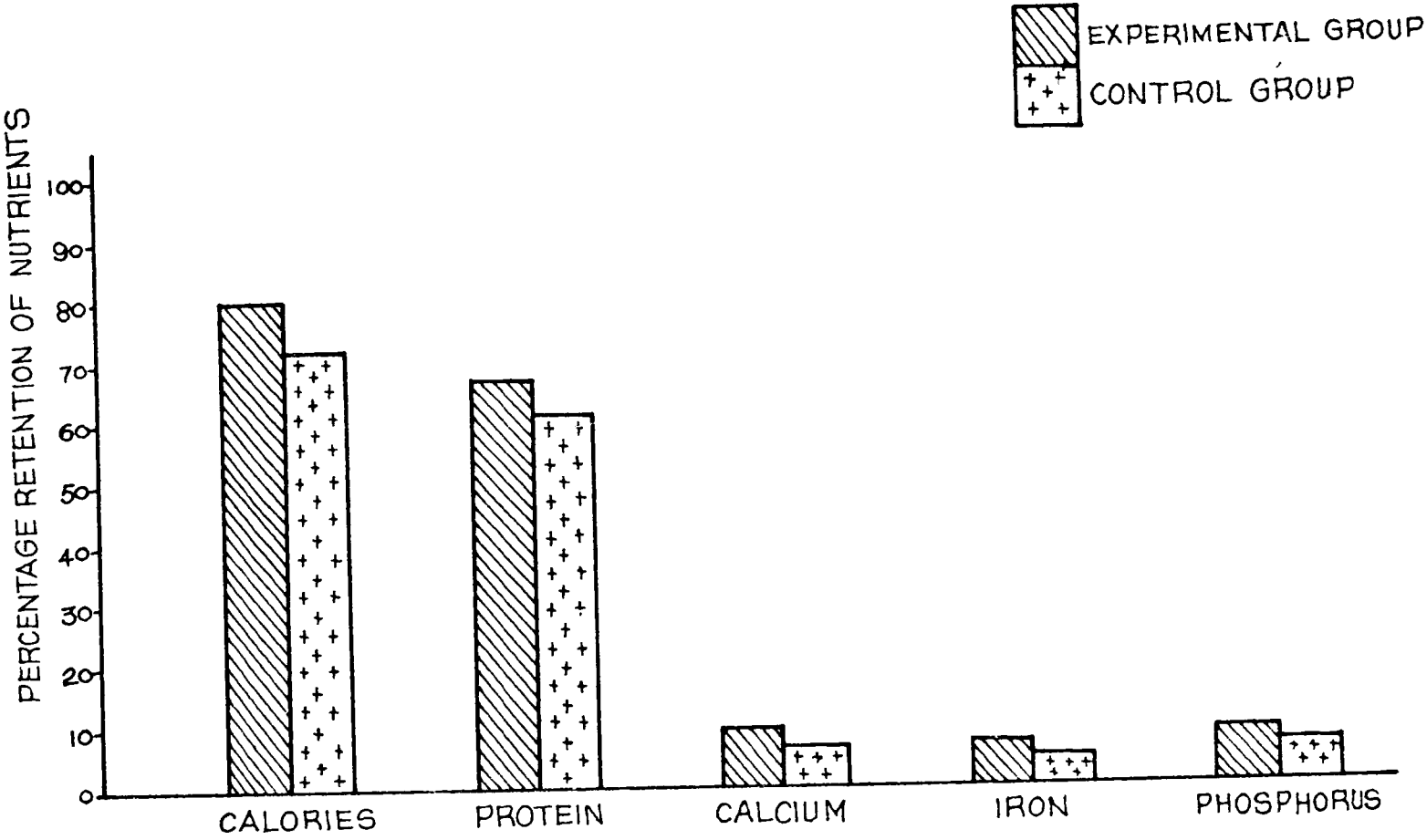
MEAN INTAKE, EXCRETION AND RETENTION OF IRON IN CHILDREN

Group	Iron intake mg/day	Excretion of iron mg/day			Iron retention mg/day	Percentage retension
		Urine	Faeces	Total		
Experimental	22.63	0.83	20.36	21.20	1.43	6.35 ± 0.34
Control	17.11	0.59	15.76	16.37	0.73	4.35 ±1.13

't' valve on comparison between the groups E and C = 3.38 (Significant at one per cent level).

The children participating in the Nutritious Meal Programme had a mean intake of 22.6 mg where as the control children consumed 17.1 mg per day. According to ICMR (1981) all the children in the control group had a deficient intake of iron. Iron retention was found to be 1.43 mg (6.35 per cent) in group E and 0.73 mg (4.35 per cent) in group C. The difference between the two groups was significant at one per cent level. Similar results have been reported by Sarojini (1975).

Diets of the poor segments of population in India are not only predominantly cereal based, containing high phytate, but they are also low in calcium and ascorbic acid. Iron absorption from such diets may, therefore be expected to be poor. Chemical balance studies employing such diets gave values for iron absorption ranging from 7 to 28 per cent with an average of 13 per cent (Apte 1968). Gopalan (1970) has suggested that for all practical purposes the average net absorption may be considered not to exceed 10 per cent. The present study recorded an absorption level of 9.7 and 7.8 per cent respectively for groups A and B. The percentage retention of all the nutrients studied is presented in figure 1.



MEAN NUTRIENT RETENTION OF EXPERIMENTAL AND CONTROL GROUPS

Figure. 1

C. Nutritional status of children:

1. Height

The mean height of the girls and boys recorded over a period of four months is presented in Tables XII and XIII and figures 2 and 3. The individual values are presented in Appendix D.

TABLE XII

MEAN HEIGHT INCREMENTS OF THE BOYS STUDIED

Age	Group and number studied	Height in cms. Initial	Final	Difference
6	E (27)	105.4	107.1	1.7
	C (5)	103.4	104.4	1.0
	ICMR Std.	105.9		
7	E (46)	109.4	110.8	1.4
	C (8)	107.9	108.7	0.8
	ICMR Std.	109.5		
8	E (28)	115.9	117.9	2.0
	C (7)	113.4	114.6	1.2
	ICMR Std.	116.3		
9	E (21)	120.9	122.6	1.7
	C (7)	118.1	119.0	0.9
	ICMR Std.	121.4		
6 - 9	Mean E	112.91	114.59	1.68 ± 0.09
	C	110.71	111.66	0.95 ± 0.13

't' value on comparison between the groups E and C = 19.72 (Significant at one per cent level).

TABLE XIII

MEAN HEIGHT INCREMENTS OF THE GIRLS STUDIED

Age	Groups and number studied	Height in cms Initial	Final	Difference
6	E (17)	108.2	109.1	1.2
	C (10)	106.5	107.4	0.9
	ICMR Std.	108.2		
7	E (15)	112.2	114.7	2.5
	C (9)	111.6	112.7	1.1
	ICMR Std.	112.3		
8	E (26)	119.5	120.8	1.3
	C (8)	118.4	119.3	0.9
	ICMR Std.	120.4		
9	E (20)	121.1	122.8	1.7
	C (6)	119.6	120.8	1.2
	ICMR Std.	121.7		
6 - 9	Mean E	115.25	116.91	1.66 $\pm$ 0.48
	C	114.0	115.02	1.02 $\pm$ 0.14

'$' value on comparison between the group E and C = 10.75.
(Significant at one per cent level).

All the children in the experimental as well as the control groups registered height increments over a period of four months. However the children in the experimental group registered greater heights than those in the control group. The mean height increment of boys was found to be 1.68 cms. while that of the girls was found to be 1.66 cms. It was found that both in the case of boys and girls the mean increments in the heights of the experimental children was significantly greater than that of the control children at one per cent level. When the final values were compared with the ICMR (1976) standard values for the children in Madras State, all the experimental children were having greater heights while the control children had lower heights than the standard values.

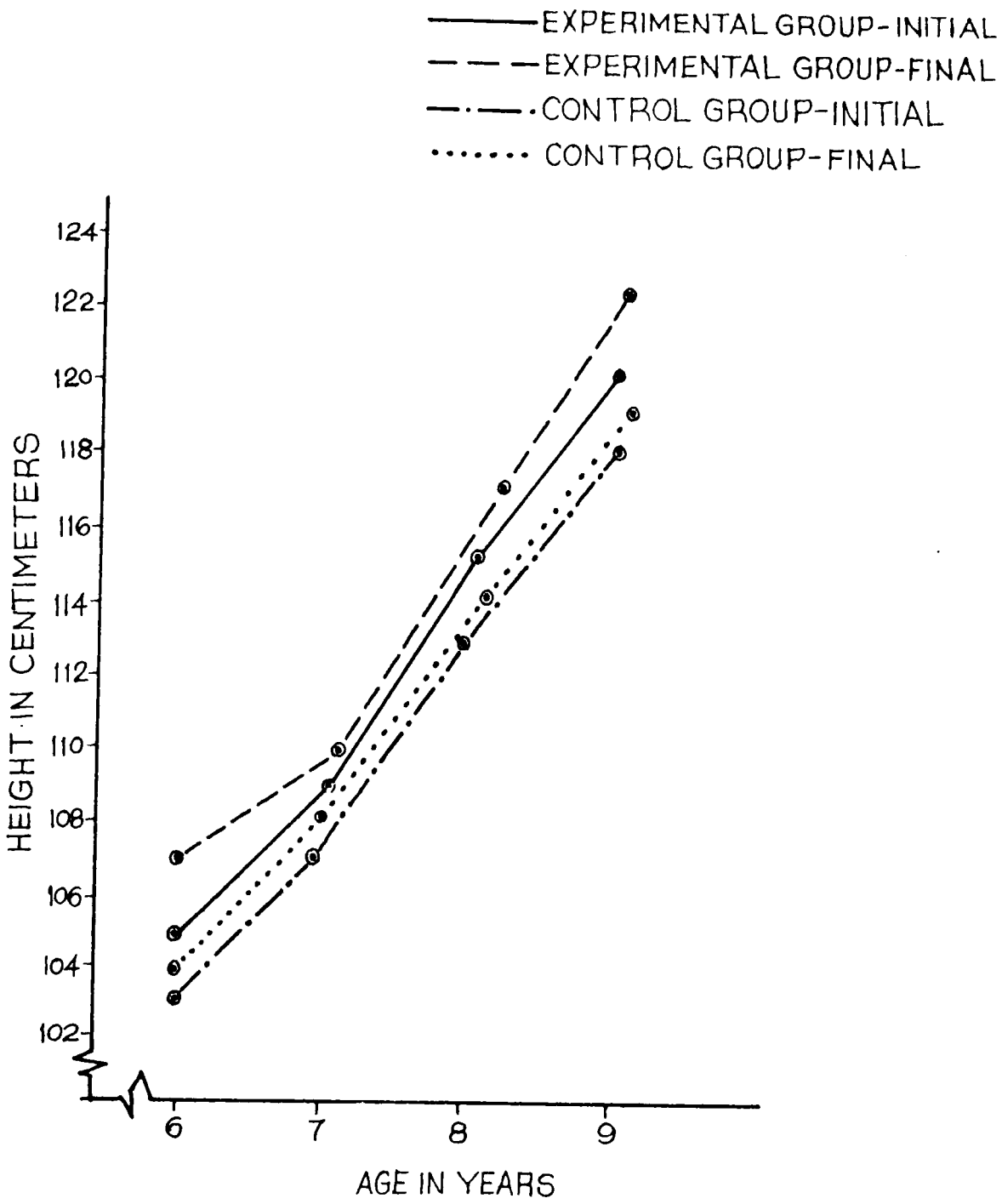


Figure.2

MEAN HEIGHT OF THE BOYS STUDIED

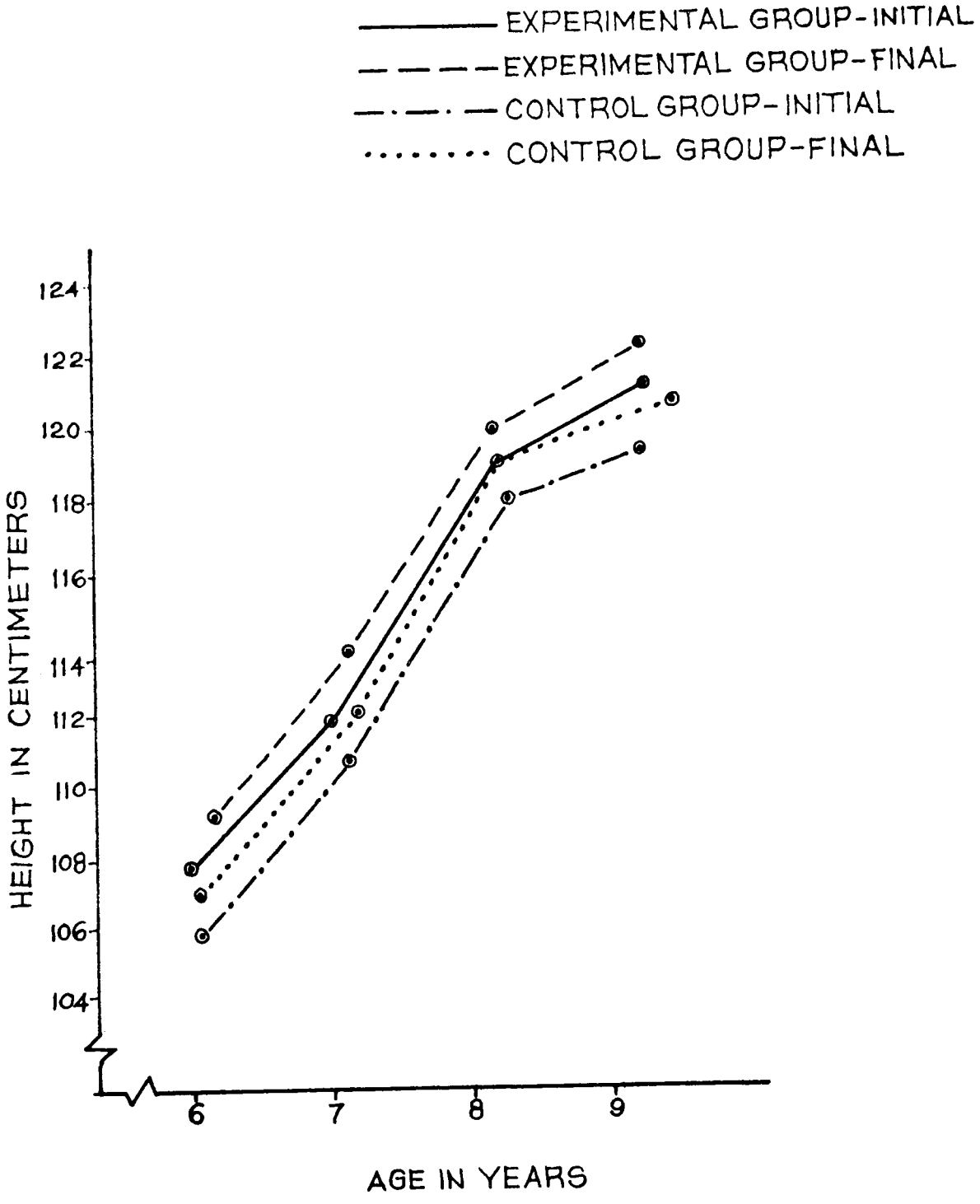


Figure. 3

MEAN HEIGHT OF THE GIRLS STUDIED

2. Weights:

The mean body weights of the girls and boys recorded over a period of four months is presented in Tables XIV and XV and figures 4 and 5. The individual values are presented in Appendix E.

TABLE XIV

MEAN WEIGHT INCREMENTS OF THE BOYS STUDIED

Age	Group and number studied		Weight in Kg. Initial	Final	Difference
6	E (27)		15.76	16.18	0.42
	C (5)		15.18	15.52	0.34
	ICMR Std.		16.5		
7	E (46)		16.64	17.16	0.52
	C (8)		16.35	16.71	0.36
	ICMR Std.		17.4		
8	E (28)		18.12	18.72	0.60
	C (7)		17.85	18.28	0.43
	ICMR Std.		19.7		
9	E (21)		20.25	20.76	0.51
	C (7)		20.0	20.34	0.34
	ICMR Std.		21.9		
6 - 9	Mean	E	17.7	18.2	0.51 ± .06
		C	17.3	17.7	0.36 ± .08

't' value on comparison between the groups E and C = 3.00

(Significant at 1% level)

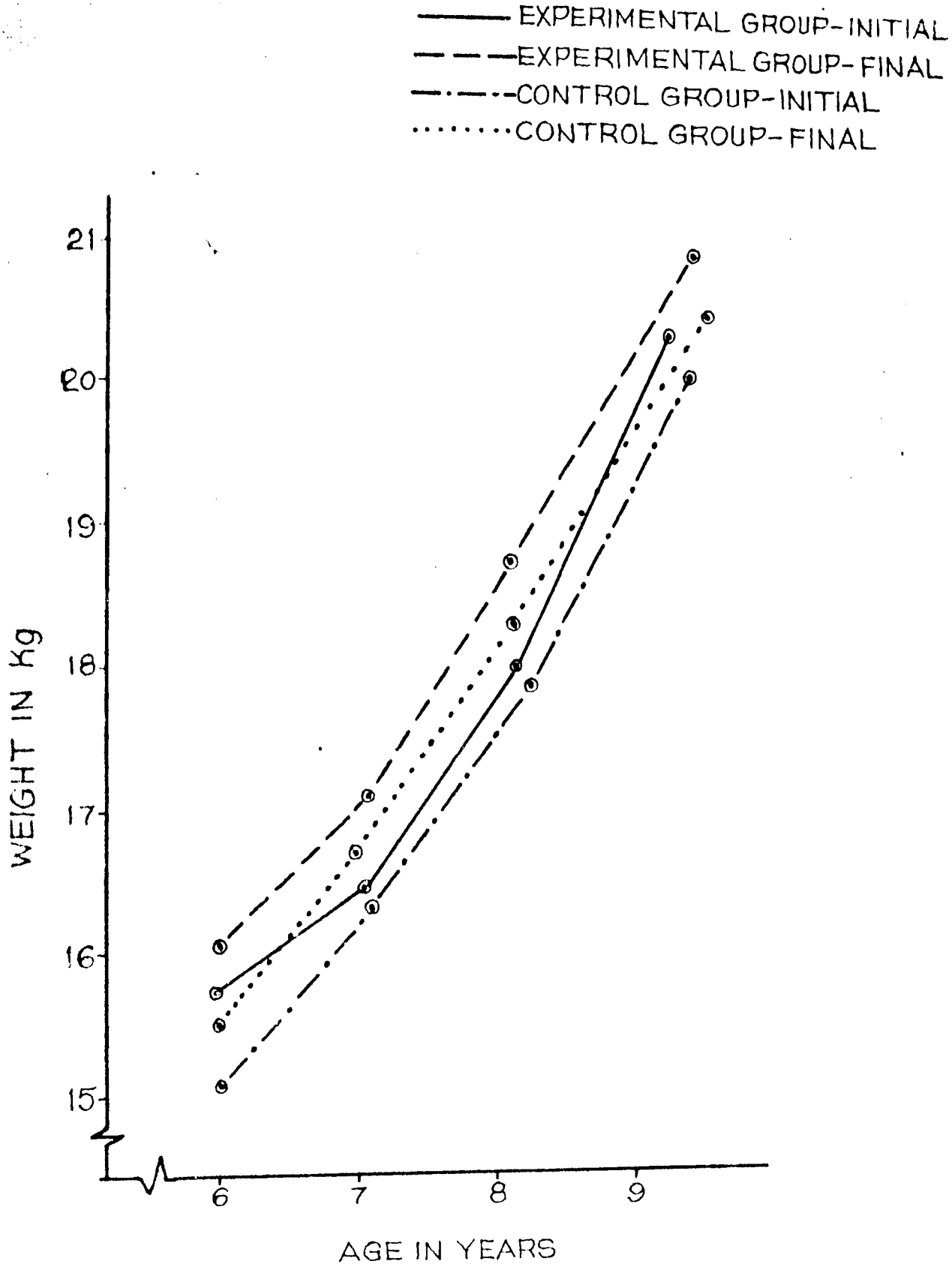
TABLE XV

MEAN WEIGHT INCREMENTS OF THE GIRLS STUDIED

Age	Group and numbers studied	Weight in Kg Initial	Final	Difference
6	E (17)	14.75	15.24	0.49
	C (10)	14.55	14.89	0.34
	ICMR Std.	15.6		
7	E (15)	16.96	17.50	0.54
	C (9)	16.14	16.43	0.29
	ICMR Std.	17.9		
8	E (26)	18.68	19.12	0.44
	C (8)	17.8	18.03	0.23
	ICMR Std.	19.1		
9	E (20)	19.54	19.85	0.31
	C (6)	18.2	18.35	0.15
	ICMR Std.	20.3		
6 - 9	Mean E	17.5	17.9	0.45 ± 0.08
	C	16.6	16.9	0.25 ± 0.07

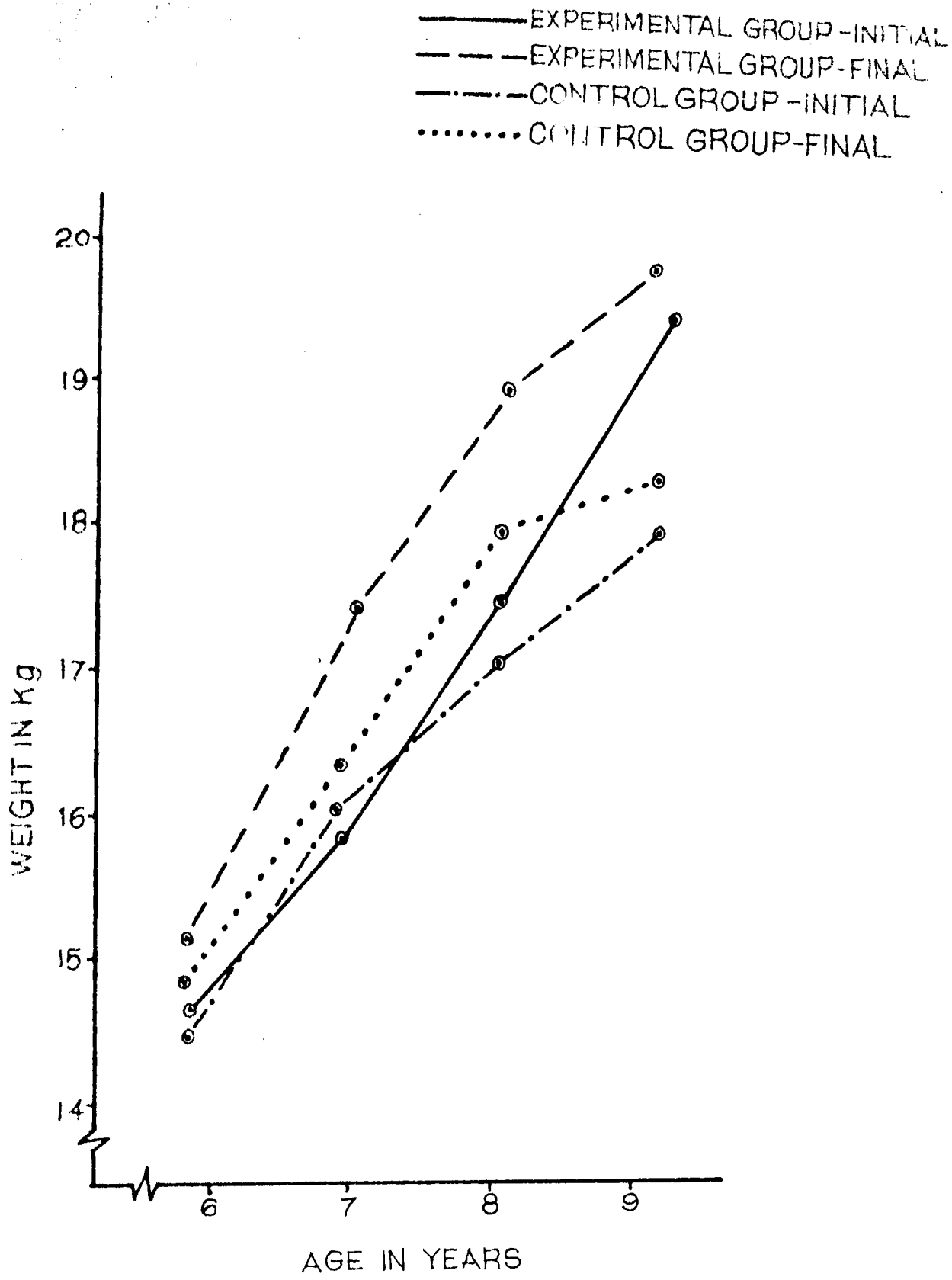
't' value on comparison between the groups E and C = 2.94 (Significant at 1% level).

All the children in the study had registered weight increments over a period of four months. The mean increase in girls was 0.45 kg and for boys was 0.54 kg. Though in heights all the children had exceeded the standard heights, they had slightly lesser weights than the ICMR standards. However the mean increase of weights registered by the experimental group was significantly greater than that of the control group.



MEAN WEIGHT INCREMENTS OF THE BOYS STUDIED

Figure. 4



MEAN WEIGHT INCREMENTS OF THE GIRLS STUDIED

Figure. 5

Mean haemoglobin levels of children:

Table XVI presents the mean initial and final blood haemoglobin level of the selected experimental and control children. The individual values are presented in Appendix - F.

TABLE XVI

MEAN INITIAL AND FINAL HAEMOGLOBIN LEVELS OF TWO GROUPS OF CHILDREN STUDIED

Groups	Haemoglobin level (g/100 ml)		Difference
	Initial	Final	
Experimental	8.36	9.33	0.97 ± 0.166
Control	8.32	8.96	0.64 ± 0.390

't' value on comparison between the groups E and C = 0.375

The mean initial blood haemoglobin levels of the experimental children was 8.36 g/100 ml while that of the control children was 8.32 g. At the end of four months study period the haemoglobin levels reached to 9.33 and 8.96 g/100 ml respectively in groups E and C. However none reached the 11 g/100 ml level which is the standard prescribed by the WHO (1976) for children. If the experimental children continue to participate in the programme their blood picture may reach the desirable level in the course of time.

4. Clinical picture of the children:

The clinical picture of the experimental and control children as observed in the beginning of the study and at the end of the study period is presented in Table XVII.

Table XVII

INITIAL AND FINAL CLINICAL PICTURE OF CHILDREN STUDIED

S.No.	Clinical signs	Percentage prevalence			
		Experimental		Control	
		Initial	Final	Initial	Control
1.	Healthy and free from deficiencies	45	65	25	29
2.	Angular stomatitis	30	25	35	32
3.	Anaemia	35	20	42	41
4.	Bleeding gums	27	19	30	27
5.	Poor musculature	29	15	25	28
6.	Deficient subcutaneous fat	22	14	27	25
7.	Xerosis of the cornea	12	10	20	20
8.	Dry rough skin	17	15	20	25
9.	Caries	19	14	17	19
10.	Crazy pavement skin	12	9	29	31

Initially 45 per cent of the experimental children and 25 per cent of the control children were healthy and free from diseases. It was observed that the experimental group children were participating from the start of the programme and this had helped them to have better initial clinical picture. However towards the end of the study 65 and 29 per cent of the children in the two groups respectively were free from diseases.

Among the different deficiency signs observed, angular stomatitis, (30 and 35 per cent) and anemia (35 and 42 per cent) were highly predominating among the experimental and control children respectively. After a period of four months, all the signs reduced considerably in the experimental children. In the case of control group children, the signs either increased or decreased slightly over a period of four months.

From the foregoing discussions it may be concluded that the Honourable Chief Minister's Nutrition Meal Programme in Tamil Nadu has paved way for the growth and over all well being of the future citizens of the country. When the children continuously participated in the programme, not only their growth rates improved but also the availability of calories, protein, calcium, phosphorus and iron from the diets improved in children.

Summary and Conclusion

V SUMMARY AND CONCLUSION

The present investigation entitled "Availability of nutrients and calories from the Nutrition Meal Programme and height and weight of the children" was carried out in three elementary schools. All the three schools put together 200 children of 6 to 9 years participating in the Nutritious Meal Programme and 60 children not participating in the programme were selected for the study.

In one of the three schools namely Sri Avinashilingam Basic School, after conducting the socio economic survey, five children from the experimental group and five children from the control group were selected for the metabolic study. Metabolic study was carried out for a period of six days, with three days of adjustment and three days of collection periods. One tenth of the total food consumed, and the total urine and faeces excreted during the collection period were collected and analysed to determine the availability of calories, nitrogen, calcium, phosphorus and iron. For all the experimental and the control children selected from three schools, the initial and final heights, weights and clinical picture are recorded. Haemoglobin estimation was done for 25 and 20 children of experimental and control groups respectively.

The results of the study revealed the following:

1. The socio-economic background of all the families was very poor. In the experimental group 62.5 per cent of families and in the control group 50 per cent of families had a meagre monthly income below Rs.400/-.

2. The mean calorie intake of the children in groups B and C were found to be deficient namely 1560 and 1216 respectively. The mean digestible energy percentage was 78.8 and 71.9 for the groups B and C respectively.

3. When compared with the ICMR (1981) recommended allowances, all the children consumed greater quantities of protein. The apparent nitrogen retention in children belonging to groups B and C were 5.117 g and 3.166 g respectively with the percentages being 65.64 and 61.28 for the two groups.

4. The mean calcium intake of children in groups A and B was found to be 334.8 and 248.5 mg respectively. The mean absorption was 39.9 and 41.0 per cent with the retention rates of 7.8 and 6.3 per cent respectively for groups A and B.

5. In the case of phosphorus the mean retention was worked out to be 56.8 mg in the experimental group and 18.8 mg in the control group.

6. The children participating in the feeding programme had a mean iron intake of 22.6 mg where as the control children

consumed 17.1 mg/day. Iron retention was found to be 1.4 mg (6.35 per cent) in group E and 0.73 mg (4.35 per cent) in group C.

7. The children in the experimental group registered significantly greater retention of calories, calcium, phosphorus and iron than the children in the control group.

8. The mean height increments of boys was found to be 1.68 cms while that of girls was found to be 1.66 cm over a period of four months. The increments recorded for the boys and girls of the control group were 0.95 cm and 1.02 cm respectively. The difference observed between the groups E and C was significant at one per cent level.

9. The mean final weights of both the groups of children were slightly lesser than the ICMR norms. However the increments registered by the children in the experimental group (0.51 kg for boys and 0.45 kg for girls) was significantly greater than that of the children in the control group (0.36kg for boys and 0.45kg for girls).

10. Initially 45 per cent of the experimental children and 25 per cent of the control children were healthy and free from disease. However towards the end of the study 65 and 29 per cent of the experimental and control children respectively were free from clinical symptoms.

11. Though all the children had less than the required level of blood haemoglobin level, the children in the experimental group had registered an increase of 0.97 g/100 ml while the children in the control group had registered an increase of 0.64 g/100 ml. The difference was significant at one per cent level.

It could be concluded that the Honourable Chief Minister's Nutrition Meal Programme for children has resulted in good physical development of children. The balance study has revealed that when the children consumed the nutritious meal the availability of calories, nitrogen, calcium, phosphorus and iron improved to an appreciable extent than the control children.

Further studies along this line under the controlled conditions may throw more light on the subject. Studies could be also recommended in future on the cost benefit analysis of the programme.

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Appendices

APPENDIX - A

SRI AVINASHILINGAM HOME SCIENCE COLLEGE FOR WOMEN
COIMBATORE

QUESTIONNAIRE TO ELICIT INFORMATION ON HONOURABLE CHIEF MINISTER'S NUTRITIOUS MEAL PROGRAMME

SCHEDULE TO ELICIT SOCIO-ECONOMIC BACKGROUND OF CHILDREN

1. Name of the interviewer :
2. Name of the interviewee :
3. Name of the village :
4. Name of the head of the family :
5. Address: Caste:
   Community
   B.C. ( ) F.C. ( ) S.C./S.T. ( )
6. Nature of the family:
   Joint ( ) Nuclear ( )
7. Education level of parents:
   Father ( ) Mother ( )
8. Occupation:
   Main Occupation :
   Subsidiary Occupation :
9. Land in possession (in acres) :
   Wet :
   Dry :
10. Monthly income : Rs.

APPENDIX - B

SRI AVINASHILINGAM HOME SCIENCE COLLEGE FOR WOMEN
COIMBATORE - 641 043

SCHEDULE FOR CLINICAL ASSESSMENT

Date:

Name :

Age :

Sex (M/F) : Birth order:

Height (in cm) : Sibs: Boys:

Girls:

Weight (in Kg)

Name of the father or guardian:

Address :

Occupation :

Income/month (Rs.) :

Size of the family :

CLINICAL ASSESSMENT

Healthy and free from any deficiency symptoms

III a) Poor musculature
b) Deficient subcutaneous fat
c) Milkd anaemia
d) Lack of interest in surroundings
e) Mild signs of not more than one of the specific nutritional disorders of deficiencies mentioned under (3) of III

III (1) (a) Nutritional oedema
(b) Gross muscular wasting
(c) Marked anaemia
(d) Xerosis of the cornea

(2) (a) Tenderness of the calf
(b) Red and/or Raw tongue/Glazed tongue
(c) Angular stomatitis
(d) Bleeding gums
(e) Angular conjunctive

(3) (a) Xerosis or pigmentation of conjunctiva
(b) Bitot's spots
(c) Caries
(d) Dry/or rough skin
(e) Crazy pavement skin
(f) Hyperkeratosis

Special remarks:

Date: Signature of the Examiner

APPENDIX - C

INTAKE, EXCRETION AND RETENTION OF CALORIES IN CHILDREN

Group	Calories intake K.cal/day	Excretion of calories in faeces K.cal/day	Calories retained K.cal/day	% retention	Mean
Experimental	1412.4	312.4	1100.00	77.88	
	1445.5	350.2	1035.5	75.78	
	1721.32	390.29	1331.03	77.32	=78.75
	1530.86	295.38	1235.48	80.70	
	1690.32	302.94	1387.38	82.07	
Control	1190.8	314.5	876.3	73.63	
	1050.2	292.1	758.1	72.12	
	1125.75	325.38	800.47	71.10	=71.94
	1300.00	345.8	954.2	73.40	
	1412.20	432.0	980.0	69.40	

INTAKE, EXCRETION AND RETENTION OF NITROGEN IN CHILDREN

Group	N intake g/day	Excretion of nitrogen g/day Urine	Faeces	Total	N retention	% N retension	Mean
Experimental	8.181	2.7	0.277	3.166	5.015	51.30	
	9.080	3.420	0.466	3.886	5.194	57.20	
	7.457	2.1	0.130	2.23	5.227	70.09	= 65.648
	7.852	2.88	0.185	3.065	4.787	60.90	
	6.810	1.341	0.106	1.447	5.363	78.75	
Control	4.474	1.7	0.07	1.77	2.704	60.43	
	4.464	1.5	0.04	1.54	2.924	65.50	
	5.902	2.1	0.1	2.2	3.702	62.72	= 61.28
	6.059	2.34	0.159	2.499	3.54	58.61	
	5.001	1.92	0.12	2.04	2.96	59.18	

INTAKE, EXCRETION AND RETENTION OF IRON IN CHILDREN

Group	Iron intake mg/day	Excretion of iron mg/day Urine	Faeces	Total	Iron retension mg/day	% retention	Mean
Experimental	23.11	0.95	20.79	21.74	1.36	5.88	
	24.25	0.87	21.82	22.69	1.56	6.43	
	23.05	0.92	20.74	21.66	1.39	6.03	= 6.35
	22.46	0.74	20.21	20.95	1.51	6.72	
	20.31	0.68	18.27	18.95	1.36	6.69	
Control	17.82	0.83	16.02	16.85	0.97	5.44	
	14.54	0.64	13.08	13.72	0.82	5.63	
	15.76	0.56	14.62	15.18	0.58	3.68	= 4.35
	17.97	0.49	16.68	17.17	0.8	4.45	
	19.47	0.67	18.50	18.97	0.5	2.56	

IMTAKE, EXCRETION AND RETENTION OF PHOSPHORUS IN CHILDREN

Group	'P' intake mg/day	Excretion of P - mg/day Urine	Faeces	Total	'P' retention	% retention	Mean
Experimental	360.60	120	210	330	30.61	8.48	
	323.21	103	180	283	40.21	12.44	
	363.78	125	212	337	26.78	7.36	= 9.088
	368.02	130	210	340	28.02	7.61	
	342.75	120	190	310	32.75	9.55	
Control	250.86	110	122	232	18.86	7.518	
	280.90	108	155	263	17.90	6.372	
	262.68	109	135	244	18.68	7.111	= 7.170
	265.37	107	138	245	20.37	7.67	
	250.50	106.5	126	233	18.00	7.18	

IMTAKE, EXCRETION AND RETENTION OF CALCIUM IN CHILDREN

Group	Calcium intake mg/day	Excretion of calcium mg/day Urine	Faeces	Total	Calcium retention mg/day	% retention	Mean
Experimental	359.84	108.25	221.25	330	29.00	8.059	
	324.62	110.35	189.65	300	24.00	7.393	
	345.56	109.42	213.58	323	22.56	6.528	=7.778
	303.72	102.56	172.44	275	28.72	9.456	
	340.38	105.4	209.6	315	25.38	7.456	
Control	259.75	98.56	144	242.56	15.19	5.84	
	230.60	89.42	125.58	215.00	15.60	6.76	=6.29
	265.95	82.45	167.55	250.00	15.95	5.99	
	246.00	78.69	151.31	230.00	16.00	6.50	
	240.38	81.05	143.95	225.00	15.38	6.39	

APPENDIX - D

INDIVIDUAL HEIGHTS IN CMS OF 6 YEAR OLD EXPERIMENTAL BOYS

S.No.	Initial	Final	Difference
1.	105.5	107.0	1.5
2.	105.0	106.5	1.5
3.	105.5	107.0	1.5
4.	105.5	107.0	1.5
5.	104.5	106.5	2.0
6.	105.0	107.0	2.0
7.	105.0	107.0	2.0
8.	105.5	107.0	1.5
9.	105.5	107.0	1.5
10.	105.5	107.5	2.0
11.	106.5	108.0	1.5
12.	105.0	107.0	2.0
13.	105.5	107.0	1.5
14.	105.5	107.0	1.5
15.	105.0	107.5	2.5
16.	105.0	107.0	2.0
17.	105.5	107.0	1.5
18.	105.5	107.5	2.0
19.	105.5	107.5	2.0
20.	104.5	106.5	2.0
21.	106.0	108.0	2.0
22.	105.0	107.0	2.0
23.	105.0	107.5	2.5
24.	106.0	107.0	1.0
25.	105.5	107.0	1.5
26.	105.5	107.0	1.5
27.	105.0	107.0	2.0

INDIVIDUAL HEIGHTS IN CMS OF 6 YEAR OLD CONTROL BOYS

S.No.	Initial	Final	Difference
1.	104.0	104.5	0.5
2.	104.0	105.5	1.5
3.	103.0	104.0	1.0
4.	104.0	105.3	1.3
5.	102.0	103.2	1.2

INDIVIDUAL HEIGHTS IN CMS OF 7 YEAR OLD EXPERIMENTAL BOYS

S.No.	Initial	Final	Difference
1.	108.0	109.5	1.5
2.	108.0	109.5	1.5
3.	109.0	110.5	1.5
4.	109.0	110.5	1.5
5.	109.0	110.5	1.5
6.	109.0	110.5	1.5
7.	110.0	111.0	1.0
8.	111.0	112.0	1.0
9.	110.0	112.0	2.0
10.	108.5	110.5	2.0
11.	109.5	111.0	1.5
12.	109.0	111.0	2.0
13.	110.0	112.0	2.0
14.	109.0	110.5	1.5
15.	109.0	110.5	1.5
16.	110.0	111.0	1.0
17.	109.0	110.5	1.5
18.	110.0	111.0	1.0
19.	108.0	109.5	1.5
20.	109.0	111.0	2.0
21.	109.0	111.0	2.0
22.	109.0	110.0	1.0
23.	108.5	110.5	2.0
24.	110.5	112.0	1.5
25.	109.5	111.0	1.5
26.	108.0	109.0	1.0

S.No.	Initial	Final	Difference
27.	110.0	111.0	1.0
28.	110.0	111.5	1.5
29.	110.0	111.5	1.5
30.	108.0	109.5	1.5
31.	110.5	112.0	1.5
32.	110.0	111.0	1.0
33.	110.0	111.0	1.0
34.	110.0	111.0	1.0
35.	109.0	110.0	1.0
36.	109.0	110.0	1.0
37.	110.0	111.0	1.0
38.	111.0	112.0	1.0
39.	109.5	111.0	1.5
40.	110.0	112.0	2.0
41.	110.5	112.0	1.5
42.	110.0	111.0	1.0
43.	109.0	110.0	1.0
44.	109.0	110.0	1.0
45.	110.5	112.0	1.5
46.	110.0	111.5	1.5

INDIVIDUAL HEIGHTS IN CMS OF 7 YEAR OLD CONTROL BOYS

S.No.	Initial	Final	Difference
1.	108.0	109.0	1.0
2.	107.5	108.2	0.7
3.	108.0	108.8	0.8
4.	107.0	108.0	1.0
5.	108.8	109.5	0.7
6.	108.0	109.0	1.0
7.	107.5	108.3	0.8
8.	108.2	108.7	0.5

INDIVIDUAL HEIGHTS IN CMS OF 8 YEARL OLD EXPERIMENTAL BOYS

S.No.	Initial	Final	Difference
1.	116.0	117.5	1.5
2.	116.0	118.0	2.0
3.	116.0	118.0	2.0
4.	115.5	117.0	1.5
5.	117.0	118.5	1.5
6.	115.3	118.3	3.0
7.	116.2	118.5	2.3
8.	115.5	118.5	3.0
9.	117.0	118.5	1.5
10.	116.3	118.3	1.7
11.	116.0	118.0	2.0
12.	116.0	118.0	2.0
13.	115.8	118.0	2.2
14.	115.2	116.5	1.3
15.	115.5	116.5	1.0
16.	116.0	118.0	2.0
17.	116.0	118.0	2.0
18.	115.5	118.0	2.2
19.	116.0	118.5	2.5
20.	116.0	118.5	2.5
21.	115.5	117.0	1.5
82.	116.0	118.0	2.0
23.	116.0	118.0	2.0
24.	115.3	118.0	2.7
25.	115.2	117.5	2.3
26.	116.0	118.0	2.0
27.	115.5	117.5	2.0
28.	116.0	118.0	2.0

INDIVIDUAL HEIGHTS IN CMS OF 8 YEAR OLD CONTROL BOYS STUDIED

S.No.	Initial	Final	Difference
1.	114.0	115.0	1.0
2.	113.0	114.0	1.0
3.	113.5	115.0	1.5
4.	114.5	115.2	0.7
5.	113.2	115.0	1.8
6.	112.0	113.0	1.0
7.	113.8	114.8	1.0

INDIVIDUAL HEIGHTS IN CMS OF 9 YEARLOLD EXPERIMENTAL BOYS

S.No.	Initial	Final	Difference
1.	119.5	120.5	1.0
2.	120.5	121.5	1.0
3.	122.0	124.0	2.0
4.	121.0	123.0	2.0
5.	121.0	123.0	2.0
6.	120.5	122.5	2.0
7.	120.5	121.0	0.5
8.	120.5	122.0	1.5
9.	122.0	124.0	2.0
10.	121.0	123.0	2.0
11.	122.0	123.0	1.0
12.	121.0	123.5	2.5
13.	122.0	123.5	1.5
14.	123.0	124.0	1.0
15.	120.0	122.0	2.0
16.	121.0	123.0	2.0
17.	120.5	122.0	1.5
18.	120.5	122.5	2.0
19.	120.5	122.5	2.0
20.	121.5	123.0	1.5
21.	119.5	121.5	2.0

INDIVIDUAL HEIGHTS IN CMS OF 9 YEAR OLD CONTROL BOYS

S.No.	Initial	Final	Difference
1.	119.0	119.9	0.9
2.	118.0	118.8	0.8
3.	117.5	118.1	0.6
4.	118.0	119.0	1.0
5.	119.0	119.8	0.8
6.	118.5	119.2	0.7
7.	117.0	118.2	1.2

INDIVIDUAL HEIGHTS IN CMS OF 6 YEAR OLD EXPERIMENTAL GIRLS

S.No.	Initial	Final	Difference
1.	108.0	109.0	1.0
2.	110.0	111.5	1.5
3.	110.0	111.0	1.0
4.	108.0	109.0	1.0
5.	108.0	109.5	1.5
6.	108.0	109.0	1.0
7.	108.0	109.5	1.5
8.	108.0	109.5	1.5
9.	107.0	108.5	1.5
10.	106.0	108.0	2.0
11.	110.0	111.0	1.0
12.	106.0	107.5	1.5
13.	110.0	111.0	1.0
14.	1070	109.0	2.0
15.	110.0	111.0	1.0
16.	106.0	108.0	2.0
17.	109.0	110.0	1.0

INDIVIDUAL HEIGHTS IN CMS OF 6 YEAR OLD CONTROL GIRLS

S.No.	Initial	Final	Difference
1.	106.0	107.0	1.0
2.	106.0	106.5	0.5
3.	108.0	109.0	1.0
4.	107.0	107.5	0.5
5.	105.0	106.0	1.0
6.	106.0	107.0	1.0
7.	105.0	106.0	1.0
8.	107.0	108.0	1.0
9.	106.0	107.0	1.0
10.	109.0	110.0	1.0

INDIVIDUAL HEIGHTS IN CMS OF 8 YEAR OLD EXPERIMENTAL GIRLS

S.No.	Initial	Final	Difference
1.	119.5	120.5	1.0
2.	119.5	120.5	1.0
3.	119.0	121.0	2.0
4.	120.0	121.0	1.0
5.	120.5	121.5	1.0
6.	120.5	121.5	1.0
7.	119.0	120.5	1.5
8.	119.0	120.0	1.0
9.	120.0	121.0	1.0
10.	119.0	120.5	1.5
11.	119.5	121.0	1.5
12.	120.0	121.0	1.0
13.	120.0	121.5	1.5
14.	119.0	120.5	1.5
15.	120.0	121.0	1.0
16.	119.0	120.0	1.0
17.	118.5	120.0	1.5
18.	120.0	121.0	1.0
19.	119.0	120.2	1.2
20.	120.0	121.3	1.3
21.	118.5	120.5	2.0
22.	119.5	121.0	1.5
23.	120.0	121.2	1.2
24.	120.0	121.3	1.3
25.	120.0	121.0	1.0
26.	119.0	120.5	1.5

INDIVIDUAL HEIGHTS IN CMS OF 8 YEAR OLD CONTROL GIRLS

S.No.	Initial	Final	Difference
1.	118.0	118.75	0.75
2.	119.0	119.5	0.5
3.	119.0	120.0	1.0
4.	117.0	117.5	0.5
5.	118.0	119.0	1.0
6.	119.0	119.75	0.75
7.	119.0	120.5	1.5
8.	118.0	119.0	1.0

INDIVIDUAL HEIGHTS IN CMS OF 9 YEAR OLD EXPERIMENTAL GIRLS

S.No.	Initial	Final	Difference
1.	121.0	122.5	1.5
2.	121.0	122.5	1.5
3.	120.0	122.0	2.0
4.	121.0	122.5	1.5
5.	120.0	122.0	2.0
6.	121.0	122.5	1.5
7.	120.0	122.0	2.0
8.	122.0	123.0	1.0
9.	120.0	121.5	1.5
10.	121.0	122.5	1.5
11.	122.0	123.0	1.0
12.	122.0	123.5	1.5
13.	121.0	122.5	1.5
14.	122.0	123.5	1.5
15.	120.0	122.5	2.5
16.	122.0	123.5	1.5
17.	123.0	124.5	1.5
18.	120.0	122.0	2.0
19.	123.0	124.5	1.5
20.	120.0	122.5	2.5

INDIVIDUAL HEIGHTS IN CMS OF 9 YEAR OLD CONTROL GIRLS

S.No.	Initial	Final	Difference
1.	119.0	120.0	1.0
2.	120.0	121.0	1.0
3.	120.0	121.0	1.0
4.	120.0	121.0	1.0
5.	120.0	121.0	1.0
6.	119.0	121.0	2.0

APPENDIX - E

INDIVIDUAL WEIGHTS IN Kg OF 6 YEAR OLD EXPERIMENTAL BOYS

S.No.	Initial	Final	Difference
1.	16.0	16.5	0.5
2.	16.0	16.5	0.5
3.	15.5	16.0	0.5
4.	16.5	17.0	0.5
5.	16.5	16.9	0.4
6.	15.0	15.6	0.6
7.	14.5	15.0	0.5
8.	15.6	16.0	0.4
9.	15.3	16.0	0.7
10.	15.5	16.0	0.5
11.	16.5	16.9	0.4
12.	16.5	16.8	0.3
13.	15.5	15.9	0.4
14.	16.1	16.5	0.4
15.	16.4	16.8	0.4
16.	15.9	16.4	0.5
17.	16.0	16.5	0.5
18.	16.0	16.5	0.5
19.	16.0	16.3	0.3
20.	15.5	16.0	0.5

S.No.	Initial	Final	Difference
21.	16.5	16.7	0.2
22.	16.5	16.7	0.2
23.	15.0	15.2	0.2
24.	14.5	15.0	0.5
25.	15.6	16.0	0.4
26.	15.3	15.5	0.2
27.	15.5	15.7	0.2

INDIVIDUAL WEIGHTS IN Kg OF 6 YEAR OLD CONTROL BOYS

S.No.	Initial	Final	Difference
1.	15.5	15.7	0.2
2.	15.6	15.9	0.3
3.	14.5	14.9	0.4
4.	15.3	15.8	0.5
5.	15.0	15.3	0.3

INDIVIDUAL WEIGHTS IN Kg OF 7 YEAR OLD EXPERIMENTAL BOYS

S.No.	Initial	Final	Difference
1.	17.0	17.4	0.4
2.	17.0	17.4	0.4
3.	16.5	17.2	0.7
4.	17.2	17.5	0.3
5.	17.4	17.8	0.4
6.	17.0	17.4	0.4
7.	16.5	17.0	0.5
8.	16.4	17.0	0.6
9.	16.3	17.0	0.7
10.	16.5	17.0	0.5
11.	16.9	17.2	0.3
12.	16.8	17.4	0.6
13.	16.3	16.9	0.6
14.	16.4	16.9	0.5
15.	16.5	17.0	0.5
16.	16.8	17.4	0.6
17.	16.4	17.0	0.6
18.	15.9	16.5	0.6
19.	16.8	17.4	0.6
20.	16.7	17.3	0.6
21.	16.5	17.0	0.5
22.	16.4	17.0	0.6
23.	16.3	17.0	0.7
24.	16.5	17.0	0.5
25.	16.5	17.0	0.5
26.	16.6	17.2	0.6
27.	16.8	17.3	0.5
28.	16.8	17.0	0.3
29.	17.0	17.4	0.4
30.	16.3	16.9	0.6

S.No.	Initial	Final	Difference
31.	16.4	16.9	0.5
32.	16.8	17.3	0.5
33.	16.9	17.4	0.5
34.	16.6	17.2	0.6
35.	17.0	17.4	0.4
36.	16.5	17.0	0.5
37.	16.3	17.0	0.7
38.	16.4	17.0	0.6
39.	16.9	17.2	0.3
40.	16.4	17.0	0.6
41.	17.0	17.4	0.4
42.	16.8	17.4	0.6
43.	16.4	16.9	0.5
44.	17.0	17.4	0.4
45.	17.0	17.5	0.5
46.	16.5	17.0	0.5

INDIVIDUAL WEIGHTS IN Kg OF 7 YEAR OLD CONTROL BOYS

S.No.	Initial	Final	Difference
1.	16.2	16.5	0.3
2.	17.0	17.3	0.3
3.	16.5	16.9	0.4
4.	16.2	16.5	0.3
5.	16.0	16.5	0.5
6.	16.3	16.6	0.3
7.	16.1	16.5	0.4

INDIVIDUAL WEIGHTS IN Kg OF 8 YEAR OLD EXPERIMENTAL BOYS

S.No.	Initial	Final	Difference
1.	18.0	18.5	0.5
2.	19.2	19.7	0.5
3.	17.4	17.9	0.5
4.	16.6	17.2	0.6
5.	18.2	18.8	0.6
6.	19.0	19.6	0.6
7.	17.0	17.5	0.5
8.	16.0	16.6	0.6
9.	17.0	17.5	0.5
10.	16.8	17.4	0.6
11.	19.2	19.8	0.6
12.	18.5	19.0	0.5
13.	18.0	18.8	0.8
14.	19.5	20.0	0.5
15.	17.0	17.8	0.8
16.	18.5	19.0	0.5
17.	17.8	18.4	0.6
18.	19.0	19.8	0.8
19.	18.5	19.3	0.8
20.	17.8	18.5	0.7
21.	19.0	19.5	0.5
22.	18.2	18.8	0.6
23.	19.2	19.8	0.6
24.	18.0	18.8	0.8
25.	17.0	17.8	0.8
26.	19.0	19.5	0.5
27.	19.0	19.6	0.6
28.	19.0	19.5	0.5

INDIVIDUALS WEIGHT IN Kg OF 8 YEAR OLD CONTROL BOYS

S.No.	Initial	Final	Difference
1.	17.2	17.8	0.6
2.	18.4	18.9	0.5
3.	18.5	18.8	0.3
4.	18.4	18.9	0.5
5.	18.0	18.6	0.6
6.	17.0	17.6	0.6
7.	17.5	17.4	0.1

INDIVIDUAL WEIGHTS IN Kg OF 9 YEAR OLD EXPERIMENTAL BOYS

S.No.	Initial	Final	Difference
1.	20.5	21.0	1.0
2.	20.0	20.5	0.5
3.	20.4	20.8	0.4
4.	20.2	20.7	0.5
5.	19.6	20.2	0.6
6.	20.6	21.0	0.4
7.	20.5	21.0	0.5
8.	20.6	21.0	0.4
9.	20.8	21.3	0.5
10.	20.9	21.4	0.5
11.	20.8	21.5	0.7
12.	20.2	20.6	0.4
13.	20.4	20.8	0.4
14.	20.0	20.6	0.6
15.	20.0	20.5	0.5
16.	20.0	20.5	0.5
17.	20.4	20.9	0.5
18.	20.2	20.8	0.6
19.	20.4	20.9	0.5
20.	19.5	20.0	0.5
21.	19.4	20.0	0.6

INDIVIDUAL WEIGHTS IN Kg OF 9 YEAR OLD CONTROL BOYS

S.No.	Initial	Final	Difference
1.	19.5	19.7	0.2
2.	20.0	20.3	0.3
3.	20.2	20.5	0.3
4.	19.9	20.3	0.4
5.	20.4	20.7	0.3
6.	20.6	21.0	0.4
7.	19.4	19.9	0.5

INDIVIDUAL WEIGHTS IN Kg OF 6 YEAR OLD EXPERIMENTAL GIRLS

S.No.	Initial	Final	Difference
1.	14.5	15.0	0.5
2.	14.8	15.2	0.4
3.	14.9	15.4	0.5
4.	15.0	15.5	0.5
5.	15.0	15.5	0.5
6.	14.5	15.0	0.5
7.	14.0	14.5	0.5
8.	14.5	15.2	0.7
9.	15.0	15.6	0.6
10.	15.2	15.5	0.3
11.	15.0	15.5	0.5
12.	14.8	15.3	0.5
13.	14.5	15.0	0.5
14.	14.6	15.1	0.5
15.	14.8	15.2	0.4
16.	14.8	15.2	0.4
17.	14.9	15.4	0.5

INDIVIDUAL WEIGHTS IN Kg OF 6 YEAR OLD CONTROL GIRLS

S.No.	Initial	Final	Difference
1.	14.5	14.8	0.3
2.	14.7	14.9	0.2
3.	14.3	14.8	0.5
4.	14.2	14.5	0.3
5.	14.0	14.4	0.4
6.	14.7	15.0	0.3
7.	15.0	15.4	0.4
8.	14.8	15.1	0.3
9.	14.6	15.0	0.4
10.	14.7	15.0	0.3

INDIVIDUAL WEIGHTS IN Kg OF 7 YEAR OLD EXPERIMENTAL GIRLS

S.No.	Initial	Final	Difference
1.	17.0	17.4	0.4
2.	17.2	17.6	0.4
3.	17.2	17.8	0.6
4.	17.4	17.9	0.5
5.	17.0	17.5	0.5
6.	16.8	17.3	0.5
7.	16.9	17.5	0.6
8.	17.0	17.5	0.5
9.	17.2	17.6	0.4
10.	16.0	16.6	0.6
11.	16.8	17.4	0.6
12.	16.9	17.5	0.6
13.	16.8	17.4	0.6
14.	17.0	17.6	0.6
15.	17.2	17.8	0.6

INDIVIDUAL WEIGHTS IN Kg OF 7 YEAR OLD CONTROL GIRLS

S.No.	Initial	Final	Difference
1.	16.0	16.5	0.5
2.	15.5	15.8	0.3
3.	15.9	16.2	0.3
4.	16.9	17.1	0.2
5.	16.5	16.8	0.3
6.	16.0	16.3	0.3
7.	16.5	16.7	0.2
8.	16.0	16.3	0.3
9.	16.0	16.2	0.2

INDIVIDUAL WEIGHTS IN Kg OF 8 YEAR OLD EXPERIMENTAL GIRLS

S.No.	Initial	Final	Difference
1.	18.5	19.0	0.5
2.	18.2	18.6	0.4
3.	18.4	18.7	0.3
4.	17.4	17.6	0.2
5.	18.2	18.4	0.2
6.	18.0	18.5	0.5
7.	18.0	18.2	0.2
8.	18.0	18.3	0.3
9.	18.0	18.5	0.5
10.	17.0	17.4	0.4
11.	17.6	17.7	0.1
12.	18.5	19.0	0.5
13.	16.8	17.0	0.2
14.	17.4	17.8	0.4
15.	18.0	18.6	0.6
16.	18.0	18.5	0.5
17.	17.0	17.6	0.6
18.	17.4	17.9	0.5
19.	18.2	18.7	0.5
20.	18.5	19.0	0.5
21.	18.7	19.2	0.5
22.	18.5	19.0	0.5
23.	18.7	19.1	0.4
24.	18.8	19.1	0.3
25.	18.0	18.5	0.5
26.	18.0	18.6	0.6

INDIVIDUAL WEIGHTS IN Kg OF 9 YEAR OLD EXPERIMENTAL GIRLS

S.No.	Initial	Final	Difference
1.	19.5	19.9	0.4
2.	19.2	19.6	0.4
3.	19.3	19.7	0.4
4.	19.4	19.8	0.4
5.	19.5	19.9	0.4
6.	19.9	20.2	0.3
7.	20.0	20.3	0.3
8.	19.0	19.4	0.4
9.	19.5	19.7	0.2
10.	19.6	19.8	0.2
11.	19.4	19.6	0.2
12.	19.6	19.8	0.2
13.	19.8	20.0	0.2
14.	19.7	19.9	0.2
15.	19.6	19.9	0.3
16.	19.5	19.9	0.4
17.	19.4	19.7	0.3
18.	19.5	19.8	0.3
19.	19.9	20.1	0.2
20.	19.6	19.9	0.3

INDIVIDUAL WEIGHTS IN Kg OF 8 YEAR OLD CONTROL GIRLS

S.No.	Initial	Final	Difference
1.	17.5	17.7	0.2
2.	17.2	17.4	0.2
3.	17.3	17.5	0.2
4.	18.0	18.3	0.3
5.	17.9	18.2	0.3
6.	18.0	18.3	0.3
7.	18.5	18.7	0.2
8.	18.0	18.2	0.2

INDIVIDUAL WEIGHTS IN Kg OF 9 YEAR OLD CONTROL GIRLS

S.No.	Initial	Final	Difference
1.	18.5	18.7	0.2
2.	19.0	19.2	0.2
3.	16.5	16.6	0.1
4.	17.5	17.6	0.1
5.	18.9	19.0	0.1
6.	18.8	19.0	0.2

APPENDIX - F

INDIVIDUAL HAEMOGLOBIN LEVELS OF EXPERIMENTAL CHILDREN STUDIED

S.No.	Initial g/100 ml	Final g/100 ml	Difference g/100 ml
1.	8.4	9.07	0.67
2.	8.23	9.75	1.52
3.	9.28	9.95	0.67
4.	7.05	8.56	1.51
5.	9.01	9.8	0.79
6.	7.35	8.65	1.3
7.	8.05	9.73	1.68
8.	7.21	8.59	1.38
9.	7.75	8.92	1.17
10.	8.16	8.46	0.3
11.	8.32	9.67	1.35
12.	9.27	9.53	0.26
13.	8.4	9.6	1.2
14.	8.6	9.8	1.2
15.	8.16	9.6	1.44
16.	9.3	9.5	0.2
17.	9.82	9.9	0.08
18.	8.75	9.8	1.05
19.	8.2	9.3	1.1
20.	8.4	9.5	1.1
21.	8.7	9.8	1.1
22.	8.5	9.0	0.5
23.	8.43	9.0	0.57
24.	8.21	9.02	0.99
25.	7.45	8.6	1.15

INDIVIDUAL HAEMOGLOBIN LEVELS OF CONTROL CHILDREN STUDIED

S.No.	Initial g/100 ml	Final g/100 ml	Difference g/100 ml
1.	8.38	8.5	0.12
2.	8.85	9.0	0.15
3.	9.003	9.2	0.197
4.	8.65	9.0	0.35
5.	8.52	9.0	0.48
6.	8.35	9.1	0.75
7.	8.63	8.75	0.12
8.	8.54	8.9	0.36
9.	8.45	8.6	0.15
10.	9.01	9.2	0.19
11.	9.2	9.3	0.1
12.	8.4	8.5	0.1
13.	9.5	9.7	0.2
14.	8.65	8.8	0.15
15.	8.01	8.2	0.19
16.	8.6	8.7	0.1
17.	8.15	8.3	0.15
18.	9.85	9.9	0.05
19.	9.01	9.2	0.19
20.	9.2	9.4	0.2