EVALUATION OF A LOW COST MEAL IN A SCHOOL LUNCH PROGRAMME

By

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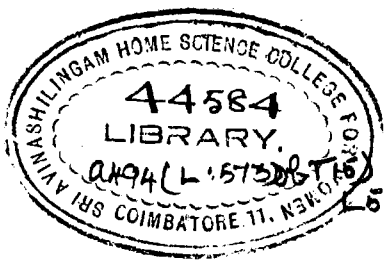

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INTRODUCTION

Children are a mirror of nation and the world itself (Indira Gandhi, 1971). They are the nation's biggest investment for development and hormony. The physical and mental development of today's children determine the prosperity and peace of tomorrow. In fostering the child's physical, mental, social and emotional growth and in helping them to attain maximum stature, good nutrition is of great importance (Devadas, 1968, 1970, and Gopalan, 1973).

Surveys carried out in India have shown that the diet and nutrition of a large segment of the general population is inadequate resulting in nutritional deficiencies (Swaminathan, 1970). Narasinga Rao (1970), Swaminathan (1970) and Vinodini Reddy, (1974) consider malnutrition as the biggest problem affecting public health in India. Gopalan (1969, 1972) warns that the high incidence of protein Calorie malnutrition in India cripples the growth of nation and 30 per cent of preschool children in rural India suffer from nutritional dwarfism.

Food and Agriculture Organisation (FAO) estimates that 10 to 15 per cent of children in the world are undernourished and half of them suffer from Protein Calorie

malnutrition. It is heartening to note that malnutrition has retarded the physical and mental growth of 300 million children in the world (Nutrition Bulletin, 1971 and Marts, 1974).

Studies carried out by the Indian Council of Medical Research (ICMR) reveal that nearly 40 per cent of children under five years of age suffer from malnutrition in India and nearly one million children die every year as a result of severe malnutrition (Report of Task Force on Nutrition, 1972 and Lorstad, 1974). Forty per cent of total deaths in India is in children below five years (Gopalan and Vijayaraghavan, 1971). Sheh et al (1971) record 8.7 per cent of the total deaths in India in the 5 to 14 years age group.

This problem of malnutrition can be overcome only through the general economic and social development of the country and a co-ordinated approach involving agriculture, education, social service and public health (WHO. Chronicle, 1972). The free school meal programme in several parts of India is one of the important measures undertaken to overcome malnutrition among school going children (Gopalan, 1970). Along with regular educational service other needs of children are simultaneously attended through this programme so as to result in a balanced allround development of children.

In India the free school meal service was introduced in Madras City as early as 1925. The midday meal programme in Tamil Nadu alone operates in 31,000 elementary schools, benefiting 18 lakhs of school children (Sundaravadivelu, 1974). United Nation's Children's Fund (UNICEF) and Co-operatives for American Relief Everywhere (CARE) are augmenting the school lunch programme through the contribution of protective foods such as salad oil, corn soya milk and bulgar wheat (Devadas, 1974). The benefical effects of school lunch have been reported through a number of studies by Devadas and co-workers (1964, 1967-1969, 1974). They have used the school lunch as a media for improving the nutritional knowledge, nutritional status and food habits of children.

Originally the Madras Midday Meal Scheme was planned to cost within 10 paise per meal per child. Devadas (1964) reports that the same meal costs more than 25 paise per child per day because of the spiralling rise of prices of foods. Because of lack of funds school authorities in both the urban and the rural areas struggle hard to run the school lunch programme today.

Hence, there is an imperate need to direct our current research towards developing low cost school lunch menus which would reduce the cost and improve the quality of the

meals. A positive solution to this problem will be a great boon to the organisers of school lunch programme in both the rural and urban areas of the country. Swaranpasricha (1973) proclaims that the present problem could be tackled by choosing locally available low cost foods which would suit the local food habits and traditions as well as the economic status of the people.

The present investigation is an attempt in this direction. It explores the feasibility of incorporating inexpensive food items in a school lunch programme and evaluates the same in promoting the nutritional status of the children. In the present study maize, green gram whole and palm jaggery were included in place of rice, red gram dhal and canejaggery respectively in a regular school lunch menu and the modified menu was tested through a school feeding programme over a period of six months.

II. REVIEW OF LITERATURE

The review of literature pertaining to the study on "Evaluation of low cost meal in a school lunch programme" is discussed under the following headings.

A. Prevalence of malnutrition among children,

B. Beneficial effects of school lunch programme,

C. Role of locally available low cost foods in school lunch programme, and

D. Assessment of nutritional status of children.

A. Prevalence of malnutrition among children

Good nutrition and malnutrition are the end results of many interacting factors operating simultaneously and concurrently on the individual in the physical, ecological and cultural environment of the community (Devadas, 1972 and Gopalan, 1973). Sundaram (1973) states that malnutrition can no longer be considered as a microclinical problem. It is a macrosocial one. Malnutrition is the biggest problem in India and is widely prevalent among weaned infants and preschool children (Swaminathan, 1968, 1970; Muralt, 1969; Somakurien, 1969; Narasinga Rao, 1970; Parvathi Rao, 1970; Hanumantha Rao, 1972; Goldsmith, 1972; Aggarwall, 1973; Hegsted, 1973; Annergers, 1973; Vinodini Reddy, 1974; Sipple, 1974 and Common, 1974). Countries

with highest rates of population have the highest rates of infants and preschool children deaths and most serious malnutrition is reported among the low income groups (Gautam, 1973 and Scrimshaw, 1974). Bengoa (1974) points out that world as a whole has about 10,000,000 children at great risk of death. In Asia alone 5,000,000 children are in severe state of malnutrition and 54,000,000 are in moderate state of malnutrition. Forty per cent mortality in India are in children below five years (Gopalan, 1971 and Vijayaraghavan, 1971).

Devadas (1973) and Kallen (1973) indicate that malnutrition prevents children from obtaining their full genetic potential for development. Frisch (1970, 1971) are of opinion that malnutrition causes permanent mental retardation. Malnutrition reduces the life expectancy and decreases the worker's productivity (Berg, A.D., 1968). Malnutrition affects not only the health of children but also their performance in school (Devadas, 1958 and Birch and Gussow, 1970). Tizard (1974) views that good home circumstances help to repair the damage caused by malnutrition in infancy.

A study conducted by Krishnamurthy et al (1973) on animals reveals that the offsprings of monkeys malnourished during pregnancy and lactation suffer severe growth failure

during the neonatal life and early infancy. The picture which was finally developed in the young monkeys resembled very much the clinical features described in marasmic infants and children (Gopalan, 1968). Gopalan and Srikantiah(1973) grade the severity of protein calorie malnutrition according to the extent of growth failure, which is assessed by the deficit of weight for age as compared to normal children. A weight deficit of 11 to 25 per cent is considered as grade I malnutrition, between 26 to 40 per cent grade II and above 40 per cent deficit grade III.

A wide nutrition survey carried out on a large number of preschool children in India discloses that in 90 per cent of them weights and heights are below the 10th percentile value of American children of corresponding ages. According to weight deficit 17 per cent of children are suffering from grade III malnutrition, 55 per cent grade I and II (Gopalan, 1973). Vijayaraghavan (1974) puts forth that nearly 70 per cent of all cases of malnutrition are seen in children of birth order four and above.

Studies reported by the World Health Organization (WHO) reveals that malnutrition is not merely a lack of protein but the result of an interaction between infection and insufficient food (UNICEF News, 1972-1973). Tinagrewal (1973) considers

that an inadequate nutrient intake, disease and maternal deprivation are significant contributing factors for malnutrition.

Malnutrition is associated with weaning, lack of suitable substitutes, failure to use available foods, poverty, ignorance, traditional beliefs and customs (Usha, et al, 1965; Baker, 1969; Merrills, 1970; Devadas 1951; UNICEF News, 1972; Gautam, 1973; Yojana, 1973; Gopalan, 1973; Hegsted, 1973; Mathur et al, 1974 and Sipole, 1974).

In addition to protein calorie malnutrition nutrition surveys reveal a high incidence of vitamin A, thiamine, riboflavin and calcium deficiencies (Alfredo Ornellas, 1973). Blindness caused by vitamin A deficiency is common in southern and eastern parts of India (Bala Subramaniyan, 1970). Someswara Rao (1974) estimates that about 10,000 cases of xerophthalmia occur annually in the Middle East. Ramdasmurthy (1971) reports that large doses of vitamin A given to children at long intervals help to avoid vitamin A deficiency.

Nutritional anaemia is also wide spread in Asia, Twenty per cent of women, 40 per cent of pregnant women and 92 per cent of children under two years of age are suffering from nutritional anaemia. Anaemia leads to many other diseases which affect productivity and contribute to the overall mortality associated with malnutrition (Bengoa, 1974).

A recent survey by the Narasinga Rao (1974) has shown that goitre is prevalent in areas of Marathwada regions in Maharashtra. Addition of iodine to salt is a prophylactic procedure for controlling goitre. Salt enriched with iodine reduced the incidence of goitre from 40 per cent to about 17 per cent.

Mathur et al (1974) estimate that the nutritional disorders prevalent among children in Uttar Pradesh, India are conjunctiva 18.3 per cent, bleeding spongy gums 0.9 per cent, pigeon chest 0.9 per cent and Bitot's spot 4.9 per cent. They also suffer from folic acid and vitamin B_{12} deficiency.

According to Lusaka (1970) National measures to prevent malnutrition are 1. Improving the economical status of people to buy foods. 2. Making available better seeds, fertilizers and knowledge of improved techniques. 3. Improving the level of education so that people can understand the value of what they are taught and 4. Improving the medical facilities. The local measures to prevent malnutrition are 1. Nutrition and health education and 2. Immunization control of worms and malaria.

B. Beneficial effects of school lunch programme

Childhood is an impressionable age and life time food habits are established during those years (Devadas et al, 1973). Recent researches in the field of nutrition indicate

that growing children will be playful and very active, so they need more nutritious food than the normal diets of adults (Vijayaraghavan, 1973).

In schools proper nutrition plays an integral part in the development of an individual with respect to health, well being and success as learner (Report of School Health Committee, 1961; Swaminathan, 1970; Richard, 1974).

In the efforts to overcome the nutritional deficiencies among children of school going age, school lunch programme plays an important role. It aims towards making available nutritious meals to school children. An ideal school lunch provides atleast 1/3 or more of the daily calorie and nutrient requirements.

Generally all over India the lunches brought by children from homes to the schools mainly are cereal preparations. They are deficient in proteins, vitamins and minerals (Devadas, et al, 1964). Poorly fed children find it difficult to study, work and play. Hence the burden of caring for the child's nutritional status has been placed on school (Richard, 1972). School feeding programme helps the children to grow at a faster rate than other children of the same age (Richard, 1972). Longitudinal records maintained by Devadas (1972) over a period of five years show that the children participating in the school lunch programme have better nutritional status than the group not

participating in the programme. They have also used the school lunch as a media to improve the nutritional knowledge of the children.

The physical, mental and social outcomes of school feeding programme have been established through several studies by Devadas and co-workers, (1964, 1969-1972). Sundaravadivelu (1970) states that the children learn the importance of food habits and appreciate their relationship to growth and wellbeing through their participation in the school lunch programme. Devadas (1959) states that the pupils participating in school lunch programme appreciate good nutrition in daily life and develop desirable eating habits through the selection of inexpensive but nutritious foods. Moreover it makes the children more sociable, handle foods sanitarily, share responsibilities, and establish good human relationship (Devadas, 1959, 1964). The human touch along with nutrition education has fostered allround social, cultural, emotional, spiritual and educational development of children (USDA, 1947). Bander (1974) adds that school lunch helps to meet friends, discuss business and develop Interpersonal Relationships with peers.

Johnston (1968) explains that in the eating learning situations in the school, provision of an affectionate atmosphere makes children healthy and happy. The school lunch programme improves the attendance and class performance of

children because the free meal encourages the poor children to goto school. Devadas et al (1968) report that the dropouts among children who participate in the school lunch programme is significantly lower than children not participating in the school lunch. Apart from all these benefits school lunch programme also improves the nutritional knowledge of the parents through the effective carry home message of the children.

While the objectives of the school lunch programmes are sound, as Devadas (1972) points out ~~that~~ there are numerous problems in fulfilling them. The crucial gaps in the school lunch programme are its isolation from nutrition education and absence of evaluation. A chain of dedicated and nutritionally oriented teachers are required from the village to national levels to implement and evaluate school lunch programmes with educational orientation.

C. Role of locally available foods in school lunch programme:

There is urgent need to develop low cost protein rich foods to supplement the nutritionally inadequate diets. Several attempts have been made by several workers to develop the production of low cost protein enriched cereals, oil seeds and legumes (Desai et al, 1970 and Thorn, J., 1974). Several nutritional recipes based on inexpensive locally available foods, involving minimal

processings, have been developed by the NIN, CFTRI and other centres working under the auspices of ICMR (Ministry of Health, 1961 and Gopalan, 1973). Devadas, (1967) stresses that efforts need to be on global and national scale to make available at little or no cost, more food to the masses through evolution of new species. Locally available foods in supplementary feeding programmes introduce an element of self-generation. Locally available foods are familiar foods and acceptable, because they fit in with the local food habits and traditions as well as the economic status of the people (Swaranpasricha, 1972). Swaminathan et al (1970) consider that the locally available and inexpensive foods in proper combinations will help to solve the protein calorie malnutrition.

Rajalakshmi et al (1974) have used locally available foods as supplements to preschool children and observed an increase in height and weight over a period of six months in the experimental group than the control group. Devadas et al (1974) have evaluated the efficacy of a low cost indigenous food supplement in school lunch. The selected low cost foods were maize, green gram and soya mixture.

Rama Rao et al (1970) report that Neera (Palm juice) is a nutritious supplement to diets which are deficient in iron, ascorbic acid and the B complex vitamins. Venkataswamy

(1957) has studied the efficacy of Neera in curing aribo-flavinosis.

A study conducted by Gopalan et al (1974) with 415 children of one to five years age on the supplementation of locally available foods to the diets of preschool children. The study revealed that with a daily supplement of 300 Kcal and 3 g. of protein, the children gained 0.5 kg. more than the unsupplemented group over a period of 14 months period.

Devadas et al (1959) have also studied the effect of neera in school lunch. There was an increase in the haemoglobin level in the group who received neera.

Sukhatme (1972) suggests the production of semi conventional, inexpensive and locally available protein rich foods as a good measure for alleviating protein malnutrition. A study was conducted by Devadas et al (1968) to assess the difference between the effects of incorporating skimmilk alone and its combination with multipurpose food in a school lunch over a period of six months. The nutritional status of school lunch group was higher than that of the non-school lunch group. Devadas et al (1970) observe significant improvements in the nutritional status of children receiving greens in the school lunch programme when compared with a comparable control group not receiving the school lunch.

Development of high yielding strains of food grains and increasing their production has become our major approach towards achieving self sufficiency in food. It is not going to be possible to attain self-sufficiency and improve the nutritional status of our population through the production of animal foods alone since they are scarce and expensive. In this situation, introduction of the high yielding varieties of grains in the dietaries, will help to face the situation.

Maize is an important food crop in India and widely cultivated as a Kharif Crop (Joginder Singh, 1974, Sharma et al 1972). Several hybrid varieties are popular among farmers. In Jamaica, maize meal is the stable food of the weaning diet (Ann Ashworth et al, 1973). About a dozen hybrids have been developed and released by the co-ordinated maize breeding scheme. The total protein content and the quality of the protein have also been satisfactory and it is widely being studied in several types of feeding programme. Such cereals and other inexpensive foods should be used widely in our feeding programme and the effect should be studied.

D. Assessment of nutritional status

Good nutritional status implies good health whereas bad nutritional status implies malnutrition and bad health (Darke, 1972).

Accurate assessments of nutritional needs and deficiencies have never been easy and always require the exercise of considerable judgement (Jelliffe, 1966 and Swaminathan, 1969). The methods for assessing the nutritional status of population in groups are food balance sheet, crop calenders, examination of food prices, food habits, food customs, food taboos and prejudices, morbidity and mortality rates, antheropometric, biochemical and other laboratory investigations, clinical assessment, vital statistics and dietary surveys (Annergers, 1973).

The pattern of growth and the physical state of the body though genetically determined are influenced by diet and nutrition (FAO/WHO Expert Committee, 1963). Beaton and McHenry (1966) opine that the nutritional status of a population is influenced by socioeconomic data, food production, consumption, education, economics, social moves, agriculture, transportation and infections.

Anthropometric measurements

Jelliffe (1970) and Garn (1973) view anthropometric measurements as valuable, since they are objective needing simple and relatively cheap apparatus. According to Swaminathan (1969) and Eunice Romerode (1974) nutritional anthropometry provide the best tool for the assessment of malnutrition.

Anthropometric measurements include height, weight, arm circumference, chest circumference and skinfold test (WHO, 1963; FAO, 1965; Waterson, 1967; Ramachandran et al, 1968; Rao et al, 1969; Trivedi et al 1971, Melaren, 1970; Davis, 1971; Fryer et al, 1972; Foods and Nutrition Notes and Reviews, 1973 and Gowrinath, 1974). According to Jaime Ariza (1973) the comparison of the growth of population groups provides an indirect evaluation of the ecologic environment in which they develop.

Swaminathan (1969) points out that the weight is the simplest method. The growth relation affects weight more markedly than height. Garn et al (1973) state that the standing height is the most used measure of nutritional status during the growing period. It is more sensitive.

Clinical assessment

Clinical examination is the most essential part of all nutritional surveys. The numerous signs and symptoms of dietary deficiencies have been classified by several scientists. (Jelliffe, 1962).

Clinical examinations

The Joint FAO/WHO Expert Committee (1950) holds that Clinical Examination of population's will give an indication of the nutritional status of the whole population. The WHO (1963) considers that the clinical examination is an

essential aspect of all nutritional surveys. Latham (1965) states that the clinical examination is the simplest and most practical method of ascertaining the nutritional status.

Martin (1954) emphasises that clinical assessment cannot be relied upon as the sole criterion of nutritional status. Goldsmith (1959) and Watkin (1962) caution that although the physical examinations are useful, laboratory procedures may be needed to substantiate diagnosis. Mitchell (1964) warns that a nutritional limitation may affect nutritional status without causing clinical symptoms.

Bio-chemical measurements

Biochemical method reflect the dietary intake (Davidson and Passmore, 1973). Bio-chemical measurements are of little value since they can show only that the subject is below average rather than below normal (Bender, 1974). According to Elwood (1973) values of biochemical or hematological variates that are lower than average or lower than an arbitarily chosen lower limit of normal cannot be considered valid evidence of pathological deficiency.

Diet surveys

This attempts to assess the total food supply of a whole nation or large community. Rutishauser, (1973) reports that even a small amount of weighed intake infor-

mation is bound to be of more value than any other method of assessment.

According to Marr (1973) it is difficult to determine the error involved in this method. One day weighment gives 55 per cent correct value and three day weighment gives 80 per cent correct information. Most of the surveys are dietary surveys usuallymade by five or seven day records of food consumption (Stordy, 1973). Black (1973) views that seven day wighment can be used as the Sunday food intake may differ considerably from the week day's intake.

Rao (1964) putsforth that a three day weighment method, along with socio-economic and dietary surveys give a complete picture about the family background. To be more accurate and specific 1/10th of the food sample should be drawn and analysed (Hawk, 1964; Manual for Nutrition Surveys, 1968 and Black, 1973).

III EXPERIMENTAL PROCEDURE

The Experimental Procedure pertaining to the study on "The evaluation of a low cost meal in a school lunch programme" consisted of the following steps.

A. Selection of the school and the subjects,

B. Selection of low cost substitutes,

C. Formulation and standardisation of school lunch menu and

D. Conduct and evaluation of the school lunch.

A. Selection of the school and the subjects

Sri Avinashilingam Junior Basic School was selected for the study for the following reasons:

A well organised school lunch programme under the Tamil Nadu Midday Meal Scheme is in operation in that School.

It is in close proximity to the college and there is good co-operation from the school authorities, school teachers and the children.

Initially height, weight and blood haemoglobin level of all the school children were measured and clinical assessment was carried out for all the children with the help of a trained physician. One hundred and twenty children who were regularly participating in the school lunch programme were divided into two comparable groups of 60 children each based on their age, initial height, weight, blood haemoglobin level and their socio-economic status. The two experimental groups

were designated as group A and group B. Another comparable group of 60 children(group C) who are not participating in the school lunch programme but had similar mean initial age, height, weight and blood haemoglobin level were selected as the control group. The mean initial heights, weights and blood haemoglobin level of the three groups of children selected are presented in Table I.

TABLE I

MEAN INITIAL AGE, HEIGHT, WEIGHT AND HAEMOGLOBIN LEVEL OF THE SELECTED CHILDREN

Group	Age yrs.months.	Height cm.	Weight kg.	Haemoglobin level g/100ml blood
A	7.7	115.0	18.4	10.0
B	7.9	114.7	18.3	9.8
C	7.4	115.6	18.9	9.9

B. Selection of low cost substitutes

In the existing school lunch programme food contributions from CARE namely bulgar wheat, Corn Soya Milk (CSM) and salad oil are being used substantially. Rice is included as the main cereal on the alternate days when CARE supplement namely bulgar wheat is not included. Today the cost of rice has gone up to Rs. 4.21/kg. and at the same time it is not available easily. The present

study was planned to partially substitute maize in place of rice because maize is a widely available cereal both in rural and urban areas. The cost of one kg. maize is only Rs. 2.00.

Deccan variety of hybrid maize was selected for the substitution as this variety is superior both in nutritive value and acceptability when compared to the white varieties of maize (Devadas et al, 1970).

Since a complete switch over to maize may not be a welcome change for children who are more used to rice, the present study was planned to combine maize with rice in a more acceptable proportion. To find out a suitable combination, rice and maize were mixed in 1:1, 1:2 and 1:3 proportions and a commonly known cereal preparation "Pongal" was prepared and the acceptability tested through children. Since all the three combinations were found to be acceptable rice and maize in 1:3 proportion was selected for this study.

Red gram dhal is being used in the existing programme. It is given in the form of Kootu with greens. The present study aimed at including green gram whole in place of red gram dhal due to its inexpensiveness. The cost of green gram whole (Rs. 3/kg) is lesser than the cost of redgram dhal (Rs. 4.20/kg). At the same time the calorie and protein contribution by the two pulses do not differ appreciably. Moreover in the traditional preparation of 'Pongal' green gram dhal goes well with the preparation.

The present study was planned to include palm jaggery in place of cane jaggery because of its inexpensiveness. The price of 1 kg. cane jaggery is Rs. 2.40 whereas palm jaggery costs only Rs. 1.80 per kg.

C. Formulation and standardisation of school lunch menu:

Formulation of the menu

Children in the group A received the regular school lunch menu (Menu A) whereas children in group B received the modified menu (Menu B), where low cost locally available foods namely maize, green gram whole and palm jaggery were incorporated in place of rice, red gram dhal and cane jaggery respectively. The children in group C did not participate in the programme. The weekly menu for both the groups are presented in Table II.

TABLE II

SCHOOL LUNCH MENUS

Days	Menu A	Menu B
Monday, Wednesday and Friday	Bulgar wheat uppuma Greens Kootu with red gram dhal. CSM payasam Tomato/ Papaya.	Bulgar wheat uppuma Greens Kootu with red gram dhal CSM payasam Tomato/papaya
Tuesday	Tamarined rice, Greens Kootu with red gram dhal, CSM Payasam, Tomato/ papaya	Maize and rice Pongal, Greens Poriyal, CSM payasam, Tomato/papaya.
Thursday	Dhalrice, Greens Kootu with red gram dhal, CSM Payasam, Tomato/Papaya.	Maize and rice pongal, Greens poriyal, CSM Payasam, Tomato/papaya.
Saturday	Lime rice, Greens Kootu with red gram dhal, CSM payasam, Tomato/papaya.	Maize and rice pongal, Greens poriyal, CSM payasam, Tomato/papaya.

The menu for group B was planned in such a manner that it was close to the usual pattern followed. There was variety in the week's menu for both the groups.

Quantities and cost of foods included in the menus:

Table III presents the amount of foods used in the lunch and the cost of meal per head per day.

TABLE III

QUANTITIES AND COST* OF FOODS USED IN MENUS - A AND B

Food	Menu A		Menu B	
	Amount g.	Cost Ps.	Amount g.	Cost Ps.
Bulgarwheat	80	Free from CARE	80	Free from CARE
or				
Rice	80	33.6	20	8.4
Maize	--	--	60	12.0
Red gram dhal	10	4.2	--	--
Green gram dhal	--	--	10	3.0
Greens	50	Free from garden	50	Free from garden
CSM	25	Free from CARE	25	Free from CARE
Jaggery	20	4.8	20	3.6
Tomato	20	0.7	20	0.7
Total		43.3		27.7

*The cost was calculated according to the price levels in Coimbatore Supermarket during January, 1975.

It is clear that the cost of menu B was definitely cheaper than that of Menu A. being Ps./15.5 head/day. This difference was due to the substitution of low cost foods in place of expensive foods in the menu.

Nutritive value of the school lunch menus:

Table IV presents the energy and nutrient contribution of the planned menus in comparison with that of the 1/3 recommended allowances of the ICMR (1971). The details of the calculation are presented in Appendix A.

TABLE IV

ENERGY AND NUTRIENT CONTRIBUTION OF THE SCHOOL LUNCH MENUS

Group	Calories	Protein g.	Calcium mg.	Iron mg.	Carotene ug.	Thiamine mg.	Riboflavin mg.	Ascorbic acid mg.
Menu A	601	14.1	275.5	18.3	2607	1.2	0.6	54.6
Menu B	600	15.2	288.8	17.3	2912	1.3	0.6	54.8
1/3 Recommended Allowance ICMR(1971)	600	10.5	134-167	5-7	333	0200	0.23	10-27

In both the menus the nutrient supply was adequate when compared to the recommended allowances for this age group.

Standardisation of the menue

Any new product however good it may be from the economic and nutritional stand points needs to be accepted by the individual consumer and the community at large

(Devadas, 1967). Standardisation is an effective means of control over quantity and quality. Hence for every recipe, the raw ingredients used and the cooked preparation were weighed and standardised in terms of volumes at the beginning of the experiment. These measurements were followed strictly throughout the experimental period. The individual servings were also standardised in terms of spoons and cups to facilitate serving.

D. Conduct and evaluation of the school lunch

Lunch was served for six days in a week. Group A and B were seated separately in two rooms and served menus A and B respectively. For those who needed more food the cereal preparation alone was served in the second and subsequent servings. Extra servings, plate waste and the daily attendance were recorded regularly.

Nutrition education was a regular feature of the lunch programme. Nutrition education was given informally to children through lectures, posters, charts and songs. The children were made to participate in the school garden and and the produce were used in the lunch preparation. The school lunch was evaluated through

Diet surveys,
Anthropometric measurements,
Biochemical evaluation and
Clinical assessments.

Diet surveys:

To find out the nutrient intake of children through home diet, food intake survey was carried out on five randomly selected children from all the three groups for three consecutive days. One tenth of the food consumed by the subjects was collected from their homes. The whole day's collection was homogenised and analysed for vitamin C on the same day (Hawk, et al, 1964). The food was preserved in the refrigerator. At the end of three days the collections were pooled and aliquotes were analysed for protein, calcium, and iron using the methods of Hawk et al (1964). Fifty grams of pooled sample was dried in an oven for constant weight and the energy value of the diet was estimated using the Parr Oxygen Bomb Calorimeter.

Anthropometric measurements

Monthly heights of all the children in the three groups were measured using a steadiometer to the nearest 0.5 cm. Weight was measured every month for all the children using a beam balance to the nearest 0.05 kg. Both heights and weights were measured throughout the experimental period of six months.

Bio-chemical evaluation

Finger prick blood was drawn from the subjects to determine the blood haemoglobin levels. Blood haemoglobin level of all the 180 children were estimated once in a month for a period of six months using the cyanmet-haemoglobin method as given by Varely (1968).

Clinical assessment

A clinical examination of all the children was carried out both at the beginning and end of the study with the help of a trained physician using the ICMR clinical schedule. This was done to ensure the normal health of the children.

IV. RESULTS AND DISCUSSION

The results of this investigation on "Evaluation of a low-cost meal in a school lunch programme" are presented and discussed under the following headings:

A. Nutrient intake of the children

B. Nutritional status of the children

1. Anthropometric measurements
2. Biochemical changes

and 3. Clinical picture

and C. Cost analysis

A. Nutrient intake of the children

Five children were randomly selected from each of the three groups and the food intake survey was carried out. The nutrient intake of the children as analysed in the laboratory is presented in Table V.

TABLE V

MEAN DAILY NUTRIENT INTAKE OF THE THREE GROUPS OF CHILDREN

Group	Calories			Protein(g)			Calcium(mg)			Iron(mg)			Ascorbic acid(mg)		
	H.D.	S.L.	Total	H.D.	S.L.	Total	H.D.	S.L.	Total	H.D.	S.L.	Total	H.D.	S.L.	Total
A	1086	593	1679	21.6	12.0	33.6	238	210	448	6.2	14.2	20.4	9.1	13.3	22.4
B	1069	578	1647	22.0	12.5	34.5	212	224	436	8.2	12.1	20.3	8.2	15.1	23.3
C	1343	--	1343	25.8	--	25.8	218	--	218	10.1	--	10.1	17.0	--	17.0
ICMR Recommended allowances			1800			22-41			400-500			15-20			30-50

H.D. - Home diet
S.L. - School lunch

The nutrient intake through the home diets was almost identical in all the three groups of children. This may be due to the similar socio-economic background of the children. It may be noted that the mean initial age was also similar among the three groups.

Calories

The mean caloric content of the home diets of children in groups A and B were 1086 and 1069 respectively. The school lunch contributed 593 Calories for group A and 578 Calories for group B. On an average school lunch contributed 35 per cent of the total calorie intake of the children. Due to this significant contribution by the school lunch programme children in groups A and B could meet upto 92.4 per cent of their daily calorie requirement. The nutrient supply through the school lunch was slightly varying for both the experimental groups. This was mainly due to the slight difference in the menus and the second serving of cereal preparation given to those who were in need. Children in group C received the lowest quantity of Calories namely 1343/day which fulfils only 74.6 per cent of their daily requirement.

Protein

Children in all the three groups received adequate quantity of protein when compared with the ICMR recommended allowance. Children in groups A and B received 22 g. of

protein through the home lunch alone. When the supply through the school lunch was added the daily consumption went up to 33.6 and 34.5g. respectively for groups A and B. Children in the control group received 25.8 g. protein through the home diet. Though this was adequate for this age group, it was lesser than the experimental groups.The results showing the deficit of calories and surplus of protein in the diets consumed by the children of this age group are in agreement with the reports of the Tamil Nadu Nutrition Project (1973).

Calcium

Children in group A and B received 238 and 212 mg. of calcium respectively through the home diets and 210 and 224 mg. respectively through the school lunch. The food contribution of calcium through the school lunch is mainly due to 50 g. of greens supplied per head/day. On an average, school lunch alone supplied 49 per cent of the total calcium intake of the children. Children in Group C received only 218 mg. of calcium including the home lunch. The poor intake of calcium by the control group may be due to the inadequate consumption of green leafy vegetables by those children. It may be recalled that the children receiving the school lunch were given nutrition education as a regular feature which might have influenced the food practices of the parents. Except children in control group the others received adequate quantity of calcium through their diets.

Iron

Children in group A and B received 14.2 and 12.1 mg. of iron respectively through the school lunch alone. It was a considerable quantity when compared with 15 to 20 mg. of daily requirement recommended by the ICMR (1971). This again was mainly due to 50 g. of greens supplied by the school lunch. The home diet supplied 6.2 and 8.2 mg. of iron respectively for children in groups A and B. Children in the control group were found to receive 10.1 mg. of iron which was lower than their daily requirement.

Ascorbic acid

The mean ascorbic acid content of the home diets of children in groups A and B were 9.1 and 8.2 mg. respectively. This could supply only around 20 per cent of their daily requirement. Because of the supply of a fruit and greens, the children in groups A and B received 13.3 and 15.1 mg. of ascorbic acid respectively through the school lunch. Inspite of that, children received inadequate quantity of ascorbic acid. Children in the control group received the lowest quantity of ascorbic acid being 17.0 mg.

Although the calculated value of the ascorbic acid is 55 mg. for the school lunch, on analysis the menu

contained only about 15 mg. of ascorbic acid. This may be due to the cooking losses of ascorbic acid.

B. Nutritional status of children

1. Anthropometric measurements

The anthropometric measurements considered for this investigation were increments in heights and weights of children. The mean height increases of the children in three different groups over a period of six months is presented in Table VI and Fig. 1 with the individual values in Appendix B.

TABLE VI

MEAN INCREASE IN HEIGHTS OF CHILDREN IN THE THREE GROUPS

Group	Heights in Cm.			Groups compared	't' value
	Initial	Final	Increase		
A	115.0±10.70	118.8±14.30	3.8± 0.60	A Vs B	0.13
B	114.7±10.25	118.1±14.57	3.4±0.44	B Vs C	2.1*
C	115.6± 7.20	117.9±7.79	2.3 ± 1.64	C Vs A	5.5**

** Significant at one per cent level.

* Significant at five per cent level.

THE TREND IN HEIGHT INCREASES OF CHILDREN IN THE THREE GROUPS

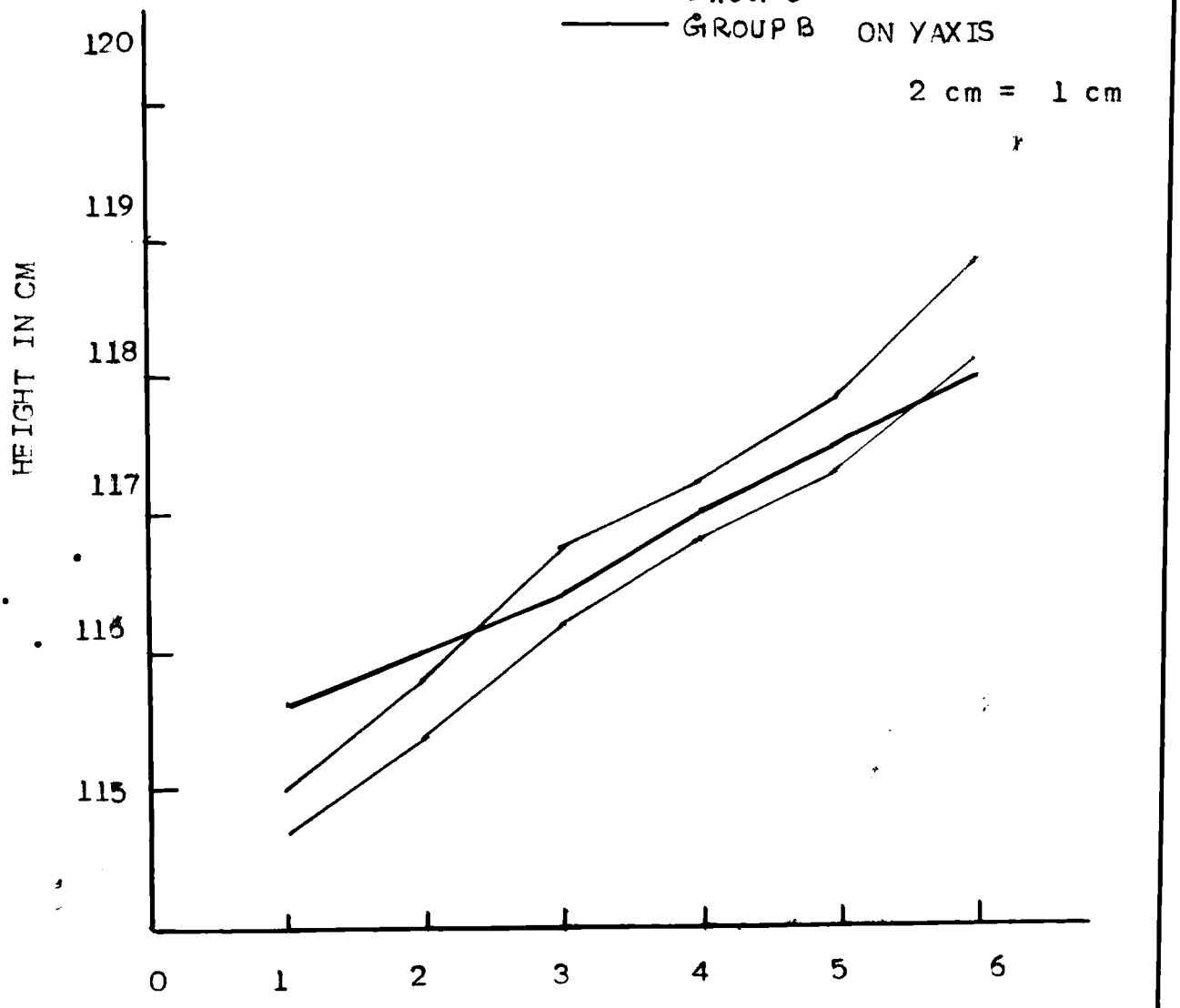

Fig. 1

The children in all the three groups recorded increases in heights during the experimental period. However a greater increase namely 3.8 cm. was evinced by the children in group A. Children in group B registered 3.4 cm. increase whereas the children in the control group recorded the lowest increase namely 2.3 c.m. The difference between the increases in heights of the two experimental groups were not statistically significant. It may be recalled that the nutrient intake of the children in these two groups were almost identical. The results reveal that the changes effected through the inclusion of low cost foods in the school lunch menu were identical with that of the normal school lunch. Thereby they prove the efficacy of the low cost menu in promoting the nutritional status of the children.

The contributions of the school lunch were undoubtedly greater than the control group. The mean height increment of group A was significantly greater than that of the control group at one per cent level and that of group B over C was significantly greater at five per cent level. This finding supports that view of several studies conducted by Devadas and Co-workers (1964, 1967, 1969-1972).

The weight changes observed in three groups during the study period are presented in Table VII and Fig. 2. with the individual values in Appendix C.

TABLE VII

MEAN INCREASE IN WEIGHTS OF CHILDREN IN THE THREE GROUPS

Group	Weight in kg.			Groups compared	't' value
	Initial	Final	Increase		
A	18.47±3.60	20.43±3.55	1.96±0.47	A Vs B	0.64
B	18.35±3.55	20.05±3.50	1.70±0.65	B Vs C	2.00*
C	18.94±3.16	19.94±3.60	1.00±0.57	C Vs A	2.45**

** Significant at one per cent level
* Significant at five per cent level

THE TREND IN WEIGHT INCREASES OF CHILDREN IN THE THREE GROUPS

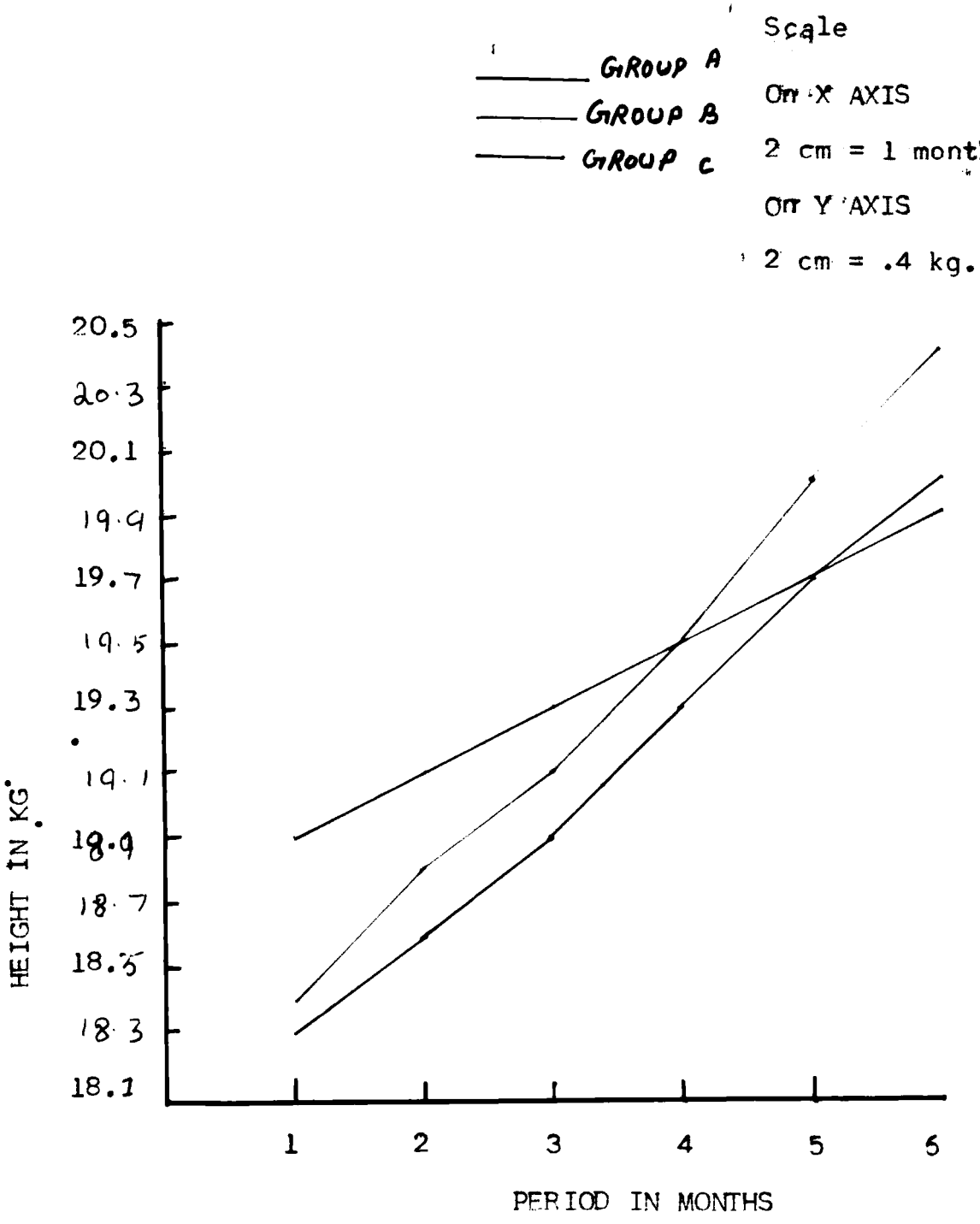

Fig. 2

All the children in the three groups evinced increments in weight over a period of six months. The mean weight increases of the children in groups A, B and C were 1.96, 1.70 and 1.00 kg. respectively. The increments observed are in accordance with the values reported by the NIN (1971). The difference in the increases in weights between the groups A and B was not statistically significant whereas the difference between the experimental group A and the control groupwas significant at one per cent level. The difference between the group B and the control group was significant at five per cent level.

Haemoglobin levels

The changes observed in the blood haemoglobin levels of children in the study are presented in Table VIII and Fig. 3. with the individual values tabulated in Appendix D.

TABLE VIII

MEAN INCREASE IN BLOOD HAEMOGLOBIN LEVELS OF CHILDREN IN THE THREE GROUPS

Group	Blood haemoglobin level (g/100 ml)				't' value
	Initial	Final	Increase	Groups compared	
A	10.0±1.38	10.8±1.34	0.8±0.12	A Vs B	No difference
B	9.8±1.40	10.6±2.00	0.8±0.34	B Vs C	3.0**
C	9.9±2.41	10.3±1.66	0.4±0.12	C Vs A	8.0**

** Significant at one per cent level.

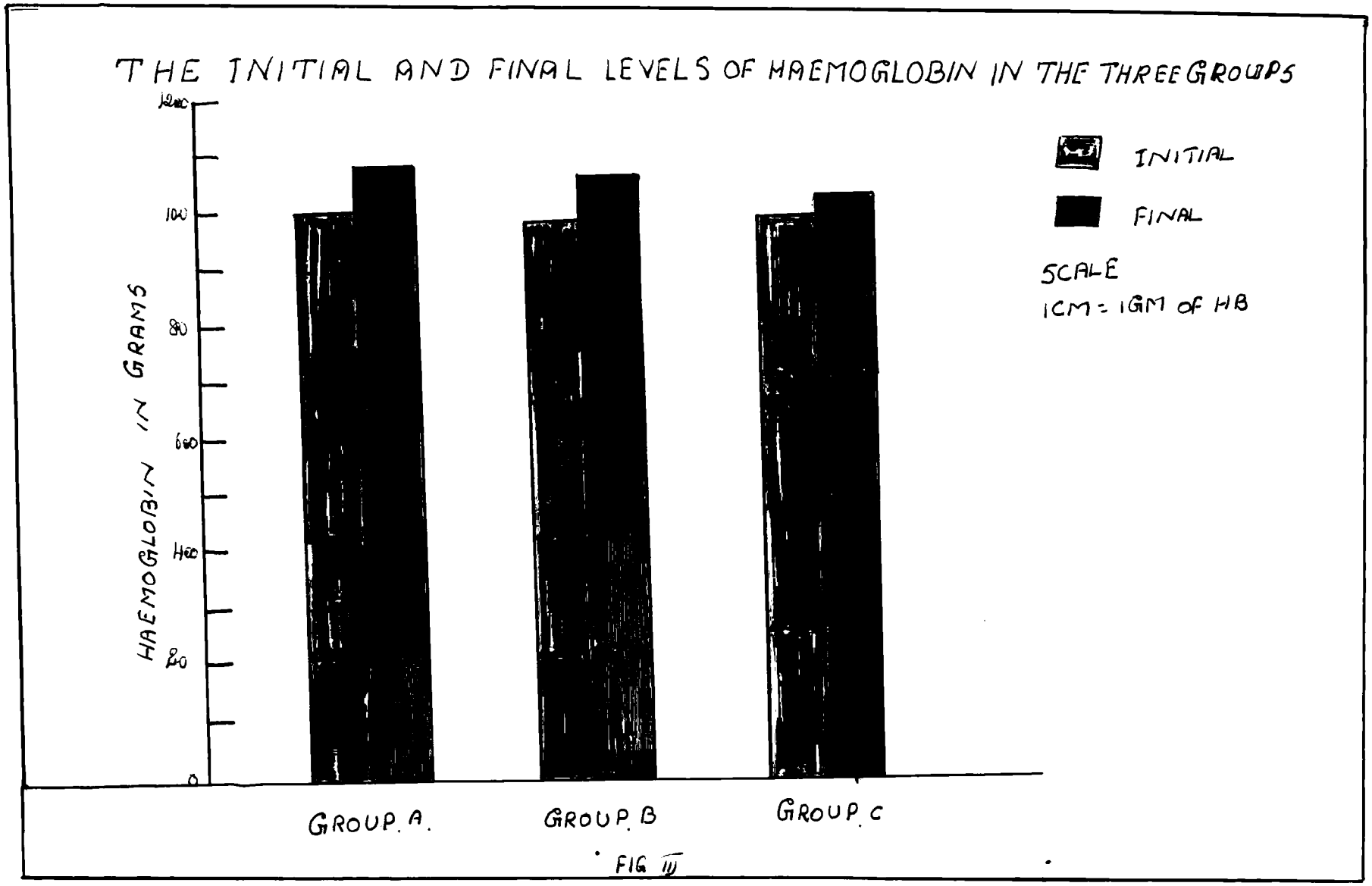
THE INITIAL AND FINAL LEVELS OF HAEMOGLOBIN IN THE THREE GROUPS
HAEMOGLOBIN IN GRAMS
100
80
60
40
0
INITIAL
FINAL
SCALE
1CM = 1GM OF HB
GROUP. A.
GROUP. B
GROUP. C

FIG III

In general there was an improvement in the blood picture of all the children with the mean increments of 0.8, 0.8 and 0.4 g/100 ml respectively for groups A, B and C. Between the two experimental groups there was no difference at all in the increases in blood haemoglobin levels. A lowest increase was registered by the control group which was significantly lower than the two experimental groups at one per cent level.

Clinical picture

A clinical examination was carried out for all the children at the beginning and at the end of the study to ensure that all the subjects were normal during the study period. The results of the study were presented in the Table IX.

TABLE IX

INITIAL AND FINAL CLINICAL PICTURE OF THE CHILDREN IN THE THREE GROUPS

Symptoms	Group A		Group B		Group C	
	Initial %	Final %	Initial %	Final %	Initial %	Final %
Angular stomatitis	16.6	8.3	13.3	5.0	20.0	15.0
Bleeding gums	8.3	4.2	10.0	4.2	5.6	4.2
Dull and dry hair	8.2	0	5.0	0	8.3	5.0
Dry and rough skin	10.0	3.3	8.3	5.0	10.0	8.2
Dental caries	20.0	13.3	15.6	13.3	20.0	15.6

A few cases of deficiency were observed initially among all the children. The children in both the experimental groups showed improvements towards the end of the study. The clinical symptioms namely angular stomatitis, bleeding gums, dry hair and rough skin were disappeared to a larger extent when compared with dental caries. However the improvements were not marked in the control group for any of the symotoms.

C. Cost analysis

Inclusion of maize, green gram and palm jaggery in school lunch programme was found to be as effective as the normal school lunch with rice, redgram dhal and cane jaggery in promoting the health of the children. At the same time when the price levels of both the menus were considered, menu A costs 43.3 ps/child/day whereas menu B with the low cost foods costs only 27.7 ps/child/day. Thus the menu B could save Rs. 9.35 for 50 children per day.

If the newly formulated menu alone is used for all the children it will definitely be economical and nutritionally beneficial in the long run.

V SUMMARY AND CONCLUSION

This investigation pertains to the "Evaluation of a low-cost meal in a school lunch programme". Maize, green gram and palm jaggery were used in place of rice, red gram dhal and cane jaggery in a school lunch programme and the growth promoting value of the low cost menu was tested on the children for a period of six months.

Two groups of sixty children (Group A and B) of six to ten years age, participating in the school lunch programme and with a similar mean initial height, weight, blood haemoglobin level and age were selected from Sri Avinashilingam Junior Basic School as the experimental groups. A comparable group of sixty children (Group C) who were not participating in the school lunch programme formed the control.

The school lunch was planned to provide one third of the recommended nutrient allowances. Group A received the normal school lunch, whereas group B received the modified menu. Nutrient intake of the children, anthropometric measurements, blood haemoglobin level and clinical picture were used as the criteria for evaluation.

The results revealed the following:

1. The home diets were almost similar in all the three groups and deficient in all the nutrients except proteins. Children participating in the lunch programme received a greater supply of all the nutrients mainly because of an adequate lunch provided to them by the school. Inspite of the good school lunch, children in group A received only 1579 calories and children in group B received only 1647 calories per day.

2. Children in all the three groups registered increments in heights and weights over a period of six months. Though the children in group A stood first in both heights and weights, the differences between the two experimental groups were not statistically significant. But the mean height and weight increments of control group were significantly lower than both the experimental groups.

3. Similar mean increases in the blood haemoglobin level were observed in both the experimental groups. The lowest increase registered by the control group was significant when compared with the two experimental groups .

4. There was a noticeable improvement in the clinical picture of the children in the experimental groups towards the end of the study.

5. The cost of the menu A was 43.3 ps/child/day whereas the cost of menu B was only 2?.7 ps/child/day. Hence the newly formulated menu had resulted in a considerably great economical benefit.

Further efforts are needed to evolve and popularise such low cost menus to suit both the urban and the rural areas according to their local problems. Such low cost menus can pave way to self-reliance, acceptance of high yielding varieties of cereals and utilisation of locally available foods. If such menus are widely popularised, it will be greatly helpful to the school authorities to conduct the school lunch programme non-stoppingly.

BIBLIOGRAPHY

Aggarwal, R.C. (1973) "Child welfare today and tomorrow". Yojana, Vol. 17, No. 12, p. 502.

Alfredo Ornellas, (1973), "Infant nutrition problems", Nutrition, Vol. 27, No. 5, p. 316.

Annergers, I.E. (1973) "The protein calorie ratio of west African diets and their relationships to protein calorie malnutrition". Ecology of food and Nutrition, Vol. 2, No. 2, pp. 225.

Ann Ashworth, Milner, P.F. and Water low, J.C.(1973) "Absorption of iron from maize and soya beans in Jamaican infants". The British Journal of Nutrition, Vol. 29, No. 2, p. 269.

Balasubramanian, S.C. (1970) "Nutrition programme for Children". Nutrition, Vol. 4, No. 3, p. 2.

Balasubramanian, S.C. (1971) "Battle against blindness". Nutrition, Vol. 5, No. 1, p. 21.

Baker, S.J.S.M., Pereira, L., and Begum, A. (1969). "Failure of vitamin E therapy in the treatment of anaemia of protein calorie malnutrition". Blood, 32, p. 719.

Bander, D.K. (1974) "School lunch is just food". School Food Service Journal, Vol. 28, No. 126, p.45.

Birch Herbert, Gussow and Joandye, (1970). Disadvanced Childrens health nutrition and school failure. New York, HorCourt, Brace and World, Inc.

Black, A.E., (1973), "Measuring dietary intake in preschool children", Nutrition, Vol. 27, No. 4, p. 245.

Beaton, G.H. and McHenry, E.W. (1966) "Assessment of Nutritional status". Nutrition, Academic Press, New York, London, Vol. 3, p. 265.

Berg, A.D. (1968), "Malnutrition and national development". Journal of Nutrition and Dietetics, Vol. 5, No. 1, p. 1.

Bengoa, J.M., (1974) "The problem of malnutrition". WHO Chronicle, Vol. 28, no. 1, p.37.

Bender, A.E. (1974) "Nutritional status of school children". The Proceedings of the Nutrition Society, Vol. 33, No. 1, p. 45.

Bengoa, J. (1974) "Hunger and Malnutrition". World Health, February - March, p. 4.

Darke, J. (1972) "The present state of knowledge about the nutritional status of children in Britain". British Journal of Nutrition, p. 24.

Davis, L.E. (1971) "Ecology of famine in the Nigeria Crises-rapid evaluation of malnutrition by arm circumferences in nutrition evaluation", American Journal of Clinical Nutrition, Vol. 24, No. 3, p. 359.

Davidson, S., Passmore, R., and Brock, J.F. (1973) "Assessment of Nutritional Status". Human Nutrition and Dietetics. Fifth Edition, p. 467.

Desai, B.L.M., Daniel, V.A., Venkat Rao, S., Swaminathan, M. and Parpia, H.A.B. (1970) "Studies on low-cost balanced foods suitable for feeding weaned infants in developing countries. II Supplementary value of low cost balanced foods based on cereals, cotton seed or peanut flour and Bengal gram flour to poor Indian diets". The Indian Journal of Nutrition and Dietetics, Vol. 7, No. 1, p.21.

Devadas, R.P. (1959). "The School Lunch Programme - Organisation and Outcomes". Ministry of Education, p. 1.

Devadas, R.P. and Ratharukmani, A.(1964) "The effects of a nutritionally balanced school lunch on the growth and nutritional status of school children". Journal of Nutrition and Dietetics, Vol. 1, No. 1, p. 28.

Devadas, R.P., Kamala Anandam, and Lakshmi Bhanumathi, (1967) "Effects of school lunch with Indian multipurpose food skimmilk powder or other combinations on the nutritional status of children". The Indian Journal of Nutrition and Dietetics, Vol. 4, No. 1, p. 51.

Devadas, R.P., Kanchanamala, M. and Chandramani, M., (1968). "Family Background of Dropouts in Selected Elementary Schools". A Dissertation submitted to the University of Madras in Partial fulfilment of the requirements for the Degree of Master of Science (Unpublished).

Devadas, R.P. (1968) "Social and cultural factors influencing malnutrition". Proceedings of the Nutritional Society of India, No. 6, p. 6.

Devadas, R.P., Mary Eapen and Annavi Susheela (1968) "Effect of supplementation of skimmilk and its combinations with multipurpose food or red gram dhal on the nutritional status of the children". Journal of Nutrition and Dietetics, Vol. 5, No. 3, p. 206.

Devadas, R.P., Sundari, K. and Susheela, A. (1969) "Effects of supplementation of two school lunch programmes with neera on the nutritional status of children".The Indian Journal of Nutrition and Dietetics, Vol. 6, No. 1, p. 29.

Devadas, R.P., Enamuthu, J. and Usha Kumari, N. (1970) "Nutritive value and the acceptability of four strains of hybrid maize".The Indian Journal of Nutrition and Dietetics, Vol. 7, No. 27, pp. 27-31.

Devadas, R.P. and Kasipandya Devi, A. (1970) "Nutritional comparison between CSM and skim - milk" . The Indian Journal of Nutrition and Dietetics, Vol. 7, No. 41, p. 228.

Devadas, R.P. (1971) "Prospects of alleviating protein malnutrition in India". Ecology of Food and Nutrition, Vol. 1, No. 1, pp. 45-51.

Devadas, R.P. Suchetha, P. and Sundari, K. (1971) "The effect of supplementation of a rural school lunch programme with green leafy vegetables on the nutritional status of children". The Indian Journal of Nutrition and Dietetics , Vol. 8, No. 4, p. 198.

Devadas, R.P. (1972) "Influence of a school lunch programme on the nutritional status and performance of children". Paper presented at the 9th International Congress of Nutrition, Mexico City 2nd to 9th, September.

Devadas, R.P. (1972) "Problems in organisation and implementation of school lunch". Proceedings of the First Asian Congress of Nutrition. pp. 181-183.

Devadas, R.P. (1972) Nutrition in Tamil Nadu, Samgam Publishers, Madras-1, p. 1.

Devadas, R.P., Vasanthi, M.N.M. and Sharadambal, M. (1972) "The nutritional status of selected preschool children in ANP programme". The Indian Journal of Nutrition and Dietetics, Vol. 9, No. 1, p. 1.

Devadas, R.P., Usha Chandrasekar and Bhooma, N. (1973) "Scope for Nutrition education in the elementary school programme". The Indian Journal of Nutrition and Dietetics, Vol. 10, No. 3, p. 119.

Devadas, R.P., Usha Chandrasekar and Kusum Latha Dhody, (1974). "Evaluation of low cost indigenous food supplement to the school lunch". The Indian Journal of Nutrition and Dietetics, Vol. 11, No. 3, p. 127.

Elwood, P.C. (1973) "Evaluation of the clinical importance of anemia". The American Journal of Clinical Nutrition, Vol. 26, No. 9, p. 958.

Eunice Rome roda Gwynn and Diva Sanjur (1974) "Nutritional anthropometry, Diet and health related Correlates among preschool children in Bogoter Colombia". Ecology of Food and Nutrition, Vol. 3, No. 4, pp. 273.

Frisch, R.E. (1971) "Malnutrition and mental develoopment". The Indian Journal of Nutrition and Dietetics, Vol. 8, No. 3, p. 149.

Fryer, B.A., Lamkin, G.M., Vivian, V.M., Eppright, E.S., and Fox, M.M. (1972) "Growth of preschool children in the north centre region". Journal of American Dietetic Association. Vol. 60, No. 1, p. 37.

Food and Agricultural Organisation and World Health Organisation (1950). Assessment of Nutritional Status, Joint FAO/WHO Expert Committee on Nutritional Status" Report of the first session: Geneva, WHO Technical Report Series No. 15, p. 20.

Garn, M. (1973) "Stature norms and nutritional surveys". Ecology of Food and Nutrition, Vol. 2, p. 79.

Gautam, S.C., Aikat, B.K., and Sehgal, S. (1973) "Immunological studies in protein calorie malnutrition, I.Humormal and cell mediated immune response in protein deficient mice". Indian Journal of Medical Research, Vol. 61, No. 1, p. 78.

Goldsmith, G.A. (1959) "Physical examination" Nutritional Diagnosis, Charles C. Thomas Publisher, Publication No. 356, p. 15.

Goldsmith, G.S. (1972), "Hunger and malnutrition whose responsibilities". Nutrition Today, June, p. 16.

Gothavari Kamalanathan, Gita Nalinakshi and Devadas, R.P. (1970) "Effect of a blend of protein foods on the nutritional status of preschool children in a rural balwadi. The Journal of Nutrition and Dietetics, Vol. 7, No. 5, p. 288.

Gopalan, C. (1969) "Observation on some epidemiological factors and biochemical features of protein calorie malnutrition. In:PCM. Ed. A Vanmuratt Springerverlog. Berlin and New York, p. 77.

Gopalan, C. (1970) "Approaches to feeding programmes". Nutritional feeding in the 4th plan, Government of Tamil Nadu, p. 49.

Gopalan, C. (1970) "Paper presented during the National Seminar on nutritional feeding in the Fourth Plan". Sri Avinashilingam Home Science College, Coimbatore-11.

Gopalan, C. (1971) "The crux of the Asian nutrition situation". Nutrition, Vol. 5, No. 3, p. 2.

Gopalan, C., Rama Sastri, B.V. and Balasubramanian, S.C. (1971) "Daily allowances of nutrients for Indians". Nutritive value of Indian Foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, p. 27.

Gopalan, C., Ramaśastri and Balasubramanian, S.C.(1971) "Nutritive value of Indian Foods", NIN, ICMR, Hyderabad, p. 200.

Gopalan, C., and Vijayaraghavan, K. (1971) "Nutrition Atlas of India", NIN, ICMR, p. 64-65.

Gopalan, C. (1972). "Nutrition and development". Nutrition, Vo.6, No. 3., p. 2.

Gopalan, C (1973). "Some recent epidemiological and biochemical studies in protein calorie malnutrition". Collected Publications of Dr. C. Gopalan, p. 215.

Gopalan, C. (1973) "Malnutrition and its impact on nutrition development". Proceedings of Nutrition Society of India, No. 13, p. 1.

Gopalan, C. (1973) "Malnutrition and its impact on National Development" Report ot Task Force on Nutrition. Proceedings of the Nutrition Society of India, Symposium on "Supplementary feeding programme for preschool children." National Institute of Nutrition, Hyderabad-7, India, No.15, pp. 1-5.

Gopalan, C., Swaminathan, M., Krishnakumari, V.K., Hanumantha Rao, D. and Vijayaraghavan, K. (1974) "Calorie supplementation and growth of preschool children". Nutrition Reviews, Vol. 32, No. 5, p. 141.

Gowrinath sastri, T. and Srikantiah, S.G. (1974) "Use of height and weight in the assessment of nutritional status of pre-school children". Review article, p. 1. (Un published data).

Hawk, Oser, B. (1954) Physiological Chemistry. The Blakiston Division, Mcgraw-Hill Book Company, New York, London, p. 255.

Hanumantha Rao, D. (1972) "Special nutrition programme crusade against malnutrition". Nutrition Vol. 5, No. 4, p. 2.

Hegsted, D.M. (1973) "Deprivation syndrome of protein calorie malnutrition". Foods and nutrition notes and Reviews, Vol. 30, No. 3 and 4, p. 29.

Indira Gandhi, (1971) "India and her children". UNICEF News, Issue, 69, p. 1.

Jaima Ariza-Macias, Helberto Luna-Jaspse, Roberto Ruedawilli, Amson, Jose Mora Parra and Franz Pardo-Tollez (1973). "A cross sectional study of growth of Colombian children from two socio-economic classes during their 1st six years of life". Ecology of Food and Nutrition. Vol. 2, No. 1, p. 51-67.

Jelliffe, N. (1962) "Clinical assessment of nutritional status". Clinical Nutrition, 2nd Edition, Horber, New York, p. 134.

Jelliffe, D.B. (1966) "Assessment of nutritional status of community". WHO Monograph, p. 53.

Jelliffe, D.B. (1970) "Evaluation of nutrition related village improvement programme". Malnutrition is a problem of Ecology Edited by Paul Gorgy and Kline, O.K., Basal and Karyer, New York, p. 152.

Johnston, P. (1968). "The expanding school lunch programme in madras state". Journal of Nutrition and Dietetics, Vol. 5, No. 2, p. 97.

Joginder Singh (1974). "Extent maize cultivation to rabi for higher yields". The strategy for Rabi, Indian Farming, October, p. 23.

Kallen, D.J. (1973). "Malnutrition, Learning and Behaviour". Ecology of Food and Nutrition, Vol. 2, No. 2, p. 134.

Krishnamurthy Shaik, Meera and Mohivdin (1973). "Effect of maternal protein calorie malnutrition on bone growth of the offspring in monkeys'. Represented from Journalof pathology and Bacteriology, Vol. 16, No. 1, p. 32-42.

Latham, M. (1965) "Assessment of nutritional status, nutrition and child". Human Nutrition in Tropical Africa, FAO, Rome: pp. 20, 29 and 47.

Lorstad, M.H. (1974) "On estimating incidence of undernutrition". Nutrition News Letter, Vol. 12, No. 1, p. 2.

Lusaka (1970) "Protein calorie malnutrition". Published by the National Food and Nutrition Commission. p. 1.

Martin, F.A. (1954) "Clinical signs as means of Judging nutritional status". Roberts Nutrition Work with Children, The University of Chicago Press, p. 18, 34.

Manual for Nutrition Surveys, (1968) "Factor analysis of measure of nutritional status of preschool children". Inter Departmental Committee and Nutritional Defense, 2nd Edition. Washington, Govt. Print. Office, p. 487.

Marr, J.W. (1973) "Surveys aims and methods". Nutrition, Journal of British Dietetic Association, Vol. 27, No. 4, p. 239.

Mathur, J.S., Mehrotra, S.K. and Maheswari, B.B. (1974) "Nutritional disorders among children below five years in a rural community". Indian Journal of Paediatrics, Vol. 41, No. 316, p. 184.

Mitchell, H.S.(1954) "Protein limitation and human growth". Journal of American Dietetics Association, Vol. 44, No. 3, p. 167.

Merrills Read, (1970)"Malnutrition and mental retardation". Journal of Nutrition - Education, Vol. 2, No. 1, p. 23.

Mclaren, D.S. and Pellett, P.L. (1970) "Nutrition in the Middle East". World Review of Nutrition and Dietetics, Vol. 12, p. 135.

Ministry of Health (1951). "Recipes based on locally available foods" Government of India Chapter IV and V.

Muralt, A.V. (1969) "Protein calorie malnutrition". A Nestle Foundation Symposium, Springerverlag, Berlin-Heidelberg, New York, p. 97.

Narasinga Rao, B.S.(1970). A Decade of Progress. Indian Council of Medical Research, Hyderabad, p. 33.

Narasinga Rao, B.S. (1974) "Common salt and its fortification", Nutrition, Vol. 8, No. 3, p. 20.

Nutrition (1972), Review of the World Health Organisation Programme, WHO Chronicle, Vol. 26, pp. 160-223.

Gommen, H.A.P.C. (1974) "Vitamin A deficiency, xerophthalmia and blindness". Nutrition Reviews, Vol. 32, No. 5, p. 151.

Parvathi Rau, M., Hanumantha Rao, D., Nadamuni Naidu and Swaminathan, M.C. (1970) "Calorie intake of preschool children when fed A.D.L.B. The Indian Journal of Nutrition and Dietetics, Vol. 7, No. 5, p. 337.

Prahlad Rao, Prashansingh, and Swaminathan, M. (1969) "Nutritional status of pre-school children of rural community near Hyderabad". Indian Journal of Medical Research, Vol. 57, pp.21-32.

Prasad, L.B. (1974) "Steps to eradicate malnutrition". Social Welfare, Vol. 21, No.8, p. 25.

Rajalakshmi, R., Sail, S.S., Shah, D.G. and Ambady, S.K. (1974) "Calorie Supplementation and growth of pre-school children". Nutrition Reviews, Vol. 32, No. 5, p. 141.

Ramachandran, K.V., Deshpandi, V.M., Apt. K., Sukla, N.N. and Shila, M.K. (1968) "A survey of school children in Bombay city" pp. 1-4 and 5-19.

Rama Rao, G., Myna Panemangalore and Rajagopalan, N. (1970) "Nutritional properties of Neera and palmgur". The Indian Journal of Nutrition and Dietetics, Vol. 7, No. 1, p. 44.

Ramdas Murthy, V. (1971) "Applied Nutrition Programme" Nutrition, Vol. 5, No. 4, p. 22.

Ramdas Murthy, V. (1974) "Ecological onstraints and nutrition status of the community". Nutrition, Vol. 8, No. 3, p. 13.

Richard, V. (1972) "One person's view of the type a lunch". School Food Service Journal, Vol. 261, No. 1, p. 17.

Rutishauser, I.H.E. (1973) "Food intake studies in preschool children in developing countries". Problems of measurement and evaluation". Nutrition, Vol. 27, No. 4, p. 253.

Scrimshaw, N.S. (1974) "Food health and family planning go together". Yojana, Vol. 18, No. 12, p. 32.

Sharma, B.N., Shyama Gopal, Yash Paul and Bhatia, I.S. (1972) "Comparative study of lipids of different varieties of maize". The Indian Journal of Nutrition and Dietetics, Vol. 9, p. 342.

Sipple, H.L. (1974) "Nutrition education today". Journal of the American Dietetic Association, Vol. 59, No. 1, p. 18.

Somakurien, Daniel, V.A., Venkat Rao, S., Swaminathan, M. and Parpia, H.A.P. (1969) "Effect of calorie restriction on the supplementary value of protein foods to poor vegetarian diets based on rice and ragi". The Indian Journal of Nutrition and Dietetics, Vol. 6, No. 2, p. 111.

Somaswaro Rao, K. (1974) "Malnutrition in the eastern mediterranean region". WHO Chronicle, Vol. 28, No. 4, p. 172.

Stordy, B.J. (1973) "University students - their food and nutrient intake". Nutrition Vol. 27, No. 4., p. 262.

Sundravadivelu, N.D. (1970) "Importance and need for feeding programme". Nutritional Feeding in the Fourth Plan. Government of Tamil Nadu, p. 42-45.

Sukhatme, P.V. (1972) "Recent trends in world's food availability and their implication". Proceedings of IXth International Congress of Nutrition, Mexico City In Press (un published data).

Sundaram, V. (1973) "The feeding programmes in Tamil Nadu". Analysis of Practical Problems and Difficulties. Government of Tamil Nadu, Madras, p. 1.

Sundravadivelu, N.D. (1974) "Educational development" Social Welfare, Vol. 20, No. 11, p. 75.

Swaminathan, M. (1967) "Nutrition and World Food Problem" Borden's Review of Nutrition Research, Vol. 28, No. 1, p. 1.

Swaminathan, M. (1968) "Diet and nutrition in India". Journal of Nutrition and Dietetics, Vol. 5, No. 3, p. 225.

Swaminathan, M. (1969) "Assessment of nutritional status of the community". Journal of Nutritional and Dietetics, Vol. 5, No. 2, p. 122.

Swaminathan, M.C. (1970) "School lunch programmes". Nutrition, Vol. 5, No. 1, p. 2.

Swaminathan, M.C., Hanumantha Rao, D. Visweswara Rao, R., Narashiman, M.V.V.C., and Naranasinai Dumo (1970). "An evaluation of supplementary feeding programme for preschool children in the rural areas around Hyderabad City". The Indian Journal of Nutrition and Dietetics, Vol. 7, No. 5, p. 342.

Swaran Pasricha, Parvathi Rao and D. Hanumantha Rao, (1973) "Recipes from locally available foods suitable for home and village processing". Proceedings of Nutrition Society of India, Symposium on Supplementary Feeding Programme for Preschool Children" held in 25th March, 1973, at the NIN, Hyderabad, No. 15, p. 27.

The Tamil Nadu Nutrition Study (1973). Tamil Nadu Nutrition Project Sidney M. Cantor Associates incorporated Haverford, Pennsylvania 19041, USA, Vol. 1, p. 82.

Tinagrewal (1973) "Supplementary food programmes as a tool for nutrition education". Proceedings of Nutrition Society of India, Symposium on Supplementary Feeding programme for Preschool Children held in 25th March 1973, at the National Institute of Nutrition, Hyderabad, No. 15, p.27.

Tizand, J. (1974) "Can the brain catch up", World Health, February-March, p. 10,

Trivedi,B.K., Srivatsa, B.C. and Maheswari, B.B. (1971) "A study of height and weight of primary school children of a rural area near Kanpur". Indian Journal of Paediatrics, Vol. 38, No. 276, p. 20.

Thorn, J. (1974) "Low cost diets and their formulation by computor" Nutrition, Vol. 28, No. 1, p. 31.

USDA (1947) Hand Book of Few Workers in School Lunch Programme. Food Distribution Administration. Nutrition and Food Conservation Branch, pp. 5-47.

Usha, T.M., Kamala Anandam and Devadas R.P. (1965) "Nutrition education". Journal of Nutrition and Dietetics, Vol. 2, No. 2, p. 91.

Venkataswamy, G. (1957), "Efficacy of Neeraincuring Riboflavin Deficiency Disease", Journal of Nutrition and Dietetics, Vol. 4, No. 4, p. 271.

Vinodini Reddy and Gupta,C.P. (1974) "Treatment of kwashiorkor with opaque - 2 maize". The American Journal of Clinical Nutrition, Vol. 27, No. 2, p. 122.

Vijayaraghavan, K.(1973), "Nutritional care of the youngerschool children". Nutrition, Vol. 7, No. 5, p. 26.

Vijayaraghavan, K. (1974) "Ecological constrains and nutrition status of the community". Nutrition, Vol. 8, No. 3, p. 13.

Watkin, D.M. (1952) "Clinical appraisal of nutritional status of man, Panal Discussion". American Journal of Clinical Nutrition, Vol. 10, p. 442.

Waterson and Lowery,G.M. (1967) "Growth and Development of Children" Vth Edition, Chicago, Year Book. Medical Publication.

WHO (1963)"Malnutrition and disease" FFHC Basic Study No. 12, World Health Organisation, Geneva, p. 129.

World Health Organisation (1963) Methods used in the assessment of nutritional status, anthropometric measurements, Clinical assessment ofnutritional status; biochemical assessment". Expert Committee on Medical Assessment of Nutritional Status Report., Geneva, WHO, Technical Report Series, No. 258, pp. 5-8, 13, 18 and 28.

Walter, E. (1974) "Schools without food services discriminate against students". School Food Service Journal, Vol. 281, No. 7, p. 78.

Yojana (1973) Applied Nutrition Programme, Vol. 17, No. 22 December, p.816.

APPENDICES

APPENDIX A

NUTRIENT CONTENT OF THE SCHOOL LUNCH MENUS

NUTRIENT CONTENT OF SCHOOL LUNCH MENU WITH CARE FOODS

Foods	Amount g.	Calories	Protein g.	Calcium mg.	Iron mg.	Carotene ug.	Thiamine mg.	Riboflavin mg.	Ascorbic acid mg.
Bulgar wheat	80	284.8	6.5	29.6	3.9	--	0.5	0.08	--
Redgram dhal	10	33.5	2.2	7.3	0.5	13.0	0.04	0.01	--
Greens	50	23. 0	2.0	198.5	12.0	2760.0	0.01	0.15	49.5
Jaggery	20	76.6	--	16.0	2.0	33.6	--	--	--
CSM	25	90.2	4.0	22.7	0.7	29.7	0.8	0.4	--
Tomato	20	5.0	0.1	9.6	--	70.0	0.2	0.01	5
Big onion	7.8	3.9	0.1	3.6	--	--	--	--	0.8
Oil	10	90	--	--	--	--	--	--	--
Total	222.8	607.1	14.9	287.3	19.1	2906.3	1.55	0.64	55.3

NUTRIENT CONTENT OF MENARIND No.1 - [illegible] A

Foods	Amount g.	Calories	Protein g.	Calcium mg.	Iron mg.	Caretene mg.	Thiamine mg.	Riboflavin mg.	Ascorbic acid mg.
Rice	80	275.3	5.1	7.2	3.2	—	0.15	0.04	—
Redgram dhal	10	33.5	2.2	7.3	0.5	13.0	0.04	0.01	—
Greens	50	23.0	2.0	198.5	12.5	2750.0	0.01	0.15	49.5
Tamarind	20	5.0	0.1	9.6	—	70.0	0.2	0.01	5.0
CSM	25	93.2	4.0	22.7	0.7	29.7	0.8	0.4	—
Jaggery	20	76.6	—	15.0	2.0	33.6	—	—	—
Tomato	20	5.0	0.1	9.6	—	70.0	0.2	0.01	5
Big onion	5	3.0	—	2.9	—	—	—	—	—
Oil	10	90	—	—	—	—	—	—	—
Total		603.1	13.5	273.8	18.9	2976.3	1.41	0.52	59.5

NUTRIENT CONTENT OF MENU A -- No. 2

Foods	Amount g.	Calories	Protein g.	Calcium mg.	Iron mg.	Carotene ug.	Thiamine mg.	Riboflavin mg.	Ascorbic acid mg.
Rice	80	276.8	5.1	7.2	3.2	—	0.15	0.04	—
Red gram dhal	10	33 .5	2.2	7.3	0.5	13.0	0.04	0.01	—
Greens	50	23.0	2.0	198.5	12.5	2760. 5	0.01	0.15	49.5
Jaggery	20	76.6	—	16.0	2.0	33.6	—	—	—
CSM	25	90.2	4.0	22.7	0.7	29.7	0.8	0.4	—
Tomato	20	5.0	0.1	9.5	—	70.2	0.2	0.01	5.0
Big onion	5	3.0	—	2.9	—	—	—	—	—
Oil	10	90.0	—	—	—	—	—	—	—
Total	59 .1	598.1	13.4	264.2	18.9	2906.5	1.1	0.59	54

NUTRIENT CONTENT OF MENU A - No. 31

Foods	Amount	Calories	Protein	Calcium	Iron	Carotene	Thiamine	Riboflavin	Ascorbic acid
	g.		g.	mg.	mg.	ug.	mg.	mg.	mg.
Rice	80	276.8	5.1	7.2	3.2	—	0.16	0.04	-
Redgram dhal	10	33.5	2.2	7.3	0.5	13.0	0.04	0.01	—
Greens	50	23.0	2.0	198.5	12.5	2760.0	0.01	0.15	49.5
Lime Juice	21	1.2	—	1.8	—	0.3	—	—	1.3
Jaggery	20	76.6	—	16.0	2.0	33.6	—	—	—
CSM	25	90.2	4.0	22.7	0.7	29.7	0.8	0.4	—
Tomato	20	5.0	0.1	9.6	—	70.0	0.1	0.02	—
Oil	10	90	—	—	—	—	—	—	—
Total		596.1	13.4	263.1	18.9	2906.6	1.11	0.62	50.8

NUTRIENT CONTENT OF MENU B

Foods	Amount g.	Calories	Protein g.	Calcium mg.	Iron mg.	Carotene ug.	Thiamine mg.	Riboflavin mg.	Ascorbic acid mg.
Maize	50	205.2	6.6	6	1.2	54.0	0.25	0.06	0
Rice	20	69.2	1.1	1.8	0.8	--	0.12	0.03	--
Greengram (whole)	10	33.4	2.4	12.4	0.7	9.4	0.04	0.03	--
Jaggery (Palm)	20	71.0	0.2	45.0	--	--	--	--	--
CSM	25	90.2	4.0	22.7	0.7	29.7	0.8	0.8	--
Greens	50	23.0	2.0	198.5	12.5	2750.0	0.01	0.1	49.5
Tomato	20	5.0	0.1	9.6	--	70.0	0.1	0.02	5.0
Oil	10	90.0	--	--	--	--	--	--	--
Onion	10	5.0	0.1	4.7	0.07	--	0.01	--	1.1
Total		592.0	16.6	300.7	15.97	2924.1	1.33	0.64	55.6

APPENDIX B

MONTHLY HEIGHTS OF INDIVIDUAL CHILDREN IN ALL THE GROUPS

MONTHLY HEIGHTS OF INDIVIDUAL CHILDREN IN GROUP A

MONTHLY HEIGHT RECORDS OF INDIVIDUAL CHILDREN IN GROUP A

No.	September	October	November	December	January	February
1	115.1	115.0	115.4	117.2	117.6	119.0
2	115.6	117.0	117.7	118.0	118.2	118.8
3	137.2	137.6	138.0	138.6	139.4	140.2
4	110.5	111.4	112.0	112.4	112.8	113.6
5	119.9	120.4	120.7	121.2	122.2	123.4
6	110.0	112.0	112.8	112.8	113.0	113.0
7	104.0	104.8	105.2	105.8	106.2	107.0
8	106.0	106.6	107.0	107.4	108.2	109.0
9	124.5	125.2	125.8	126.4	127.2	128.2
10	124.2	125.6	126.2	127.0	127.8	128.9
11	126.6	126.5	127.5	128.0	128.5	129.3
12	131.7	131.9	132.2	132.6	134.0	135.0
13	118.8	112.7	113.7	114.0	114.6	115.4
14	95.2	96.0	96.4	97.2	98.4	99.2
15	105.8	106.7	107.7	108.0	108.6	108.8
16	120.0	120.4	121.0	122.6	123.0	123.9
17	133.4	134.0	134.4	135.0	135.6	136.6
18	126.4	126.8	127.0	127.4	127.8	130.0
19	10[illegible].1	106.0	106.4	107.0	108.0	190.0
20	104.9	105.2	105.8	106.6	107.8	108.8
21	110.4	110.8	111.4	111.8	112.8	113.8
22	104.4	105.3	106.8	107.2	107.4	108.0

contd...

No.	September	October	November	December	January	February
23	127.2	127.6	128.2	129.0	129.9	130.4
24	101.4	102.4	103.2	103.8	104.6	105.4
25	130.3	131.1	131.6	132.8	133.8	133.9
26	96.1	96.5	97.0	98.0	98.8	99.7
27	110.0	111.0	112.0	112.8	113.4	113.6
28	122.8	124.0	125.2	125.8	126.6	126.6
29	115.3	115.8	116.7	117.2	117.8	118.3
30	125.5	126.0	126.4	127.2	127.8	128.7
31	120.5	121.2	122.3	122.3	123.9	123.6
32	133.8	134.1	134.6	135.2	136.2	137.6
33	117.4	118.9	120.0	120.9	121.6	121.6
34	109.7	109.9	110.0	110.6	111.1	111.3
35	114.4	115.0	115.8	116.4	117.2	117.8
36	117.2	118.0	118.4	118.8	119.6	120.5
37	114.4	115.0	115.4	116.4	116.6	117.2
38	123.5	123.8	124.4	124.8	126.4	127.2
39	103.8	105.0	106.0	106.8	107.6	107.6
40	105.6	106.0	106.2	107.0	108.2	109.2
41	113.5	115.2	116.2	116.8	117.1	117.4
42	98.4	99.2	101.4	101.8	102.0	103.1
43	113.5	115.2	117.3	117.5	116.7	117.9
44	124.0	124.6	125.0	125.6	126.2	127.1
45	111.6	112.4	112.8	113.2	114.0	114.6

contd..

No.	September	October	November	December	January	February
46	96.6	97.0	97.3	98.0	98.6	99.2
47	103.8	105.0	106.2	107.0	107.6	108.4
48	128.0	128.6	129.0	130.2	131.1	132.0
49	119.9	120.3	121.0	121.9	122.8	124.0
50	101.2	101.6	102.7	103.2	104.0	105.6
51	131.9	132.5	133.1	133.6	134.6	136.6
52	125.1	125.6	126.4	127.2	128.5	129.5
53	103.8	104.9	106.9	107.9	108.7	106.6
54	106.8	107.2	108.8	109.8	110.9	111.3
55	128.4	129.0	129.5	130.6	131.8	131.1
56	106.8	107.1	107.7	108.5	109.6	110.0
57	100.0	100.2	100.4	101.4	102. 2	103.8
58	117.0	118.2	119.2	120.0	120.9	121.0
59	108.6	110.4	110.8	111.8	112.6	112.4
60.	132.6	133.3	134.3	135.2	136.4	135.4
Mean	115.0	115.8	116.5	117.2	117.8	118.8

MONTHLY HEIGHTS OF INDIVIDUAL CHILDREN IN GROUP B

MONTHLY HEIGHTS OF CHILDREN IN GROUP B

No.	September	October	November	December	January	February
1	112.4	112.7	113.9	114.3	114.8	116.1
2	116.5	117.2	118.1	118.8	119.4	120.6
3	136.6	137.4	138.4	139.0	139.4	140.3
4	105.5	106.2	107.0	107.6	108.2	109.2
5	117.8	118.2	119.9	120.0	120.6	121.4
6	110.4	111.2	112.5	113.4	114.0	114.6
7	103.0	104.2	105.7	106.0	106.1	106.2
8	126.4	127.1	128.2	128.5	129.2	131.1
9	121.3	121.8	122.0	122.8	123.3	124.3
10	124.4	125.0	125.3	126.4	127.0	128.3
11	124.3	125.3	125.9	126.0	125.4	127.9
12	131.3	132.0	132.6	133.6	134.2	134.8
13	112.1	113.0	113.4	114.0	114.6	115.8
14	95.5	96.3	96.4	97.0	97.6	98.3
15	104.8	105.7	106.4	106.8	106.9	107.2
16	120.0	120.8	121.4	122.0	122.6	123.1
17	133.7	134.0	134.4	135.2	136.2	137.4
18	125.3	126.4	127.2	127.8	128.0	128.6
19	105.1	105.7	106.2	106.8	107.8	108.9
20	106.9	107.3	107.6	108.4	109.2	110.4

contd .....

No.	September	October	November	December	January	February
21	109.9	110.0	110.4	112.5	113.0	114.0
22	106.5	107.0	108.2	109.0	109.6	110.8
23	121.8	122.4	123.6	124.2	124.8	125.1
24	104.2	105.2	106.0	107.0	107.7	107.7
25	131.7	132.2	132.5	133.0	133.8	134.8
26	96.7	97.7	98.2	98.3	98.3	99.4
27	110.0	110.6	111.7	112.0	112.8	113.5
28	122.1	122.6	123.4	124.6	125.2	126.5
29	120.0	120.5	121.0	121.6	123.0	124.1
30	124.3	125.2	126.2	126.4	127.5	128.8
31	128.7	128.9	130.0	130.6	131.2	132.0
32	123.8	124.3	125.1	125.8	126.4	127.1
33	111.8	112.2	113.2	113.8	114.2	115.4
34	114.7	115.2	116.2	117.4	117.8	118.0
35	118.0	118.7	119.7	120.0	120.6	121.2
36	106.4	107.6	108.0	109.0	109.2	109.5
37	115.2	115.4	115.4	116.0	116.2	116.6
38	99.4	100.2	101.2	102.5	103.0	103.7
39	121.9	122.7	123.1	123.4	123.6	124.9
40	131.0	131.6	132.7	132.9	133.3	134.5

contd..

No.	September	October	November	December	January	February
41	110.5	110.6	110.9	112.4	113.0	113.8
42	96.8	97.7	97.8	98.6	98.9	99.8
43	104.5	105.2	105.6	106.2	107.2	108.4
44	122.7	123.6	124.5	125.6	126.0	126.9
45	122.0	123.0	124.2	125.0	125.6	126.0
46	108.0	108.6	109.8	110.0	110.2	110.8
47	128.8	130.2	130.6	130.8	131.0	131.8
48	120.0	120.6	121.0	121.6	122.6	123.1
49	97.7	98.3	99.8	100.0	100.2	100.5
50	109.3	109.9	110.6	111.3	112.0	112.4
51	123.8	124.6	125.2	125.3	125.6	125.8
52	119.0	120.0	120.4	120.6	121.0	121.0
53	125.0	126.0	127.2	128.0	128.0	128.2
54	93.8	94.3	95.5	95.8	96.0	96.9
55	108.0	109.4	110.5	110.5	110.6	111.1
56	115.0	117.6	118.8	119.0	119.2	119.2
57	112.3	112.5	113.0	113.8	114.2	115.8
58	108.4	109.6	110.5	110.5	110.6	110.8
59	107.3	108.0	109.2	110.4	110.4	110.7
60	98.9	100.0	100.9	101.2	101.6	102.2
Mean	114.7	115.4	116.2	116.8	117.3	118.1

MONTHLY HEIGHTS OF INDIVIDUAL CHILDREN IN GROUP C

MONTHLY HEIGHT RECORDS OF CHILDREN IN GROUP C

No.	September	October	November	December	January	February
1	105.3	106.0	106.4	106.8	107.0	107.7
2	100.7	100.9	101.5	102.6	103.0	103.6
3	108.5	109.4	110.2	110.5	110.7	111.2
4	107.4	107.8	109.1	109.2	109.4	109.6
5	101.9	102.6	103.5	103.6	104.0	104.5
6	113.0	113.8	114.3	114.8	115.0	115.2
7	107.0	107.6	108.5	109.0	109.4	109.8
8	116.0	117.2	117.8	118.0	118.2	118.2
9	113.2	114.0	114.0	114.2	114.4	114.4
10	99.8	100.5	100.5	100.8	101.0	101.4
11	108.8	109.8	110.0	110.1	110.2	110.2
12	95.8	96.0	96.8	97.0	97.4	97.8
13	108.5	108.9	109.6	110.0	110.2	110.2
14	108.5	108.9	108.8	108.9	109.2	109.5
15	105.1	105.2	106.6	107.0	107.3	107.3
16	106.5	106.9	107.2	107.4	108.0	108.4
17	120.6	121.8	122.2	123.0	123.2	123.2
18	109.2	110.2	111.8	112.0	112.2	112.4
19	120.3	120.9	121.0	121.4	121.8	122.6
20	122.9	123.4	123.7	124.0	124.5	124.9

contd..

No.	September	October	November	December	January	February
21	108.0	108.8	108.8	109.2	109.8	110.2
22	107.6	108.4	108.8	109.0	109.6	110.4
23	102.0	102.6	103.8	104.6	105.2	105.2
24	109.9	110.2	111.2	112.6	113.0	113.6
25	106.0	107.2	108.0	108.8	109.2	110.1
26	120.8	121.4	121.8	122.4	123.6	124.9
27	120.8	121.3	122.4	122.6	122.8	123.0
28	120.7	121.4	121.6	122.0	123.0	123.6
29	120.3	120.9	121.2	121.8	122.2	122.9
30	122.0	123.0	123.6	124.0	124.8	124.8
31	119.4	121.3	121.2	121.4	121.5	121.5
32	106.8	107.2	108.0	109.0	109.6	110.2
33.	116.4	117.0	107.2	108.4	109.8	110.0
34	123.3	124.2	124.8	125.0	125.2	125.5
35	124.6	125.0	125.2	126.0	126.4	127.0
36	125.0	126.0	126.6	127.4	128.2	129.0
37	122.0	122.6	123.0	123.4	124.0	124.5
38	110.3	110.6	111.0	111.4	112.0	112.5
39	110.4	110.6	110.8	111.2	112.1	112.1
40	123.3	123.9	124.2	125.2	126.0	126.2
41	126.0	126.4	126.8	127.2	127.8	128.4
42	126.4	126.8	127.2	127.8	128.0	128.4
43	120.0	120.4	120.8	121.2	122.0	122.2
44	100.8	101.2	101.6	102.2	103.0	103.5
45	125.1	125.8	126.0	126.0	126.2	126.3

contd..

No.	September	October	November	December	January	February
46	124.7	125.2	125.4	126.0	127.0	127.5
47	120.5	121.2	121.8	123.0	124.0	123.8
48	124.0	125.0	125.0	127.0	127.4	128,0
49	122.0	123.0	124.4	125.2	125.8	125.5
50	127.9	128.2	128.4	128.8	129.2	129.8
51	115.9	116.2	116.8	117.0	117.4	118.0
52	123.3	124.2	125.0	125.2	125.2	126.9
53	106.8	107.0	107.2	107.8	108.6	109.9
54	127.4	128.0	128.2	128.4	128.6	128.8
55	120.6	121.4	121.4	121.6	122.0	123.4
56	119.0	120.0	121.4	122.2	122.2	123.0
57	120.4	121.6	122.6	123.2	124.4	125.0
58	125.6	126.2	127.4	128.6	128.8	129.1
59	124.6	125.2	125.6	127.0	127.8	128.0
60	126.4	127.0	127.6	128.2	128.6	129.0
Mean	115.6	116.0	115.4	117.0	117.5	117.9

APPENDIX C

MONTHLY WEIGHTS OF INDIVIDUAL CHILDREN IN ALL THE GROUPS

MONTHLY WEIGHTS OF INDIVIDUAL CHILDREN IN GROUP B

MONTHLY WEIGHT RECORDS OF CHILDREN IN GROUP B

No.	September	October	November	December	January	February
1	17.80	18.10	19.00	19.90	20.55	20.95
2	18.00	19.00	19.60	19.50	19.60	19.65
3	26.65	27.15	27.45	28.0	28.45	29.30
4	14.15	15.00	15.0	16.50	17.60	18.40
5	19.25	20.0	21.20	22.60	23.00	23.15
6	16.90	16.90	17.60	17.90	18.00	18.05
7	14.50	14.75	15.00	15.50	15.50	15.90
8	23.90	24.65	24.95	25.10	25.20	25.55
9	22.85	22.90	22.75	23.00	23.80	23.95
10	21.75	22.25	22.40	22.90	22.90	22.90
11	20.95	21.65	21.35	21.55	22.30	22.40
12	22.95	23.30	23.40	23.40	23.55	24.35
13	15.75	16.45	17.20	17.00	17.00	16.95
14	12.45	12.65	12.80	13.60	14.00	14.60
15	15.40	15.80	16.10	16.40	16.70	16.95
16	20.00	20.15	20.90	20.90	20.95	21.35
17	23.00	24.00	24.75	24.80	24.95	25.00
18	23.60	23.90	24.00	24.50	24.50	24.80
19	15.45	16.90	17.25	17.30	17.40	17.45
20	16.10	16.20	16.45	16.90	17.85	17.90

contd....

No.	September	October	November	December	January	February
21	15.70	15.00	15.00	15.50	17.15	17.30
22	16.75	17.00	15.80	18.00	18.75	17.90
23	18.90	18.15	19.00	19.95	20.90	20.65
24	14.65	14.75	14.90	15.90	16.50	16.50
25	23.25	24.00	24.20	24.50	25.90	25.80
26	12.40	12.65	12.80	13.50	13.90	13.90
27	15.65	16.36	17.40	18.00	18.50	18.25
28	22.50	22.35	22.80	23.40	23.50	23.90
29	19.75	19.20	19.70	20.40	21.00	20.90
30	20.35	21.00	21.75	22.60	22.85	22.35
31	19.50	19.75	20.00	21.00	21.85	21.75
32	25.0	24.90	24.75	25.20	25.90	26.75
33	21.50	22.45	22.40	23.40	24.15	23.65
34	16.50	15.95	17.05	17.30	17.60	17.90
35	15.65	17.00	17.60	18.60	18.95	18.90
36	18.05	19.40	19.60	19.50	20.00	19.65
37	17.50	17.60	17.70	17.80	18.70	19.35
38	19.50	20.00	20.40	20.50	20.85	21.45
39	16.25	18.10	16.25	17.50	18.55	18.70
40	15.35	16.00	16.20	16.50	17.80	17.85
41	19.0	19.45	19.20	19.50	20.00	20.80

contd....

No.	September	October	November	December	January	February
42	13.90	14.15	14.10	14.00	14.95	14.95
43	18.50	19.50	19.70	20.10	20.70	20.70
44	23.50	23.90	24.70	24.80	25.00	25.30
45	17.35	17.25	17.85	17.85	18.40	18.45
46	13.40	13.55	13.50	13.80	14.20	14.50
47	13.50	14.80	15.20	15.90	15.85	14.95
48	21.50	20.80	21.80	21.00	23.05	22.50
49	21.0	20.35	20.70	21.00	21.50	21.90
50	15.50	16.70	16.80	17.50	18.40	18.40
51	24.0	24.90	25.35	25.50	26.20	25.75
52	20.0	20.30	20.75	21.40	23.30	21.55
53	12.95	13.20	13.50	14.00	14.50	14.40
54	17.20	18.05	18.90	18.95	19.55	19.00
55	22.55	21.95	21.95	22.50	23.30	23.50
56	14.00	13.80	14.20	15.50	15.95	15.15
57	13.00	14.10	14.70	14.70	15.80	14.70
58	18.10	19.05	18.90	19.40	19.80	19.90
59	17.95	18.25	18.80	19.60	20.45	20.00
60	24.60	25.70	26.70	27.00	27.00	26.50
Mean	18.47	18.85	19.17	19.58	20.00	20.43

MONTHLY WEIGHTS OF INDIVIDUAL CHILDREN IN GROUP A

MONTHLY WEIGHT RECORDS OF CHILDREN IN GROUP A

No.	September	October	November	December	January	February
1	17.80	18.40	18.50	18.55	18.70	19.75
2	18.00	18.90	18.90	19.00	19.20	19.55
3	29.00	29.10	29.15	30.00	30.50	30.85
4	18.50	18.40	18.50	18.10	18.90	19.90
5	18.75	18.50	18.00	18.00	18.90	19.95
6	16.75	17.35	17.50	18.00	18.50	18.30
7	14.50	14.60	14.85	15.90	15.50	15.60
8	15.00	15.90	15.90	22.90	23.70	16.35
9	23.45	23.45	23.85	24.00	24.60	24.60
10	21.30	22.50	22.30	22.30	22.85	22.80
11	21.70	22.15	22.00	22.30	22.30	22.85
12	22.45	23.10	23.60	23.30	23.45	23.80
13	17.25	17.40	17.50	17.50	17.50	18.40
14	12.50	12.50	12.70	12.80	12.50	13.90
15	15.25	15.50	15.50	20.15	20.35	16.75
16	20.00	20.85	20.10	24.55	24.50	21.55
17	23.30	23.35	24.20	24.55	24.55	24.80
18	23.30	22.00	22.45	23.00	23.50	24.50
19	15.50	16.00	15.50	16.50	17.00	16.80
20	15.10	16.40	15.75	17.50	18.20	18.70

contd..

No.	September	October	November	December	January	February
21	15.30	15.70	16.20	15.20	16.45	16.55
22	16.25	16.25	16.60	17.45	17.50	18.00
23	19.00	19.15	19.15	19.45	19.60	20.40
24	14.65	14.95	15.20	15.00	15.60	15.80
25	23.70	23.45	23.75	24.00	24.40	24.65
26	12.00	12.10	12.00	12.40	12.80	13.15
27	15.60	15.90	15.85	15.90	16.60	17.20
28	22.40	22.50	22.90	23.00	23.20	23.70
29	20.35	20.95	20.95	20.60	21.50	21.95
30	19.50	19.10	19.65	19.80	20.20	20.80
31	25.10	25.15	25.35	25.80	26.50	26.70
32	21.50	22.00	22.35	22.80	23.20	23.85
33	15.95	16.10	16.65	17.00	17.10	17.30
34	17.75	17.85	18.95	18.90	18.20	18.95
35	19.10	19.60	19.75	19.60	20.30	20.90
36	16.10	16.15	16.60	16.80	17.50	17.60
37	18.95	20.00	20.60	20.10	20.85	20.95
38	13.70	13.20	13.50	14.00	14.70	14.80
39	18.40	19.00	19.25	19.60	19.80	19.95
40	23.55	23.90	24.50	24.60	24.85	25.00

contd..

No.	September	October	November	December	January	February
41	17.25	17.75	18.00	17.00	17.95	18.45
42	13.20	13.65	14.10	14.30	14.60	14.80
43	13.75	14.00	14.15	14.60	14.80	15.00
44	22.05	22.10	22.90	23.35	23.55	23.85
45	21.00	21.15	20.75	21.35	21.80	22.60
46	15.00	15.25	15.75	15.90	15.80	17.50
47	24.35	23.90	23.90	23.95	24.60	25.95
48	19.90	20.05	20.60	21.80	22.0	21.60
49	12.45	12.70	12.90	13.80	13.95	14.20
50	17.80	18.10	18.00	18.00	18.55	19.60
51	22.40	22.60	22.90	23.00	23.60	23.55
52	18.50	18.55	19.0	19.40	19.6	20.50
53	23.00	23.05	23.50	24.00	24.85	24.25
54	11.30	11.30	11.60	12.40	13.10	13.75
55	16.80	18.25	17.00	17.15	17.25	18.40
56	20.00	20.60	20.60	20.80	21.20	21.95
57	15.00	15.10	15.00	15.10	15.20	15.75
58	15.65	16.05	16.90	16.80	16.70	16.95
59	15.25	15.70	15.80	16.60	17.10	17.55
60	15.60	15.80	16.25	15.45	15.30	15.95
Mean	18.35	18.57	18.97	19.28	19.65	20.05

MONTHLY WEIGHTS OF INDIVIDUAL CHILDREN
IN GROUP C

MONTHLY WEIGHT RECORDS OF CHILDREN IN GROUP C

No.	September	October	November	December	January	February
1	15.30	15.35	15.30	15.60	15.70	15.85
2	12.40	12.25	12.25	12.50	12.70	12.55
3	12.45	12.75	12.20	12.60	12.50	12.65
4	15.00	15.10	15.15	15.00	15.20	15.20
5	16.05	16.00	16.40	16.00	16.75	16.80
6	17.00	17.50	17.50	18.00	18.75	18.75
7	15.20	15.60	15.65	15.70	15.70	15.60
8	15.40	15.80	16.00	16.20	16.45	16.10
9	18.15	18.00	18.05	18.20	18.65	18.80
10	14.45	14.60	14.25	14.20	14.30	14.60
11	15.85	15.90	16.50	16.50	16.75	16.55
12	12.65	12.70	13.20	13.40	13.50	13.60
13	15.40	15.65	15.80	16.0	16.20	16.30
14	13.35	13.60	13.85	13.70	13.75	13.80
15	13.95	14.15	14.05	14.20	14.35	14.65
16	17.65	17.85	18.00	18.80	18.10	18.95
17	19.50	20.00	20.00	20.40	20.80	21.00
18	18.70	19.35	19.20	19.40	19.80	20.30
19	20.40	20.55	20.25	20.90	21.10	21.30
20	20.00	20.65	20.95	21.15	21.55	21.50

contd..

No.	September	October	November	December	January	February
21	20.50	21.05	21.50	22.00	22.75	24.00
22	15.00	15.25	15.20	15.35	15.35	15.50
23	14.70	14.80	15.00	14.80	14.75	15.25
24	17.60	17.75	18.10	18.10	18.15	18.50
25	18.25	18.40	18.60	18.40	18.50	18.60
26	20.80	21.60	21.45	21.10	21.50	21.30
27	20.25	20.80	21.00	21.50	21.60	22.05
28	20.30	20.40	20.60	20.80	21.05	20.70
29	25.00	25.60	25.80	26.00	26.50	26.85
30	20.25	20.75	21.40	21.40	21.50	21.70
31	19.65	20.60	20.80	21.00	21.25	21.00
32	18.00	18.35	18.40	18.60	18.75	19.00
33	17.20	17.85	17.95	18.00	18.10	18.10
34	20.05	20.95	20.70	20.90	21.10	21.30
35	20.00	20.50	21.40	21.00	21.50	21.60
36	20.00	20.30	20.40	20.60	20.80	22.00
37	21.40	21.90	21.70	21.80	22.0	22.30
38	18.00	18.30	18.40	18.40	18.45	18.50
39	18.25	18.35	18.50	18.60	18.70	18.75
40	21.35	21.90	22.00	21.90	21.60	21.65

contd...

No.	September	October	November	December	January	February
41	20.50	21.60	21.60	21.80	21.80	21.90
42	20.80	21.20	21.35	21.65	21.80	22.10
43	20.20	20.60	20.80	21.50	21.80	22.10
44	19.55	20.20	19.75	19.75	19.80	20.00
45	20.05	20.35	20.50	20.70	20.80	21.00
46	20.15	20.60	20.40	20.60	21.15	21.25
47	23.0	23.35	23.20	23.40	23.60	25.00
48	19.95	20.05	20.20	20.30	20.40	20.30
49	22.25	23.0	23.20	23.50	23.80	23.85
50	22.60	22.40	22.40	21.0	21.40	21.60
51	18.00	18.25	17.90	18.0	18.20	18.40
52	25.35	25.80	26.0	26.50	27.00	27.35
53	19.50	19.80	19.70	19.90	21.00	21.20
54	20.40	20.85	20.50	20.50	20.65	20.90
55	21.50	22.0	22.10	22.20	22.20	22.30
56	21.00	21.40	22.0	23.10	23.50	23.25
57	20.25	20.85	21.35	21.45	21.50	21.75
58	21.75	22.35	22.30	22.40	22.50	22.50
59	27.15	27.75	27.75	28.00	28.60	29.05
60	27.25	27.90	27.25	28.05	28.00	28.20
Mean	18.9	19.10	19.37	19.55	19.76	19.94

APPENDIX D

MONTHLY HAEMOGLOBIN OF INDIVIDUAL CHILDREN IN ALL THE GROUPS

MONTHLY HAEMOGLOBIN OF INDIVIDUAL CHILDREN IN

GROUP A

MONTHLY HAEMOGLOBIN RECORDS OF CHILDREN IN GROUP A

No.	September	October	November	December	January	February
1	11.8	11.9	12.2	12.4	12.5	12.6
2	12.1	12.3	12.6	12.7	12.8	12.9
3	9.9	10.2	10.4	10.6	10.8	11.0
4	10.1	10.2	10.3	10.5	10.7	10.9
5	7.6	7.8	7.9	8.2	8.4	8.6
6	8.2	8.4	8.6	8.8	8.9	9.0
7	8.2	8.3	8.5	8.7	8.8	9.0
8	9.2	9.3	9.5	9.6	9.8	10.0
9	10.6	10.7	10.9	11.0	11.2	11.4
10	10.1	10.3	10.4	10.6	10.8	10.9
11	8.1	8.2	8.3	8.6	8.7	8.8
12	9.2	9.4	9.5	9.7	9.8	10.0
13	8.0	8.2	8.3	8.6	8.7	8.8
14	9.4	9.6	9.7	9.9	10.0	10.2
15	10.8	10.9	11.0	11.3	10.4	11.5
16	10.9	11.0	11.1	11.2	11.3	11.4
17	9.6	9.8	9.9	10.2	10.3	10.4
18	10.6	10.7	10.9	11.0	11.2	11.4
19	8.0	8.2	8.3	8.4	8.5	8.6
20	9.6	9.7	9.8	10.0	10.2	10.4

contd...

No.	September	October	November	December	January	February
21	9.9	10.1	10.3	10.5	10.7	10.9
22	9.2	9.4	9.5	9.7	9.8	10.0
23	11.2	11.4	11.6	11.8	12.0	12.0
24	8.6	8.7	8.9	9.0	9.2	9.4
25	9.0	9.2	9.5	9.6	9.7	9.7
26	8.8	8.9	9.0	9.2	9.4	9.6
27	9.4	9.5	9.6	9.8	9.9	10.1
28	9.8	9.9	10.1	10.3	10.5	10.6
29	10.6	10.7	10.8	10.9	11.2	11.4
30	9.4	9.6	9.7	9.8	10.0	10.2
31	12.2	12.3	12.5	12.5	12.7	12.9
32	10.2	10.3	10.5	10.6	10.8	11.0
33	9.0	9.2	9.4	9.6	9.8	9.8
34	11.8	11.9	12.0	12.2	12.4	12.6
35	12.0	12.1	12.2	12.3	12.4	12.6
36	10.4	10.6	10.7	10.9	11.0	11.2
37	9.3	9.4	9.6	9.7	9.9	10.1
38	9.1	9.3	9.5	9.7	9.8	10.0
39	10.8	10.9	11.0	10.3	11.5	11.6
40	12.4	12.7	12.9	13.0	13.2	13.4

contd..

No.	September	October	November	December	January	February
41	12.8	13.0	13.2	13.4	13.6	13.8
42	12.4	12.4	12.5	12.6	12.6	12.6
43	10.2	10.3	10.5	10.8	11.0	11.2
44	10.9	11.1	11.3	11.5	11.7	11.8
45	10.6	10.7	10.8	10.9	11.0	11.2
46	9.8	10.3	10.3	10.6	10.7	10.8
47	10.0	10.1	10.2	10.4	10.5	10.6
48	12.8	12.9	13.0	13.2	13.4	13.5
49	12.4	12.6	12.8	13.0	13.1	13.2
50	8.2	8.3	8.5	8.6	8.8	9.2
51	11.5	11.6	11.6	11.7	11.7	11.8
52	11.3	11.5	11.6	11.7	11.8	12.0
53	11.4	11.6	11.7	11.8	12.2	12.4
54	10.0	10.2	10.4	10.5	10.7	10.8
55	9.4	9.5	9.6	9.7	9.8	10.0
56	9.6	9.7	9.8	9.9	9.9	10.0
57	8.0	8.1	8.2	8.2	8.3	8.4
58	10.0	10.1	10.2	10.3	10.5	10.6
59	7.2	7.3	7.4	7.5	7.8	8.0
60	12.0	12.2	12.3	12.4	12.5	12.6
Mean	10.0	10.2	10.3	10.5	10.6	10.8

MONTHLY HAEMOGLOBIN OF INDIVIDUAL CHILDREN
IN GROUP B

MONTHLY HAEMOGLOBIN RECORDS OF CHILDREN IN GROUP B

No.	September	October	November	December	January	February
1	9.2	9.3	9.5	9.8	9.9	10.1
2	7.6	7.8	7.9	8.0	8.2	8.4
3	10.8	11.0	11.2	11.2	11.3	11.5
4	8.2	8.3	8.5	8.6	8.7	8.9
5	7.2	7.4	7.5	7.6	7.8	8.0
6	8.3	8.5	8.7	8.9	9.1	9.3
7	9.1	9.3	9.5	9.6	9.8	10.0
8	11.3	11.5	11.6	11.7	11.8	12.1
9	10.4	10.6	10.7	10.8	11.0	11.2
10	9.6	9.8	10.0	11.2	10.4	10.6
11	10.0	10.2	10.4	10.6	10.7	10.8
12	10.0	10.3	10.5	10.7	10.8	10.9
13	10.6	10.8	10.9	11.0	11.2	11.4
14	9.8	9.9	10.2	10.4	10.5	10.6
15	10.6	10.8	10.9	11.0	11.2	11.4
16	8.0	8.2	8.4	8.6	8.7	8.8
17	8.8	8.8	8.9	9.0	9.0	9.0
28	10.4	10.6	10.7	10.8	11.0	11.1
19	8.4	8.6	8.7	8.8	9.0	9.2
20	9.4	9.6	9.7	9.9	10.0	10.2

contd..

No.	September	October	November	December	January	February
21	10.2	10.3	10.5	10.6	10.7	10.9
22	7.6	7.7	7.8	7.9	8.2	8.4
23	10.4	10.6	10.8	11.0	11.0	11.1
24	8.4	8.6	8.7	8.8	9.0	9.2
25	12.3	12.5	12.6	12.7	12.8	12.9
26	12.1	12.3	12.5	12.6	12.8	12.9
27	10.9	11.0	11.3	11.4	11.5	11.6
28	12.0	12.3	12.5	12.6	12.7	12.8
29	11.3	11.4	11.5	11.6	11.8	11.9
30	10.9	11.0	11.1	11.3	11.6	11.7
31	9.1	9.3	9.5	9.7	9.8	9.9
32	8.8	9.0	9.2	9.4	9.5	9.6
33	9.1	9.3	9.5	9.6	9.7	9.8
34	9.1	9.2	9.4	9.6	9.7	9.8
35	13.1	13.2	13.4	13.6	13.8	13.9
36	10.8	10.9	11.2	11.4	11.5	11.6
37	10.6	10.7	10.8	10.9	11.0	11.2
38	11.8	12.0	12.1	12.3	12.5	12.6
39	7.9	8.0	8.2	8.3	8.4	8.5
40	12.0	12.2	12.4	12.6	12.7	12.8

contd...

No.	September	October	November	December	January	February
41	8.2	8.3	8.4	8.5	8.8	9.0
42	7.6	7.8	7.9	8.0	8.2	8.4
43	10.1	10.3	10.5	10.6	10.8	11.0
44	7.6	7.8	7.9	8.0	8.2	8.4
45	12.0	12.3	12.5	12.7	12.8	12.9
46	12.0	12.2	12.6	12.7	12.8	12.9
47	8	8.2	8.3	8.5	8.6	8.6
48	8.6	8.8	8.9	9.2	9.4	9.8
49	7.8	8.0	8.2	8.4	8.5	8.6
50	12.9	13.0	13.2	13.4	13.5	13.6
51	11.1	11.3	11.5	11.6	11.8	12.0
52	11.4	11.6	11.7	11.9	12.2	12.4
53	11.3	11.5	11.6	11.7	11.9	12.2
54	12.0	12.3	12.5	12.8	12.8	12.9
55	11.6	11.8	11.9	12.0	12.2	12.3
56	8.0	8.2	8.4	8.6	8.8	8.9
57	9.6	9.8	9.9	10.1	10.2	10.4
58	8	8.2	8.4	8.6	8.7	8.8
59	9	9.2	9.4	9.6	9.7	9.8
60	9.6	9.8	8.9	9.1	9? 3	9.6
Mean	9.8	10.0	10.2	10.3	10.4	10.6

MONTHLY HAEMOGLOBIN OF INDIVIDUAL CHILDREN
IN GROUP C

MONTHLY HAEMOGLOBIN RECORDS OF CHILDREN IN GROUP C

No.	September	October	November	December	January	February
1	7.6	7.7	7.8	7.8	7.9	8.0
2	10.5	10.6	10.7	10.8	10.8	10.9
3	9.3	9.3	9.4	9.5	9.5	9.6
4	11.9	12.0	12.1	12.2	12.3	12.4
5	7.8	7.9	8.0	8.1	8.2	8.2
6	8.0	8.0	8.1	8.2	8.3	8.4
7	6.8	6.9	7.0	7.1	7.2	7.2
8	5.6	5.7	5.8	5.8	5.9	6.0
9	8.4	8.5	8.5	8.6	8.7	8.8
10	8.6	8.6	8.7	8.8	8.8	8.8
11	11.1	11.2	11.4	11.5	11.7	11.8
12	9.1	9.1	9.2	9.3	9.4	9.4
13	11.9	11.9	12.0	12.1	12.2	12.2
14	7.8	7.9	8	8.1	8.2	8.4
15	8.0	8.1	8.2	8.2	8.3	8.4
16	10.4	10.4	10.5	10.5	10.6	10.6
17	10.1	10.1	10.2	10.3	10.3	10.4
18	8.5	8.6	8.7	8.8	8.9	9.0
19	9.6	9.6	9.7	9.8	9.9	10.0
20	9.5	9.7	9.8	9.8	9.9	10.0

contd..

MONTHLY HAEMOGLOBIN RECORDS OF CHILDREN IN GROUP C

No.	September	October	November	December	January	February
1	7.6	7.7	7.8	7.8	7.9	8.0
2	10.5	10.6	10.7	10.8	10.8	10.9
3	9.3	9.3	9.4	9.5	9.5	9.6
4	11.9	12.0	12.1	12.2	12.3	12.4
5	7.8	7.9	8.0	8.1	8.2	8.2
6	8.0	8.0	8.1	8.2	8.3	8.4
7	6.8	6.9	7.0	7.1	7.2	7.2
8	5.6	5.7	5.8	5.8	5.9	6.0
9	8.4	8.5	8.5	8.6	8.7	8.8
10	8.6	8.6	8.7	8.8	8.8	8.8
11	11.1	11.2	11.4	11.5	11.7	11.8
12	9.1	9.1	9.2	9.3	9.4	9.4
13	11.9	11.9	12.0	12.1	12.2	12.2
14	7.8	7.9	8	8.1	8.2	8.4
15	8.0	8.1	8.2	8.2	8.3	8.4
16	10.4	10.4	10.5	10.5	10.6	10.6
17	10.1	10.1	10.2	10.3	10.3	10.4
18	8.5	8.6	8.7	8.8	8.9	9.0
19	9.6	9.6	9.7	9.8	9.9	10.0
20	9.5	9.7	9.8	9.8	9.9	10.0

contd..

No.	September	October	November	December	January	February
21	11.9	12.0	12.1	12.2	12.3	12.4
22	9.3	9.4	9.5	9.5	9.6	9.6
23	13.1	13.1	13.2	13.3	13.4	13.5
24	11.9	12.0	12.1	12.2	12.3	12.4
25	9.1	9.2	9.3	9.4	9.6	9.7
26	8.3	8.4	8.5	8.6	8.7	8.8
27	9.1	9.2	9.3	9.4	9.5	9.6
28	10.1	10.2	10.3	10.4	10.5	10.7
29	12.1	12.2	12.3	12.4	12.5	12.5
30	9.6	9.6	9.7	9.8	9.9	10.0
31	7.8	7.9	7.9	8.0	8.1	8.2
32	9.6	9.7	9.7	9.8	9.9	10.0
33	9.3	9.3	9.4	9.5	9.5	9.5
34	9.6	9.7	9.8	9.9	10.1	10.2
35	9.5	9.6	9.7	9.8	9.9	10.0
36	8.6	8.7	8.8	8.9	9.0	9.1
37	9.3	9.4	9.5	9.6	9.7	9.8
38	8.5	8,6	8.7	8.8	8.9	9.0
39	13.1	13.1	13.2	13.2	13.3	13.3
40	9.0	9.1	9.2	9.3	9.4	9.4

Contd.....

No.	September	October	November	December	January	February
41	11.1	11.2	11.3	11.4	11.4	11.5
42	9.6	9.7	9.8	9.9	9.9	10.0
43	9.6	9.7	9.8	9.9	10.1	10.2
44	11.0	11.0	11.1	11.2	11.3	11.4
45	12.9	12.9	13.0	13.1	13.2	13.2
46	11.1	11.1	11.2	11.2	11.3	11.3
47	12.1	12.1	12.2	12.3	12.3	12.3
48	10.0	10.1	10.1	10.2	10.3	10.4
49	9.5	9.6	9.7	9.8	10.0	10.2
50	9.3	9.4	9.6	9.7	9.8	9.9
51	10.6	10.6	10.7	10.7	10.8	10.8
52	11.9	11.9	12.0	12.0	12.0	12.3
53	10.2	10.3	10.4	10.5	10.6	10.6
54	10.6	10.6	10.6	10.7	10.7	10.8
55	12.2	12.3	12.3	12.3	12.4	12.6
56	9.1	9.2	9.2	9.3	9.3	9.4
57	13.6	13.7	13.8	13.8	13.9	14.0
58	10.6	10.6	10.7	10.7	10.8	10.8
59	12.9	12.9	13.0	13.1	13.2	13.2
60	12.2	12.3	12.4	12.4	12.5	12.6
Mean	9.9	10.0	10.1	10.1	10.3	10.3