DIETARY HABITS AND NUTRITIONAL PROFILE OF SCHOOL CHILDREN PARTICIPATING IN THE SCHOOL LUNCH PROGRAMME

By

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THESIS

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DECLARATION

I hereby declare that this thesis entitled "**Dietary habits and nutritional profile of school children participating in the school lunch programmes**" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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DEDICATED

TO
MY
BELOVED
FAMILY

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INTRODUCTION

INTRODUCTION

Nutritional well being of a nation's children is the most important over all measurement of its efforts towards national development. A majority of India's children live in an economic and social environment which impedes their physical and mental development. Hence, our children do not attain their optimum growth. Growth failure among school children is more pronounced in developing countries (Owolabi *et al.*, 1996). During the growth period when the child is deprived of required nutrient and energy, his development suffers.

Children constitute the most precious resource for a country. Hence utmost care must be exercised to promote their health and to protect them from diseases. The school going children being an active phase of growth are known to respond more effectively to the changes in health and nutritional inputs (Darshan *et al.*, 1988). Improvement of nutrition enhances the educational performance of children and hence the importance of school meal for children becomes important (Usha and Giri, 1989).

To tackle the problem of malnutrition among children, many co-ordinated nutrition intervention strategies have been developed; Supplementary feeding being a major one among them. Mid day meal programme for school children is one of the earliest supplementary programmes in India. This welfare programme is in operation successfully in several states including Kerala. This is aimed at providing additional food to the children to fill an observed gap between their intake and requirement and thus prevent marginal causes of under nutrition from lapsing into severe forms. Under this programme food supplements are provided to school children to meet at least one third of the calories and half of the protein requirements of the day.

School children constitute one of the important segments of the population. They account for over 20 per cent of the population in India. The school age is a dynamic period of growth and development as children under-go physical, mental, emotional and social changes. Malnurition is a common problem during school age and its extent in school children of the state has been sufficiently estimated. Hence the study was undertaken to find out the food consumption pattern and nutritional status of school children who are the beneficiaries of school lunch programme of the state.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

This chapter related to the present study of Dietary habits and nutritional profile of school children participating in school lunch programme is discussed under the following headings.

2.1 Importance of school age

The foundation of the personality of a man is laid in the formative years of life. Deficiencies arising in this period of rapid growth and development causes irrepairable damage to the further development of the children (Indian Council of Social Scientific Research, 1980; Mohanram, 1982 and Ghosh, 1986).

The school going period being an active phase of growth, are known to respond more effectively to the changes in health and nutritional inputs (Darshan *et al.*, 1988).

The school age is a dynamic period of growth and development as children undergo physical mental emotional and social changes (Pai and Naik, 1989). School children constitute one of the important segments of the population. As suggested by Singh and Shah (1990), children constitute the most precious resource for a country. Hence utmost care must be exercised to promote their health

and to protect them from disease. Optimum nutrition in terms of quality and quantity is essential for growth and development of our children (UNICEF, 1990).

The quality of human resources of any country is largely determined by the quality of its children. India has often been referred to as a nation of the young (Gopalan, 1992).

According to Ashwell (1990), Pollitt (1990) and Choksi (1995), nutritional factors played a significant role in resistance to infection in infants and children. Adequate nutrients are needed for proper functioning of the immune system for the defensive mechanism of the body.

Childhood nutritional status was found to be significantly correlated with nutritional status at adult hood (Vazir, 1990).

If the nutritional foundations are not provided adequately to the child it will affect his overall development. From the nutritional stand point children constituted the most vulnerable segment of any population (Directorate of Health Services, 1991; Cohen, 1993 and Choksi, 1995).

2.2 Prevalence of malnutrition among school children

Malnutrition is a condition when one or two nutrients are less or are in excess in the body (Begum, 1991). Malnutrition has been described as a biological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients (WHO, 1993).

According to Waterlow (1972) about 36 per cent of children in developing world are malnourished.

Srikantia (1989) and Gopalan (1992) had observed that the most important nutritional disease in the developing countries is protein energy malnutrition (PEM).

UNICEF (1990) has estimated that the percentage of children deficient in calories was higher than that of children deficient in proteins.

A study by Fernadez (1995) in Mexico indicate that 46 per cent of children were malnourished, 30 per cent exhibited mild malnutrition, 13 per cent moderate and 5 per cent were severely malnourished.

In Asia the percentage of prevalence of severe PEM ranges from 1.1 to 20 and for mild forms 16 to 46.4 (Singh, 1996). According to the author malnutrition contribute to about half of the deaths of children. More than 20 million children in India had severe forms of malnutrition.

Kapil (1996) reported that the silent form of hunger and malnutrition continue with over 43.8 per cent children suffering from moderate malnutrition and about 37.6 per cent from mild malnutrition.

National Nutrition Monitoring Bureau (1989) in their studies in school children indicated that prevalence of mild malnutrition increased from 25.5 per cent to 34.1 per cent though the severe malnutrition declined from 10.0 per cent to 9.3 per cent during 1975 to 1989.

Chandra (1996) had conducted an initial survey of 3082 children in Tamil Nadu and found that only 5 per cent of the children had severe forms of malnutrition.

According to UNICEF (1991), WHO (1991) and ICMR (1995) the major nutritional deficiency among children in India are protein energy malnutrition, vitamin A deficiency, iron and B complex deficiencies.

Reddy (1997) observed that the percentage of underweight children contributed nearly 53 per cent of the child population in India.

One of the major public health problems in the developing world is vitamin A deficiency. The impact of vitamin A deficiency and xerophthalmia is widely recognised as leading cause of childhood blindness (WHO, 1987).

Longitudinal studies carried out in India by Vijayaraghavan (1989) indicated that the incidence of corneal involvement due to vitamin A deficiency was one per 1000 school children.

According to Vijayaraghavan (1989) about 5-10 per cent of children belonging to poor socio-economic groups particularly in rural areas suffered from xerophthalmia.

Among the vitamin A deficiency the most evident condition is conjunctival xerosis (Gopalan, 1991; UNICEF, 1991; WHO, 1991; Devadas, 1994 and Scrimshaw, 1994).

Hussain *et al.* (1991) in his study on malnourished children in Sudan observed different manifestations of vitamin A deficiency like conjunctival xerosis (56%), Bitot's spots (12%), corneal xerosis (11%), corneal ulceration (11%), nyctalopia (4%) and corneal scar (2%).

Studies on school age children have shown that prevalence of marginal vitamin A deficiency is high and deserve attention (Carlier *et al.*, 1992; Ravinder and Sushma, 1997).

Reddy (1993) had indicated that the proportion of nutritional blindness in India has reduced drastically to 0.04 per cent from 2 per cent since 1973.

Gopaldas and Abbi (1995) had conducted a survey in 4302 children of 7-10 years old to study the prevalence of vitamin A deficiency. Manifestations of occular signs of vitamin A deficiency was seen in 10 per cent of school children.

Ninety five children from New Delhi, with acute diarrhoea were studied by Aneja and Mehra (1994) for the presence of xerophthalmia and subclinical vitamin A deficiency. The result suggested a high prevalence of vitamin A deficiency in these young children.

The most widespread micro nutrient deficiencies in the world today are that of iron, iodine and vitamin A (Devadas, 1994 and Scrimshaw, 1994).

National Institute of Nutrition (1995a) reported that in Kerala 34 per cent children are moderately to severely malnourished. In Gujarat it is almost double (67%). The prevalence ranged from 0.4 per cent in Tamil Nadu and Andhra Pradesh to 1.4 per cent in Madhya Pradesh and Orissa.

In Andhra Pradesh the incidence of severe forms of malnutrition was three fold in post drought condition than the pre drought period (NIN, 1995a).

According to NIN (1996) 5-10 per cent of children with vitamin A deficiency had xerophthalmia and 40 per cent had decreased serum retinol levels.

Studies conducted by Tharakan (1997), revealed that majority of our school children suffered from deficiencies of micronutrients like vitamin A, iron and iodine.

Iodine deficiency, another significant nutritional problem has been viewed with serious implications. It is widespread in India and has become a public health problem (UNICEF, 1990; Gopalan, 1992; Kodayat and Latif, 1994; Scrimshaw, 1994; Rao, 1994 and Kochupillai, 1997). It is estimated that nearly 800 million of

the world population are at the risk of iodine deficiency disorder (IDD) of which 170 million are in India and no state is completely free from IDD (Rao, 1994). According to Vir (1994) goitre is the most common visible ill effect of iodine deficiency and its prevalence varied from 40-60 per cent with as much as 20 per cent prevalence of grade II goitre.

A survey for estimation of goitre in school children was undertaken by Pillai (1995) and goitre prevalence was found to be 59.8 per cent.

Rajajee (1989) estimated that nearly 35-50 per cent of children in India in rural areas belonging to low income group has anaemia due to iron deficiency. Muratee (1990) and Morene (1993) has opined that young children and pregnant women are the most affected group with an estimated global prevalence of about 40 per cent and 50 per cent.

The problem of iron deficiency anaemia is world wide. Soekirmn and Jalal (1991) reported that nearly 200 million school children in Indonesia suffered from anaemia and they had learning disabilities which resulted in sub optimal scholastic performance.

Kapur and Dahiya (1992) observed the prevalence of one or more nutritional deficiency symptoms among 80 per cent of children.

2.3 Factors contributing to malnutrition

The term malnutrition is an outcome of multifaceous factors which included social, economical and environmental factors. Rao (1993) reported that varying levels of such factors will therefore show different prevalence rates of malnutrition.

A child's nutritional status at any point depend on his or her past history which may particularly account for his or her present status (Pelletier *et al.*, 1995).

Dietary deficiency of various nutrients namely calcium, vitamin A, riboflavin and iron occurred more frequently and to a greater degree among children, pregnant and lactating women in India (WHO, 1987; Dasgupta, 1989; Gopalan, 1989; Vijayaraghavan, 1990 and World Bank, 1995).

Jonstin and James (1997) reported that inadequate dietary intake and disease are the immediate causes or determinants of malnutrition. The inadequacy may include energy, protein, vitamin and minerals.

Hunger and undernutrition at the household level is dependent on such factors as the total income earned and one who controlled the expenditure (Islam, 1989 and Vazir, 1990).

Studies conducted by several scholars had indicated that the inadequate calorie intake was due to poor purchasing power (Vazir, 1990; Saibaba, 1991; NIN, 1993 and Devi and Geervani, 1994).

Poverty and food deprivation are the root causes of malnutrition (World Development Report, 1990 and Bhaskaram, 1996). Nutritional problems of developing countries are due to the fact that majority of the population subsist on inadequate diet with respect to quantity and quality of food necessary for the physiological needs and welfare (Gopalan, 1991).

Poverty, ignorance and disturbed emotional status due to the maladjustment in schools are some of the factors which produce malnutrition among school children (Begum, 1991).

Poor child spacing has been the major reason for the apparent risk at higher birth order (Vazir, 1988). Scheier (1978) showed that the birth weight was significantly correlated to the nutritional status of children.

A positive association between parental literacy and nutritional status was reported by Vazir (1990) and Devadas *et al.* (1991).

Gopalan (1991) observed that the level of female literacy is the most important single indicator of social development of a community. Female literacy apparently holds the key to the success of health and nutrition of the family. In rural areas problems of under educated mothers, taboos and customary food practices were reported as the significant causative factor of malnutrition in young children.

According to UNICEF (1990) and Gopalan (1991) diarrhoea is also a major cause of childhood malnutrition. The major cause of diarrhoea are poor hygiene and lack of clean drinking water.

The higher morbidity and mortality in the under nourished are due to lack of sanitation, impaired immunity and infectious diseases [Horner *et al.* (1981), Bhaskaram (1985), Bhaskaram (1989), Gopalan *et al.* (1989), Bhasin (1990), Islam (1989), Reddy (1989), Vazir (1990), Gopalan (1991), Maendough (1991), Saibaba (1991), Devi and Geervani (1994)].

Saibaba (1991) and Mathai (1997) reported that lack of health services like immunization, maternal and child health services had a negative effect on the nutritional status of children.

Various infections common during childhood like diarrhoea, whooping cough, tuberculosis and measles precede and precipitate malnutrition in children (Guerrant *et al.*, 1992). Tuncibilek *et al.* (1995) and Bhaskaram (1996) reported that the severity of under nutrition in a community can be significantly reduced if the superceeding factor of infection is held in check.

A survey conducted by Cohen *et al.* (1985) in Bangladesh revealed that a high proportion of children with xerophthalmia had diarrhoea in the preceding month. Similar findings were reported by Mathai (1997).

2.4 Effects of malnutrition

Malnutrition is a causative factor for various deficiency disease like marasmus, kwashiorkor, xerophthalmia, scurvy, rickets, beri beri, pellagra and anaemia (Swaminathan, 1986 and Begum, 1991).

The malnourished children had poor physical growth and experienced high rate of infections than those who are well nourished (Chen *et al.*, 1980; Kadam *et al.*, 1983; Awashthi *et al.*, 1990 and Reddy, 1997).

According to Reddy (1989) severe protein energy malnutrition was often preceeded by an episode of infection, diarrhoea and respiratory infections. Apart from inadequate dietary intake recurrent infections contributed widespread malnutrition in children. It was seen that parasitic infestation was more common in malnourished children than in normal children.

According to Bhaskaram (1989) measles reduced the absorption and increased the requirement of nutrients and lead to malnutrition.

In India, one out of 100 children born, was likely to die at or before birth. Another ten died before completion of one year. Another 6 to 7 died between the ages four to five years. Out of the remaining survived, about 60-70 were destined to have a miserable existence. The rest progressed to anywhere close to their full potential (UNICEF, 1990).

The consequences of malnutrition were mainly observed as impairment in physical and mental development of children and the working and earning capacity of adults (UNICEF, 1990 and World Bank, 1995).

Improper nourishment resulted in stunted physical growth and development which lead to generalised functional impairment, disability,

diminished productivity and inability to cope with environmental hazards including resistance to infection (Harris, 1997). Good nutrition ensures protection while poor nutrition increases susceptability to infections (Ashwell, 1990; Pollitt, 1990 and Choksi, 1995).

Growth is a key indicator of child health and malnutrition is a key determinant of the high childhood mortality (Murthy, 1993). Flattering of growth is strongly associated with poor health, poor hygiene and lack of clean drinking water.

Reddy (1991) had reported that most children with corneal xerophthalmia also had other conditions such as severe protein energy malnutrition, history of measles, diarrhoea, respiratory illness and a variety of other infections which independently contributed to high mortality.

One of the major health problems in the developing world is vitamin A deficiency, and xerophthalmia is one of the leading causes of childhood blindness (WHO, 1987). In Asia above 5 lakhs young children lost their sight every year because of vitamin A deficiency and two third of them died of becoming blind (UNICEF, 1991).

Gopalan (1992) estimated that about 40,000 children turned blind each year due to vitamin A deficiency.

Malnutrition particularly of children has been described as the disease of the poor and children are exposed to long term consequences of malnutrition (Pelletier *et al.*, 1995).

The effect of nutritional anaemia on mental functions was studied by Oski and Hong (1978) and it was revealed that children with anaemia or even mild iron deficiency showed poor attentiveness, memory and academic performance. Their mental functions improved after the iron deficiency was corrected.

Recent evidence indicated that anaemia in infants and children lead to impairment in work capacity, reduced learning ability and immune response (NIN, 1982 and International Conference on Nutrition, 1992).

Deficiency of iron in the body caused functional disturbances in various tissues. The effects of iron deficiency on immune functions, mental functions and physical performance were of practical importance (Rajajee, 1989 and WHO, 1990).

Patirgolu and Dogan (1991) conducted a study on the effects of iron deficiency anaemia on human behaviour and it was found that iron deficiency anaemia adversely affected the cognitive development, performance and behaviour in children.

Anaemia is an important problem of serious public health significance and has an impact on psychological and physical development, behaviour and work performance.

Nair (1990) reported that iodine deficiency is a great threat to optimal physical and mental development of several million children. Iodine deficiency disorder is an important disorder which have severe impact on children and adults. With every passing hour 10 children were being born in India who did not attain their optimal mental and physical potential due to neonatal hypothyroidism. Over 100 million people in the South East Asian Region suffered from endemic goitre, 6 million suffered cretinism and more than 35 million were mentally or physically disabled (Raman, 1992).

2.5 Food consumption pattern of school children

Children must consume sufficient high quality proteins, vitamins, minerals and energy in their diets or acceptable growth (Cameron and Hofrandes, 1988).

Optimum nutrition in terms of quality and quantity is essential for growth and development of school children (UNICEF, 1990).

Berge (1980) conducted a dietary survey in 160 school children of 8 to 9 years old in the industrial community of Gjovik, Norway and observed that all children ate 5 meals a day. Intake of fresh fruits and hence vitamin C by girls was greater than that of boys of the same age.

Normal health and development during childhood year and is mainly based on a sound nutritional intake. The interaction between the growth of the mind and the body has been observed and experimented by various investigators (Muller, 1981; Ukoro, 1988; Devadas, 1991; NIPCCID, 1992; UNICEF, 1992; Sauoma, 1992; Vella *et al.* 1994 and Kanbur, 1995).

National Dairy Council (1981) conducted a study in school children in England and Wales and found that 5 per cent took no breakfast and ate only one meal throughout the rest of the day. A further 3 per cent ate a cereal breakfast and seemed to eat snacks or nothing at all during the rest of the day.

Satapathy *et al.* (1984) revealed that among lower socio economic group in South Orissa, 72 per cent of the children were undernourished due to poor quality of foods. A diet inadequate in basic foods adversely affected the nutritional status of children (Robinson, 1985).

A 24 hour recall survey conducted by Subhasini and Satinder (1987), in school children in Punjab revealed that the cereal and pulse consumption was only 59-64 per cent and 37-60 per cent respectively.

Data regarding dietary intake of 225 children in Delhi was collected by Saxena (1986) and revealed a high prevalence of under nutrition among school children due to poor dietary intake.

The dietary intake of 100 school children from Ludhiana city, was recorded using the 24 hour recall method for 3 consequtive days. Consumption of cereals, legumes, green leafy vegetables and sugar and jaggery was low whereas consumption of milk and milk products, fats and oils and roots and tubers was high (Kapoor and Dahiya, 1992).

Studies at village school hostels in Vilmus showed that girls in particular consumed more energy daily than required (Adomaitis, 1978).

A survey of nutrient intake by school children in Lagos (Sri Lanka) revealed that there was inadequate intakes of all the water soluble vitamins when compared with RDA (Oguntone and Clara, 1985).

A nutrition survey was carried out to investigate dietary intake in the Nan Hyang elementary school on 133 children, 7-9 years old and revealed that total daily energy and other nutrient intakes were below the RDA. The survey showed that 15 per cent of subjects skipped a meal more than ones a day (Mo, 1988).

An abundance of energy giving foods, good quality of proteins and minerals are required in the diet of school children because of their rapid growth. The adequacy of dietary intake of vitamin A was found to be 8-12 per cent of the recommended dietary allowances among school children (Rao, 1996).

Nirmala and Varalakshmi (1991) conducted studies on dietary intake of rural school children of Hyderabad and revealed the deficiency of energy and vitamins particularly vitamin A, thiamine and riboflavin.

A child required more calories/kg of the body when they are active and growing fast (Lucas, 1992). Sharma (1995), revealed that the diets of a large proportion of school age children are deficient in both micro and macro nutrients.

2.6 Growth studies in school children

To monitor the health of school children growth rate is one of the most simple, reliable and important parameters and also children who experienced childhood diseases repeatedly were found to suffer impaired growth (Rajagopalan, 1983).

Measurement of growth of children is an important, widely used method for assessment of nutritional status of communities (Agarwal, 1991).

Studies at village school hostels in Vilmus showed that girls in particular injested more energy daily than required and anthropometric studies showed general improvement of nutritional status in the past 10 years (Adomaitis, 1978).

Pushpamma *et al.* (1983) assessed the nutritional status of rural school children of Andhra Pradesh and reported that the anthropometric measurements of children were found to be below when compared with local standard both in height and weight were lower than the standards.

Studies conducted by Easwaran and Devadas (1984), had indicated that considerable proportion of our school children were malnourished and have a decreased growth rate.

Pai and Naik (1989), assessed the nutritional status of 254 rural school children by anthropometry and the results revealed a significant difference in the weight of boys and girls. All the children were below the ICMR standards both in height and weight.

Growth of 511 boys and 215 girls from 3 schools in Imphal, India was studied by Yaima (1989) and the results revealed that both boys and girls were significantly taller than the well to do children.

The degree of malnutrition in 240 randomly selected school children in Himachal Pradesh, was assessed by anthropometric measurements and found that severe form of malnutrition were more prevalent in children (Sood, 1993).

Bhasin (1990) conducted a study on the heights and weights of 4405 well to do children from 5 public school in Haryana. Values for mean height and weight of the Haryana children were significantly higher for both sexes at all ages.

Prevalence of over weight and obesity was investigated in 520 school children in the central western area of New Southwales, Australia. The study demonstrated the difficulty in applying anthropometric standards to this particular age group (Williams and Bergan, 1991).

Height and weight were estimated in 5073 boys and 4521 girls in Sassari and they indicated that school children in Sassari were taller and heavier than in the past on the basis of anthropometric studies (Malina, 1972).

2.7 Studies on school lunch programme

Devadas (1986) opined that continuous participation of children in school lunch programme will certainly improve their nutritional status.

Improvement of school children's nutrition enhances their educational performance and hence the importance of school meal in the planning programmes of children becomes important (Usha and Giri, 1989). School lunch programme is aimed at providing additional food to the children to fill an observed gap between their intake and requirement and thus prevent marginal causes of undernutrition from lapsing into severe forms (Ramesh *et al.*, 1994).

Mid Day Meal Programme for school children is one of the earliest supplementary feeding programmes in India. This welfare scheme was in operation

in several states even before independence and was supported by international agencies like WHO, UNICEF and CARE (NIN, 1995b).

A study on food service for school children proved that the lunch provided by the school generally met 1/3rd of the daily allowance of protein, fat, iron, thiamine and riboflavin (Singh, 1973).

A comprehensive study of the school lunch programme in North Carolina revealed that protein intake of children was highest. Riboflavin and vitamin A intake were satisfactory. Children got enough iron and calcium (Herd and Weeks, 1975).

A study was conducted on 154 school children who participated in school lunch programme and 154 control children not covered by school lunch programme to observe the impact of the school lunch programme on their, physical development, mental ability and behavioural pattern. The results reported that the children who participated in school lunch programme had improved their physical development (Chandrasekhar and Amrithaveni, 1976).

In four elementary schools in Coimbatore city, only in one school the school lunch provided more than one third of the recommended allowances of nutrients. The mean increments in height and weight of children in that school were significantly higher and school performance were better than those of the children in the other 3 schools (Dhanalakshmi and Devadas, 1978).

Rosenhurg (1978) conducted a study on school lunch and observed that school lunch supplied between 15 and 20 per cent of daily energy requirement and between 25 and 30 per cent of daily protein requirement for 380 children.

Studies conducted by Vaden (1980) indicated that the children who participated in the school lunch programme had better total diet than the others. The

nutrients supplied by school lunch programme in U.S.A. was examined using National Food consumption survey by Akin (1983). The results indicated a positive effect on nutrient consumption by both low income and high income children.

A nutrition survey of Korean elementary school children in urban areas was made by Lee *et al.* (1988) to investigate nutritional status in relation to school lunch programmes. The survey showed that the elementary school feeding largely supplemented the inadequate intake of children at home.

A noonmeal programme was evaluated through food analysis and measurement of the nutritional status of children by Usha and Giri (1989). The study revealed that except fat, the rest of the nutrients in the noonmeal were found to be more than the control and one third of the recommended daily allowances. It was concluded that the noonmeal programme had produced encouraging results.

Sumi (1996) assessed the mineral and trace element composition of 72 school lunches collected from Japanese elementary schools and found that it was varying depending on the kind of staple food served. But the sodium intake was higher in lunches prepared in the school kitchen.

Rewal (1981) conducted a study on 3839 children randomly selected in 396 schools participating in the Mid day Meal programme in Madhya Pradesh. He observed that the school meal increased the percentage of children meeting the RDA from 13 to 30 per cent.

The nutritional status of 276 school children of high socio economic status attending an elementary school where a school lunch programme was in operation was examined by Lee *et al.* (1990). The total energy and other nutrient intakes exceeded recommended values except for iron. The study indicated that the school lunch programme contributed significantly to the nutritional well being of the children.

Marples (1996) reported the school children's attitude towards the school lunch programme. 1804 high school students were randomly selected to participate in a study using a questionnaire. Results showed that the quality and variety of food offered were significant factors affecting the students decisions. The length of the lunch period and the amount of time spent waiting in line also were significant factors that affected the participation in school lunch programme.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The study on the dietary habits and nutritional profile of school children participating in the school lunch programme was undertaken to find out the food consumption pattern and nutritional status of school children (7-9 age group) who are the beneficiaries of school lunch programme of the state.

This chapter deals with the methods and procedures followed in the various phases of research and they are given under the following heads:

3.1 Locality of the study

3.2 Selection of samples

3.3 Plan of study

3.4 Methods selected for study

3.5 Development of tools

3.6 Conduct of the study

3.1 Locality of the study

The study was conducted in Ollukkara block, Thrissur district in Kerala state. From the seven panchayats under the block, four panchayats were selected at random. The four panchayats selected were Madakkathara, Kolazhy, Vilvattom and Pananchery. From each panchayat two schools were selected randomly of which one school with school lunch programme and the other without school lunch programme.

3.2 Selection of samples

From the school with school lunch programme 20 children in the age group of 7-9 years and from the school without school lunch programme, 20 children in the same age group were selected randomly from each panchayat.

Children not participating in the school lunch programme formed the control sample. Thus a total of 80 children participating in school lunch programme and 80 children not participating in school lunch programme formed the sample size for the study (Total 160 children).

3.3 Plan of study

The plan of study comprised

1) A base line survey to elicit information on the socio economic details of the families of school children.
2) A dietary survey of the families to assess the food consumption pattern of the families and the dietary habits of the index child in the family. A 24 hour recall survey to assess the food consumption of the index child.
3) Assessment of the nutritional status of school children by conducting
   a) A clinical examination of the selected children with the help of a qualified physician, to identify the manifestations of clinical symptoms of malnutrition
   b) An anthropometric survey to monitor the height, weight and mid upper arm circumference of school children.
   c) A food weighment survey, to determine the actual food and nutrient intake of school children.

4. Analysis of the data using suitable statistical techniques.

3.4 Methods selected for the study

Devadas and Kulandaivel (1975) pointed out that interview method is a systematic approach by which a person enter and more or less imaginatively into an inner life of a comparative stranger. Interview method was reported to be the most suitable way since it proceeds systematically and records the collected information quickly. Oral questionnaire or interview is the most commonly used method of diet

survey (Begum, 1991). The same method can also be adopted to elicit information regarding socio-economic details of the families. Hence in this study also data was collected using pretested interview schedules through house visits.

A 24 hour recall survey method was selected for assessing the food consumption of school children.

A clinical examination was conducted by a qualified physician to identify manifestations of clinical symptoms of malnutrition in all children.

An anthropometric survey was conducted to record the height, weight and mid upper arm circumference (MUAC) of school children.

A one day food weighment survey was conducted to find out actual food and nutrient consumption of school children.

3.5 Development of tools

According to Sidhu (1985) and Best (1989) selection of suitable tools is vital in conducting a research work as they are the instruments which are used in research for gathering new facts. To elicit information regarding the socio-economic and dietary pattern of the families oral questionnaire method was used.

The interview schedule for obtaining the socio-economic characteristics of the families were structured in such a way to collect details regarding the social status of the family, religion and educational level of the parents, family size, living condition and details regarding the index child like birth order and morbidity pattern. The pretested questionnaire is presented in Appendix I.

The schedule to elicit information on the food consumption pattern and food habits of the families and that of the index child in the family consisted of the details regarding food expenditure pattern, vegetarian/ non vegetarian, frequency of

use of various foods, use of various processed foods in the family and by the index child and meal pattern of the school children etc. This also included the details about the foods consumed by the index child for the past 24 hours (recall survey). The pretested schedule structured is presented in Appendix II.

Suitably structured questionnaire was developed for clinical survey. The questionnaire is presented in Appendix III.

Separate schedule was devised for food weighment survey. Food weighment survey was carried out using a standard food weighing balance and standard measuring cups and spoons. The questionnaire is presented in Appendix IV.

3.6 Conduct of the study

3.6.1 Survey of socio-economic and dietary pattern of families and 24 hour recall survey

The information on the socio-economic and dietary pattern of the families were found out with the help of face to face interview method. Mostly it was the mother who was the respondent.

The one day (24 hour) dietary recall method has been used in dietary assessment. Standard measuring cups, spoons and a scale was used in estimating quantities of foods consumed. In 24 hour recall method the respondent (mother) reported the types and amounts of foods the index children consumed over the previous 24 hour period. The respondent recalled the food intake for the preceding 24 hour by interview and by completing a questionnaire. She recalled what was eaten by the child, how much food was eaten, how the food was prepared and when it was eaten and it was recorded in the questionnaire. The accuracy of the answers were checked by supplementary questions whenever necessary.

Plate I. Shows the clinical examination of children

Plate II. Shows the procedure of taking weight

3.6.2 Clinical survey

Clinical examination is an important, practical and sound method of assessing the nutritional status of a community (Jelliffe, 1966 and Kamath, 1989). Swaminathan (1986) opined that clinical examination is the most important part of nutritional assessment since it provided direct information of signs and symptoms of dietary deficiencies prevalent among people. In the present study, clinical examination of 160 children was conducted to assess the signs and symptoms of nutritional deficiencies with the help of a qualified physician. Plate 1 shows the clinical examination of children.

3.6.3 Anthropometric survey

Anthropometry had been accepted as an important tool in the identification of nutritionally vulnerable groups, monitoring changes in the extent of malnutrition and for evaluating the impact of intervention (Rao and Vijayaraghavan, 1996). As recommended by Jelliffe (1966) in field anthropometry only total height is measured. Comparison of weight for age values with regional standards at corresponding ages would help to determine the degree of underweight in a community (Gopaldas and Seshadri, 1987).

Height of the children was measured using a fibre glass tape. The subject was asked to stand straight without shoes, with the heels, buttocks, shoulder and occipit against the wall. The height was recorded from the scale in the wall.

Weight of the children was recorded using a bathroom balance, which was checked by caliberation with standard weights. Weight was recorded with minimum clothing on the subject. Plate 2 shows the procedure of taking weight. According to Swaminathan (1987) body weight is still the most ideal measure for assessment of nutritional status. According to Kaul and Nyamingo (1990) a change

Plate III. Shows the procedure of taking mid upper arm circumference

Plate IV. Shows the weighing of cooked foods

in body weight may be the result of change in the health of an individual, change in dietary supplies or even changes in one's physical activity.

Mid upper arm circumference gives an assessment of muscle mass, subcutaneous tissue and hence indirectly to the nutritional status. Mid upper arm circumference of children was measured (Plate 3) using a tape at the level mid way between the acromial and olecranon process with the arm hanging freely relaxed with the tape applied at right angles to the long axis of the humerous (Malina, 1972). In the present study anthropometric measurements like height, weight and mid upper arm circumference of all the children were recorded.

3.6.4 Food weighment survey

For assessing the nutritional status of school children a one day food weighment survey was conducted in a subsample (30 children - 15 from control group and 15 from experimental group). Since the diets consumed by rural low income categories are more or less uniform with negligible variations in their day to day intakes, the food intake pattern and quantities of food consumed can be obtained by following a one day weighment method (Jansi and Sarojini, 1991). Hence a one day food weighment survey was conducted in the present study.

This method is the most reliable one for assessing the actual food consumption pattern. In this method the investigator weighed the raw foods included in the meal for a day, and the cooked weights of each preparation was also recorded. The amount of each food consumed by the child was also weighed, so also the plate wastage, to get the exact amounts of food consumed. Any other extra foods consumed by the child like toffee, biscuits etc. was also taken into account. All these weighments were done using standard measuring cups and spoons and also by means of a food weighing balance. Plate 4 shows the weighing of cooked foods. The amount of cooked food items consumed by the child was then converted to its

raw equivalents. The nutritive value of the foods consumed was calculated using the food composition Table (Gopalan *et al.*, 1989).

3.6.5 Statistical analysis of the data

For the interpretation and narration of the results, the data obtained were analysed using statistical techniques such as correlation and multiple regression analysis and the regression method of the double sampling procedure for examining the validity of the dietary recall survey.

RESULTS

4. RESULTS

The results of the research work entitled 'Dietary habits and nutritional profile of school children participating in the school lunch programme' are projected under the following headings:

4.1 Demographic details of the families which included socio-economic conditions of the families and details of the selected school children

4.2 Dietary habits of families and food consumption of school children

4.3 Nutritional status of school children assessed by

a) Clinical examination of the selected children with the help of a qualified physician
b) Anthropometric measurements of school children
c) Actual food and nutrient intake of school children

4.1 Demographic details of the families

Distribution of the families according to the type of family, family size (adults) and number of children in the family is presented in Table 1.

Table 1. Type of family, family size and number of children

Variable	Category	Control group (n=80)		Experimental group (n=80)	
		Numbers	Percentage	Numbers	Percent-age
Type of family	Joint	11	13.75	4	5.0
	Nuclear	69	86.25	76	95.0
Family size	2	69	86.25	76	95.0
(No. of adults)	3	-	-	-	-
	4	11	13.75	4	5.0
	5 and above	-	-	-	-
No. of children	1	9	11.25	1	1.25
	2	60	75.0	75	93.75
	3	11	13.8	4	5.0
	4 and above	-	-	-	-

Majority of the families in both control and experimental group were nuclear families (86.25 and 95%) with two adults (86.25 and 95%) and two children (75 and 93.75%). Joint family system was observed in 13.75 per cent of the families in control group whereas it was only 5 percent in experimental group. In control group 11.25 per cent of the families had only one child and this was 1.25 in the experimental group. Three children were found in 13.8 per cent of the families in control when compared to the experimental group which was only five per cent.

Distribution of the families based on religion is presented in Table 2.

Table 2. Distribution of families based on religion

Community	Control group (n=80)		Experimental group (n=80)	
	Number	Percentage	Number	Percentage
Hindu	42	52.5	48	60.0
Nair	12	15.0	8	10.0
SC	24	30.0	34	42.5
OBC	6	7.5	6	7.5
Christian	10	12.5	15	18.75
Muslim	28	35.0	17	21.3
Total	80	100	80	100

As revealed in Table 2 majority of the families surveyed were Hindus in control as well as experimental group (52.5 and 60 per cent). Muslims constituted the second major community in both the groups, the highest (35%) in control whereas 21.3 per cent in experimental group. Christians was found to be 12.5 per cent in control and 18.75 per cent in experimental group. Among Hindus majority were schedule caste families, 30 per cent in control and 42.5 per cent in experimental group. Next is the Nair families which constituted 15 per cent in control group and 10 per cent in the experimental group. In both groups 7.5 per cent of the Hindus belonged to the other Backward community.

Educational status of the parents are presented in Table 3.

Table 3. Educational status of the parents

Educational status	Control group (n=80)				Experimental group (n=80)			
	Father		Mother		Father		Mother	
	No.	%	No.	%	No.	%	No.	%
Illeterate	-	-	-	-	-	-	-	-
Lower primary	30	37.5	5	6.3	58	72.5	40	50.0
Upper primary	32	40.0	50	62.5	20	25.0	15	18.8
High school	18	22.5	20	25.0	2	2.5	25	31.3
College	-	-	5	6.3	-	-	-	-
Total	80	100	80	100	80	100	80	100

As revealed in Table 3, 40 and 37.5 per cent of the fathers in control group were having educational status at upper primary and lower primary levels respectively. About 22.5 per cent of the fathers were educated at High school level. In experimental group majority of the fathers (72.5%) were educated only upto lower primary level followed by upper primary level (25%). Only 2.5 per cent of the fathers have high school level education. Regarding the educational status of mothers in control group majority of the mothers (62.5%) were educated at upper primary level followed by high school level (25%). About 6.3 per cent of the mothers have college level education. In experimental group about 50 per cent of the mothers were educated at lower primary level followed by high school level (31.3%).

Occupational status of the parents are given in Table 4.

Table 4. Type of occupation of parents

Type of occupation	Control group (n=80)				Experimental group (n=80)			
	Father		Mother		Father		Mother	
	Number	Percent-age	Number	Percent-age	Number	Percent-age	Number	Percent-age
Permanent	55	68.8	46	57.5	50	62.5	38	47.5
Temporary	5	6.3	14	17.5	10	12.5	15	18.8
Daily wages	2	2.5	18	22.5	10	12.5	17	21.2
Business	3	3.8	-	-	5	6.3	-	-
Agriculture	15	18.8	2	2.5	5	6.3	10	12.5
Total	80	100	80	100	80	100	80	100

As seen in Table 4, in control group majority of the fathers (68.8%) and mothers (57.5%) have permanent jobs. While in experimental group 62.5 per cent of fathers and 47.5 per cent of mothers have permanent job. Agriculture was found to be the second major occupation of fathers in control group (18.8%) but mothers (22.5%) worked for daily wages. Mothers were also found to be working in temporary jobs (17.5%). In experimental group 12.5 per cent of fathers and 21.3 per cent of mothers worked as labourers for daily wages. Temporary jobs were taken up by 12.5 per cent of fathers whereas it is 18.8 per cent in the case of mothers.

Average monthly income of the families are presented in Table 5.

Table 5. Distribution of families based on average monthly income

	Control (n=80)		Experimental (n=80)	
Income level (Rs)	Number	Percentage	Number	Percentage
500-1000	6	7.5	10	12.5
1001-2000	60	75.0	64	80.0
2001-3000	12	15.0	5	6.2
3001-4000	2	2.5	1	1.3

As revealed in Table 5, majority of the families in control group (75%) and experimental group (80%) were having monthly income upto Rs.2,000. In

control group 15 per cent of the families were having income between Rs.2,000-3,000. In the experimental group 12.5 per cent of the families were having monthly income ranging from Rs.500-1,000. A very few percentage of families were having income above Rs.3,000/month in control (2.5%) and experimental group (1.3%).

Housing condition of the families were assessed by observing the type of house, type of roof, structure of house and separate rooms in the house etc. The details are presented in Table 6.

Table 6. Housing condition of the families

Housing condition	Control group (n=80)		Experimental group (n=80)	
	Numbers	Percent-age	Numbers	Percent-age
1. Own house	55	68.8	70	87.5
2. Rented house	25	31.3	10	12.5
3. Type of house				
2 rooms	20	25.0	25	31.3
3-5 rooms	60	75.0	55	68.8
6-8 rooms	-	-	-	-
7-8 rooms	-	-	-	-
3. Type of roof				
Tiled	55	68.8	60	75.0
Concrete	25	31.3	20	6.3
Thatched	-	-	-	-
4. Structure of house				
Mud built	-	-	-	-
Brick built	80	100.0	80	100.0
Thatched	-	-	-	-
5. Separate rooms				
Drawing room	58	72.5	50	62.5
Bedroom	80	100.0	60	75.0
6. Separate kitchen	80	100.0	80	100.0

As revealed in Table 6 majority of the families in control group (68.8%) and experimental group lived in their own homes where as 31.3 per cent of the families in control group and 12.5 per cent in experimental group lived in rented houses. Three to five rooms were observed in majority of the houses in control (75%) and experimental group (68.8%). All the houses in both groups were built with bricks and 68.8 per cent of the houses in control and 75 per cent of houses in experimental group were tiled. Concrete roofs were observed in 31.3 per cent of houses in control group whereas it is only 6.3 per cent of houses in experimental group. All the houses in control group were having separate bed room while only 75 per cent of the houses in experimental group had separate bed rooms. In 72.5 per cent of houses in control group had separate drawing rooms and it is 62.5 per cent in the case of experimental group houses. All the houses in both groups had separate kitchen.

Other living facilities such as source of drinking water, lavatory and drainage facilities etc. were assessed and the results are presented in Table 7.

As shown in Table 7, majority of the families in control (97.5%) and experimental group (87.8%) had electric connections in their houses. All families in both groups had lavatory and drainage facilities in their houses. In the control group 95 per cent of the families had their own wells as source of drinking water and the remaining families resorted to public taps and wells. In experimental group 75 per cent of the families had their own wells and the remaining families (12.5%) depended on public taps and wells. About 31.3 per cent of the families in control group and 42.5 per cent in experimental group have bicycles as their means of transport. All the families in both groups possessed radio as a source of information. In the control group 42.5 per cent of the families possessed television and in the experimental group it was 28.8 per cent.

Table 7. Other living facilities of the families

Other facilities	Control group (n=80)		Experimental group (n=80)	
	Numbers	Percent-age	Numbers	Percent-age
1. Electricity facilities				
Yes	79	97.5	75	87.8
No	1	1.3	5	6.3
2. Lavatory	80	100.0	80	100.0
3. Drainage	80	100.0	80	100.0
4. Source of drinking water				
Own well	76	95.0	60	75.0
Public tap	2	2.5	10	12.5
Public well	2	2.5	10	12.5
River	-	-	-	-
Tank	-	-	-	-
5. Transport facilities				
Bicycle	25	31.3	34	42.5
Motorbike	5	6.3	1	1.3
Car	-	-	-	-
Jeep	-	-	-	-
6. Recreational facilities				
Radio	80	100.0	80	100.0
Television	34	42.5	23	28.8
Transister	-	-	-	-
VCR	-	-	-	-

Monthly expenditure pattern of the families were studied and the details are presented in Table 8 and 9.

Table 8. Monthly expenditure pattern of control group families (n=80)

Range of monthly expenditure (%)	Percentage of families							
	Food	Cloth-ing	Rent	Trans-port	Educat-ion	Entert-ainment	Health	Savings
0-10	-	100	39.1	100	75.4	13.6	100	6.50
11-20	-	-	40.05	-	-	63.1	-	53.50
21-30	-	-	20.85	-	-	23.3	-	40.00
31-40	-	-	-	-	24.6	-	-	-
41-50	-	-	-	-	-	-	-	-
51-60	73.8	-	-	-	-	-	-	-
61-70	20.4	-	-	-	-	-	-	-
71-80	5.8	-	-	-	-	-	-	-
81-90	-	-	-	-	-	-	-	-

As revealed in Table 8 about 73.8 per cent of the families in control group spent 51-60 per cent of their monthly income on food. Food expenditure for 20.4 per cent of families was found between 61-70 per cent of monthly income and only 5.8 per cent of families spent 71.80 per cent of their income on food. All the families in control group spent only upto 10 per cent of their monthly income on clothing, transport and health. For 53.5 per cent of the families it is seen that 11-20 per cent of their income is saved.

Table 9. Monthly expenditure pattern of experimental group families (n=80)

Range of monthly expenditure (%)	Percentage of families							
	Food	Cloth-ing	Rent	Trans-port	Educat-ion	Entert-ainment	Health	Savings
0-10	-	100	15.6	100	50.0	10.6	100	5.3
11-20	-	-	40.0	-	32.1	62.1	-	60.5
21-30	-	-	44.4	-	17.9	27.3	-	34.2
31-40	-	-	-	-	-	-	-	-
41-50	-	-	-	-	-	-	-	-
51-60	71.0	-	-	-	-	-	-	-
61-70	25.4	-	-	-	-	-	-	-
71-80	3.6	-	-	-	-	-	-	-
81-90	-	-	-	-	-	-	-	-

As revealed in Table 9, 71 per cent of families in experimental group spent 51-60 per cent of their monthly income on food. About 25.4 per cent of the families spent 61-70 per cent whereas 3.6 per cent spent upto 71 per cent of their monthly income on food. Almost all families spent only upto 10 per cent of their income on clothing, transport and health. It is seen that 50.0 per cent of the families in this group is spending upto 10 per cent of their income on education and 15.6 per cent of families spent upto 10 per cent of income for payment of rent. About 60.5 per cent of families saved 20 per cent and 34.2 per cent saved 30 per cent of their monthly income.

The school going child (7-9 age group) in the family was considered as the index child and details regarding the index child is presented in the following tables.

Distribution of school children based on gender is given in Table 10.

Table 10. Distribution of school children based on gender

Gender	Control group		Experimental group	
	Number	Percentage	Number	Percentage
Male	35	43.8	50	62.5
Female	45	56.2	30	37.5
Total	80	100.0	80	100.0

From the above table, about 43.8 per cent of children in control group were males and 56.3 per cent were females. In experimental group 62.5 per cent of index children were males and 37.5 per cent were females.

Birth order of the children is presented in Table 11.

Table 11. Birth order of school children

Birth order	Control group (n=80)		Experimental group (n=80)	
	Number	Percentage	Number	Percentage
1st	23	28.8	33	41.2
2nd	57	71.2	47	58.8
3rd	-	-	-	-
4th	-	-	-	-
Total	80	100.0	80	100.0

As revealed in Table 11 majority of children in control group (71.2%) and experimental group (58.8%) were of the 2nd birth order. About 28.8 per cent of children in control group and 41.2 per cent of children in experimental group were of the first birth order. No children were found to be in 3rd birth order.

As stated by mothers the incidence of various diseases for the past one year among the selected school children were recorded and is given in Table 12.

Table 12. Incidence of various diseases

Diseases	Control group (n=80)		Experimental group (n=80)	
	Number	Percentage	Number	Percentage
1.Diarrhoea	72	90.0	70	87.5
2. Respiratory tract infection	6	7.5	11	13.8
3. Pneumonia	1	1.3	-	-
4. Measles	7	8.8	3	3.8
5. Cholera	-	-	-	-
6. Chicken pox	28	35.0	23	28.8
7. Typhoid	-	-	-	-
8. Tuberculosis	-	-	-	-
9. Mumps	44	55.0	51	63.8
10. Fever	80	100.0	80	100.0
11. Jaundice	-	-	-	-

As shown in Table 12 about 90.0 per cent of children in control group and 87.5 per cent of children in experimental group had the incidence of diarrohea during the past one year. All the children had fever. One of the major infectious disease occurred was mumps (55% in control and 63.8% in experimental) followed by chicken pox (35% in control and 28.8% in experimental group). Respiratory tract infections were found to occur in 7.5 per cent of children in control and 13.8 per cent in experimental group children.

The immunization status of school children were studied and is presented in Table 13.

Table 13. Immunization status of children

Immunization status	Control group		Experimental group	
	Number	Percentage	Number	Percentage
Complete	69	86.3	70	87.5
Partially complete	11	13.7	10	12.5
Not taken	-	-	-	-
Total	80	100.0	80	100.0

The above table, revealed that, in control group 69 per cent of children and in experimental group 87.5 per cent of children had followed their complete immunization schedule whereas 13.7 per cent in control group and 12.5 per cent in experimental group were only partially immunized.

4.2 Dietary habits of the families

Dietary habits and food consumption pattern of the families were studied and the results are presented.

Table 14 presents the dietary habits of the families.

Table 14. Dietary habits of the families

Food habit	Control group		Experimental group	
	Number	Percentage	Number	Percentage
Vegetarian	-	-	-	-
Non vegetarian	80	100.0	80	100.0

From the above table it is observed that all the families in both groups were non vegetarians.

Table 15. Frequency of use of foods items by control group families (n=80)

Food items	Percentage of families					
	Daily	Weekly				Occasionally
		Once	Twice	Thrice	Four	
Cereals	100.0	-	-	-	-	-
Pulses	-	30.25	25.38	27.75	16.62	-
Green leafy vegetables	-	89.35	8.30	-	-	2.35
Roots and tubers	-	55.2	27.30	17.50	-	-
Other vegetable	90.3	9.7	-	-	-	-
Fruits	30.4	60.3	-	-	-	9.40
Milk and milk products	100.0	-	-	-	-	-
Meat	-	85.2	-	-	-	14.80
Fish	-	65.3	-	-	-	34.70
Egg	-	73.9	-	-	-	26.10
Fats and oil	100.0	-	-	-	-	-
Sugar and jaggery	100.0	-	-	-	-	-
Bakery items	-	-	-	30.4	-	69.60

The frequency of use of various food items by the families were enquired and is presented in Table 15 and Table 16.

As revealed in Tables 15 and 16 all the families in control and experimental group included food groups such as cereals, milk and milk products,

fats and oils and sugar and jaggery in their daily diet. Consumption of pulses four days a week was found in 16.62 per cent of families in control group whereas in experimental group it was only in 8.13 per cent. About 27.75 per cent of families in control and 28.75 per cent of families in experimental group consumed pulses three days a week. Pulse consumption was restricted to weekly once in 30.25 per cent families in control 36.25 per cent families in experimental group.

Table 16. Frequency of use of foods items by experimental group families (n=80)

Food items	Percentage of families					
	Daily	Weekly				Occasionally
		Once	Twice	Thrice	Four	
Cereals	100.00	-	-	-	-	-
Pulses	-	36.25	26.88	28.75	8.13	-
Green leafy vegetables	-	86.25	11.25	-	-	2.50
Roots and tubers	-	61.25	14.38	24.40	-	-
Other vegetable	88.13	5.63	3.75	-	2.50	-
Fruits	-	59.38	20.00	-	-	20.60
Milk and milk products	100.00	-	-	-	-	-
Meat	-	52.50	-	-	-	47.50
Fish	-	76.88	11.88	-	-	11.25
Egg	-	71.25	-	-	-	28.75
Fats and oil	100.00	-	-	-	-	-
Sugar and jaggery	100.00	-	-	-	-	-
Bakery items	-	-	-	30.4	-	69.60

Green leafy vegetables were consumed only once a week by majority of the families in control (89.35%) and experimental group (86.25%). About 2-3 per cent of families in both groups consumed green leafy vegetables only occasionally. Daily inclusion of other vegetables were found to be in 90.3 per cent of families in control group and 88.13 per cent of families in experimental group.

Roots and tubers were consumed once a week (55.2%) twice a week (27.3%) and thrice a week (17.50%) by the control group families. But 61.25 per cent of families in experimental group consumed roots and tubers only once a week.

Consumption of fruits was restricted to once a week by majority of the families in control (60.3%) and experimental group (59.38%). Daily consumption was observed in 30.4 per cent of families in control group whereas 20.6 per cent of families in experimental group consumed fruits only occasionally.

Majority of the families in both groups consumed non vegetarian foods only once a week. Consumption of meat was restricted to once a week by majority of the families in control (85.2%) and in experiment group (52.5%). About 14.8 per cent families in control and 47.5 per cent families in experimental group consumed meat only occasionally. Consumption of fish was restricted to once a week by majority of families in control (65.3%) and experiment group (76.88%). In 34.7 per cent families in control and 11.25 per cent families in experimental group consumption of fish was only occasionally.

Consumption of egg was also found once a week by 73.9 per cent families in control and 71.25 per cent families in experimental group. Occasional consumption of this food item was observed in 26.1 per cent families in control and 28.75 per cent in experimental group.

Consumption of ready to eat bakery items was found to be occasional in all families in experimental group and 69.6 per cent families in control group. About 30.4 per cent families consumed procured bakery items thrice a week.

All the families in the control and experimental group were found to follow three major meal pattern.

Type of processed foods and beverages consumed by the families and frequency of purchase of processed foods are presented in Table 17 and 18.

Table 17. Type of processed foods and beverage consumed by the families (control group n=80)

Food items	Once a week		Occasionally		Never	
	Number	Percent-age	Number	Percent-age	Number	Percent-age
Bread	24	30.0	56	70.0	-	-
Biscuit	43	53.8	37	46.3	-	-
Noodles	-	-	33	41.2	47	58.8
Carbonated beverages	30	37.5	50	62.5	-	-
Fruit squash	-	-	80	100.0	-	-
Pappads	-	-	80	100.0	-	-
Corn flakes	9	11.3	71	88.8	-	-

As revealed in Table 17 in the control group majority of the families (70%) purchased bread occasionally whereas 30 per cent of the families purchased it once in a week. Biscuits were purchased once a week by 53.8 per cent of the families and occasional purchase was found in 46.3 per cent of families. Regarding noodles 58.8 per cent of families never purchased this and 41.3 per cent purchased it only occasionally. Carbonated beverages were also found to be purchased occasionally in 62.5 per cent of the families but in 37.5 per cent of families this was purchased once a week. Processed foods like squash and pappads were purchased by all the families only occasionally. About 11.3 per cent of the families purchased corn flakes once a week.

Table 18. Type of processed foods and beverage consumed by the families (experimental group n=80)

Food items	Once a week		Occasionally		Never	
	Number	Percent-age	Number	Percent-age	Number	Percent-age
Bread	33	41.3	47	58.8	-	-
Biscuit	52	65.0	28	35.0	-	-
Noodles	11	13.8	69	86.3	-	-
Carbonated beverages	24	30.0	56	49.0	-	-
Fruit squash	-	-	80	100.0	-	-
Pappads	-	-	80	100.0	-	-
Corn flakes	4	5.0	-	-	76	95

As indicated in Table 18 in experimental group 58.8 per cent of families purchased bread occasionally whereas 41.3 per cent purchased it once a week. Sixty five per cent of the families purchased biscuits once a week. About 86.3 per cent of the families purchased noodles occasionally whereas 13.8 per cent purchased it once a week. Forty nine per cent of the families purchased carbonated beverages occasionally and 30 per cent of the families purchased once a week. All the families purchased processed foods like squash and pappads occasionally. About 5 per cent of the families purchased corn flakes once a week but 95 per cent of the families never purchased this processed food item.

The source of information about these processed foods/beverages were enquired and is presented in Table 19.

Table 19. Source of information regarding processed foods.

Source of information	Control group (n=80)		Experimental group (n=80)	
	Number	Percentage	Number	Percentage
Friends	48	60.0	30	37.5
Television advertisements	32	40.0	50	62.5

Above table reveals that in the control group the main source of information was found to be friends (60%) followed by Television advertisements. In experimental group 62.5 per cent of the families were influenced by Television advertisements followed by friends (37.5%).

Food and nutrient intake of selected school children were assessed by 24 hour recall survey and the results are presented below.

Table 20 and 21 presents the mean food intake of school children in the control and experimental group which is also presented in Fig. 1.

Table 20. Mean food intake of children (Recall method)

Food items (gms)	RDA* (g)	Control group (n=80)		Experimental group (n=80)		't' value
		Intake	% of RDA	Intake	% of RDA	
Cereals	270	230.80	85.44	253.45	93.90	8.9446**
Pulses	20	18.23	91.15	25.40	125.00	8.9942**
Green leafy vegetables	50	8.56	17.12	6.30	12.60	8.9446**
Other vegetables	30	14.00	46.67	13.00	43.30	9.0112**
Roots and tubers	20	16.32	81.60	15.30	76.50	8.9474**
Fruits	50	18.13	36.26	17.42	34.80	0.5655^{NS}
Milk	250	136.63	54.70	125.40	50.16	11.6740**
Meat / fish / egg	30	10.40	34.60	9.50	31.70	8.0511**
Fats and oils	30	11.50	38.30	10.50	35.00	8.2782**
Sugar and jaggery	40	13.20	33.00	12.12	12.12	8.9478**

* ICMR (1990)
** Significant at 1% level
NS - Non significant

Table 20 reveals that cereal consumption was only 85.44 per cent of RDA in control and 93.9 per cent in experimental group. Regarding the consumption of pulses, 91.15 per cent of RDA was met by the control group and in experimental group it was more than the RDA (125%). The consumption of green leafy

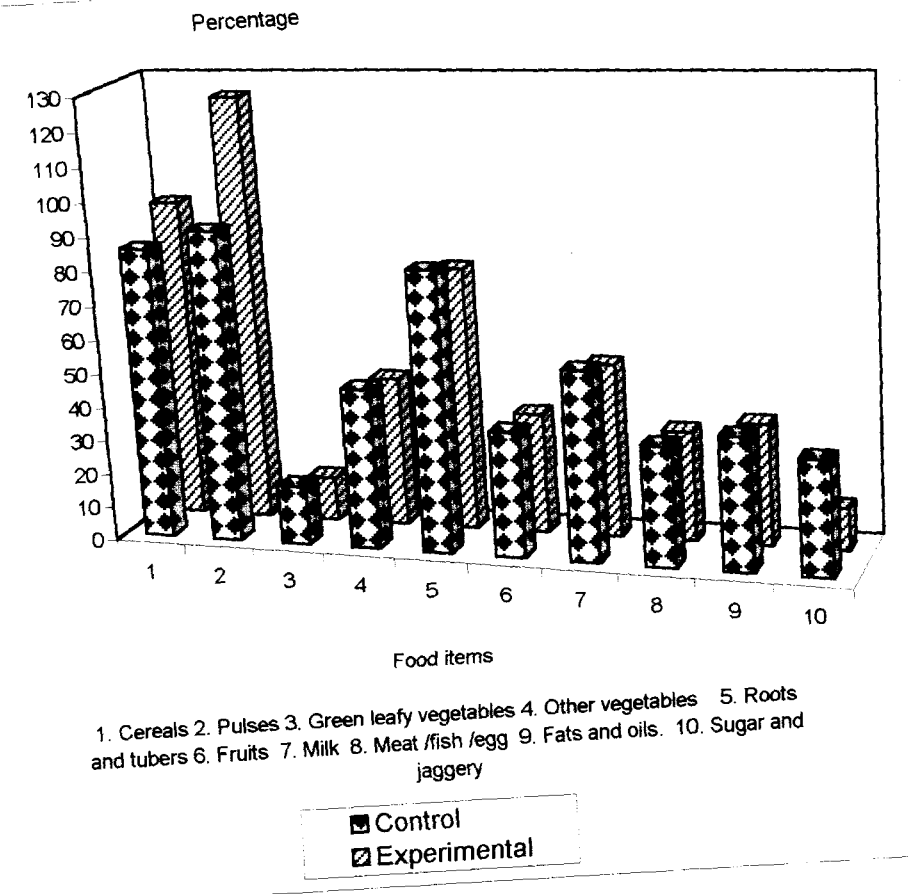


Fig. 1. Food intake of school children as percentage of RDA (recall method)

vegetables was found to be very low in both groups (17.12 and 12.6% respectively in control and experimental group). The consumption of other vegetables were found to be between 40-46 per cent of RDA in both the groups. In control group 81.6 per cent of RDA for roots and tubers was met and it was only 76.5 per cent of RDA in the case of experimental group. Consumption of fruits, flesh foods, fats and oils and sugar and jaggery was found to be below 40 per cent of RDA in both the control and experimental groups. Consumption of milk was found to be 54.7 per cent and 50.16 per cent of RDA in control and experimental groups irrespectively.

As indicated in the table 20 a significant increase in the intake of only cereals and pulses was observed in experimental group when compared to the control group. The intake of all other food groups was found to be significantly low in the experimental group than the control group.

Table 21 reveals the mean nutrient intake of school children in the control and experimental group which is also presented in Fig. 2).

Table 21. Mean nutrient intake of children (Recall method)

Nutrients	RDA* (g)	Control group (n=80)		Experimental group (n=80)		't' value
		Intake	% of RDA	Intake	% of RDA	
Energy (Kcal)	1950	815	42	1293	66	6.168**
Protein (g)	41	32	79.07	39	95.46	1.2247^{NS}
Calcium (mg)	400	245	61.37	33	82.67	2.045**
Iron (mg)	26	22	84.83	24.10	92.69	1.7945**
Retinol (mcg)	600	640	107	685	114.15	3.8140**
Thiamine (mg)	1.0	0.612	61.20	1.389	38.90	1.3649*
Riboflavin (mg)	1.2	1.23	102.50	1.672	139.33	2.4113**
Niacin (mg)	13	7.4	56.92	9.9	76.1	2.5654**
Vitamin C (mg)	40	25.3	63.25	29.24	73.10	0.7284^{NS}

* ICMR (1981)
** Significant at 1% level
* Significant at 5% level
NS - Non significant

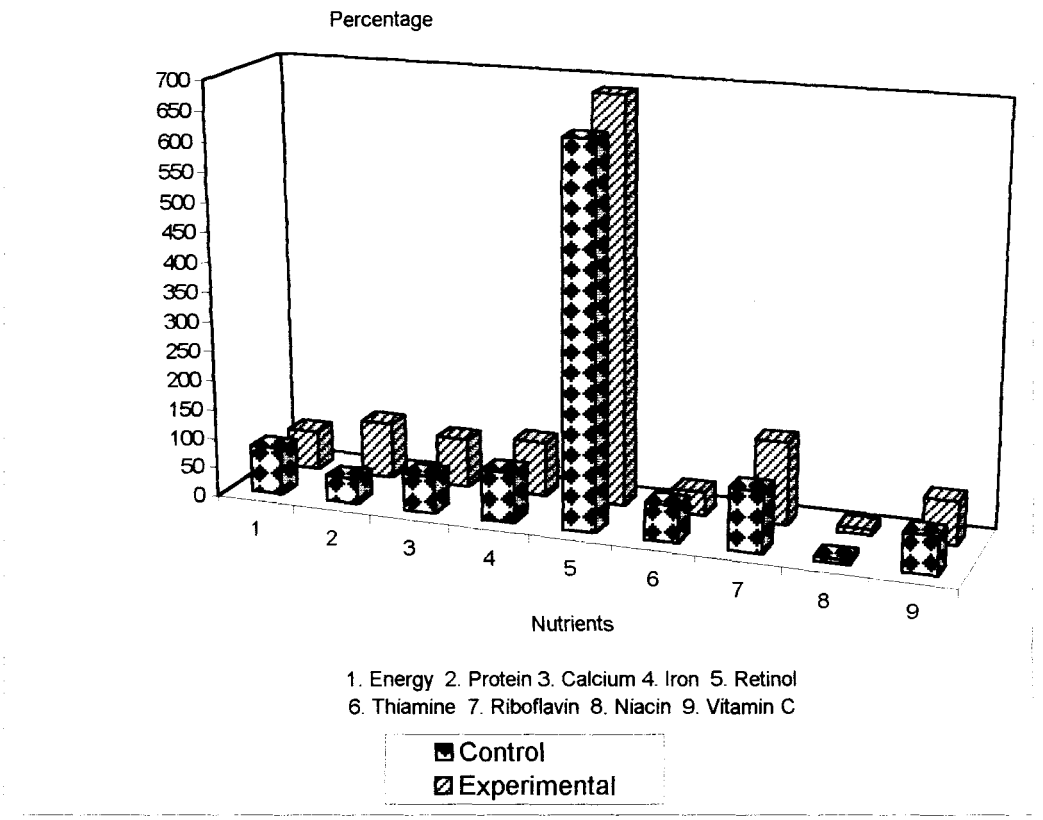


Fig. 2. Nutrient intake of school children as percentage of RDA (recall method)

As indicated in Table 21 the energy intake was only 42 per cent of RDA in control and 66 per cent in experimental group. Protein intake in experimental group was found to be 95.46 per cent RDA where as it was only 79.07 per cent in control group. Regarding Calcium and iron intake it was 82.67 per cent and 92.69 per cent of RDA in experimental group where as it was only 61.37 per cent and 84.83 per cent respectively in control group. Retinol intake was found to be 107 per cent and 114 per cent of RDA in control group and experimental group respectively. Thiamine intake was 61.27 per cent of RDA in control and 38.9 per cent in experimental group. Regarding vitamin C intake 73.10 per cent of RDA was met by the experimental group whereas it was only 63.25 per cent in control group.

As indicated in the table 21 a significant increase in the intake of nutrients like energy, calcium and iron was observed in experimental group when compared to the control group. Eventhough there was an increase in the intake of protein, thiamine, and vitamin C in experimental group, when compared to the control group, the increase was not significant.

4.3 Nutritional status of school children assessed by

a) Clinical examination of children

School children in control and experimental groups were examined by a physician for any manifestation of clinical symptoms and the results are presented in Table 22.

As revealed in Table 22, 81.3 per cent of children in experimental group and in 93.8 per cent of children in control group exhibited one or other symptoms of malnutrition.

Table 22. Details of clinical examination

Presence of clinical symptoms	Number of children	
	Control group (n=80)	Experimental group (n=80)
Present	75(93.8)	65(81.3)
Abstent	5(6.2)	15(18.75)
Total	80(100)	80(100)
Type of clinical symptoms		
Emaciation	3(4)	1(1.5)
Dental caries	60(80)	60(92.3)
Anaemia	10(13.3)	3(4.6)
Night blindness	2(2.7)	1(1.5)

Figures in parenthesis indicates percentage

The most prevalent deficiency symptoms observed was anaemia which was clinically manifested in 13.3 per cent of children in control group and in 4.6 per cent of children in experimental group. Emaciation was found in 4 per cent of children in control group and in 1.5 per cent of children in the experimental group. Vitamin A deficiency manifested as night blindness was reported in 2.7 per cent of children in the control group and in 1.5 per cent of children in experimental group. Dental caries which is not considered as a clinical symptom of malnutrition was widely prevalent in 80 per cent of children in control and 92.3 per cent of children in experimental group.

b) Anthropometric measurements of school children

Anthropometric measurements such as height, weight and mid upper arm circumference of school children were recorded and compared with the Indian standards (ICMR, 1990) and the results are presented in Table 23.

Table 23 presents the mean heights and weights of school children in both control and experimental group.

Table 23. Mean heights and weights of children

Measurement	Indian standard * (ICMR 1990)	Control group (n=80)	Experimental group (n=80)
Height (cm)	127.96	126.1	126.7
Weight (kg)	26.90	23.5	24.7

*Indian Council of Medical Research (1990)

As revealed from Table 23 the mean heights of children in both control (126.1) and experimental group (126.7) was found to be low when compared with Indian standards. In the case of body weight also the mean weights of control (23.5) and experimental group (24.7) were below the standard values.

Table 24 projects the comparison of heights of children in control and experimental group.

Table 24. Comparison of height in control and experimental group of children

Group	Below standard	Above standard*	Total
Control	51 (63.8)	29 (36.2)	80
Experimental	48 (60.0)	32 (40.0)	80

Chi square = 0.10587^{NS} * ICMR (1990)

NS - Nonsignificant
Figures in parenthesis indicates percentages

As indicated in the table about 63.8 per cent of children in the control group have mean heights below the standard whereas 36.2 per cent of children were having heights above the standard value. In experimental group about 60 per cent of children were having mean heights below the standard and 40 per cent were having mean heights above the standard. Chi square analysis revealed that this difference in the heights between the control and the experimental group in comparison with the standard is not significant.

Table 25 projects the comparison of weights of children in control and experimental group.

Table 25. Comparison of weight in control and experimental group children

Group	Below standard	Above standard*	Total
Control	70 (97.5)	10 (12.5)	80
Experimental	59 (73.95)	21 (26.25)	80

Chi square = 4.001** * ICMR (1990)

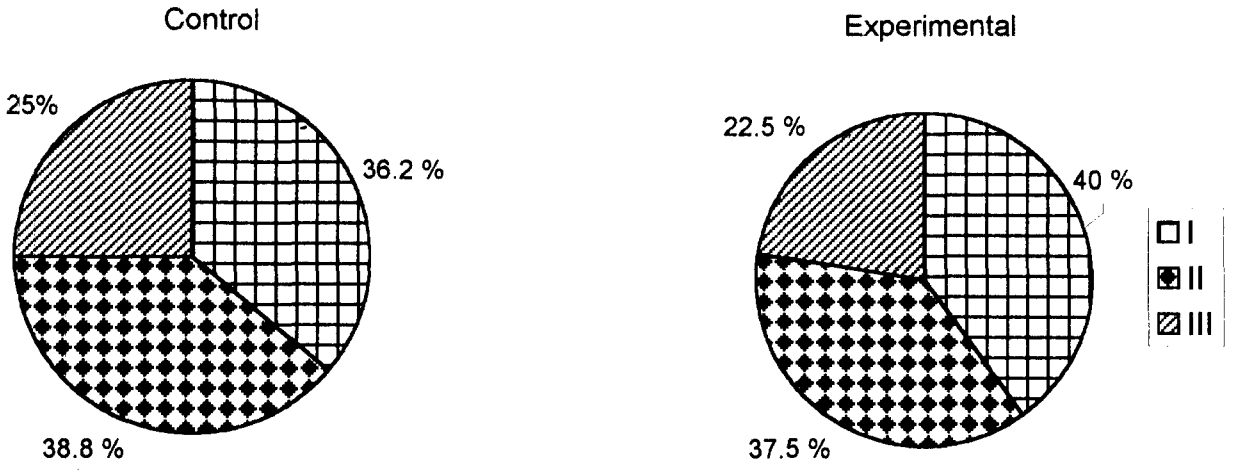
**Significant at 5% level
Figures in parenthesis indicates percentages

As indicated in the table the difference in the body weights between the control and experimental group in comparison with the standard is found to be significant.

Prevalence of malnutrition among school children as per height for age according to Waterlow's classification (1972) is given in Table 26 and also presented in Fig. 3.

Table 26. Prevalence of malnutrition among children
(Height for age - Waterlows classification (1972)

Waterlows classification of standard	Control group (n=80)		Experimental group (n=80)	
	Number	Percentage	Number	Percetage
<85% (Severe malnutrition) of standard	-	-	-	-
85-90% (Moderate malnutrition) of standard	20	25.0	18	22.5
90-85% (Marginal malnutrition) of standard	31	38.8	30	37.5
>95% (Normal)	29	36.2	32	40.0



I - Normal
II - Marginal malnutrition
III - Moderate malnutrition

Fig. 3. Prevalence of malnutrition among children (7-9 age group) (Height for age - Waterlow's classification)

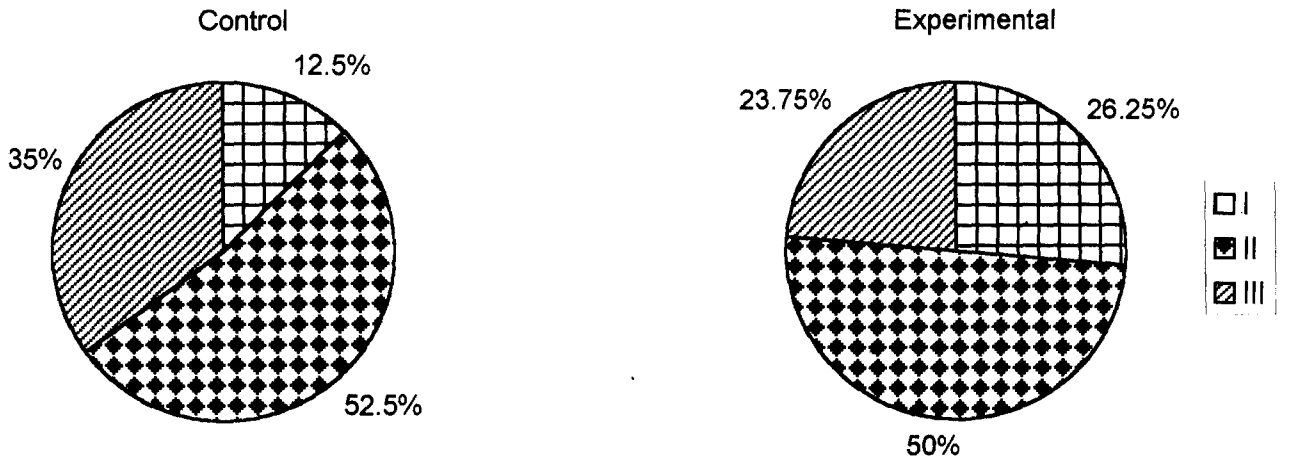
As revealed in Table 35 about 40 per cent of children in the experimental group were having normal height for their age whereas it is 36.2 per cent in the control group. Prevalence of marginal malnutrition was more in the control group (38.8%) when compared to the experimental group (37.5%). Moderate malnutrition was observed in 25 per cent of children in the control group and it is 22.5 per cent in the experimental group children. Severe malnutrition was not observed in both groups.

Prevalence of malnutrition among school children as per weight for age according to Gomez (1956) classification is given in Table 27 and also presented in Fig. 4.

Table 27. Prevalence of malnutrition among children
(Weight for age - Gomez classification (1956)

Gomez classification of standard	Control group (n=80)		Experimental group (n=80)	
	Number	Percentage	Number	Percetage
<85% (Severe malnutrition) of standard	-	-	-	-
85-90% (Moderate malnutrition) of standard	28	35.0	19	23.75
90-95% (Marginal malnutrition) of standard	42	52.5	40	50.00
>95% (Normal)	10	12.5	21	26.25

As indicated in Table 27 with regard to weight for age 26.25 per cent of children in the experimental group belonged to the normal group while in control group it was 12.5 per cent. Grade I malnutrition was prevalent in 50 per cent of children in experimental group and 52.5 per cent of children in the control group. Prevalence of grade II malnutrition was found to be more in control group children (35%) where as it was 23.75 per cent in experimental group children. Grade III malnurition was not observed in both groups.



I - Normal
II - Marginal malnutrition
III - Moderate malnutrition

Fig. 4. Prevalence of malnutrition among children (7-9 age group) (Weight for age - Gomez classification 1956)

Anthropometric ratios were worked out using the data and weight/height^2 ratio as suggested by Rao and Singh (1970) is given in Table 28. the results are also presented in Fig. 5.

Table 28. Distribution of children by nutritional status (Weight/Height^2 ratio - Rao and Singh, 1970)

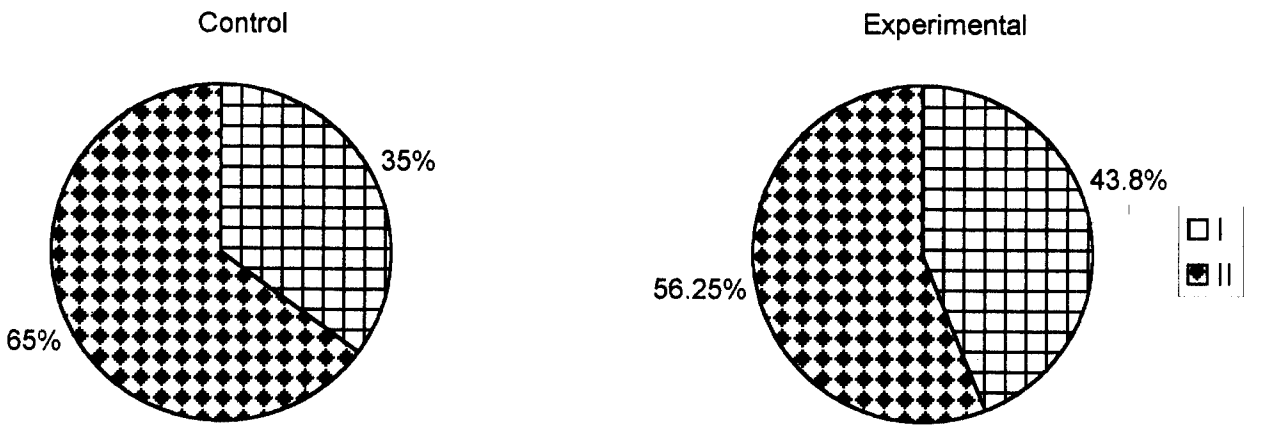
Anthropometric ratio	Classification	Control group (n=80)		Experimental group (n=80)	
		No.	%	No.	%
Weight / Height^2	Normal (>0.0015)	28	35.0	35	43.8
	Moderate malnutrition (0.0013-0.0015)	52	65.0	45	56.25
	Under nutrition (<0.0013)	-	-	-	-

As shown in Table 28, weight/height^2 ratio indicated that 43.8 per cent children in the experimental group and 35 per cent in control group were normal. Moderate malnutrition was prevalent more in control group (65%) when compared to the experimental group which is 56.25 per cent.

Observations of the mid-upper arm circumference (MUAC) of the children were interpreted according to Gopaldas (1987) classification and is presented in Table 29. The results are also presented in Fig. 6.

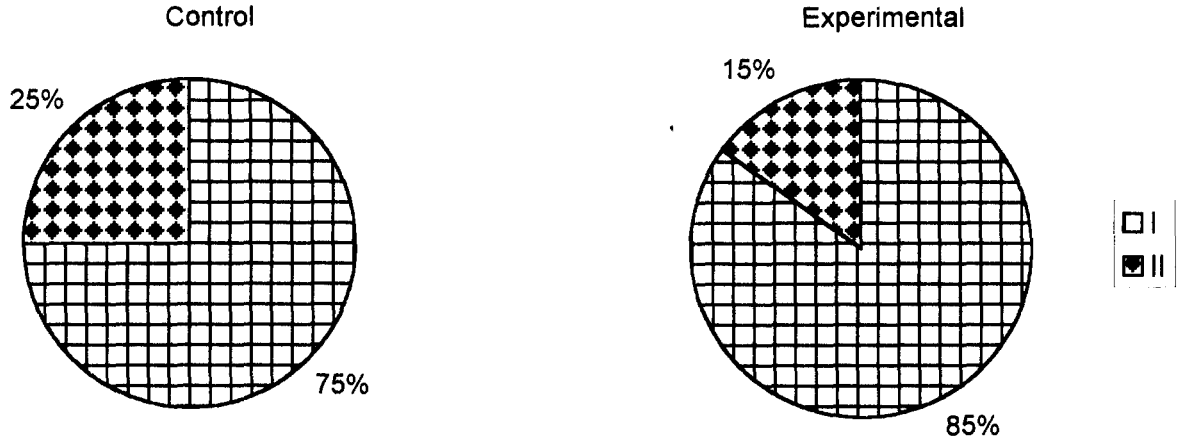
Table 29. Distribution of children based on MUAC (7-9 age group) (Gopaldas, 1987)

Anthropometric measurement	Classification	Control (n=80)		Experimental (n=80)	
		Number	Percentage	Number	Percentage
MUAC	Normal (>13.5 cm)	60	75	68	85.0
	Moderate malnutrition (12.5-13.5 cm)	20	25	12	15.0
	Under nutrition (<12.5 cm)	-	-	-	-



I - Normal
II - Moderate malnutrition

Fig. 5. Distribution of children by nutritional status (7-9 age group) (Weight / Height^2 ratio - Rao and Singh 1970)



I - Normal
II - Moderate malnutrition

Fig. 6. Distribution of children by MUAC (7-9 age group) (Tara Gopal Das classification)

As indicated in Table 29 in control group. 75 per cent of children in the control group belonged to normal whereas 25 per cent children came under the group with moderate malnutrition. In experimental group 85 per cent children came under the normal group whereas only 15 per cent children came under the group with moderate malnutrition.

c) Actual food and nutrient intake

Actual food and nutrient intake of school children was assessed by conducting a one day food weighment survey in a subsample (15 from each group) and the results are presented in the following tables.

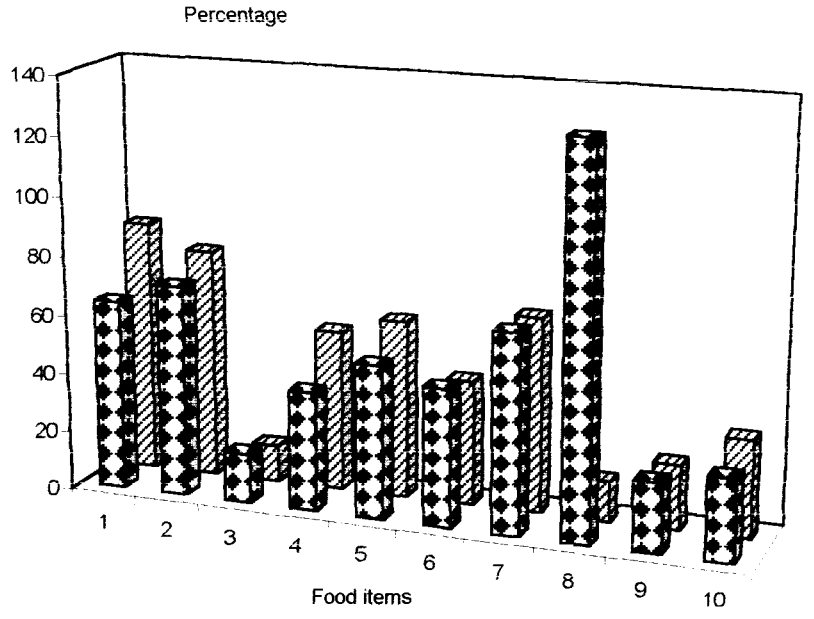
Table 30 presents the mean food intake of school children compared to RDA in both control and experimental group which is also presented in Fig. 7.

Table 30. Mean food intake of children (Weighment method)

Food items (g)	RDA* (g)	Control group (n=15)		Experimental group (n=15)		't' value
		Intake	% of RDA	Intake	% of RDA	
Cereals	270	173.4	64.22	230.4	85.33	3.87298**
Pulses	20	14.3	71.50	15.5	77.50	4.74450**
Green leafy vegetables	50	8.3	16.60	6.2	12.40	3.87310**
Other vegetables	30	12.0	40.00	16.3	54.30	3.87290**
Roots and tubers	20	10.3	51.50	12.0	60.00	3.87300**
Fruits	50	23.0	46.00	21.0	42.00	3.87300**
Milk	250	167.5	67.00	164.0	65.60	3.87290**
Meat / fish / egg	30	39.0	130.00	40.5	135.0	3.87280**
Fats and oils	30	7.0	23.33	6.5	21.67	3.87250**
Sugar and jaggery	40	11.0	27.50	13.0	32.50	3.87300**

* ICMR (1981)

** Significant at 1% level



1. Cereals 2. Pulses 3. Green leafy vegetables 4. Other vegetables 5. Roots and tubers
6. Fruits 7. Milk 8. Meat /fish /egg 9. Fats and oils. 10. Sugar and jaggery

Control
Experimental

Fig.7. Food intake of school children as percentage of RDA (weighment method)

As shown in Table 30 consumption of all the food groups in both control and experimental group were below the RDA except for flesh foods which was 130 per cent of RDA in control and 135 per cent of RDA in experimental group. Cereal consumption was only 64.22 per cent of RDA in control group whereas it was 85.33 per cent in experimental group children. Similarly, the consumption of pulses was also more in experimental group children which met 77.5 per cent of RDA and it was 71.5 per cent in control group children. consumption of green leafy vegetables was very poor in both the groups which was only 16.6 per cent of RDA in control and still reduced to 12.4 per cent in experimental group children. Regarding the consumption of other vegetables 54.3 per cent of RDA was met by the experimental group children whereas it was only 40 per cent in control group. Sixty per cent of the RDA was met in the case of roots and tubers in experimental group and it was 51.5 per cent in control group. Consumption of fruits in both groups ranged between 42-46 per cent of RDA. Similarly milk consumption was found to be between 65-67 per cent of RDA. Consumption of fats and oils was 23.33 per cent of RDA in control and 21.67 per cent in experimental group children. Sugar and jaggery was consumed only at a level of 27.5 per cent of RDA in control and 32.5 per cent of RDA in experimental group.

As indicated in the above table when the food intake of control and experimental group children were compared statistically it was found that there was a significant increase in the intake of food groups such as cereals, pulses, other vegetables, roots and tubers, flesh foods and sugar and jaggery in the experimental group children when compared to the control group. But the intake of foods such as green leafy vegetables, fruits, milk and fats and oils were found to be significantly high in control group children.

Nutrient intake of children were calculated and is presented in Table 31 and in Fig. 8.

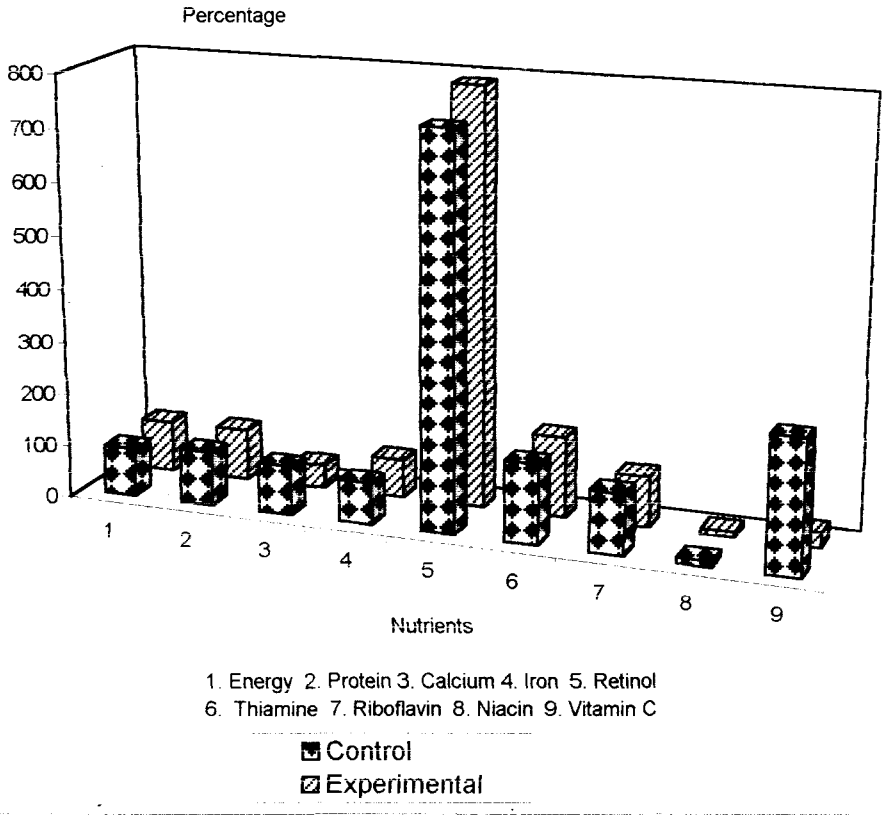


Fig.8. Nutrient intake of school children as percentage of RDA (weighment method)

Table 31. Mean nutrient intake of children (Weighment method)

Nutrients	RDA*	Control group (n=15)		Experimental group (n=15)		't' value
		Intake	% of RDA	Intake	% of RDA	
Energy (Kcal)	1950	1784	91.48	1841	94.39	0.4384^{NS}
Protein (g)	41	41.79	101.94	39.28	95.80	0.5268^{NS}
Calcium (mg)	400	374.530	93.63	179.713	44.93	3.9036**
Iron (mg)	26	20.310	78.12	18.993	73.05	0.3237^{NS}
Retinol (µg)	600	740.4	123.4	788.6	131.43	1.7708**
Thiamine (mg)	1.0	1.514	151.40	1.514	151.40	0.0387^{NS}
Riboflavin (mg)	1.2	1.381	115.08	1.147	95.58	1.1438^{NS}
Niacin (mg)	13	9.7	74.6	9.8	75.46	0.1445^{NS}
Vitamin C (mg)	40	10.77	25.19	11.46	28.67	4.6720**

*ICMR (1990)

As shown in the table energy consumption was found to be 91.48 per cent of RDA in control group and in experimental group it was 94.39 per cent. Protein consumption was 101.94 per cent of RDA in control and 95.8 per cent in experimental group. More than 90 per cent of RDA for calcium was met by the control group and in experimental group calcium intake was found to be only 44.93 per cent of RDA. Iron intake was found to be above 70 per cent in both the groups. Regarding retinol 123.4 per cent of RDA was met in control group whereas in experimental group it was 131.43 per cent. Intake of B vitamins such as thiamin, riboflavin and niacin was found to be 151.4 per cent, 115.08 per cent and 74.6 per cent of RDA in control group, whereas in experimental group thiamin, riboflavin and niacin intake was found to be 151.4, 95.58 and 75.4 per cent of RDA respectively. Regarding vitamin C consumption it was 25.19 per cent of RDA in control group whereas it was 28.67 per cent in experimental group children.

Table 31 reveals that eventhough there is an increase in the intake of nutrients such as energy, retinol in the experimental group the increase was not

significant. Similarly the intake of proteins and iron, thiamin and riboflavin was found to be high in control group when compared to the experimental group but the increase was not significant. Regarding the intake of calcium the intake by the control group was significantly high when compared to experimental group.

Validity of the 24 hour recall survey

Validity of the 24 hour dietary recall survey was examined by comparing the data with that of the weighment survey using correlation analysis and is presented in Tables 32 and 33.

Table 32 presents the comparison of mean food intake of children computed in recall and weighment method.

Table 32. Comparison of mean food intake of children in Recall and Weighment methods

Food items (gms)	Control group			Experimental group		
	Recall	Weigh-ment	Correlat-ion	Recall	Weigh-ment	Correlat-ion
Cereals	218.71	185.86	0.818*	228.80	181.09	0.106^{NS}
Pulses	15.36	10.33	0.718*	17.07	14.30	0.414^{NS}
Green leafy vegetables	23.14	14.47	0.176^{NS}	31.69	12.42	0.150^{NS}
Other vegetables	21.95	13.87	0.370^{NS}	18.77	12.42	0.016^{NS}
Roots and tubers	17.39	9.55	0.076^{NS}	15.07	8.47	0.153^{NS}
Fruits	15.99	12.43	0.298^{NS}	22.71	14.17	0.021^{NS}
Milk	158.76	141.93	0.315^{NS}	465.67	169.27	0.462^{NS}
Meat / fish / egg	15.96	16.43	0.154^{NS}	15.00	12.07	0.152^{NS}
Fats and oils	8.61	4.41	0.469^{NS}	8.46	5.53	0.039^{NS}
Sugar and jaggery	20.59	6.87	0.083^{NS}	14.96	9.83	0.425^{NS}
			0.417^{NS}			

**Significant at 1 per cent level NS - Nonsignificant

As revealed in the table no positive correlation was obtained for any of the food groups except for cereals in control group which was found to have a positive correlation between the computed amount in recall survey and weighed amount in weighment survey.

Table 33 presents the comparison of mean nutrient intake of children in recall and weighment methods.

Table 33. Comparison of mean nutrient intake of children in Recall and Weighment methods

Nutrients	Control group			Experimental group		
	Recall	Weigh-ment	Correlat-ion	Recall	Weigh-ment	Correlat-ion
Energy (Kcal)	740.17	1783.95	-0.621 ^{NS}	969.67	1840.67	0.440^{NS}
Protein (g)	17.17	41.80	0.135^{NS}	24.72	39.27	0.558^{NS}
Calcium (mg)	120.53	261.20	0.333^{NS}	151.57	163.01	0.178^{NS}
Iron (mg)	24.22	20.45	-0.288^{NS}	16.32	18.99	0.029^{NS}
Retinol (mcg)	640.35	740.40	0.301^{NS}	684.88	788.60	-0.297^{NS}
Thiamine (mg)	0.54	1.51	-0.481^{NS}	0.47	1.51	0.611^{NS}
Riboflavin (mg)	0.27	1.38	-0.749^{NS}	0.35	1.15	0.340^{NS}
Niacin (mg)	6.32	9.00	-0.608^{NS}	8.73	9.87	-0.013^{NS}
Vitamin C (mg)	17.60	23.87	0.114^{NS}	16.03	15.85	0.360^{NS}

NS - Nonsignificant

As indicated in table no positive correlation existed between the intakes of any of the nutrients calculated as per the recall survey and weighment survey in both control and experimental groups.

DISCUSSION

5. DISCUSSION

5.1 Demographic variables

The sample selected for the study consisted of two groups of children in the age group of 7-9 years. Each group has 80 children. First group consisted of children who are not participating in the school lunch programme (control) and the second group who are participating in the existing school lunch programme (experimental).

Type and size of the families, religion, income and educational status of the parents etc. are some of the important factors which indirectly influence the nutritional status of children.

The present study indicated that majority of the families in control (86.25%) and experimental group (95%) followed nuclear family system. Saxena (1986) also observed that nuclear families are better than the joint families in health and development. The same family structure pattern was observed by Thomas (1989) and Joseph (1992) who conducted studies among agricultural labourers in the State. Urbanisation and changes in social values might have brought about this phenomenon in the family structure of modern societies.

Size of the family is a prominent factor deciding the nutritional status of the children as large family size is regarded as a risk factor for malnutrition in developing countries among young children (Wowenberg *et al.*, 1970; UNICEF, 1984 and Tuncibilek *et al.*, 1995). In the present study majority of the families in the control (86.25%) and experimental group 995%0 had four members (2 adults and 2 children), which still falls below 5.3, the average size of the families in Kerala (Census, 1991). Studies conducted by Cherian (1992), Jayanthakumari (1993) and Udaya (1996) also revealed the same family pattern in Kerala.

Majority of the families consisted primarily of scheduled class Hindus (30% in control and 42.5% in experimental) and backward class Hindus (7.5%) in both groups. Muslim community constituted of 35 per cent in the control and 21.3 per cent in the experimental group. Christian families were found to be a minority in control (12.5%) and experimental group (18.75%).

A positive association between parental literacy and nutritional status was reported by Devadas (1994). The study revealed all the parents were literate in both groups. This is a very special feature of Kerala. According to Census report of India (1991) Kerala is the most literate State (94%) with a female literacy of 82.93 per cent. The present study also indicated a high educational level for mothers and as suggested by UNICEF (1991) the level of education of the mothers also seemed to effect the nutritional status of children. Similar results were reported by Shyna (1996), Udaya (1996) and Jose (1998) in Thrissur district. Studies by Mathen (1998) in Kerala and NIN (1996) in the States of Haryana, Andra Pradesh, Karnataka and Gujarat, reported a higher percentage of literacy among the male members than the female members.

The study revealed that majority of the fathers (68.8%) and mothers (57.5%) were permanently employed in the control group as well as in the experimental group (62.5 and 47.5%).

Monthly income for most of the families in control (75%) and experimental group (80%) ranged from Rs.1000-2000).

As observed, living conditions of the families were satisfactory in both groups. Majority of the families in control group (75%) and experimental group (68.8%) had their own houses with 3-5 rooms. Most of the houses in the two groups were tiled, built with brick walls and having separate kitchen and bedroom. Drinking water source for most of the families in two groups were from their own wells. Lavatory and drainage facilities were found in 100 per cent of the families in

the two groups. More than 85 per cent of the families in the two groups had electric connections in their houses. Majority of the families resorted to public conveyance as their means of transportation. Recreational facilities for almost all the families were the possession of a Radio and Television. With regard to rural housing conditions similar findings were reported by Shyna (1996), Udaya (1996) and Mathen (1998) in their studies in Thrissur district.

Monthly expenditure pattern of the families revealed that majority of the families in control group (73.8%) and experimental group (71%), spent (51-60%) of their monthly income on food. Similar findings were observed by Usha *et al.* (1990) in rural low income families in Thiruvananthapuram district and Udaya (1996), Mathen (1998) and Jose (1998) in Thrissur district.

The present study also reported that less than 10 per cent of the monthly income was spent on clothing, rent, transport, education, entertainment and health. The same pattern was observed by Usha *et al.* (1989), Augustine (1993), Karuna (1993) and Rai and Sarup (1995) in their Kerala studies. But majority of the families in control (53.5%) and experimental group (60.5%) saved 11.20 per cent of their monthly income. This is in line with the study conducted by Udaya (1996) who reported that 56 per cent of the families saved money.

In the present study 56.2 per cent of school children were girls whereas in experimental group majority were boys (62.5%).

Majority of the children in the control group (71.2%) and experimental group (58.8%) were of second birth order. Various infections common during childhood like diarrhoea, whooping cough, tuberculosis and measles precede and precipitate malnutrition in children (Guerrant *et al.* 1992 and Mathai, 1997). In the present study as reported by mothers in both groups children had diarrhoea during the past one year. Other common infectious diseases reported to have occurred in children were mumps, chicken pox and measles in both groups.

Majority of children in the control (86.3%) and experimental group (87.5%) were subjected to their complete immunization schedule. In complete immunization was observed in 13.7 per cent children in control group and in 12.5 per cent children in experimental group. This is in accordance to the findings of Mubarak *et al.* (1990). The greater compliance to the immunization schedule could be due to the greater awareness with respect to health among mothers.

5.2 Dietary habit

The present study revealed that all the families in both groups were habitual non vegetarian with a dietary habit of three major meals a day. Usha *et al.* (1990), Cherian (1992), Jayanthakumari (1993), Augustine (1993), Udaya (1996) and Shyna (1996) also observed same dietary pattern among majority of the rural families of Kerala.

The frequency of use of various food items showed that all the families consumed food groups such as cereals, milk and milk products, fats and oils and sugar and jaggery daily. This is mainly because the staple food is rice. The daily inclusion of milk and milk products, sugar and jaggery is mainly from coffee or tea. The main source of fats and oils is coconut oil used for seasoning curries and other cooking procedures. The same dietary pattern was observed in the study conducted by Shyna (1996) in rural households of Thrissur district. The consumption of pulses was found to be about three days a week in many families but it was restricted to once a week by 30.25 per cent families in control and 36.25 per cent families in experimental group. Even though all families were non vegetarians daily consumption of non vegetarian foods were not observed mainly because of its high cost. Among non vegetarian foods, fish consumption was found in 65.3 per cent families in control and 76.88 per cent families in experimental groups. Once a week meat consumption was also found to be in majority of the families in both groups.

Protective foods like vegetables was consumed daily by 90.3 per cent of families in control and 88.13 per cent families in experimental group. Consumption of green leafy vegetables was observed only once a week by majority of the families.

Moderate consumption of roots and tubers were observed in majority of the families but frequency of consumption of fruits was very low.

Processed foods like bread was consumed occasionally by most of the families in both groups. Where as biscuits were consumed by majority of the families once a week. All the families consumed squash, pappads etc. occasionally in both the groups. It was striking to note that in control group (37.5%) and experimental group (30%), once a week consumption of carbonated beverages like pepsi, cococola, fanta etc. was observed.

Majority of the families in both groups reported that friends and television advertisements were the main source of information for them about these processed foods and influenced them in purchasing these foods. This is in line with the study conducted by Shaw *et al.* (1993) who reported that the increase in the consumption of processed foods among Indians appeared to be due to the easy availability of these products even in the rural market. This justifies the argument that demand for proccured foods was often increased and reinforced by the media of communication. Increasingly, students are more influenced by the advertisements and they are also attracted by the packaging and the incentives given by the companies.

Food habits of school children assessed by a 24 hour recall survey revealed that the cereal consumption was low in both groups when compared to RDA, but when compared to control group, consumption of cereals by experimental group children was significantly high. A 24 hour recall survey conducted by Subhasini and Satinder (1987) in school children also revealed that the cereal

consumption was only 59-64 per cent of RDA. Pulse consumption was also found to be significantly high in experimental group when compared to control group. This may be due to the daily consumption of cereals and pulses in this group through school lunch programme. The consumption of all other food groups was low in two groups when compared to RDA.

Regarding nutrient intake riboflavin and retinol was found to be high when compared to RDA in both groups. All other nutrients were below the RDA in both groups. When both groups were compared a significant increase in the intake of nutrients like energy, calcium, iron and retinol was observed in experimental group. Vitamin C intake was found to be low in both groups.

5.3 Clinical examination

Dental caries was observed in most of the children irrespective of the groups. This is mainly due to the poor oral hygiene and also consumption of sticky sweets (Srilakshmi, 1999). The most common nutritional deficiency diseases observed among children was anaemia, in both groups (13.3 and 4.6% respectively). Night blindness was also observed in 2.7 per cent children in control group and 1.5 per cent in experimental group.

5.4 Anthropometric measurements

Measurement of growth of children is an important, widely used method for assessment of nutritional status of communities (Agarwal, 1989). To monitor the health status of school children growth rate is one of the most reliable and simple method (Rajagopalan, 1983).

In the present study, anthropometric measurements such as body weight, height and mid upper arm circumference of children were recorded and compared with Indian standards as suggested by ICMR (1994).

The present study revealed that the mean heights and weights of children in both control and experimental group was low, when compared with Indian standards.

Chi-square analysis revealed that the difference in the heights between the control and experimental group is not significant, but the difference in the body weights between the control and experimental group of children was significant.

The height deficit for age is regarded as a measure of long duration (chronic) malnutrition or stunting in children (Gopaldas and Seshadri, 1987). As a result the children may look apparently normal but when compared to their age it will be evident that there is considerable growth retardation. Distribution of children according to Waterlow (1972) classification based on height for age revealed that about 40 per cent children in the experimental group and 36.2 per cent children in the control group were having normal height for their age. Height deficit as indicated by marginal malnutrition and moderate malnutrition was more in the control group (38.8% ad 25% respectively) as against 37.5 per cent and 22.5 per cent in the experimental group. Severe malnutrition was not observed in both groups. In both groups about 60 per cent of the children were having marginal and moderate malnutrition.

Weight for age has been used as an index of malnutrition which reveals current nutritional status (Lucas, 1992; Narin, 1992; Sathi *et al.*, 1991).

Distribution of children based on different grades of malnutrition as suggested by Gomez *et al.* (1956) using ICMR (1990) standards revealed that in both control and experimental groups about 50 per cent of children showed weight deficit indicating grade I malnutrition. Grade II malnutrition was observed more in control group children (35%) as against the experimental group children (23.75%). Children with normal weight was more in experimental group than in control group. In general the pattern of prevalence of malnutrition as shown by weight deficit in the

present study is such that in control group about 87.5 per cent of children were having grade I and grade II malnutrition whereas in experimental group 73.75 per cent of children had grade I and grade II malnutrition, but the prevalence rate in grade II is far less when compared to the control group.

Comparison of weight/height^2 ratio with the classification of Rao and Singh (1970) for various grades of malnutrition indicated that in experimental group more children belonged to normal group (43.8%) when compared to control group (35%). Prevalence of moderate malnutrition was more in control group.

Mid upper arm circumference (MUAC) is recognized to indicate the status of muscle development. It has been reported that MUAC may be useful not only in identifying malnutrition but also in determining the mortality risk in children (Rao and Vijayaraghavan, 1996).

In the present study, observations of the mid upper arm circumference of the children were interpreted according to the classifications suggested by Gopaldas (1987). The results indicated that majority of the children in control and experimental groups had normal nutritional status (75 and 85% respectively). The prevalence of moderate malnutrition was more in control group children.

From the above observations it can be concluded that there was no incidence of severe grades of malnutrition among children. This is in accordance with the results obtained as per NNMB (1991) studies in Kerala that there is a classic change of severely malnourished children from 10.3 to 2 per cent by 1975-1990.

Nutrient intake, anthropometric measurements and their classification to different degrees of malnutrition can be explained by the report of Gopalan (1989). According to him, in Kerala inspite of the low intakes of energy and protein, the prevalence of severe grades of malnutrition is also the lowest in the State. In the present study also there observed a deficit in the intakes of nutrients such as calories,

proteins, vitamin A, iron and even then severe grades of malnutrition was not observed in both groups. This may be attributed to the better housing conditions and good personal hygiene of the families and the immediate medical attention given to children as the families are fairly literate (especially female literacy). Easily available and better utilization of health care facilities may be the other factors contributing to the absence of reverse grades of malnutrition.

The nutritional status of children as indicated by anthropometric measurements when compared with Indian standards, both groups of children were found to have low values. But based on different grades of malnutrition, about 75.25 per cent of children who participated in school lunch programme came under normal nutritional status and grade I malnutrition. But 87.5 per cent children in the control group came under grade I and grade II malnutrition.

5.5 Actual food and nutrient intake of school children

Observations from weighment survey revealed that except for flesh foods consumption of all food groups in control and experimental group were lower than the levels recommended by ICMR (1990). When the food intake of control and experimental group children were compared there was a significant increase in the intake of cereals, pulses, other vegetable, roots and tubers, flesh foods and sugar and jaggery in the experimental group. But the intake of foods such as green leafy vegetables, fruits, milk and fats and oils were found to be significantly high in control group.

Regarding nutrient intake, despite the low intakes of all food groups except flesh foods, the intake of B vitamin such as thiamine, riboflavin and niacin was found to be 151.4 per cent, 115.08 per cent and 74.6 per cent of RDA in control group whereas it was 151.4 per cent, 95.58 per cent and 75.4 per cent of RDA in experimental group respectively. Since the main source of energy in a rural Indian diet is from cereals and roots and tubers, naturally there observed a calorie gap in

their dietaries. Energy consumption level of school children was found to be 91.48 per cent of RDA in control group and 94.39 per cent in experimental group. Protein intake in both group was found to be satisfactory, may be due to the consumption of high amounts of flesh foods. In NNMB (1991) studies also the average protein intake in Kerala was close to RDA. But when the two groups were compared in their nutrient intakes there was not much significant difference between these two group, except for the high intake of calcium by the control and intake of retinol by the experimental group children.

The lower levels of intake of food groups and nutrients may be due to poor purchasing power as a result of low income levels of households. This low intake is surprising considering the impressive increase of food production. The NNMB (1994) shows that in more than 40 per cent of rural households the diets continue to be deficient in calories. This may be due to low purchasing capacity of the rural population. Though, the monthly per capita income of the households had increased, inflation and the consequent decline in the rupee value over the time has offset the benefit. In fact when adjustment was made for the rupee value there was no significant changes in the economic status of the rural families. With this level of income, the families cannot afford adequate diet, in the context of current food prices.

The present study also reveals the comparison of the mean food and nutrient intake calculated for children in 24 hour recall survey and by one day weighment method. The results indicated a positive correlation only in the intake of cereals in the control group. Regarding all other food groups no correlation was found in the intakes calculated in recall and weighment methods.

Regarding nutrients also no positive correlation existed between the intakes of any of the nutrients in both groups. This is in line with the studies conducted by Bazzarre and Myers (1978) who reported that the ability of the methods to produce comparable estimate varies greatly. The recall method depends

on the subjects ability to remember and adequately describe his/her diet. In the present study mothers were the respondents who actually described their children's food intake. In weighment method the investigator precisely weighed all the foods before and after cooking as well as the subjects portion of it. Hence this data can be taken as precise. Thimmayamma and Rao (1996) also reported that weighment method is relatively more accurate as it involves direct weighing of foods.

SUMMARY

6. SUMMARY

In the present study the dietary habits and nutritional profile of school children (7-9 age group) who were the beneficiaries of school lunch programme was ascertained. A total of 80 children participating in school lunch programme and 80 children not participating in school lunch programme formed the sample size for the study and a total of 160 children (families) were selected from Ollukkara Block of Thrissur district for the study.

Information regarding the socio economic details of the families indicated that majority of the families were nuclear families with two adults and two children. Most of the families were scheduled class Hindus. Educational status of the families revealed that all the parents were literate in both groups and were permanently employed. Monthly income for most of the families ranged from Rs.1,000-2,000. Housing conditions and living facilities of the families were found to be satisfactory.

Details regarding the index child revealed that majority of the children in both groups were of the second birth order and most of them were completely immunized.

Dietary habits of the families revealed that all the families were habitual non vegetarians. Their dietary pattern mainly comprised of the staple rice, vegetables. pulses and fats and oils. Daily consumption of sugar and milk were mainly from coffee and tea. Eventhough, all the families were non vegetarians, daily consumption of non vegetarian foods were not observed mainly because of its high cost. Among non vegetarian foods, fish consumption was found to be comparatively high in both groups. Consumption of green leafy vegetables and fruits by the families were found to be negligible.

Occasional consumption of processed foods like bread, biscuits, squash and pappads were observed among the families. But the consumption of carbonated beverages was found to be high in both groups. The study revealed that friends and

television advertisements were the main source of information for them about these processed foods.

Food consumption of school children assessed by a 24 hour recall survey indicated that the cereal and pulse consumption was high in experimental group when compared to the control group. The consumption of all other food groups was low in both groups when compared to RDA. Regarding nutrient intake by the school children, majority of the nutrients were below the RDA in both groups.

As revealed in clinical examination, dental caries was observed among most of the children. The most common nutritional deficiency disease observed among children was anaemia.

The anthropometric profile of school children was interpreted by comparing with Indian standards, as suggested by ICMR (1990). The study revealed that the mean height and weight of the children were low in both groups, when compared with Indian standards. There was significant difference in the body weights between the control and experimental group children but no significant difference between heights. Height for age distribution of children (Waterlow, 1972) revealed that height deficit as indicated by marginal malnutrition was more in the control group. Severe malnutrition was not observed in both groups. Distribution of children based on different grades of malnutrition as suggested by Gomez *et al.* (1956) revealed that children with normal weight was more in experimental group. The pattern of prevalence of malnutrition as shown by weight deficit is such that in control group 87.5 per cent of children were having grade I and grade II malnutrition whereas in experimental group 73.75 per cent of children had grade I and grade II malnutrition, but the prevalence rate in grade II is far less when compared to the control group. Weight/height^2 ratio with the classification of Rao and Singh (1970) for various grades of malnutrition indicated that in experimental group more children belonged to normal group. Prevalence of moderate malnutrition was more in control group.

Mid upper arm circumference of the children when interpretted according to the classification of Gopaldas (1987) indicated that majority of children in control and experimental group came under normal group. The prevalence of moderate malnutrition was more in control group children.

Actual food intake of school children assessed through weighment survey revealed that the intake of all the food groups except flesh foods were low when compared to RDA, but when the experimental and control groups were compared there was a significant increase in the intake of cereals, pulses, other vegetables, roots and tubers flesh foods and sugar and jaggery in the experimental groups.

Regarding nutrient intake, the intake of vitamins such as riboflavin was found to be high in control group where as niacine and retinol intake was high in experimental group.

Energy consumption level of school children was found to be 91.48 per cent of RDA in control group and 94.39 per cent in experimental group. Protein intake in both group was found to be satisfactory. When the two groups were compared in their nutrient intakes, there was not much significant difference between these two groups.

A comparison of food and nutrient intake of children by 24 hour recall and weighment methods revealed a positive correlation only in the intake of cereals in the control group. No positive correlation was observed between the intakes of any of the nutrients in both groups.

From the above observations it can be concluded that there was no incidence of severe grades of malnutrition among children. When compared with Indian standard values, both groups of children were found to have low values. But based on different grades of malnutrition most of the children in experimental group came under normal nutritional status and grade I malnutrition. But majority of children in the control group where having grade I and grade II malnutrition.

REFERENCES

REFERENCES

Adomaitis, A. 1978. Evaluation of the nutrition of school children and possibilities of improvement. Ernatrungs forschung - wissenschaff - und - praicis. **23**(6):167-169

Agarwal, D.K. 1989. Influence of malnutrition in social maturity, visual, mental co-ordination and memory in rural school children. *Indian J. of Medical Res.* **90**:320-327

Agarwal, K.N. 1991. Growth performance of Efficient Indian children. Ministry of Human Resource Development, Govt. of India, p.1

Akin, J.S. 1983. The school lunch programme and nutrient intake. *Proc. of Agrl. Economics.* **65**(3):477-485

Aneja, S. and Mehra, S. 1994. Vitamin A deficiency in children with acute diarrhoea. *J. Diarrhoeal - Diseases - Research,* **12**(2):125-128

Ashwell, M. 1990. Why we eat and what we eat. Proceedings of the Twelfth British Nutrition Foundation, Annual Conference, p.18

Augustine, J. 1993. Factors influencing the working efficiency of women engaged in stone breaking with special reference to Nutritional status, M.Sc.(FS&N) thesis, KAU, Vellanikkara, Thrissur, Kerala

Awashthi, C.P., Kalia, M. and Maurya, D.M. 1990. Nutritional profile of rural pre-school children of Sultanpure Dt. Of Eastern U.P. *Proc. Indian Institute of Rural Studies.* p.19

Awasthi, S. 1997. Prevalence of malnutrition and intestinal parasites in school children in Lucknow. *J. of Indian pediatr.* **34**(7):599-605

Bazzarre, T. and Myerr, M. 1978. The collection of food intake data in cancer epidemiology studies. *Indian J. Nutr.* **1**:22-45

Begum, M.R. 1991. *A text book of food, nutrition and dietetics*. Sterling Publishers, New Delhi.

Berge, S. 1980. Dietary survey among school children. *Amer. J. Nutr.* No.23, pp.64

Best, J.W. 1989. *Research in Education*. Prentice Hall of India Ptd. Ltd., New Delhi

Bhasin, S.K. 1990. Height and weight of well to do school children in Haryana. *Indian J. Pediatr.* **27**(10):1089-1093

Bhaskaram, P. 1985. Malnutrition - Infection the vicious cycle. Nutr. News. **6**(4)

Bhaskaram, P. 1989. Nutrition and immunity. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, India, **35**:123

Bhaskaram, P. 1996. Nutrition - immunization interactions and relevance to child health. *Nutr. News.* **17**(4)

Cameron, M. and Hofnander, Y. 1988. *Mannual in feeding infants and young children.* Oxford University press, New Delhi, p.19

Carlier, C., Etchepare, M., Ceccon, J.F. and Amedee, M.O. 1992. Assessment of the vitamin A status of school age senegalese children during a cross sectional study. *Inter. J. Nutr. Res.* **62**:209-215

Chandra, S. 1996. Anthropometric measurements of boys and girls (6-9 years) Panipat city. Haryana Agricultural University. *J. Res.* 1996, **26**(3):211-215

Chandrasekhar, U. and Amrithaveni, V. 1976. Scope for nutrition education in the primary school lunch programme and curriculum, *Indian J. Nutr. Dietet.* **11**(6):321-327

Chen, L., Choudhury, A.K. and Huffman, S.C. 1980. Anthropometric assessment of energy protein malnutrition. *Amer. J. Clin. Nutr.* **18**(7):782-789

Cherian, L. 1992. Food consumptions and energy expenditure pattern of agricultural labourers of Trivandrum District. M.Sc. (FS&N) thesis, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala.

Choksi, M.A. 1995. Advancing social development world Bank contribution to the social summit. World Bank, Washington, D.C.

Cohen, M. 1993. Fronds farming, the politics of hunger, silver spring. Bread for the world 35

Cohen, N., Rahman, H. and Spragne, J. 1985. *World Health Stat.* **2**(38):317

Darshan, S., Roy, C., Rao, P.N. and Nayar, S. 1988. Nutritional status of rural children of Vidharbha region - Maharashtra. *Indian J. Nutr. Dietet.* **25**:144

Dasgupta, R. 1989. *Nutritional planning in India.* Diamond Printers, New Delhi.

Devadas, R.P. and Kulandaivel, K. 1975. *Handbook of Methodology of Research.* Sri. Ramakrishna Mission Vidyalaya Press, Coimbatore, p.50-54

Devadas, R.P. 1986. Nutritional status of selected rural school children of Tamil Nadu. *Indian J. Nutr. Dietet.* **24**(1):87

Devadas, R.P., Chandrasekhar, V., Premakumari, S. and Geetha, G. 1991. Female literacy and family improvement. Part II correlation between family literacy and morbidity pattern among children. *Indian J. Nutr. Dietet.* **28**:70-77

Devadas, R.P. 1991. Assessing status of a given group. Sri.Avinashalingam Homescience Autonomous College for Women, Coimbatore, p.1-14

Devadas, R.P. 1994. Empowering women towards improving family nutrition. Proc. NIN Platinum Jubilee Symp. Nutr. Soc. India. National Institute of Nutrition, Hyderabad, India. **41**:85-105

Devi, P.Y. and Geervani, P. 1994. Determinants of nutrition status of school children in Andhra Pradesh, *Indian Fd. Nutr. Bulletin* **15**(4):335-342

Dhanalakshmi, U. and Devadas, R.P. 1978. Evaluation of school lunch programme in four selected primary schools in Coimbatore. *Indian J. Nutr. Dietet.* **15**(5):144-148

Directorate of Health Services. 1991. Kerala Family Welfare Programmes in Kerala. A Brouchure, 11

Easwaran, P. and Devadas, R.P. 1984. Growth performance and secular trends among school children of Coimbatore. *Indian J. Nutr. Dietet.* **21**:355

Fernadez. 1995. Nutritional anthropometry. *J. Amer. Dietet. Association.* **88**(5):553-555

Ghosh, S. 1986. Successful growth monitoring. *J. Indian Acad. Pediatr.* **23**:759-765

Gomez, F., Ramos, G.R., Frenk, S., Cvavitoto, J., Charez, R. and Vazquez, J. 1956. Mortality in second and third degree malnutrition. *J. Trop. Pediatr.* **2**:77

Gopalan, C., Sastri, B.V.R. and Balasubramanian, S.C. 1989. *Nutritive value of Indian Foods*. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India.

Gopalan, C. 1989. Malnutrition among pre-school children. *Fd. Nutr. Bulletin*, 6

Gopalan, C. 1991. Prefaratory chapter in recent bonds in Nutrition. *Proc. First Interal. Symposium.* Nutrition Foundation of India, ICMR, 3

Gopalan, C. 1991. The National Nutrition Science. The changing profile *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, India, **37**:10-11

Gopalan, C. 1992. Growth characters in primary child health care. Time for assessment. NFI Bulletin. **13**(3):

Gopaldas, T. and Seshadri, S. 1987. Nutrition Monitoring and Assessment. Oxford University Press, Delhi

Gopaldas, T. 1976. Nutrition Monitoring and Assessment. Oxford University Press, New Delhi.

Gopaldas, T. and Abbi, R. 1995. Prevalence of xerophthalmia and efficacy of vitamin A prophylaxis in preventing xerophthalmia co-existing with malnutrition. *J. Trop. Pediatr.* **39**(4):205-208

Guerrant, R.L., Schorling, J.B., Muttalifee, J.F. and DeSouza, M.A. 1992. Diarrhoea as a cause and an effect of malnutrition : diarrhoea prevents catch up growth and malnutrition increases diarrhoea frequency and duration. *Amer. J. Trop. Med. Hygiene* **47**:28-35

Hareis, R.J. 1997. Reducing elementary school children's risks for chronic disease through school lunch modifications nutrition education. *J. Nutr. Education* **29**(4):196-202

Herd, M.K. and Weeks, R.J. 1975. Major nutrients in the lunch. *J. Amer. Dietet. Association* **67**(4):356-360

Horner, M.R., Stinton, N.L. and Pringle, D.J. 1981. Malnutrition and associated factors in preschool Aliskito Indians in Nicaragur. *Ecology Fd. Nutr.* **10**(4):213-220

Hussain, M.A., Ahmed, S.M. and Elsheik, E.H. 1991. Xerophthalmia in malnourished sudanese children. Trop. Doctor (England) **21**(4):139-141

ICMR. 1981. *Nutritive value of Indian Foods*. National Institute of Nutrition, Hyderabad

ICMR, 1990. *Nutrient requirements and recommended dietary allowances for Indians*. National Institute of Nutrition, Hyderabad

ICSSR. 1980. Health for all. An alternate strategy. Mortality and Morbidity, 2

International conference on Nutrition Report. 1992. Nutrition - the Global challenge, Rome, 5-11 Dec. 1992,3-7

Islam, N. 1989. *Undernutrition and poverty*. Magnitude, pattern and resources for alleviation. 1988 world food conference. Proc. Volume II issue papers (eds.) Hetnuth, J.W. and Johnson, S.R. lowa state University Press, Ames, USA p.156-177

Jansi, G. and Sarojini, G. 1991. Analogy of Health and nutritional status of preschoolers in fishing families. *J. Res.* Andhra Pradesh Agricultural University. **21**(1):2-15

Jayanthakumari, S. 1993. Food consumption pattern of selected farm families in Thiruvanandapuram District. M.Sc. (Home Science) thesis, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala

Jelliffe, D.B. 1966. The assessment of the nutritional status of the community. WHO Monograph series, 33, W.H.O., Geneva

Jonstin, J.A. and James, V. 1997. Reducing elementary school children's risks for chronic disease through school lunch modifications, nutrition education. *J. Nutr. edn.* **29**(4):196-202

Jose, P.M. 1998. Maternal Employment and Nutritional status of preschool children. M.Sc. (Home Science) thesis, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala

Joseph, S.K. 1992. Impact of banana based supplementary foods on the nutritional status of infants. M.Sc. (Home Sci.) thesis, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala

Kadam, S.S., Salunkha, D.K., Jadhav, S.J. and Bhonsale, R.K.I. 1983. Protein caloric malnutrition. Brain development, intelligence and behaviour prenatal nutrition. *Indian J. Nutr. Dietet.* **20**(12):385

Kamath, S.V. 1989. Influence of nutritional status in intelligence of children in NES Block Trivandrum. M.Sc. (FS&N) thesis, Kerala Agricultural University, Thrissur

Kanbur, R. 1995. Investment in health care. A key ingredient in the formation of human capital and sustainability of socio economic development. World Bank, Washington, DC, 1

Kapil, U. 1996. Prevalence of under weight stunting and wasting. *Acad. Indian Pediatr.* **34**(7):627-631

Kapoor, A.C. and Dahiya, S. 1992. Nutritional assessment of selected 8 to 10 year old children of rural area of Haryana. *Indian J. Nutr. Dietet.* **29**(8):261-268

Karuna, M.S. 1993. Nutritional status of women engaged in fish vending in Trivandrum district. Ph.D. thesis, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala

Kaul, S.S. and Nyamingo, K.I. 1990. *Ecology, Growth and Nutritional Status*, Ashish Publishing House, New Delhi.

Kochupillai, N. 1997. Wide prevalence of iron and iodine deficiency related health problems are major impediments to equitable human development in India. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, India **44**:19-28

Kodayat, B.A. and Latif, D.K. 1994. Social marketing strategies to improve vitamin A status. Indonesia experience. *Proc. NIN Platinum Jubilee Symp. Nutr. Soc. India.* National Institute of nutrition, Hyderabad, India **41**:118-129

Lee, K.S., Lee, W.M. and Lee, S.Y. 1988. Effect of school lunch programmes on urban elementary school children. *Korean J. Nutr.* **21**(6):392-409

Lee, E.W., Lee, S.K. and Lee, Y.N. 1990. A nutrition survey of children attending an elementary school without school lunch programme in a low income group of seoul. *Korean J. Nutr.* **23**(7):513-520

Lucas, B. 1992. Nutrition in childhood, W.B. Saunders, Philadilphia.

Maendough, G. 1991. Better nutrition for the world poor. A challenge for the future. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, India **37**:91

Malina, R.N. 1972. Weight, height and limb circumference in American Negro children. *J. Trop. Pediatr. Environ. Child Health.* **18**:280-281

Marples, C.A. 1996. Factors affecting the participation of students in the school lunch programme. *J. Nutr.* Recipe and Menu Development **2**(1):3-14

Mathai, S.T. 1997. Nutrition and health education for adolescent girls. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, India **44**:95-116

Mathen, M.M. 1998. Nutritional status and intelligence of preschool beneficiaries of ICDS and non-beneficiaries of Thrissur District. M.Sc.(Home Science) thesis, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala

Mo, S. 1988. Effect of school lunch programmes on urban elementary school children, *Korean J. Nutr.* **21**(6):392-409

Mohanram, E. 1982. Work efficiency in nutrition. *Nutrition*. National Institute of Nutrition. **16**(3):8

Morene, E.M. 1993. Healthy families make healthy babies. World Health Organisation WHO, Geneva **3**(56):24

Mubarak, K., Safquat, S., Malik, U., Pirzada, R. and Dureshi, A.F. 1990. Health, attitudes and beliefs of working women. *J. Social Sci.* **31**(9):1029-33

Muller, D. 1981. The current status of urban/rural differences in Phychological disorder, an emerging trend for depression. INMD. **169**:18-27

Muratee, S. 1990. All about anaemia. Nutrition. **24**(2):3-12

Murthy, R. 1993. A round up on research achievement. *Nutrition*. National Institute of Nutrition. **27**(1):17

Nair, K.M. 1990. Iron balance in man. *Nutrition*. National Institute of Nutrition. **24**:13-22

Narin, C.M.D. 1992. Water electrolytes and acid balance. Krauses Food, Nutrition and diet therapy. Saunders. 141

National Dairy Council, 1981. What are children eating these days. 16pp.

NIN, 1982. Iron deficiency anaemia and mental function. Nutrition News. National Institute of Nutrition. Hyderabad **3**(1):

NIN, 1993. Women's work and its impact on health and nutrition. A. Rep. 1992-93. National Institute of Nutrition, Hyderabad, India, 14-21

NIN, 1995a. *The Impact of Women's work on Child and Health.* A summary report of the womens work and child development network. National Institute of Nutrition, Hyderabad, India, p.15

NIN, 1995b. Status of Mid-Day Meal Programme in Tamil Nadu States. Nutrition News, National Institute of Nutrition, Hyderabad, **16**(4):

NIN, 1996. Energy cost of women's work. A Rep. 1995-96. National Institute of Nutrition, Hyderabad, India, p.19-20

NIPCCID. 1992. Report of the SAARC conference on South Asian children, New Delhi, p.101

Nirmala, M.K. and Varalakshmi, S. 1991. Biochemical and functional consequences of riboflavin deficiency among school children. *Indian J. Nutr. Dietet.* **22**:236

NNMB, 1989. National Nutrition Monitoring Bureau. Report of repeat surveys, NIN, Hyderabad.

NNMB, 1991. National Nutrition Monitoring Bureau. Report of repeat surveys (1988-1990), NIN, Hyderabad.

NNMB, 1994. National Nutrition Monitoring Bureau. Report of repeat surveys. NIN, Hyderabad.

Oguntone, T. and Clara, R. 1985. Water soluble vitamins intake at school by Lagos children. *Indian J. Nutr. Dietet.* **22**:236

Oski, F.A. and Hong, A.S. 1978. Iron depletion, brain growth and development. *J. Pediatr.* **92**:21

Owolabi, A.O., Mac-Inegite, J.O., Olowomyan, F.O. and Chindo, H.O. 1996. A comparative study of the nutritional status of children in villages in Northern Nigeria using and not using soyabeans. *Fd. Nutr. Bull.* **17**(1):42-48

Pai, M.S. and Naik, R.K. 1989. Nutritional status of selected school children of Dharwad District. *Indian J. Nutr. Dietet.* **26**(4):108-112

Patirgolu, T. and Dogan, P. 1991. Iron deficiency anaemia and catecholamine metabolism. *Acad. Indian Pediatr.* **28**:51-56

Pelletier, Z.D., Frongillo, F.A.J., Sitoweder, D.G. and Hobicht, J.P. 1995. The effects of malnutrition on child mortality in developing countries. *Fd. Nutr. Bull.* **73**(4):28

Pillai, P.B. 1995. Prevalence of endemic goitre in school children. Medical Journal Armed Forces India. **51**(1):34-38

Pollitt, E. 1990. Malnutrition in the classroom. UNESCO. p.192

Pushpamma, Geervani, P. and Manorama, R. 1983. Food and nutrient intake and nutritional status of preschool and school age children in these regions of Andhra Pradesh. *Nutr. Rep.* **28**:427-437

Rai, S.C. and Sarup, S. 1995. Pattern of rural development in Southern India. Kurukshetra, p.27

Rajagopalan, S. 1983. Nutritional Indicators and measurements of poverty. TNAU, Coimbatore.

Rajajee, S. 1989. Nutritional Anaemias in childhood. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, **35**:122

Raman. 1992. Nutritional problems in India. *Nutrition.* National Institute of Nutrition, **19**:2

Ramesh, P., Praveen, C. and Monica, S. 1994. The impact of supplementary feeding programmes on the nutritional status and morbidity of children. *Indian J. Nutr. Dietet.* **21**(5):174-179

Rao, K.V. and Singh, D. 1970. An evaluation of the relationship between nutritional status and anthropometric measurements. *Amer. J. Clin. Nutr.* **23**:83-89

Rao, K.V. and Vijayaraghavan, K. 1996. Anthropometric Assessment of Nutritional Status. (ed. Banji, M.S., Rao, P.V. and Reddy, V.). *Textbook of Human Nutrition.* p.125

Rao, N.P. 1993. Major nutritional problems and programmes in India. *Little flower Res. Bulletin*, Angamally, **4**(1):12

Rao, B.S.N. 1994. Salt fortification to control iodine and iron deficiency. *Proc. NIN Platinum jubilee symp. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, India **41**:149

Rao, P. 1996. Dietary Assessment as a part of Nutritional Status. (ed. Banji, M.S., Rao, P.V. and Reddy, V.). *Textbook of Human Nutrition.* p.125

Ravinder, C. and Sushma, S. 1997. Feasibility of consumption of red palm oil in home based diets to combat vitamin A deficiency in under privileged school age children. *Proc. National Workshop on Red Palm Oil and Health* : Perspectives for India. CSIR, New Delhi, p.67

Reddy, V. 1989. Nutritional consequences of infection. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, India, **35**:124

Reddy, V. 1991. Protein Energy Malnutrition. *Textbook of Human Nutrition.* (ed. Banji, M.S., Rao, P.V. and Reddy, V.). Oxford and IBH Publishing Co. Pvt. Ltd. p.251

Reddy, V. 1993. *Textbook of Human Nutrition.* (ed. Banji, M.S., Rao, P.V. and Reddy, V.). Oxford and IBH Publishing Co. Pvt. Ltd. p.251

Reddy, V. 1997. *Textbook of Human Nutrition.* (ed. Banji, M.S., Rao, P.V. and Reddy, V.). Oxford and IBH Publishing Co. Pvt. Ltd. p.251

Census of India 1991, series 1 paper 1 of 1991. Provisional population total. Registrar General and Census Commission of India. p.67

Rewal, S. 1981. Results of a school lunch programme in India. *Fd. Nutr. Bulletin.* **3**(4):42-47

Robinson, C.H. 1985. Anaemia and Iron deficiency. *Normal and therapeutic nutrition.* **37**(1):25-30

Rosenhurg, O. 1978. School lunch of pupils in the first four series of level. Revista-de-saude-publica **12**(1):55-66

Saibaba, A. 1991. Child survival. A global study. *Nutrition* **25**(1):199

Satapathy, R.K., Sarangi, B. and Das, P.K. 1984. A community survey of infant feeding and weaning in Delhi urban slums. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, **32**:139

Sathi, N., Elizabeth, K.E., Nair, M.K.C. and Bai, S. 1991. Growth fattering and developmental delay in children with protein energy malnutrition. *J. Indian Acad. Pediatr.* **28**(3):255-258

Sauoma, E. 1992. Food and nutrition. Creating a well fed world. Food and Agricultural Organisation. 1.

Saxena, H.J. 1986. The Joint and nuclear family. A personal experience. *J. Indian Social Work.* XLVII:**32**:26

Scheier, G.E. 1978. Food programmes and other factors affecting nutrient intake of children. *Amer. J. Agrl. Economics.* **6**(4):609-618

Scrimshaw, N.S. 1994. Complementaries among interventions in the prevention of malnutrition in developing countries. *Nutr. Soc. India.* NIN Hyderabad, India. **41**:67

Sharma, K.V. 1995. Evaluation of mid day meal programme in ten states in India. *Nutr. News.* **16**:1-4

Shaw, A., Mathur, P. and N.N. Mehrotra. 1993. A study of consumers attitude towards processed foods, Foods packer Vol.XLVII No.2

Sindhu, K.S. 1985. *Methodology of Research in Education.* Steriling Publishers Pvt. Ltd., New Delhi. p.985

Singh, J. and Shah, K. 1990. Protein energy malnutrition. The third world syndrome. *Indian J. Nutr. Dietet.* **22**(4):173-175

Singh, R. 1996. A profile of malnutrition cases at BPKIHS. JNMA, **34**(120):254-257

Singh, W.S. 1973. A study on food science for school children. *Korean J. Nutr.* **6**(3):217-235

Soekirmn and Jalal, F. 1991. Priorities in dealing with micronutrient problems in Indonesia. A policy conference on micronutrient malnutrition. Montred Quebec, Canada, 71-81

Sood, R. 1993. Nutritional status of school going children of Kangra valley of Himachal Pradesh. *Indian J. Nutr. Dietet.* **30**(10):290-295

Srikantia, S.G. 1989. Nutritional deficiency diseases. Women and Nutritional status in India. Nutrition foundation of India. p.224

Srilakshmi, B. 1999. Nutrition and Food requirements of school children. *Dietetics.* New age International Publishers. IInd Edn. P.74

Subhasini, V. and Satinder, B. 1987. Nutritional Profile of school children. *Proc. Nutr. Soc. India* **33**:138

Sumi, H. 1996. Mineral contents of school lunches. *Japanese J. Nutr.* **54**(4):243-250

Swaminathan, M. 1986. *Principles of Nutrition and Dietetics.* The Bangalore Printing and Publishing Co. Ltd., Bangalore, p.5

Swaminathan, M.C. 1987. Non-invasive parameters for field monitoring and evaluation their sensitivity, specificity and cost in Nutrition Monitoring and Assessment (eds. Gopaldas, T. and Seshadri, S.). Oxford University Press, Delhi, p.22

Shyna, K. 1996. Nutritional profile and mental functions of preschool children belonging to agricultural labourer families in Thrissur District. M.Sc. Home Science thesis, Kerala Agricultural University, Thrissur

Tharakan, 1997. Nutrition programmes of the Department of Women and Child Development. *Proc. of the National Workshop on Red Palm. Oil and Health.* Perspective for India. CSIR, New Delhi, p.105

Thimmayamma, B.V.S. and Rao, P. 1996. Dietary Assessment as part of Nutritional status. *Text book of Human Nutrition.* (eds. Banji, M.S., Rao, N.P. and Reddy, V.) Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, p.125-135

Thomas, S.P. 1989. Effect of birth order and spacing on the nutritional status of mother and child. M.Sc. (FS&N) thesis, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala

Udaya, P.K. 1996. Food consumption pattern and nutritional status of farm women in Thrissur district. M.Sc. Home Science thesis, Kerala Agricultural University, Thrissur

UKORO, 1988. Health for all - All for health. Information kit, World Health Organization-1

UNICEF, 1984. The state of world's children. UNICEF division of information and public affairs, UNICEF House, New York. p.27-35

UNICEF, 1990. *The state of the worlds children.* Oxford University Press, New York.

UNICEF, 1990. Development goals and strategies for children in 1990's. New York, p.16

UNICEF, 1991. Strategies for children in the 1990's. *A UNICEF Policy Review*, UNICEF, New York, USA.

UNICEF, 1991. The world summit for children, a global event, UNICEF, Annual Report-7

UNICEF, 1992. The state of worlds children. UNICEF. Oxford University Press, New York.

Usha, K. and Giri, J. 1989. Evaluation of Noon meal through biochemical parameters. *Indian J. Nutr. Dietet.* **26**(7):183

Usha, V., Thomas, S.P. and Prema, L. 1990. The nutritional status of farm woman of institutional farm. Workshop on women in Agriculture. Background papers, National Institute of Devt. Rajendra Nagar, Hyderabad.

Vaden, A.G. 1980. Factors differentiating participants and non participants of the National school lunch programme. *J. Amer. Dietet. Assoc.* **76**(5):451-458

Vazir, S. 1988. Undernutrition - does it compromise mental development? *Nutr. News.* **9**(5)

Vazir, S. 1990. Undernutrition and intelligence. *Nutr. News.* **11**(5)

Vella, V., Tomkins, A., Nidka, J., Marshal, T. and Gortinouis, T. 1994. Anthropometry as a predictor for mortality among Ugandan children. *Europian J. Clin. Nutr.* **48**:189

Vijayaraghavan, K. 1989. Vitamin A deficiency and its control. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, **35**:120

Vijayaraghavan, K. 1990. Vitamin A intake and vitamin A deficiency in rural children. *J. Indian Acad. Pediatr.* **279**(3):143-151

Vir, S. 1994. Control of iodine deficiency - The national programme - current status. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad, India, **41**:14

Waterlow, J.C. 1972. Classification and definition of protein calorie malnutrition. *British Med. J.* **3**:566-569

WHO. 1987. Evaluation of the strategy for the health for all by the year 2000 AD. WHO, Genera 21

WHO. 1990. South east Asian nutrition research net work. Report of the consultative meeting. Nathon Pathom, Thailand 4

WHO. 1991. An international decade on food and nutrition in Africa, WHO regional office for Africa, Mimeo, DOAFR/NUJ/107

WHO. 1993. World health. WHO magazine, Geneva **3**(4):298

Williams, A. and Bergan, J.G. 1991. Anthropometric assessment of school children in rural New South Wales. *Proc. Nutr. Soc.* Australia. **16**:48

World Bank. 1995. Financing health care in Africa through user free and insurance. World Bank, Washington, DC 5

World Development Report. 1990. World Bank, Oxford University Press, New York.

Wowenberg, M.F., Todhunter, E.N., Wilson, E.D., Feeny, M.C. and Sarage, J.R. 1970. *Food and Man.* Wiley Eastern publishers, New Delhi

Yaima, E. 1989. A study of height and weight of urban school going children of imphal. *Indian J. Pub. Health.* **33**(1):15-17

* Originals not seen

APPENDICES

APPENDIX-I

INTERVIEW SCHEDULE TO ELICITE INFORMATION REGARDING THE SOCIO-ECONOMIC CONDITIONS OF THE FAMILIES

1. Name of the head of the family :

2. Address :

3. Place of survey :

4. Block :

5. Panchayat :

6. Distance to nearby city :

7. Age of the respondent :

8. Identification number of the child :

9. Type of family : Joint/Nuclear

10. Family size : Adults Children

11. Religion : Hindu Christian Muslim

1) FC
2) BC
3) SC
4) ST

12. Educational level

	Illiterate	LPS	UPS	High school	College
Father					
Mother					
1st child					
2nd child					
3rd child					

13. Occupational status

		Employed	Not employed
Head of the family	:		
Mother	:		
Any other members	:		

14. Type of occupation

	Govt. job	Temporary job	Daily wages	Business	Agriculture
Head of the family					
Mother					
Any other member					

15. Total family income : In rupees/month :

16. Other sources of income if any : Yes/No

17. If yes, sources from

1) Poultry	:	
2) Cattle wealth	:	
3) Receipts from properties (land, building)	:	
4) Income from investments	:	
5) Other earnings	:	

18. Total income from these sources (rupees/month) :

11. Details of housing condition :

a) Type of house	:	1 room/2 rooms/3-4 rooms/ 6-8 rooms
b) Type of roof	:	Thatched/Tiled/Concrete
c) Structure of the house	:	Mud-built/brick-built/thatched

20. Details of ownership

a) Staying in own house	:	Yes/No
b) Staying in rented house	:	Yes/No
c) Staying in quarters	:	Yes/No

21. Other characteristics

a) Specific kitchen	:	Yes/no
b) Usage of different rooms in the house	:	1. Drawing room 2. Study room 3. Bed room 4. Store room
c) Source of drinking water	:	Own well/Public tap/Public well/Tank/ Rivers
d) Lavatory facilities	:	Yes/No Own latrine/public latrine/open field
e) Drainage facilities	:	Yes/No
f) Electricity facilities	:	Yes/No
g) Recreation facilities	:	Owns a radio/TV/transistor/VCR
h) Transport facilities	:	Bicycle/Motor bike/Bus/Car/Auto/Jeep
i) Are you a member of any social organisation	:	1. Mahila samajam 2. Co-operative society 3. Youth club 4. Others 5. Nil

22. Details regarding index child : Male/Female
Age

1) Number of children in the family :

2) Birth order of index child :

3) Birth weight of index child :

4) morbidity pattern of the index child

i) Did your child (index) suffered from any of the following during the past one year?

1. Diarrhoea
2. Dysentry
3. Respiratory tract infection

4) Pneumonia
5) Poliomyelitus
6) Measles
7) Cholera
8) Chickenpox
9) Typhoid
10) T.B.
11) Mumps
12) Whooping cough
13) Fever
14) Jaundice
15) Any others

ii) Does any of the illness occur frequently? Yes/No

If yes, what type of illness?

1.
2.
3.
4.

23. Do you change the dietary pattern of child during the following conditions? : Yes/No

If yes, diseases

No.	Disease	Food items	Reasons	Food items	Reasons
1	Cholera				
2	Diarrhoea				
3	Fever				
4	Vomiting				
5					
6					
7					
8					

24. Do you use medicines to cure these conditions? : Yes/No

25.	Have you breast fed your children?	:	Yes/No
26.	Index child	:	Yes/No
27.	Do you give supplementary foods to the children?	:	Yes/No
	Index child	:	Yes/No
	If yes, what type of foods from which month onwards	:	
	If no, reasons	:	
28.	Is there any supplementary feeding programme present in your locality? 1) ICDS 2) School lunch 3) Any other 4) No programme 5) Not known	:	
29.	Does your child (index) participate in the school lunch programme	:	Yes/No
	If yes, does your child like the food given	:	Yes/No
	1) If yes, what are the benefits he is getting?	:	1) Food 2) Medicine 3) Immunization 4) Education
30.	Are you satisfied with the programme?	:	Yes/No
31.	What is your opinion about this programme?	:	a) Good b) Could be improved c) Any others d) No idea
32.	Do you have any suggestion regarding the operation of school lunch programme?	:	Yes/No

If yes, what type whether regarding

1) Quality of food
2) Quantity of food
3) Taste of food
4) Variety in the meals
5) Cleanliness
6) Any other

33. Do you feel that your child has improved after participating in this programme? : Yes/No

34. If yes, what are the outcoming?

1. Nutritional improvement
2. Academic improvement
3. Good habits/manner
4. Any other
5. No knowledge

APPENDIX-II

INTERVIEW SCHEDULE TO ELICIT INFORMATION ON FOOD CONSUMPTION AND DIETARY PATTERN OF THE FAMILIES

1. Identification No. of the child :
2. Name of the housewife :
3. Address :
4. Place of residence :
5. Age :
6. Food habit : Vegetarian/Non-vegetarian
7. Expenditure on food :

Sl. No	Item	Frequency of purchase				Price % of food expend-iture
		Daily	Weekly	Monthly	Occassionally	
1	Cereals					
2	Pulses					
3	Leafy vegetables					
4	Roots and tubers					
5	Other vegetables					
6	Fruits					
7	Milk and milk products					
8	Fleshy foods					
9	Spices and condiments					
10	Others					

8. Frequency of use of different food materials

Foods	Frequency of use															
	Daily				Weekly				Occassionally				Never			
	Once	Twoice	Thrice	Four	Once	Twice	Thrice	Four	Once	Twice	Thrice	Four	One	Twice	Thrice	Four
1. Cereals																
2. Pulses																
3. Green leafy vegetables																
4. Roots and tubers																
5. Other vegetables																
6. Fruits																
7. Milk and milk products																
8. Meat																
9. Fish																
10. Egg																
11. Fats and oils																
12. Sugar and jaggery																
13. Backery items																

9. Do you produce any food materials at home? : Yes/No

If Yes, details of foods produced

Sl.No.	Item	Quantity produced	Quantity consumed	Quantity sold
1				
2				
3				

10. Meal pattern of the family : One major meal
Two major meals
Three major meals

1) The type of food the child prefered : Vegetarian/Non-vegetarian

If vegetarian, foods - the type of food preparation

1.
2.
3.
4.
5.

If non-vegetarian foods - the type of food preparation

1.
2.
3.
4.
5.

2) Does he dislike any particular food item : Yes/No

If Yes, what food items

1.
2.
3.
4.
5.

Give reasons

3) Does the child insist on buying any particular processed foods/ beverage? : Yes/No

If Yes, what type of foods?

1.
2.
3.
4.

4) The source of information to the child regarding processed foods/beverages

1. Friends
2. T.V.
3. Books
4. Neighbours
5. Any other source

5) Do you buy these foods for the child? : Yes/No

If Yes, frequency of buying : Whenever the child ask/Once in a week/ Occasionally/Never

6) Does the child eat the meals properly? : Yes/No

If No, reason

1.
2.
3.
4.

7) Does the child skips any of the meals? : Yes/No

If Yes, which meals

1. Breakfast
2. Lunch
3. Supper

8) Immunization details of the index child : Complete/Partially complete/ Not immunized

9) Does your child (index) participate in school lunch programme? : Yes/No

23. When anybody in your family is sick, do you make use of Health Centres? : Yes/No

If Yes, :

1. Hospital
2. Dispensary
3. Maternal and child welfare
4. Ayurvedic
5. Homoeo
6. Others

Individual Food Consumption Survey - 24 hour Recall

Name of the meal	Menu	Quantity consumed by the child
Breakfast		
Lunch		
Tea		
Dinner		

APPENDIX-III

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF HORTICULTURE
DEPARTMENT OF HOME SCIENCE
NUTRITION ASSESSMENT SCHEDULE

State : District : Taluk : Block :

F.No : Sl.No. : Village : Date :

Name of the subject: Sex: M/F Date of Birth :

Name of father/guardian: Occupation:

Age : Yrs mths

Physiological status: BF/BF+S/Not BF/Pre/Lact/NPNL/Not Applicable

Duration in months

CLINICAL EXAMINATION

	:	Sparse	01
Hair	:	Discoloured	02
	:	Easily plucked	03
		Moon face	04
		Oedema	05
		Emaciation	06
		Marasmus	07
		Conj. Xerosis	08
		Bitot's spot	09
		Night blindnes	10
		Angular stomatitis	11
		Cheilosis	12
		Nasolabial Dyssebacea	13
	:	Red & Raw	14
Tongue	:	Papillae atrophic	15
	:	Papillae hypertrophic	16
		Pellagra	17
		Phrynoderma	18
		Koilonychia	19
		Epiphyseal enlargement	20
		Beading of ribs	21

		Knocknees/bow legs	22
		Frontal parietal bossing	23
	:	Caries	24
Teeth	:	Mottled Enamel	25
	:	Goitre	26
		Tuberculosis	27
		Filariasis	28
		Leprosy	29
		Others (specify)	30

FAMILY DIET SURVEY - ONE DAY WEIGHMENT

Identification No. of the child:

Family No: Name of the head of the family: Date:
Village : District : State:

Age and sex composition of those who have part takes the meal

Age	Adult	12-21	9-12	7-9	5-7	3-5	1-3	Below 1	Guest
M									
F									
-									

Cereals

1. Rice
2. Wheat flour
3. Ragi
4. Maida
5. Rava
6. Others

Pulses

7. Bengal gram
8. Black gram
9. Red gram
10. Soyabean
11. Greengram
12. Others
13. Leafy vegetables
14. Other vegetables

Roots and Tubers

15. Carrot
16. Onion (big)
17. Beetroot
18. Tapioca

19. Potato
20. Sweet potato
21. Yam
22. Others

Nuts and Oil seeds

23. Cashewnut
24. Coconut, dry
25. Coconut fresh
26. Groundnut
27. Others
28. Spices and condiments

Fruits

29. Amla
30. Apple
31. Banana, ripe
32. Lime & Orange
33. Mango, ripe
34. Melon water
35. Papaya, ripe
36. Tomato, ripe
37. Others

Fish

38. Fish, fresh
39. Fish, dry

Other flesh foods

40. Meat
41. Chicken
42. Liver, goat
43. Egg, hen

Milk and Milk products

44. Milk
    Curds
    Butter milk
45. Skimmed milk, liquid
46. Cheese

Fats and oils

47. Butter
48. Ghee
49. Hydrogenated oil
50. Cooking oil

Other food stuff

51. Biscuit, sweet
52. Biscuit, salt
53. Bread, white
54. Sugar
55. Jaggery
56. Pappad
57. Sago
58. Toddy
59. Farex
60. Amul

DIETARY HABITS AND NUTRITIONAL PROFILE OF SCHOOL CHILDREN PARTICIPATING IN THE SCHOOL LUNCH PROGRAMME

By

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ABSTRACT OF THE THESIS

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ABSTRACT

A study was conducted among the school children (7-9 age group) to find out the food consumption pattern and nutritional status of children who are the beneficiaries of school lunch programme of the state.

The socio-economic details inferred through the survey were found to be satisfactory. Nuclear families with better living conditions and good educational levels of the parents were the main factors observed. Most of the children were completely immunized.

Food consumption survey results revealed a dietary pattern of rice, pulses, vegetables and coconut oil. The consumption of green leafy vegetables and fruits by the families was found to be negligible. Dietary profile of school children revealed that the intake of all the food groups except that of flesh foods were below the RDA. But when compared to the control group there was a significant increase in the intake of cereals, pulses, other vegetables, roots and tubers, flesh foods and sugar and jaggery in the experimental group.

Dental caries was observed in majority of the children. Anaemia was the most prevalent nutritional deficiency disorder among children.

Prevalence of malnutrition as revealed by anthropometric survey indicated that the mean height and weight of children in both control and experimental group was low, when compared with Indian standards. But the difference in the body weight between the control and experimental group of children were statistically significant. Severe malnutrition was not observed in both groups. From the above observations it can be concluded that there was no incidence of severe grades of malnutrition among children. When compared with Indian standard values, both groups of children were found to have low values. But based on different grades of malnutrition most of the children in experimental group came

under normal nutritional status and grade I malnutrition. But majority of children in the control group where having grade I and grade II malnutrition.

Intake of protein and vitamins such as riboflavin was found to be high in control group when compared to RDA. But in experimental group the intake of retinal and niacin was high when compared to RDA. The intake of all other nutrients were below the RDA in both groups.