NUTRITIONAL AND HEALTH IMPACT OF SUBSTITUTING GREENGRAM BY SOYA PRODUCTS IN SCHOOL LUNCH PROGRAMME IN THRISSUR DISTRICT

By

N. LATHA DEVI

THESIS

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Faculty of Agriculture
Kerala Agricultural University

DEPARTMENT OF HOME SCIENCE
COLLEGE OF HORTICULTURE
VELLANIKKARA, THRISSUR - 680 656
Kerala, India

2000

DECLARATION

I hereby declare that this thesis entitled **"Nutritional and health impact of substituting greengram by soya products in school lunch programme in Thrissur district"** 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, associateship, fellowship or other similar title, of any other University or Society.

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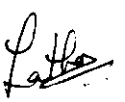

N. LATHA DEVI

CERTIFICATE

Certified that this thesis entitled **"Nutritional and health impact of substituting greengram by soya products in school lunch programme in Thrissur district"** is a record of research work done independently by **Ms.N.Latha Devi**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

Dr. V.Usha
(Chairperson, Advisory Committee)
Associate professor
Department of Home Science
College of Horticulture

Vellanikkara
19-3-2000

CERTIFICATE

We, the undersigned members of the Advisory Committee of **Ms.N.Latha Devi,** a candidate for the degree of **Master of Science in Home Science** with major in **Food Science and Nutrition,** agree that the thesis entitled **"Nutritional and health impact of substituting greengram by soya products in school lunch programme in Thrissur district"** may be submitted by Ms.N.Latha Devi, in partial fulfillment of the requirement for the degree.

Dr. V. Usha
(Chairperson, Advisory commitee).
Associate Professor
Department of Home Science
College of Horticulture
Vellanikkara

Dr.V.Indira
Associate Professor & Head
Department of Home Science
College of Horticulture
Vellanikkara

Smt.Omana Pavunny
Assistant Professor
Department of Home Science
College of Horticulture
Vellanikkara

Dr.V.K.G.Unnithan
Associate Professor
Department of Agrl. Statistics
College of Horticulture
Vellanikkara

EXTERNAL EXAMINER

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N.Latha Devi

DEDICATED
TO
MY
BELOVED
FAMILY

CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

INTRODUCTION

Malnutrition among children is a serious problem in developing countries. The school age is a dynamic period of growth and development as children undergo physical, mental, emotional and social changes (Mathura and Naik, 1989). Generally malnutrition is more pronounced in school age children (Owolabi *et al.*, 1996).Protein Energy Malnutrition (PEM) can result in biochemical changes, haematological changes, pathological changes and can also consequently result in several clinical manifestations (Reddy, 1996).

Studies reveal that improvement of nutrition enhances the educational performance of children and hence the importance of school meal in planning programmes of 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 programme in India. This welfare programme is in operation successfully in several states, including Kerala. Under this scheme food supplements are provided to school children to meet atleast a third of the calories and half of the protein requirements of the day.

Nutrition oriented agriculture and food processing - that is choosing certain low cost locally available agricultural commodities and processing them into acceptable foods, are important in combating malnutrition. Even in this Technological Era, man's hunt for new food to satisfy the need of its teeming millions is a continuous struggle and has thus thrown open new areas of both agrobased and technology based products with high potentials(Chandrasekhar,1995).

Soyabean, a new entrant in the Indian food arena is very important because it is an economically feasible and nutritionally superior protein rich food. It has been

called for centuries by the Chinese as the "Yellow Jewel", "Great Treasure", "Cindrella Crop" and "Chinese Cow" depicting its worth as a gold mine both economically and probably in terms of its nutritional significance. On weight to weight basis, when all the common pulses provide 20-25 g of protein per 100 g, soyabeans provide 43 g of protein. Technological improvement in food industry has made it possible to develop various soya products.

In India, using innovative technology, edible grade product with 50 per cent protein holds great promise to meet the present day nutritional requirement of various groups in an economically feasible manner. Hence this study was undertaken to assess the acceptability, feasibility, nutritional and health impact and cost of substituting soya grit / chunks for green gram in school lunch programme in selected schools of Thrissur district.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

This chapter, related to the present study of nutritional and health impact of substituting soya products for greengram in school lunch programme, is discussed under the following headings.

2.1 The need for good nutrition during school age

Malnutrition in infants and children is an important cause of ill health and high childhood mortality in many countries. The malnourished children had poor physical growth and experienced high rate of infection than those who were well nourished (Chen *et al.* 1980; Kadam *et al.*, 1983 and Reddy, 1991). Compared with well nourished children, the undernourished boys and girls showed moderate growth deficit that accumulated throughout childhood (Buschang and Malina, 1983).

Albanese *et al.* (1984) conducted a study on scholastic progress and nutritional status of elementary school children and indicated that under weight boys and girls underscored in the Metroplitan Achievement Tests. Studies conducted by Easwaran and Devadas (1984) had indicated that considerable proportion of school children are malnourished and have a decreased growth rate.

Malnutrition is a causative factor for various deficiency diseases like marasmus, kwarshiorkor, xerophthalmia, scurvy, rickets, beri-beri, pellagra and anaemia (Swaminathan, 1986 and Begum, 1991). The relative risk of having an

Intelligence Quotient (IQ) below 90 is higher in children with severe, moderate and mild forms of malnutrition (Agarwal *et al.*, 1987).

The school children being in an active phase of growth are known to respond more effectively to the changes in health and nutritional inputs (Darshan *et al.*, 1988). The frequency of occurrence of diarrhoea increased with increase in undernutrition (Cameron and Stavern, 1988; UNICEF, 1991 and Anand *et al.*, 1992).

PEM adversely affected the athletic performance and nutritional profile of the athletic children (Chandrasekhar and Priya, 1989). Improvement in the nutrition of children enhances their educational performance (Usha and Giri, 1989). The authors further stated that an abundance of energy giving foods, good quality of proteins and minerals are required in the diets of school children because of their rapid growth. The effects of iron deficiency on immune functions mental functions and physical work performance are of practical importance (Rajajee, 1989 and WHO, 1990).

According to Bhandari *et al.* (1989), the mean weight for age in the children with persistent diarrhoea is significantly lower and in an under weight child, there is a higher risk of diarrhoea becoming persistent. Impaired glucose tolerance was noted in Grade II and IV protein energy malnutrition and serum insulin responses were lower in grade IV PEM (Garg *et al.*, 1989).

Optimum nutrition in terms of both quality and quantity is essential for growth and development of school children (UNICEF, 1990). A study by Qamara *et al.* (1990) revealed that girls with low energy intakes were significantly smaller than those with adequate intakes. Prevention of malnutrition and intensive management of acute diarrhoea in malnourished children should help to reduce the risk of persistent diarrhoea (Anderson *et al.*, 1990).

The consequences of malnutritionwere mainly observed as impairement in physical and mental development of children (UNICEF, 1990 and World Bank, 1995). In a study conducted by NIN (1990) among 123 school children, it was found that, well nourished children attained higher scores in IQ tests than the under nourished children, irrespective of their participation in the various developmental programmes.

Improper nourishment resulted in stunted physical growth and development which lead to generalised functional impairement, diability, diminished productivity and inability to cope with environmental hazards, including resistance to infection (Harris, 1992). Gopalan (1992) estimated that about 40,000 children turned blind each year mainly due to vitamin A deficiency.

According to Upadhyay *et al.* (1992) children with grade II and III malnutrition showed poor development in all aspects of behaviour. Studies conducted on school performance and nutritional status in Jamaican school children revealed that mild to moderate levels of malnutrition are associated with poor school achievement and retarded growth (Simeon *et al.*, 1994).

According to Anand *et al.* (1994), faltering of growth was strongly associated with poor health and malnutrition. 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).

Undernourished rural Indian children when compared to normal nourished children registered a relative deficit of memory quotients, and an overall decrease in many of the mental abilities (Agarwal *et al.*, 1995). According to Singh *et al.* (1996), malnutrition contribute to about half of the deaths of young children.

2.2 Prevalence of malnutrition in school children

High prevalence of malnutrition among school children has been reported from China (Croll, 1986). Ivanoic *et al.* (1987) observed that pupils of high socio-economic status had better nutritional status and birth weight than those of low socio-economic status. Owing to a comparatively slow pace of scientific advances and scarce food availability, the problem of malnutrition has assumed great importance in most developing countries, particularly among school children (Ahmed and Gilani, 1988).

Of 6867 children coming within 6 to 17 years of age, in the Masvingo district of Zimbabwe, 21.1 per cent were under National Centre for Health Statistics (NCHS) standard for weight for age (Schuon and Fleischer, 1988). Ukoli *et al.* (1993) studied the growth problems of 1390 Nigerian school children (4-10 years of age), and compared with United States National Centre for Health Statistics (NCHS) reference population and found out that, Nigerian children had an excess prevalence of short stature and about 20 per cent of children were under weight. These data demonstrated an excess of acute and chronic malnutrition among school children.

Nutritional studies carried out in different regions of Brazil by Andrade *et al.* (1995) and Stefani *et al.* (1995) observed prevalence of chronic malnutrition among school age children, coming under 12 years of age. Growth retardation among school children in Chile was studied by Amigo and Bustos (1995) which indicated that small size in school age children of low socio-economic level is determined by adverse environmental factors, under nutrition being the main contribution. As observed by Owolabi *et al.* (1996) malnutrition is prevalent more among school age children.

A study conducted by Pushpamma *et al.* (1983) revealed that the nutritional status of school children living in the rural areas of Andhra Pradesh were

less than those reported for higher income group of the state. Choudhary and Rao (1983) also observed that urban children tend to be better in nutritional status than rural children.

Rao *et al.* (1984) reported that under nourishment is prevalent among the rural primary school children in Wardha district of Maharashtra. Studies conducted by Easwaran and Devadas (1984) indicated that considerable proportion of school children are malnourished and have a decreased growth rate.

Usha and Mushtari (1985) revealed that iron deficiency anaemia is a common deficiency condition seen among Indian school children. A study carried out in 1336 children, six to eight years old, from 22 schools in Varanasi, Uttar Pradesh revealed that only 15.7 per cent of children were of normal weight for age, 50.4 per cent had moderate malnutrition, 2.4 per cent had severe malnutrition and only 14 per cent were of normal weight for height (Agarwal *et al.*, 1987).

Srikantia (1989) had observed that the most important nutritional disease, in the developing countries like India, is PEM. Both boys and girls in the sample of urban school going children at Imphal was found to be significantly taller than the Indian standard height for age, when compared to their rural counter part, as reported by Yaima and Narendra (1989).

Studies conducted by Mathura and Rama (1989) reported that nutritional status of selected rural school children of Dharwad district in Karnataka were significantly below the ICMR standard, both in height and weight. The prevalence of vitamin A deficiency which was estimated in 366 rural Indian children (1-15 years old) was found to be 24.1 to 34.8 per cent (Khamgaonkar *et al.*, 1990). Nirmala and Varalakshmi (1991) conducted studies on rural school children of Hyderabad and revealed the deficiency of energy and vitamins, particularly vitamin A, thiamine and riboflavin.

The nutritional status of 250 children, aged 8-10 years, in a rural area of Haryana was studied by Dahiya *et al.* (1992) and revealed that 80 per cent of children had one or more nutritional deficiency symptoms. A study conducted in the Kangara district of Himachal Pradesh, among school children indicated widespread malnutrition in these children which is attributed to ignorance, illiteracy, poor eating habits and inadequate nutrient intake (Sood *et al.*, 1993).

Vitamin A deficiency is prevalent among school children at a high rate, as reported by Devadas (1991). A study conducted in Panipat city of Haryana by Chandna and Sehgal (1994) revealed that severe malnutrition is present among school children. The nutritional status of 434 children aged three to nine years in Udaipur city of Rajasthan, was assessed by anthropometry and clinical examination which indicated that, with increasing family size, prevalence of mild to moderate malnutrition also increased (Tewari and Tewari, 1995). The authors further states that, there was a marked decrease in the nutritional status of children from families with more than 10 individuals.

Saxena *et al.* (1997) concluded, from a study carried out among children living in two urban slums of National Capital Territory (NCT) of Delhi, that a high prevalence of undernutrition and poor dietary intake were prevalent indicated in children. Studies in different parts of India have shown that among school children, prevalence of marginal vitamin A deficiency is high and deserves attention (Ravinder and Sushama, 1997). Malnutrition is a common problem, during school age period, yet its extent in the school children of Kerala has been estimated only to a very small proportion. Studies conducted by Tharakan (1997) revealed that majority of our school children suffered from deficiencies of micronutrients like vitamin A, iron and iodine.

2.3 Dietary habits and food and nutrient consumption pattern of school children

2.3.1 Food consumption

Normal health and development during childhood years are mainly based on sound food and nutrient intake. A study in Norway revealed that intake of fresh fruit and hence vitamin C by girls was greater than those of boys of the same age and all children ate five meals a day (Berge, 1980).

A study conducted in UK indicated that majority of children had atleast two meals a day (National Dairy Council, 1982). The results of a study carried out by Puri *et al.* (1983) revealed that the diets of children were inadequate in quality and quantity. A study on the food and nutrient intake of school age children, in three regions of Andhra Pradesh, indicated a deficit in their food intake (Pushpamma *et al.*, 1983).

Kusin *et al.* (1984), after a study on measured food intake and its effects on nutritional status of children in rural East Java, Indonesia, showed that low availability of food is one of the casual factors of low intake of food and the consequent high incidence of 'wasting' among children. Reports from China indicated that intra-familial distribution of foods and individual food consumption are the major factors on which nutritional status of children are dependent (Croll, 1986).

A 24 hour dietary recall survey conducted by Subhasini and Satinder (1987) in school children in Punjab revealed that, the cereal and pulse consumption was only 59 to 64 per cent and 37 to 60 per cent of RDA. A study conducted on the nutritional status of school children in relation to food availability, in Keita district of Nigeria revealed widespread deficits in both height for age and weight for height during severe food shortage and a reduction in the deficits in weight for height, three months after the good harvest (Paci, 1988).

Studies from Japan revealed that children showed high preferance for cereals, meat, eggs and milk, but not for fish and vegetables (Watabe, 1989). The same study showed that preference levels were higher among boys than girls.

Food and nutrient intake data of 420 school children belonging to urban slum of coimbatore city indicated that, intake of all foods except flesh food fell short of RDA (Usha and George, 1990).However,another study, among children (eight to ten years of age) in rural areas of the same state showed that the frequency of consumption of vegetables, fruits and milk was higher in high income families than low income ones (Dahiya *et al.*, 1992).

A nutrition survey carried out in Panipat city of Haryana, among children aged six to twelve years, indicated that intake of all food stuffs in all income groups was lower than RDA (Chandna and Sehgal, 1994). The nutritional adequacy of food consumed by seven to fifteen year old children in an Integrated Centre of Public Education in the city of Americana, State of Sao Paulo, Brazil, indicated that insufficient food consumption is responsible for energy deficits (Silva and Da-Silva, 1995).

A baseline data from 2 school based nutrition education studies in the metropolitan Atlanta area in the USA indicated that, fruit and vegetables were most frequently consumed at week day lunch and second most frequently at dinner (Baranowski *et al.*, 1997). The same study further revealed that fruits and vegetables were consumed at breakfast or as snacks.

Data regarding the dietary intake of a subsample of 225 children, collected by trained nutritionists utilizing the 24 hour recall method observed a high prevalence of under nutrition and a poor dietary intake in children (Saxena *et al.*, 1997). A study by Singh *et al.* (1997) pointed out that variation existed in the consumption levels of various foods and nutrients by both boys and girls.

2.3.2 Nutrient consumption

A study conducted among children (eight to twelve years of age) at public schools in Washington State, USA, indicated that girls got less than boys of all nutrients except ascorbic acid (Price *et al.*, 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 the Recommended Dietary Allowance (RDA) (Oguntona and Clara, 1985).

The dietary pattern of school children attending the institute of child health in Coimbatore revealed that the intake of calories, proteins, calcium, iron and ß-carotene was very much lower than the RDA (Geetha, 1986). Meal frequency and socio-economic status were significantly correlated to energy and protein adequacy in children (Thimmayamma and Rau, 1987).

According to Khamgaonkar *et al.* (1990), in Indian children, the adequacy of dietary intake of vitamin A was eight to twelve per cent, when compared with the RDA. A nutrition survey among children in Non Hyang elementary school in Korea pointed out that, total daily energy and nutrient intake were below the RDA except for vitamin A and ascorbic acid (Mo *et al.*, 1990).

According to Lee *et al.* (1992), in American children, although total energy and nutrient intakes exceeded recommended values, it was not so in the case of iron. Intake of energy, protein, calcium, iron, thiamine and beta-carotene was significantly higher in children of high income group (Chandna and Sehgal, 1994).

Sharma (1995) revealed that diets of a large proportion of school children are deficient in both macro and micro nutrients. According to Singh *et al.* (1997), among Indian children, the nutrient intake was low for iron, thiamin, niacin and ascorbic acid, higher for protein, calcium and retinol and adequate for energy and riboflavin.

2.4 Importance of soya/products in the diets of children

Soyabean with its high protein content, could be a substitute for expensive meat products as there is a world wide shortage of affordable proteins (Kale, 1985). Further, due to the high phosphate contents, it is beneficial in the treatment of nervous diseases and some medicinal authorities have used it in the cure of rickets, pulmonary diseases and anaemia.

Studies on experimental animals have indicated that, heat processing improves the protein quality of soyabean and improves its biological value, comparable to that of animal proteins (Swaminathan, 1986). Soyabeans hold a great promise to meet the present day nutritional requirements of population groups (Gandhi and Ali, 1987).

In vegetable diets, pulses and legumes are the major providers of protein and soyabean as a pulse is unparallel to other pulses as a source of protein (Chandrasekhar, 1995). The same author also reported that, on weight-to-weight basis, when all the common pulses provide 20-25 g of protein, soyabean provides 43 g of protein, and costs only three-fourth to one third of the cost of the commonly consumed pulses. Soya has been considered to have some desirable therapeutic qualities and it is reported that, being alkaline in nature, soya neutralises the amount of uric acid in the system, thus helping in overcoming the severity of diseases like rheumatism, kidney trouble and gout (Devadas, 1991).

In human nutrition, soyabean and processed soya products are a valuable source of high quality protein and are comparable to foods of animal origin (Devadas, 1995). Vystoski and Zilova (1995) reported that the biological value and availability of soya proteins and the heating and preventive effectiveness of using soya proteins in nutrition are very high.

Soyabean has the highest protein content among the plant products, containing over 40 per cent proteins, 20 per cent fat, 35 per cent carbohydrates and 5 per cent minerals (Saibaba, 1997). According to the author, soyabean protein has all eight essential amino acids, which our body needs. In addition, it also contains important nutrients such as iron and calcium, which is essential for bone development and growth.

Keeping in view the nutritional as well as economic value of soyabean, all possible efforts should be taken up to popularise its cultivation and consumption by the public (Saibaba, 1997).

Modern technology has developed techniques for the processing of soyabean into full fat soya flour, defatted soya flour, protein isolate, protein concentrate, textured soya protein and spun soya protein (Ang, 1985). The use of soya protein products in a wide variety of food products is expanding rapidly (Ashraf, 1986). Soyabean meal in the form of soya flour, soya concentrate and soya isolate is currently used in infant formula, beverages, cereals, simulated milk, textured meat analogs and meat extenders (Duke, 1987). Soyabean is used to produce textured vegetable protein (TVP) to replace meat (Manay and Shadaksharaswamy, 1987).

Soyabean contains 43 per cent protein, but depending on the processing, it may contain as much as 50 per cent portion of the total solids (Ruals *et al.*, 1988). With appropriate processing, soyabean can be one of the useful pulse foods in the country (Patil and Ali, 1989). While soyabean can be consumed as beans in various preparations, technological imporvement in food industry has made it possible to develop various soya products like soya milk, soya oil, full fat soya flour, soya grits, soya chunks and defatted soya flour and an array of extruded products (Chandrasekhar, 1995).In India, using innovative technology, edible grade products from soya have been developed, and of these, the most important and available ones are the defatted soya flour and soya chunks and soya grits (Chandrsekhar, 1995).

Both defatted soya flour and soya chunks - an extruded product of soya flour - are being popularised as they are extremely palatable, easily digestible and can easily blend for incorporation in common recipes (Chandrasekhar, 1995). The defatted soya grits and soya chunks with 50 per cent protein hold great promise to meet the present day nutritional requirement of various population groups in an economically feasible manner (Devadas, 1995).

The use of soyabean, in children's diet can surely be of great value in tackling the protein calorie malnutrition prevalent in the developing countries (Swaminathan, 1966 and Kapoor and Gupta, 1981). Kothari *et al.* (1985) reported that, feeding soya milk to children suffering from protein calorie malnutrition resulted in a weight gain from 0.7 to 2.8 kg.

A study among elementary school children in Tokyo, Japan, showed that the mean energy and protein intake met the recommended levels for those who regularly consumed soyabean in different forms (Hongo *et al.*, 1992). A study conducted by Avinashilingam Deemed University showed that soya flour apart from promoting better nutritional profile among the children was also capable of enhancing their physical and mental growth, as confirmed by increments in haemoglobin level, height, body weight and mental abilities (Chandrasekar, 1995).

From a longitudinal study for one year, conducted by Sri Avinashilingam Deemed University, it was evident that substitution of soyabean in the place of dhal in the noon meals of children can bring about desirable changes in their nutritional profiles (Devadas, 1995). A combination of milk and soya products can result in functional and/or nutritional benefits in a number of areas as reported by Mann (1995).

A comparative study of the nutritional status of children in villages of northern Nigeria, using and not using soyabeans appeared to validate the importance

of soyabean in the diet of children, especially when animal protein sources are very expensive (Owolabi *et al.*, 1996).

2.5 Nutrition intervention studies on school children

To combat malnutrition and to ensure good nutritional status of children, several supplementary feeding programmes have been initiated (UNICEF, 1990). Nutrition interventions, aimed at provision of food and nutrients directly to people who are at risk of developing malnutrition, constitute a familiar strategy pursued by the health and social welfare sectors in many developing countries (Rao, 1996).

A study conducted by Song (1973) revealed that lunch provided by the schools generally met 1/3 of the daily allowance of protein, fat, iron, thiamin and riboflavin. A study conducted in Manila concluded that a universal free school lunch programme subsidised by the government is essential in schools (Guzman *et al.*, 1974). Through school lunch programme, the nutrient requirements for the school children can be met (Frey *et al.*, 1975).

A comprehensive study of the school lunch programme in North Carolina revealed that, protein intake was highest, riboflavin and vitamin A were satisfactory and while younger children got enough calcium and iron, older children got nearly enough calcium (Head and Weeks, 1975). Another study in Nagoya city, Japan indicated that, protein from school lunch was better utilized in the body (Kojima, 1978).

A study among children, eight to twelve years old at public schools in Washington State, USA showed that, children given school lunch had higher intakes than those not getting it and risk of malnutrition was low among the former group (Price *et al.*, 1978). Provision of school meals in USA, since the National School Lunch Act of 1946, was running fairly well and providing real service to many children (Macdonald, 1979).

In the opinion of Davidson (1979), school lunch more nearly fulfilled the USA recommended dietary allowances than did packed lunch. A study in USA concluded that those who participated in the school lunch programme had better lunch and better diet than those not taking school lunch (Howe and Vaden, 1980).

Teachers in Japan at elementary schools regarded school lunch as a means of training in social behaviour (Udaka and Kadota, 1982). Another study from Japan revealed that, at schools where lunch was cooked, teachers were very interested in the school lunch programme and enthusiastic about the correction of eating habits, teaching of table manners and providing a good environment for school lunch (Saito, 1983).

A study conducted on the nutritional impact of school lunch programme clearly indicated the programme's positive effect on nutrient consumption by both low income and high income group children; the effect being more for the former group (Akin *et al.*, 1983). Results of a study carried out in USA pointed out that, the National School Lunch Programme (NSLP) had a significant impact on the nutrient intake of school age children, who participated in the same (Hihn *et al.*, 1984).

Mazilli (1988) evaluated the nutritional value of lunch provided for 346 children in Brazil in 18 education and feeding centres. In all the centres, they provided textured soyabean protein along with cereal gruel. This lunch provided 13 to 20 per cent of recommended energy intake and 21 to 44 per cent of the recommended protein intake of the children.

A nutrition survey of Korean elementary school children in urban areas was made to investigate nutritional state, in relation to school lunch programme. The result indicated that, children taking school lunch every day showed higher values for dietary intake, anthropometric measurements and biochemical findings than the other

groups of children, taking school lunch intermittently and children taking no school lunch at all (Lee *et al.*, 1988).

A study conducted in Japan showed that, school lunch containing soya sauce with sugar as one of the food items resulted in increased physical development (Masuda *et al.*, 1989). A nutrition survey of children (6 to 13 years old) in an elementary school in Kyonggo province of Korea showed that, the elementary school feeding largely supplemented the inadequate intake of these children at home (Kim *et al.*, 1989).

Nutrition survey of 274 children, 6 to 12 years of age, was carried out in the Nau Hyang elementary school that had no school lunch programme, which showed lower results than the Korean standards and lower results when compared to those of Yun Jung elementary school children, having school lunch programme (Chung *et al.*, 1992).

A study from USA revealed that schools could retain students' participation in the school lunch programme by providing tasty foods (Synder *et al.*, 1992).

Obong and Akosa (1993) suggested that it is necessary to evaluate the quality of school lunch in terms of their contribution to nutrient intake in order to suggest ways of alleviating the problems.

A study conducted in Italy by Arrigo *et al.* (1994) revealed that the feeding programme for elementary school children was low in energy and fats and the main meal of the day was deficient in polyenoic fatty acids, vitamins and minerals. A nutrition survey conducted to assess the dietary effects of participation in the National School Lunch programme (NSLP) and the School Breakfast Programme (SBP) in the USA revealed a higher intake of energy, calcium, riboflavin, phosphorus and magnesium (Gordon *et al.*, 1995).

Another study in Coimbatore district indicated that, in schools, where there was school lunch programme in existance, a decrease in the incidence of signs of deficiency among the children and an improvement in the knowledge of nutrition and health among the children and in their households were observed (Devadas *et al.*, 1981). A study on children participating in the Mid Day Meal (MDM) programme in Madhya Pradesh State in Central India revealed that, the school meal increased the percentage of children meeting the RDA from 13 to 30 per cent (Rewal, 1981).

An attempt made to investigate the nutritional impact of the MDM programme in several states of India on school children indicated that MDM food supplement could at least bridge the deficits of energy and protein in the home diet, but not of iron and vitamin A (Kanani and Gopaldas, 1983). Supplementation of food providing 450 to 500 Kcal and 10 to 12 g protein for about 175 days to school children resulted in better academic performance and more frequent school attendance (Agarwal *et al.*, 1987).

Eventhough MDM scheme has helped to a great extent in elevating the nutritional status of children, studies conducted in Baroda indicated that, MDM has been found to contribute less energy and protein as percentage of recommended daily allowance (Kanani and Gopaldas, 1988). A study conducted in Coimbatore revealed that except for fat, the rest of the nutrients in the noon meal were found to be more than the control and one-third of the recommended daily allowance and so it was concluded that the noon meal programme had encouraging results (Usha and Giri, 1989).

Mid Day Meal programme for school children is one of the earliest supplementary feeding programmes in India (Sharma, 1995). The basic aims of MDM are to raise school enrollment rate in rural areas and to improve the nutritional levels of school going children and it can fill the dietary gap of about 600 Kcal in this vulnerable group of population. MDM programme was started because, home diets of children are inadequate (Rao, 1996).

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The study on the nutritional and health impact of substituting green gram by soya products in school lunch programme in Thrissur district was aimed to assess the acceptability, feasibility, nutritional and health impact and cost of substituting soya grit/chunks for green gram in school lunch programme in selected schools of Thrissur district.

3.1 Selection of the study area

The study was conducted in Thrissur district. The schools were selected by multi stage random sampling. From the 3 educational districts in Thrissur district, one educational district (Thrissur district) was selected at random and from that district, Ollukkara block was randomly selected. From Ollukkara block, 3 schools were randomly selected for the study.

School 1 (Group I) - usual school lunch (Rice + greengram)
School 2 (Group II) - School lunch with soya
School 3 (Group III) - No school lunch

3.2 Selection of the sample

The study was conducted in children of 7-9 age group. Preliminary data on socio-economic characters and anthropometric measurements were collected from children attending the school lunch programme in 7-9 age group, from school-1 and school-2 and also from school-3, where there was noschool lunch. Based on these data, in each school, the population was stratified into five strata and ten children were selected randomly from each stratum, so as to make a total sample size of 50 in each group (50 from one school). Thus a total of 150 children in the age group of 7-9 years formed the sample size for the study.

Out of the 50 school children (7-9 age group) selected from each school, 5 children were randomly selected for the indepth study and these 15 children constituted the subsample for the study.

3.3 Plan of action (Research Plan)

The plan of action of the present study comprised of

i) A base line survey to collect the socio-economic details of the families of the selected school children.

ii) A dietary survey to assess the food habits and food consumption pattern of the family members, especially of the index child in the family.

iii) A survey to assess the details regarding the existing school lunch programme, from the mothers of children participating in the school lunch and also from the teachers, of the two schools, where this programme is in operation.

iv) An organoleptic study to assess the acceptability of soya grit/chunks.

v) A training for the cooks in the school in the proper storage and preparation of the recipe.

vi) Supplementary studies in the schools with soya grits.

vii) An evaluation of the impact of supplementary study through the assessment of nutritional and health status of children by conducting

1. A food weighment survey (subsample) to determine the actual food and nutrient intake of school children.
2. An anthropometric survey to record height, body weight and mid upper arm circumference (MUAC)of school children before and after the study.
3. Clinical examination of the children before and after the supplementary study by qualified physicians, to locate manifestations of deficiency symptoms.

viii) Data analysis using suitable statistical techniques.

3.4 Methods selected for the study

The method adopted for obtaining the data pertaining to the socio-economic status, dietary habits of the families and details regarding the existing school lunch programme from the mothers and teachers was by interviewing with the help of a questionnaire.

Interview method is reported to be the most suitable way, since it proceeds systematically and records the collected information quickly (Bass *et al.*, 1979 and Devadas and Kulandaivel, 1975). Oral questionnaire or interview is the most commonly used method of diet survey (Begum, 1991). Hence in this study also data regarding the socio-economic background as well as food and nutrient consumption of the families and details of the existing school lunch programme from the mothers and the teachers were collected using pretested interview schedule, through personal visits.

According to Yenigi (1997), sensory methods are used to evaluate the quality of food as well as to determine consumer preference among food items. For consumers the perceivable sensory attributes like colour, appearance, feel, aroma, taste and texture are the deciding factors in food acceptance. In the present study, acceptability of soya grit/chunks were assessed using the scoring method (Swaminathan, 1974).

A training for the cooks in the school in the proper storage and preparation of the recipe was conducted through discussions and demonstration methods.

Diet surveys constitute an essential part of any complete study of nutritional status of individual or groups and provide essential information on nutrient intake levels, source of nutrition, food habits and attitudes (Gopaldas and Sheshadri, 1987). Rao (1975) stated that any single day or two day weighment could be better mentioned in micro samples. Hence in this study, a one day food weighment survey

was conducted among the subsample. The exact amount of the food consumed by the child and the nutritive value of the foods consumed were computed.

Anthropometry has been accepted as an important tool for assessment of nutritional status, particularly of children (Vijayaraghavan, 1987). The extent of height deficit in relation to age as compared to regional standards may be regarded as a measure of the duration of malnutrition (Gopaldas and Sheshadri, 1987). According to Rao and Vijayaraghavan (1996), body weight is sensitive even to small changes in nutritional status due to childhood morbidities and rapid loss of body weight in children could be considered as an indicator of potential malnutrition. MUAC is useful, not only in identifying malnutrition, but also in determining the mortality risk in children (Malina, 1972 and Rao and Vijayaraghavan, 1996). In the present study, the growth pattern of all the children was assessed by taking anthropometric measurements viz. height, bodyweight and mid upper arm circumference, both before and after the study period.

According to Swaminathan (1986) clinical examination is the most important part of nutritional assessment as direct information on signs and symptoms of dietary deficiencies prevalent are obtained. In this study also, clinical examination of all the children was done with the help of a qualified physician, both before and after the study period.

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. For obtaining data regarding the socio-economic and dietary pattern and details of the existing school lunch programme, oral questionnaire method was used.

To gather information on the socio-economic characteristics of the families, the interview schedule was structured such that, it included details pertaining to the type of the family, family size, religion, educational level of family members, occupational status of family members, monthly income and expenditure pattern, details of housing conditions, water and sanitary facilities, social participation and utilization of information sources. The schedule also contained details with respect to the index child like birth weight, birth order, morbidity pattern, participation in supplementary feeding programmes and use of health care facilities. The pretested questionnaire is presented in Appendix I.

The schedule to elicit information on the food habits and food consumption pattern of the families consisted of the details regarding food expenditure pattern, frequency of purchase and frequency of use of foods, foods prepared on special occassions, production of food items at home, daily meal pattern, participation in the local supplementary feeding programme etc. The pretested schedule is presented in Appendix II.

Separate schedules were formulated to gather the details regarding the existing school lunch programme from the mothers and also from the teachers. The first one included information on the duration of participation of the child in the programme, weekly participation pattern, type of food and cooking conditions, reason for participating in the programme, opinion about the introduction of another type of food item, suggestions for the improvement of the programme and the changes observed in the child after participation in the programme. This questionnaire is presented in Appendix III. The latter one comprised of details such as duration of the programme in the school, authority implementing and financing the programme, enrollment of children in the programme, types and other characteristics of the food given and the changes observed in the children after participating in the programme. The questionnaire is presented in Appendix IV.

For food weighment survey also, separate schedules were structured. The questionnaires are presented in Appendix V A and V B. A standardized food weighing balance and standard measuring cups and spoons were used for conducting the food weighment.

Organoleptic evaluation of the soya supplemented recipes were carried out with the help of a score card among technical experts, teachers, students and parents. The score card used is presented in Appendix VI. Five quality attributes like appearance, colour, flavour, texture and taste were included as the quality attributes. Each of the above mentioned qualities was assessed by a five point hedonic scale. Suitably structured questionnaire was also developed for clinical examination.This questionnaire is presented in Appendix VII .

3.6 Conduct of the study

3.6.1 Survey of socio-economic and dietary pattern of families

The information on the socio-economic and dietary pattern of the families were collected, with the help of interview method. Mostly,the mother was the respondent. The accuracy of the answers were checked by supplementary questions, whenever necessary.

3.6.2 Survey to gather details regarding the existing school lunch programme

This survey was conducted among the mothers of children and also among the teachers, of the two schools, where school lunch programme is in operation.

3.6.3 Food weighment survey

A one day food weightment survey was conducted among the subsample (15 children). The weights of raw ingredients included in the meal for a day and the weight of the cooked foods were recorded. The exact amount of the food consumed by the child was also recorded. Any other extra foods consumed by the child like

snacks, biscuits, toffees etc. outside the house was also recorded. All these weights were taken with standard measuring cups and spoons and also by means of a good food weighing balance. 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 computed using food composition table (ICMR, 1989).

3.6.4 Organoleptic studies with soya grits and chunks

Lunch as per the observed school lunch pattern was prepared using the same ingredients and method of cooking and in this diet, soya grits were substituted for greengram at the different replacement levels of 10%, 20%, 30%, 40%, 50%, 75% and 100%. The same study was done using soya chunks also. Organoleptic evaluation of the different combinations was done by technical experts, school children, teachers and parents.

Acceptability trials were conducted using the scoring method (Swaminathan, 1974). The judges were requested to taste one sample and score it. They were requested to taste the second sample after washing the mouth. Each quality attribute was assessed by the panel members after testing the same samples several times if needed. The judges were permitted to take their own time and to judge the samples leisurely. The most acceptable combination of greengram and soya was identified based on this organoleptic study.

3.6.5 The cooks in the school were trained in the proper storage and also in the preparation of soya grits with greengram.

3.6.6 Supplementary studies in schools

For supplementary studies, the schools were grouped as

School-1 with existing school lunch

School-2 with soya supplemented school lunch

School-3 with no school lunch

The most acceptable combination of soya supplemented greengram preparation was served for the children in school-2. The other two served as the controls. Acceptability of soya substituted school lunch to children was assessed by observing their ability to consume the entire quantity served without any plate wastage and also without any side effects to the children. The feeding trial was continued for a period of four months.

3.6.7 Anthropometric survey

Anthropometry has been recognised as a reliable tool in the identification of nutritionally vulnerable groups, monitoring changes in the extent of malnutrition and for evaluating the impact of interventions (Rao and Vijayaraghavan, 1996). Before implementing the feeding trial and also after the study, growth pattern of the children belonging to both experimental and control group schools was assessed by taking anthropometric measurements viz. height, body weight and mid upper arm circumference, using standardised procedures.

As recommended by Jelliffee (1966) in field anthropometry, only total height is measured. In this study, height of the children was measured using a fibre glass tape. The subject was asked to stand erect without shoes, with the heels, buttocks, shoulders and occipit against the wall.

Weights of the children were recorded using a bathroom balance which was checked by caliberation with standard weights. Weight was recorded with minimum clothing on the subject.

MUAC of children was measured before and after the study period. It is usually done 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.

3.6.8 Clinical examination

Clinical examination of the children was done with the help of a qualified physician, before and after the supplementary study.

3.6.9 Statistical analysis of the data

For the interpretation and narration of the results, the data obtained were analysed using statistical techniques such as percentage analysis, paired `t' test, Student's`t' test, and analysis of variance.

Plate. 1 Soya grits at 20 per cent replacement level with greengram – cooked and uncooked

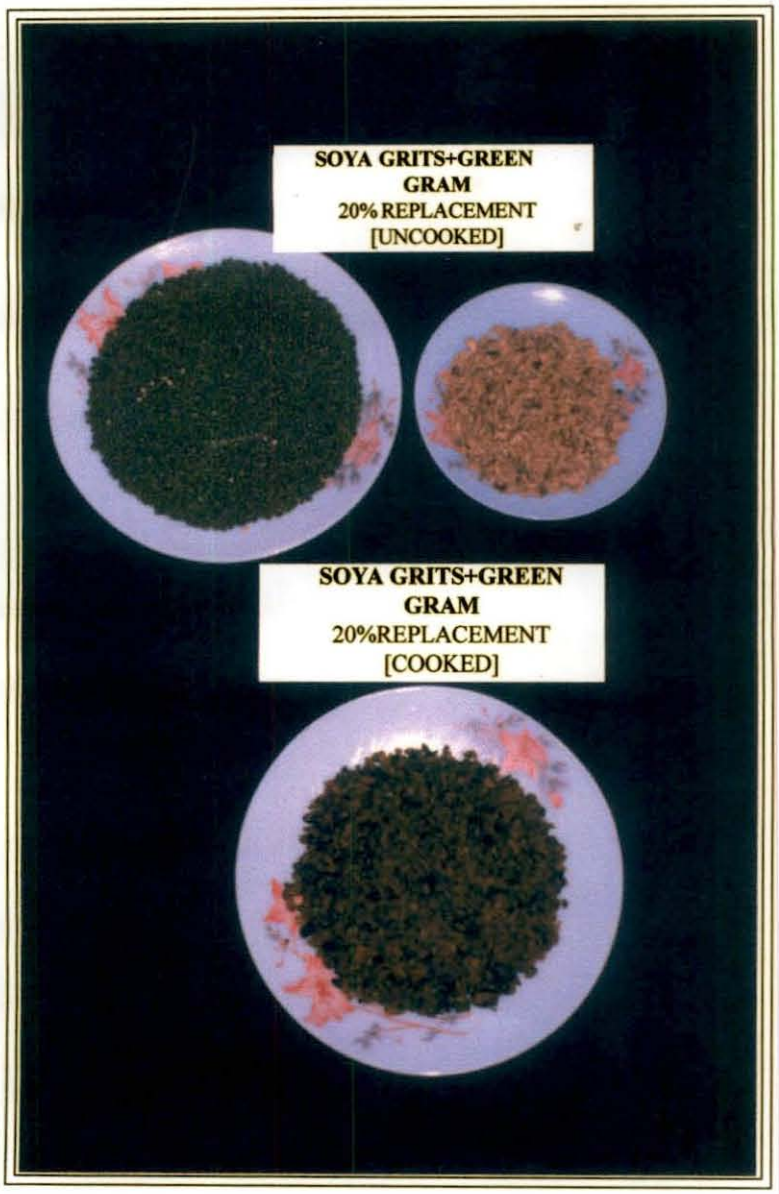

SOYA GRITS+GREEN GRAM
20% REPLACEMENT
[UNCOOKED]
SOYA GRITS+GREEN GRAM
20%REPLACEMENT
[COOKED]

Plate. 2 Preparation of soya supplemented lunch at the school

Plate. 3 Serving of the soya supplemented lunch to school children

Plate. 4 Children consuming the soya supplemented luch at the school

Plate. 5 Conducting food weighment survey

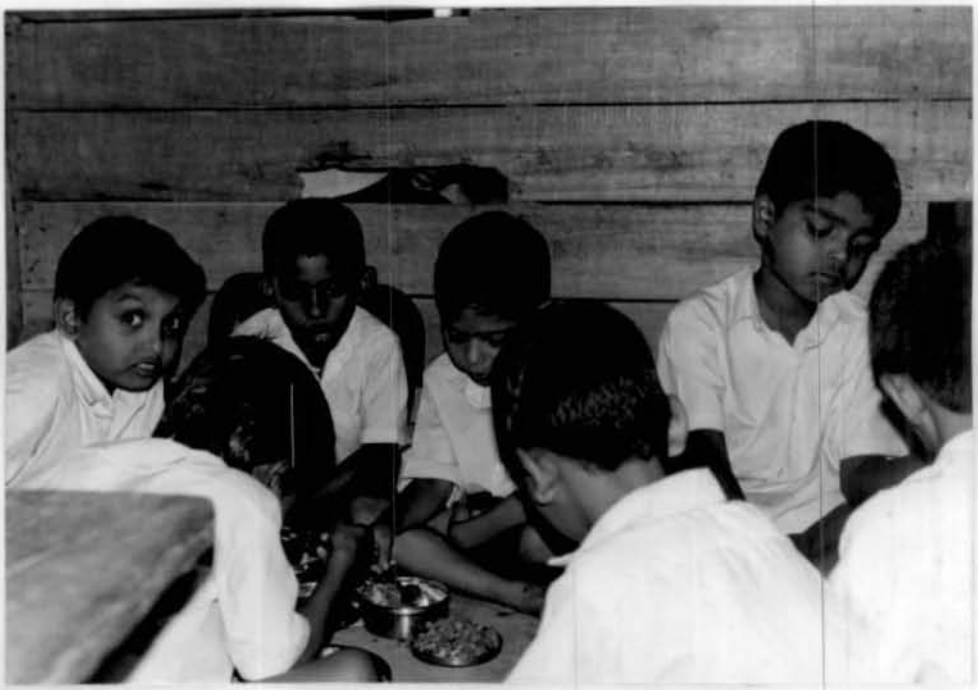


Plate. 6 Conducting anthropometric survey (measuring weight)

Plate. 7 Conducting clinical examination

RESULTS

4. RESULT

The results of the study, on the "Nutritional and health impact of substituting greengram by soyaproducts in school lunch programme in Thrissur district", are presented under the following headings.

1. Socio-economic background of the families and details regarding the index child
2. Food consumption pattern of the families
3. Information regarding the existing school lunch programme
4. Organoleptic studies with soya grit/chunks
5. Nutritional status of children

4.1 Socio-economic background of the families and details regarding the index child

Distribution of the families based on religion, type of family and family size are given in Table 1.

As shown in Table 1, about 50 per cent of the families in the soya supplemented lunch (SSL) group and no school lunch (NSL) group were christians, whereas it was 38 per cent in the existing school lunch (ESL) group. Families belonging to Hindus were found to be more in group NSL (42%), when compared to SSL (38%) and ESL (34%). About 28 per cent of the families in group ESL belonged to Muslim community which was found to be even less in SSL (12%) and NSL (8%).

Table 1. Distribution of families based on religion, type of family and family size

Details	Number of families		
	SSL (n=50)	ESL (n=50)	NSL (n=50)
Religion			
Hindus	19	17	21
	(38)	(34)	(42)
Christians	25	19	25
	(50)	(38)	(50)
Muslims	6	14	4
	(12)	(28)	(8)
Caste			
Forward	27	20	27
	(54)	(40)	(54)
Scheduled Caste	9	7	8
	(18)	(14)	(16)
OBC	14	23	15
	(28)	(46)	(30)
Type of family			
Joint	11	17	10
	(22)	(34)	(20)
Nuclear	39	33	40
	(78)	(66)	(80)
Family size			
≤4	42	41	43
	(84)	(82)	(86)
5-8	8	9	7
	(16)	(18)	(14)
>8	-	-	-

n = number of families
Number in parentheses are percentage

Out of the families surveyed, majority of the SSL (54%) and NSL (54%) groups belonged to the forward caste. In the case of ESL, 40 per cent came under forward caste and 46 per cent belonged to other backward community. Families belonging to scheduled caste comprised of 18 per cent, 14 per cent and 16 per cent in the SSL, ESL and NSL categories respectively. Twenty eight per cent in SSL group and 30 per cent in NSL group belonged to other backward community.

The table further reveals that, majority of the families in SSL (78%), ESL (66%) and NSL (80%) groups followed nuclear family system.

In all groups most of the families had size upto four and 16 per cent in SSL, 18 per cent in ESL and 14 per cent in NSL groups had family size above four and none families had it above eight.

Details pertaining to the educational status of parents of the children are furnished in Table 2.

Table 2. Educational status of the parents

Educational status	SSL (n=50)		ESL (n=50)		NSL (n=50)	
	F	M	F	M	F	M
Illiterate	2 (4)	2 (4)	1 (2)	1 (2)	3 (6)	2 (4)
L.P.S.	8 (16)	4 (8)	7 (14)	4 (8)	11 (22)	4 (8)
U.P.S.	8 (16)	18 (36)	18 (36)	8 (16)	8 (16)	19 (38)
High School	29 (58)	25 (50)	17 (34)	21 (42)	27 (54)	24 (48)
College and Higher education	3 (6)	1 (2)	7 (14)	16 (32)	1 (2)	1 (2)
Total	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)

n - number of families
F - Father of the index child
M - Mother of the index child
Number in parentheses are percentage

As is clear from the table, majority of the fathers in the SSL (58%) and NSL (54%) groups had studied up to high school level. In the case of ESL group, 36 per cent of fathers studied up to upper primary and 34 per cent had high school education. Only a small per cent of fathers were illiterate in all the 3 groups - SSL

(4%), ESL (2%) and NSL (6%). Highly educated fathers were also minimum in the three groups.

Regarding the educational status of mothers, high school educational level was recorded for the majority of mothers, in the SSL (50%), ESL (42%) and NSL (48%) categories. Thirty six per cent of the mothers of SSL group and 38 per cent of NSL group had education up to upper primary level. Illiterate, L.P.S. and higher educational levels were registered for only a small segment of mothers in SSL and NSL groups, with the exception of ESL group, where 32 per cent of the mothers were having college level educational status.

The occupational status of the family members of all the 3 groups are presented in Table 3.

Table 3. Occupational status of family members

Educational status	SSL			ESL			NSL		
	F	M	O	F	M	O	F	M	O
Government job	3 (6)	-	-	1 (2)	-	-	3 (6)	-	-
Private job	16 (32)	-	-	20 (40)	-	-	26 (52)	-	-
Casual labourers	31 (62)	3 (6)	2 (4)	29 (58)	3 (6)	1 (2)	21 (42)	2 (4)	-
Unemployed	-	47 (94)	48 (96)	-	47 (94)	49 (98)	-	48 (96)	50 (100)
Total	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)

F - Father
M - Mother
O - Other members of the family
Number in parentheses are percentage

In ther SSL category, 62 per cent of fathers were casual labourers and 94 per cent of mothers were unemployed. Thirty two per cent of the fathers in this group were doing private jobs and only 6 per cent were having regular government jobs. Most of the other members present in the family were unemployed.

In ESL category also 58 per cent of fathers were casual labourers and 94 per cent of mothers were unemployed. Forty per cent of fathers in this group were doing private jobs and only 2 per cent were having regular government jobs. In the NSL group, majority of the fathers (52%) were having private jobs and 96 per cent of mothers were unemployed. About 42 per cent of fathers in this group were also casual labourers and only 6 per cent were having government jobs.

Information on the monthly income of the families is presented in Table 4.

Table 4. Monthly income of the families

Monthly income (Rs.)	Number of families		
	SSL	ESL	NSL
Upto 2000	25 (50)	26 (52)	25 (50)
2000-4000	24 (48)	24 (48)	25 (50)
4000-5000	1* (2)	-	-
Total	50 (100)	50 (100)	50 (100)

Number in parentheses are percentage

As revealed in the table, only one family (in SSL group only) had monthly income above Rs.4,000/-. Roughly half of the families had income less than Rs.2,000/- and other half had monthly income above Rs.2,000/-; but below Rs.4,000/-.

Table 5a. Distribution of families based on monthly expenditure pattern

(n = 150)

Range of monthly expenditure (in percentage)	Food (%)			Clothing (%)			Shelter (%)			Rent (%)			Transportation			Education		
	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL
0-10	-	-	-	100	100	100	100	100	100	98	96	96	100	100	100	94	92	92
11-20	-	-	10	-	-	-	-	-	-	2	2	2	-	-	-	6	8	8
21-30	6	10	12	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-
31-40	12	12	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41-50	28	28	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-60	32	32	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 60	22	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

n = number of families

Table 5b. Distribution of families based on monthly expenditure pattern
(n = 150)

Range of monthly expenditure (in percentage)	Entertainment(%)			Health (%)			Savings (%)			Own expenses(%)			Repayment of loans (%)			Kuries (%)			Others (%)		
	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL
0-10	100	100	100	98	98	98	98	96	96	98	100	100	68	64	64	80	80	80	60	60	60
11-20	-	-	-	2	2	2	-	2	-	-	-	-	12	1	1	18	18	18	28	30	30
21-30	-	-	-	-	-	-	2	2	4	-	-	-	10	12	12	2	2	2	8	6	6
31-40	-	-	-	-	-	-	-	-	-	-	-	-	4	2	2	-	-	-	4	4	4
41-50	-	-	-	-	-	-	-	-	-	2	-	-	6	12	12	-	-	-	-	-	-
51-60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

n = number of families

Details regarding the monthly income expenditure pattern of the families on food, clothing, shelter, rent, transport and education are given in Table 5a and the same on entertainment, health, savings, own expenses, repayment of loans, kuries and other needs like fuel, water etc. are revealed in Table 5b.

The Table 5a depicts that in both SSL (54%) and ESL (50%) groups, more than half of the families spent above 50 per cent of their income on food. Fifty per cent of families in the NSL category spent between 41 and 50 per cent of their monthly income on food.

All the families in the 3 groups spent only up to 10 per cent of their income on clothing and shelter. More than 90 per cent of the families in all 3 categories spent up to 10 per cent only, as monthly rent.

All the families in SSL, ESL and NSL groups spent only between 0 and 10 per cent of their monthly income on transport. Majority of the families in SSL (94%), ESL (92%) and NSL (92%) spent merely up to 10 per cent of monthly income for education.

As is clear from Table 5b, 100 per cent families of all 3 categories spent only less than 10 per cent of their monthly income for entertainment. Two per cent of families in each of the 3 groups spent between 11 and 20 per cent of their monthly income on health. The rest of the families put aside only up to 10 per cent of their monthly income for the same purpose.

Ninety eight per cent families of SSL as well as 96 per cent of both ESL and NSL saved less than 10 per cent of their income for future expenses. Except two per cent in the SSL category, which spent between 41 and 50 per cent of income on personal expenses, all of the families in the three groups spent only between 0 and 10 percent of their income for the same purpose.

Sixty eight per cent families of SSL and 64 per cent of both ESL as well as NSL groups spent between 0 and 10 per cent of their monthly income for the repayment of loans. The rest of the families spent between 11 and 50 per cent of their monthly income for the same.

Twenty per cent families in all the 3 groups spent between 11 and 30 per cent of their income on monthly 'kuries'. All the rest spent up to 10 per cent only. For other purposes, such as for fuel, water etc. 60 per cent families in all 3 groups spent between 0 and 10 per cent of their income and the remaining families spent between 11 and 40 per cent.

The analysis of variance performed indicated that no significant difference existed between the 3 groups, with regard to the monthly expenditure pattern on all the items (Appendix VIII).

Living conditions of the families were assessed by observing the housing conditions like type of house, type of roof, structure of house, separate rooms in the house etc. The details are given in Table 6.

Ninety six per cent of the families of both SSL and ESL as well as 98 per cent families of NSL group had their own houses. Majority of the families in SSL (90%), ESL (88%) and NSL (88%) categories had three to five rooms for their houses.

Ninety eight per cent of the families of SSL, 96 per cent of ESL and 100 per cent of NSL stayed in single storeyed houses. Majority of the families in the three groups viz. SSL (90%), ESL (92%) and NSL (92%) had houses built with bricks. Regarding the roofing, mos of the families in all three groups (SSL-48%), ESL-60% and NSL-56%) had thatched roof. Houses with tiled roof were found to be from 30 to 34 per cent. About 20 per cent of houses in SSL group were concrete houses, whereas it was only 10 per cent in ESL and NSL groups. Majority of the

Table 6. Housing conditions of the families

Housing conditions	Number of families		
	SSL (n=50)	ESL (n=50)	NSL (n=50)
1. Ownership of house			
Own	48 (96)	48 (96)	49 (98)
Rented	2 (4)	2 (4)	1 (2)
2. Number of rooms			
<3	5 (10)	6 (12)	6 (12)
3-5	45 (90)	44 (88)	44 (88)
>5	-	-	-
3. Type of house			
Single storeyed	49 (98)	48 (96)	50 (100)
Double storeyed	1 (2)	2 (4)	-
4. Type of wall			
Mud	5 (10)	4 (8)	4 (8)
Brick	45 (90)	46 (92)	46 (92)
5. Type of roof			
Thatched	24 (48)	30 (60)	28 (56)
Tiled	16 (32)	15 (30)	17 (34)
Concrete	10 (20)	5 (10)	5 (10)
6. Separate kitchen			
Present	46 (92)	44 (88)	48 (96)
Absent	4 (8)	6 (12)	2 (4)

n - number of families
Number in parentheses are percentage

Table 7. Other living facilities of the families

Other facilities	Number of families		
	SSL (n=50)	ESL (n=50)	NSL (n=50)
1. Source of water			
Own well	27 (54)	27 (54)	25 (50)
Public tap	7 (14)	7 (14)	6 (12)
Public well	16 (32)	16 (32)	19 (38)
Others	-	-	-
2. Lavatory			
Own	47 (94)	50 (100)	50 (100)
Public	3 (6)	-	-
Open	-	-	-
3. Drainage			
Present	50 (100)	48 (96)	50 (100)
Absent	-	2 (4)	-
4. Details of drains			
Open	50 (100)	48 (100)	50 (100)
Closed	-	-	-
Total	50 (100)	48 (100)	50 (100)
5. Electricity			
Present	43 (86)	42 (84)	45 (90)
Absent	7 (14)	8 (16)	5 (10)
6. Recreation			
Present	40 (80)	40 (80)	36 (72)
Absent	10 (20)	10 (20)	14 (28)
7. Transport			
Public transport	35 (70)	34 (68)	37 (74)
Private transport	15 (30)	16 (32)	13 (26)

n = number of families
Number in parentheses are percentage

families in all the three groups (SSL - 92%, ESL - 88% and NSL - 96%) were having separate kitchen. About 12 per cent of families in ESL, eight per cent of families in SSL and four per cent families in NSL were found not to possess a separate kitchen for cooking food for the family.

Other living facilities, which included sources of drinking water, lavatory, drainage, electricity, recreation and transport facilities, are presented in Table 7.

From the above table, it can be observed that more than 50 per cent of the families in all the three groups had their own well as the source of drinking water. About 32-38 per cent of the families in all three groups depended on public wells. Fourteen per cent of the families in SSL and ESL groups and 12 per cent in NSL group depended on public taps for their drinking water.

Almost all the families had their own lavatory facilities. Only six per cent of the families in SSL group used public lavatory. All the families had good drainage systems. Majority of the families (SSL-86%, ESL-84% and NSL-90%) had electric connections in their homes. About 72-80 per cent of the families studied in all the three groups had recreational facilities like Television and radio at home. Majority of the families (SSL-70%, ESL-68% and NSL-74%) utilised the public transport facilities, whereas about 26-32 per cent of the families had their own transport facilities like bicycle, scooter etc.

Details regarding the index child

Details regarding the index child with respect to gender, age, birth weight and birth order were collected from all the three groups and are given in Table 8.

Table 8. Details of children

Details	SSL (n=50)	ESL (n=50)	NSL (n=50)
Gender			
Male	20 (40)	22 (44)	26 (52)
Female	30 (60)	28 (56)	24 (48)
Age			
7 years	15 (30)	14 (28)	16 (32)
> 7 - ≤ 8 years	20 (40)	21 (42)	20 (40)
> 8 - ≤ 9 years	15 (30)	15 (30)	14 (28)
Birth weight			
< 2.5 kg	15 (30)	13 (26)	14 (28)
≥ 2.5 kg	35 (70)	37 (74)	36 (72)
Birth order			
1st	17 (34)	18 (36)	19 (38)
2nd	25 (50)	23 (46)	24 (48)
3rd	8 (16)	9 (18)	7 (14)

n = number of children
Number in parenthesis are percentage

Table 8 reveals that majority of the children in the SSL (60%) and ESL (56%) groups were females. In the NSL category, 52 per cent of the children surveyed were males and 48 per cent were females.

The age group of majority of the children in all the three groups (SSL-40%, ESL-42% and NSL-40%) were seven-eight years. Thirty per cent of children in SSL and ESL belonged to eight-nine age group; whereas, 28 per cent in NSL

group belonged to this age group. Thirty per cent of children in SSL, 28 per cent in ESL and 32 per cent in NSL belonged to seven years of age.

About 70-74 per cent of all the children had normal and above normal birth weights. Thirty per cent of children in SSL had birth weights below normal. Whereas, it was found to be 26 per cent in ESL and 28 per cent in NSL. Majority of the children in SSL (50%), ESL (46%) and NSL (48%) belonged to the second birth order. Thirty four per cent of children in SSL group, 36 per cent in ESL and 38 per cent in NSL belonged to the first birth order. About 14-18 per cent of children in the three groups were of the third birth order.

The immunization pattern of the selected children is presented in Table 9.

Table 9. Immunization of status of children

Details	SSL (n=50)	ESL (n=50)	NSL (n=50)
Complete	45 (90)	46 (92)	44 (88)
Partially complete	5 (10)	5 (8)	6 (12)
Incomplete	-	-	-

n = number of children
Number in parenthesis are percentage

As revealed from the table, above 90 per cent of the children in SSL and ESL categories had taken the immunization course completely. Whereas, 88 per cent of children in NSL had taken the immunization completely. None in any group reported as having an incomplete schedule of immunization.

As stated by the mothers, the incidence of various diseases for the past one year, among children were recorded and is presented as morbidity pattern in Table 10.

Table 10. Morbidity pattern of children

Details	SSL (n=50)	ESL (n=50)	NSL (n=50)
Diarrhoea and vomiting	-	1 (2)	-
Measles	-	-	-
Chicken pox	-	-	-
Mumps	3 (6)	1 (2)	-
Fever	45 (90)	48 (96)	49 (98)
Jaundice	-	-	-
Respiratory diseases	2 (4)	-	-
Others	-	-	-
None	-	-	1 (2)

n = number of children
Number in parentheses are percentage

As observed from the table, in SSL group, six per cent of the children were affected with mumps and four per cent with respiratory diseases. In ESL group, two per cent of children were affected with diarrhoea and vomiting as well as mumps. In NSL group no other infectious diseases were observed among children except fever, which was observed in 98 per cent of the children. Incidence of fever was also observed in 90 per cent of children in SSL and 96 per cent of children in ESL group.

It was observed that all the families adhered to allopathic treatments for their children utilising the services of primary health centres. The nearest health centre was within three km reach by the families.

Table 11a. Monthly food expenditure pattern of the families
(n = 150)

Range of monthly expenditure (in percentage)	Cereals (%)			Pulses (%)			Green leafy vegetables (%)			Roots & tubers (%)			Other vegetables (%)			Fruits (%)		
	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL
0-10	-	-	-	74	82	86	100	100	100	100	98	98	96	52	70	64	88	64
11-20	4	4	2	24	16	4	-	-	-	-	2	2	4	38	22	32	8	28
21-30	44	48	54	2	2	-	-	-	-	-	-	-	-	8	8	4	4	4
31-40	28	30	26	-	-	-	-	-	-	-	-	-	-	2	-	-	-	4
41-50	22	16	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 60	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

n = number of families

Table 11b. Monthly food expenditure pattern of the families
(n = 150)

Range of monthly expenditure (in percentage)	Milk and milk products (%)			Fleshy foods (%)			Nuts and oil seeds (%)			Spices and condiments (%)			Others (%)		
	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL	SSL	ESL	NSL
0-10	86	56	54	58	30	30	26	100	100	100	100	100	40	44	46
11-20	10	38	40	34	56	58	60	-	-	-	-	-	58	54	52
21-30	4	6	6	8	14	12	14	-	-	-	-	-	2	2	2
31-40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51-60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
> 60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

n = number of families

4.2 Food consumption pattern of the families

Food habits of the families showed that all the families consumed non-vegetarian foods and they followed a three major meal pattern.

Table 11a indicates the monthly food expenditure pattern of the families on cereals, pulses, green leafy vegetables, roots and tubers, other vegetables and fruits and Table 11b, depicts the same on milk and milk products, fleshy foods, nuts and oil seeds, spices and condiments and other food items.

As is evident from the Tables except for two per cent of families in all the three groups, which spent above 60 per cent of the monthly income on cereals, all the rest of the families spent between 11 and 50 per cent.

Majority of the families of SSL (74%), ESL (82%) and NSL (86%) categories spent below 10 per cent of their monthly income on pulses. Two per cent of families in both SSL and ESL groups spent between 21 and 30 per cent. The rest spent between 11 and 20 per cent.

Hundred per cent families in all the three groups spent only upto 10 per cent on green leafy vegetables as well as spices and condiments. Expenditure on roots and tubers was below 10 per cent for all the families, except two per cent of them in ESL and NSL groups, for whom the expenditure was in the range of 11 to 20 per cent.

In the case of other vegetables and fruits, majority of the families spent less than 40 per cent of food expenses. With regard to milk and milk products, fleshy foods, nuts and oil seeds as well as other foods the percentage of money spent was below 30 per cent of the total food expenditure.

The analysis of variance done indicated that except for green leafy vegetables, fruits and fleshy foods, the expenditure pattern on all the other food items showed no significant difference between the three groups. The ANOVA is furnished in Appendix IX.

Table 12. Percentage distribution of families according to the frequency of use of food items

Food items	Group	Daily	Weekly	Monthly	Occasionally	Never	Total
1	2	3	4	5	6	7	8
Cereals	SSL	100	-	-	-	-	100
	ESL	100	-	-	-	-	100
	NSL	100	-	-	-	-	100
Pulses	SSL	12	78	-	10	-	100
	ESL	20	62	-	18	-	100
	NSL	18	72	-	10	-	100
Green leafy vegetables	SSL	6	44	-	50	-	100
	ESL	12	46	-	40	2	100
	NSL	10	48	-	42	-	100
Roots and tubers	SSL	16	74	-	18	-	100
	ESL	12	68	-	18	2	100
	NSL	10	74	-	16	-	100
Other vegetables	SSL	96	2	-	2	-	100
	ESL	92	4	-	4	-	100
	NSL	94	6	-	-	-	100
Fruits	SSL	8	18	-	70	4	100
	ESL	6	18	-	74	2	100
	NSL	10	18	-	72	-	100
Milk and milk products	SSL	56	8	-	32	4	100
	ESL	52	8	-	32	8	100
	NSL	56	10	-	34	-	100
Meat	SSL	6	50	-	40	4	100
	ESL	4	60	-	32	4	100
	NSL	12	60	-	26	2	100
Fish	SSL	12	32	-	34	2	100
	ESL	18	58	-	16	2	100
	NSL	16	64	-	20	-	100
Egg	SSL	20	44	-	30	6	100
	ESL	18	46	-	32	4	100
	NSL	12	60	-	22	6	100

Table 12. Continued

1	2	3	4	5	6	7	8
Fats and oils	SSL	100	-	-	-	-	100
	ESL	100	-	-	-	-	100
	NSL	100	-	-	-	-	100
Sugar and jaggery	SSL	98	2	-	-	-	100
	ESL	100	-	-	-	-	100
	NSL	100	-	-	-	-	100
Bakery items	SSL	12	10	-	46	32	100
	ESL	12	6	-	54	28	100
	NSL	18	6	-	52	24	100

The frequency of use of different food items by the families were enquired and are presented in Table 12.

All the families consumed cereals daily since rice is our staple food. Pulse/dhal consumption was observed for more than one day in a week by 78 per cent of the families in SSL, 72 per cent in NSL and 62 per cent in ESL group. Ten per cent of the families in both SSL and NSL group consumed pulses only occasionally; whereas it was 18 per cent in ESL. Daily consumption was observed in 20 per cent of the families in ESL, 18 per cent in NSL and 12 per cent in SSL.

Only occasional consumption of green leafy vegetables was found in 50 per cent of the families in SSL, 42 per cent in NSL and 40 per cent in ESL groups. Seventy four per cent of the families in both SSL and NSL groups and 68 per cent in ESL consumed roots and tubers weekly. Daily consumption was observed in 10-16 per cent of the families from all the groups. Occasional consumption was also observed in 16-18 per cent of the families.

Majority of the families (SSL-96%, ESL-92% and NSL-94%) consumed other vegetables daily. Consumption of fruits was found to be occasional in most of the families (74% in ESL, 72% in NSL and 70% in SSL).

Daily consumption of milk and milk products was observed in 56 per cent of families in both SSL and NSL groups and in 52 per cent in ESL group. This was mainly through the consumption of tea/coffee with milk by these families. Thirty two per cent of the families in both SSL and ESL and 34 per cent of the families in NSL consumed milk and milk products only occasionally.

Most of the families in three groups (SSL-50%, ESL-60% and NSL-60%) included meat in their diet on weekly basis. Forty per cent of the families in SSL, 32 per cent in ESL and 26 per cent in NSL group consumed meat, only occasionally.

Majority of the families in NSL and ESL groups (64 and 58%) consumed fish weekly, whereas, it was only 32 per cent in SSL. About 34 per cent of the families in this group consumed fish, only occasionally.

Consumption of egg was also observed on weekly basis by most of the families (60% in NSL, 46% in ESL and 44% in SSL). About 32 per cent of the families in ESL, 30 per cent of the families in SSL and 22 per cent in NSL consumed egg only occasionally.

Inclusion of food groups like fats and oils and sugar and jaggery was found to be on daily basis in all the families from the three groups. Regarding the inclusion of bakery foods, most of the families (54% in ESL, 52% in NSL and 46% in SSL) included these items occasionally, while 24-32 per cent of the families in each of the three groups never included such items in their diets.

Based on the frequency of use of different food groups in the daily diet of the surveyed families, food frequency scores were calculated as suggested by Reaburn *et al.* (1979). The formula used is given in Appendix X.

Table 13. Frequency score (%) on different food items

Food items	SSL	ESL	NSL
Cereals	100.00	100.00	100.00
Pulse	64.33	62.33	64.67
Green leafy vegetables	41.17	50.00	51.67
Roots and tubers	60.67	58.33	61.67
Other vegetables	97.00	96.33	97.00
Fruits	32.67	32.33	36.00
Milk and milk products	66.00	62.33	67.00
Meat	54.33	59.00	61.00
Fish	50.33	55.00	58.33
Egg	46.67	45.33	46.00
Fats and oils	100.00	100.00	100.00
Sugar and jaggery	99.00	100.00	100.00
Bakery items	28.00	26.00	31.67

Table 13 shows the frequency score in percentage for different food items consumed by the families. The table reveals that for cereals as well as fats and oils in all groups and for sugar and jaggery in ESL and NSL groups, the maximum score of 100 was recorded.

Food frequency score for pulses, green leafy vegetables, roots and tubers, fruits, milk and milk products, meat, fish and bakery items was more in NSL group (64.67%, 51.67%, 61.67%, 36%, 67%, 61%, 58.33% and 31.67%) than SSL group (64.33%, 41.17%, 60.67%, 32.67%, 66%, 54.33%, 50.33% and 28%) and ESL group (62.33%, 50%, 58.33%, 32.33%, 62.33%, 59%, 55% and 26%).

On the basis of the frequency scores obtained by different food items, they were categorized into three different groups - most frequently used foods (having a score of above 75%), medium frequently used foods (percentage score between 50 to 75%) and less frequently used foods (percentage score below 50%) and are presented in Table 14.

Table 14. Frequency of use of food items

Frequency of use	SSL	ESL	NSL
Most frequently used foods (score above 75%)	Cereal, other vegetables, fats and oils and sugar and jaggery	Cereal, other vegetables, fats and oils and sugar and jaggery	Cereal, other vegetables, fats and oils and sugar and jaggery
Medium frequently used foods (score 50 to 75%)	Pulse, roots and tubers, milk and milk products, meat and fish	Pulse, green leafy vegetables, roots and tubers, milk and milk products, meat and fish	Pulse, green leafy vegetables, roots and tubers, milk products, meal and fish
Less frequently used foods (score below 50%)	Green leafy vegetables, fruits, egg and bakery items	Fruits, egg and bakery items	Fruits, egg and bakery items

This table suggests that cereals, other vegetables, fats and oils and sugar and jaggery were the most frequently used food items in all the three groups. For all the three groups, pulses, roots and tubers, milk and milk products, meat and fish

Table 15. Food prepared on special occasions

Occasion		Number of families		
		SSL (n=50)	ESL (n=50)	NSL (n=50)
Birth day				
	Vegetarian	28 (56)	23 (46)	31 (62)
	Non vegetarian	22 (44)	27 (54)	19 (38)
Marriage				
	Vegetarian	22 (44)	19 (38)	21 (42)
	Non vegetarian	28 (56)	31 (62)	29 58)
Death				
	Vegetarian	50 (100)	50 (100)	50 (100)
	Non vegetarian	-	-	-
Festival				
	Vegetarian	22 (44)	33 (66)	21 (42)
	Non vegetarian	28 (56)	17 (34)	29 (58)
Feasts				
	Vegetarian	22 (44)	33 (66)	21 (42)
	Non vegetarian	28 (56)	17 (34)	29 (58)
Others				
	Vegetarian	22 (44)	33 (66)	21 (42)
	Non vegetarian	28 (56)	17 (34)	29 (58)

n - number of families
Number in parentheses are percentage

were the medium frequently used food items. Apart from these, green leafy vegetables were also a medium frequently used food item for both ESL and NSL groups. On the contrary, green leafy vegetables were a less frequently used food item in SSL group. Fruits, egg and bakery items were less frequently used items for all the three groups.

Details pertaining to the foods prepared during special occasions, such as birth day, marriage, death, festivals, feasts and other festive occasions, by the families of the 3 groups are furnished in Table 15.

As shown in the table, during birth day, majority of families in the SSL (56%) and NSL (62%) groups prepared vegetarian items such as sadhya, payasam, vegetarian snacks, chips etc. On the contrary, in ESL category, majority prepared non-vegetarian items such as meat, fish and egg items, biriyani etc.

Forty six per cent of the families of SSL, 62 per cent of ESL and 58 per cent of NSL groups prepared non-vegetarian items during marriage. Families in all the three groups were found to prepare vegetarian items on the death of any member in the family.

Majority of the families in the SSL and NSL categories prepared non-vegetarian items on festivals, feasts and other special occasions. But in the ESL category, majority of the families (66%) prepared vegetarian food items for festivals, feasts and other festive occasions.

4.3 Details regarding the existing school lunch programme

Details regarding the duration of participation of children in the school lunch programme is given in Table 16.

Table 16. Duration of participation of children in the school lunch programme

Duration (in years)	SSL (n=50)	ESL (n=50)
< 1	2	6
	(4)	(12)
1-2	8	20
	(16)	(40)
2-4	37	18
	(74)	(36)
> 4	3	6
	(6)	(12)

n = number of children
Number in parentheses are percentage

As revealed in the table, 74 per cent of children in the SSL group were participating in the scheme for about two to four years, whereas most of the children (40%) in ESL group were participating for one to two years. Thirty six per cent of children in ESL group were found to be participating for two to four years.

Table 17 presents the opinion of the mothers regarding the foods given in school lunch.

As revealed in the Table 17 all the mothers opined that the quantity of food served in the school lunch programme was sufficient. Majority of the mothers in both groups (98%) suggested that the food is very nourishing. Regarding the type of food given, 98 per cent of the mothers in SSL group opined that it was good and children liked the taste of soya supplemented lunch.

In ESL group, 94 per cent of the mothers were of the opinion that the food served was good and 88 per cent reveal that children liked the taste of the food served in the usual school lunch. According to the mothers, about 12 per cent of the children did not like the taste of the food served in the usual school lunch.

On further enquiry regarding the programme, all the mothers agreed that good cleanliness was observed regarding the cooking practices, utensils, cooking and eating place, water facilities and storage facilities. About 72 per cent of mothers

Table 17. Opinion of the mothers regarding the foods given in school lunch

Details	SSL (n=50)	ESL (n=50)
1. Enough food given at school		
Yes	50 (100)	50 (100)
No	-	-
2. Food given is nourishing		
Yes	49 (98)	49 (98)
No	1 (2)	1 (2)
3. Type of food given		
Good	49 (98)	47 (94)
Bad	1 (2)	3 (6)
4. Children liked the taste of food served		
Yes	49 (98)	44 (88)
No	1 (2)	6 (12)

n = number of children
Number in parentheses are percentage

in both the groups did not know the authority implementing this programme at schools.

Information collected from the teachers regarding the school lunch programme indicated that enrollment of children in this programme was mainly based on the financial status of the families. All the teachers agreed that the expenses (except the cost of food material) were mainly met from the Parents Teachers Association (PTA) funds such as, utensils and other expenses like oil, onion, mustard etc. Regarding a major expense, such as fuel for the preparation, 41.7 per cent of the teachers in SSL group suggested that they collected it from local people; whereas all the teachers in ESL group and 58.3 per cent in SSL group reported that the expense for fuel was mainly met by the teachers themselves.

4.4 Organoleptic evaluation of soya at different replacement levels

4.4.1 Soyagrits

Details regarding the organoleptic evaluation of soya grits at different replacement levels are given in Table 18.

Table 18. Mean scores for the acceptability tests with soya grits

Quality parameters	Replacement levels (%)						
	100 (green gram)	10	20	30	40	50	75
Appearance	3.07	3.45	3.41	3.03	2.96	2.99	3.04
Colour	3.27	3.36	3.39	3.18	2.89	2.86	3.07
Flavour	2.58	3.38	3.42	3.14	2.78	2.89	2.64
Texture	2.55	3.39	3.47	3.01	2.92	2.91	2.69
Taste	2.15	3.58	3.53	3.26	2.84	2.80	2.53
Total	13.62	17.16	17.22	15.62	14.39	14.45	13.97

Maximum total score = 25
F value = 25.65

The organoleptic qualities of the soya grits at different replacement levels prepared in the same way as the usual school lunch were assessed. As is clear from the table, it is found that soya grits at 20 per cent replacement level got the highest total mean score (17.22) when compared to other replacement levels.

Statistical analysis revealed that acceptability at 20 per cent replacement level, which got the highest total score, was highly significant with other replacement levels. But acceptability at 20 per cent replacement level was not significant from that of the acceptability at 10 per cent replacement level. But nutritive evaluation indicated that, 20 per cent soya replaced lunch had better nutritive value than 10 per cent level, especially with regard to good quality protein, which is very essential for the physical and mental growth of children.

4.4.2 Soya chunks

Information on the organoleptic qualities of soya chunks at different replacement levels are furnished in Table 19.

Table 19. Mean scores for the acceptability tests with soya chunks

Quality parameters	Replacement levels (%)						
	100 (green gram)	10	20	30	40	50	75
Appearance	3.07	2.98	2.97	2.77	2.21	2.09	2.19
Colour	3.27	2.97	2.71	2.33	2.14	1.89	2.03
Flavour	2.58	3.08	2.96	2.89	2.54	2.06	1.83
Texture	2.55	2.25	2.76	2.46	2.46	1.47	1.78
Taste	2.15	3.04	2.41	3.68	2.54	1.85	1.67
Total	13.62	14.32	13.81	14.13	11.89	9.36	9.50

Maximum total score = 25

As is evident from the table, soya chunk preparation at 10 per cent replacement level was the most acceptable one with the total mean score of 14.32. On comparing the soya grit preparation, having maximum total mean score, with soya chunk preparation with maximum mean score, it was found that soya grits at 20 per cent replacement level is highly significant with respect to organoleptic qualities, when compared to soya chunks at 10 per cent replacement level. Hence soya grits at 20 per cent replacement level was used for the supplementary study.

4.4.3 Details regarding the cost of soya grits introduced in the school lunch programme at 20 per cent replacement level

The cost of green gram and soya grits at 20 per cent replacement level was computed as per market price of raw ingredients and the results are furnished in Table 20.

Table 20. Cost of green gram and soya grits at 20% replacement

Details	Cost (Rs.)
Soya grits (100 g)	5.50
Green gram (100 g)	2.15
Soya grits - 100% replacement (30 g)	1.65
Green gram - 100% replacement (30 g)	0.65
Soya grits replacement level - 20% (green gram - 24 g + soya grits - 6 g)	0.85

The table shows that 100 g of soya grits cost almost double than that for 100 g of green gram. The existing school lunch has 100 per cent green gram (30 g), costing Rs.0.65/-. The 20 per cent soya replacement level consisted of 24 g of green gram and 6 g of soya grits and it costs Rs.0.85/-. Thus an increase in Rs.0.20/- per child was observed in soya substituted school lunch.

Table 21. Nutritional composition of soya supplemented school lunch

Food	Nutrients								
	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (IU)	Carotene (mcg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)
Soya grits supplemented lunch (20%)	8.94	97.56	45.96	2.35	-	22.60	0.20	0.09	0.62
Existing school lunch (green gram 100%)	7.20	100.20	37.20	2.19	-	28.20	0.14	0.08	0.63

Table 22. Mean food intake of children in comparison with RDA

Food item	RDA (g)	Mean food intake (g)					
		SSL	't' value	ESL	't' value	NSL	't' value
Cereals	325	304.8 (93.8)	0.44^{NS}	290.0 (89.2)	2.26^{NS}	320.8 (98.7)	0.77^{NS}
Pulses	20	39.0 (195.0)	7.77**	40.0 (200.0)	7.32**	35.86 (179.3)	7.01**
Green leafy vegetables	50	19.0 (38.0)	3.90*	18.0 (36.0)	3.79*	25.0 (50.0)	8.83**
Other vegetables	30	35.2 (117.3)	1.47^{NS}	32.7 (109.0)	0.86^{NS}	31.2 (104.0)	1.06^{NS}
Roots and tubers	20	28.0 (140.0)	2.36^{NS}	27.6 (138.0)	1.55^{NS}	40.0 (200.0)	10.00**
Fruits	50	18.0 (36.0)	4.01*	37.0 (74.0)	1.19^{NS}	55.16 (110.3)	1.70^{NS}
Milk and milk products	250	199.0 (79.6)	1.34^{NS}	220.5 (88.2)	1.04^{NS}	190.6 (76.2)	4.73**
Fleshy foods	60	52.0 (86.7)	1.07^{NS}	66.2 (110.3)	0.79^{NS}	61.4 (102.3)	0.17^{NS}
Fats and oils	35	36.0 (102.9)	0.34^{NS}	36.3 (100.8)	0.34^{NS}	42.4 (121.1)	7.30**
Sugar and Jaggery	45	46.0 (102.2)	0.23^{NS}	47.7 (106.0)	0.83^{NS}	50.8 (112.8)	2.24^{NS}

** Significant at 1 per cent level; * Significant at 5 per cent level; NS - Not significant; Number in parentheses are percentage of RDA

4.4.4 Nutritional composition of soya replaced lunch

Table 21 presents the nutritional composition of soya replaced school lunch in comparison with the existing school lunch programme with green gram.

The table reveals that soya grits at 20 per cent supplementation level supplied 8.94 g of protein per day; while the existing school lunch provided only 7.2 g. Calcium supplied through soya supplemented lunch was also more (45.96 mg), when compared with the existing school lunch which gave only 37.2 mg of calcium per day.

Other nutrients like iron, thiamine and riboflavin levels were also high in the soya supplemented school lunch than the existing school lunch. Nutrients such as calories, carotene and niacin were found to be low in soya supplemented school lunch.

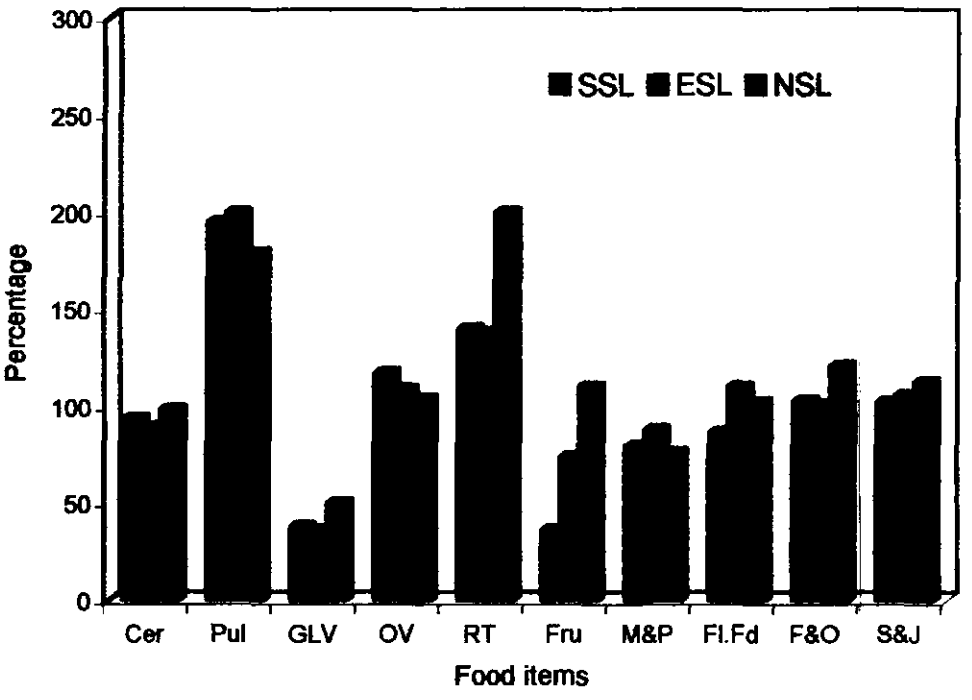
4.5 Nutritional status of children

Nutritional status of the children were assessed by assessing the actual food and nutrient consumption pattern of the children, anthropometric measurements and clinical examination of the children, before and after the supplementary study. The results are presented as follows.

4.5.1 Food and nutrient intake

The data on the actual food intake of children as assessed by weighment survey is given in Table 22.

Table 22 reveals the details regarding the intake of different food items by the children of SSL, ESL and NSL categories. In SSL, ESL and NSL groups, even though the consumption of cereals was low, this was not significant, when



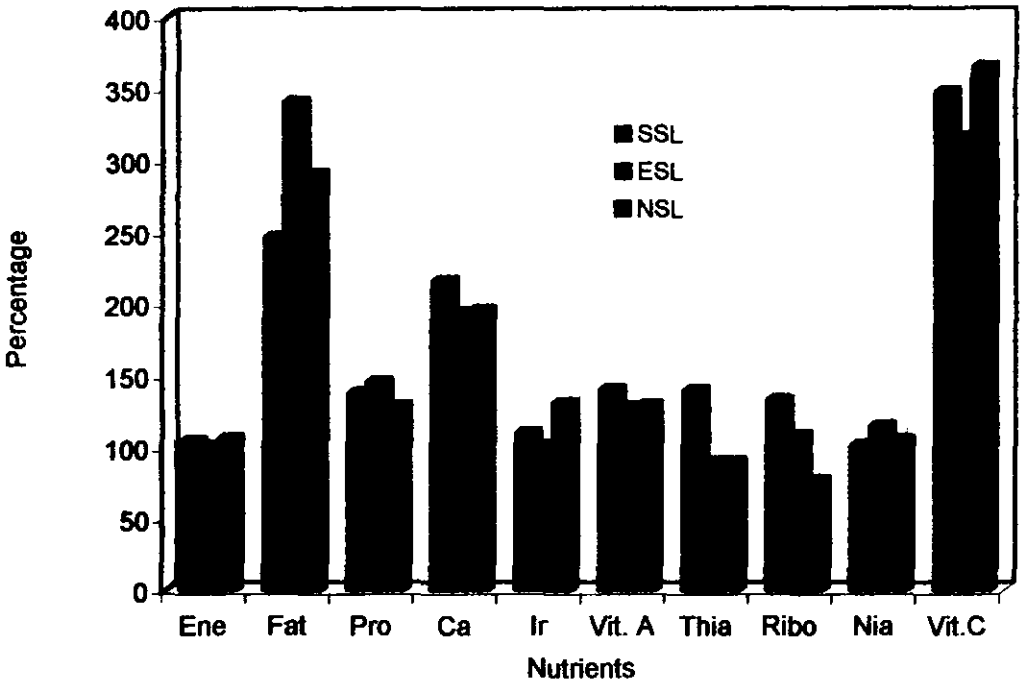
Cer - Cereals
Pul - Pulses
GLV - Green Leafy Vegetables
OV - Other vegetables
RT - Roots and Tubers
Fru - Fruits
M & P - Milk and Milk products
Fl.Fd - Fleshy foods
F&O - Fats and oils
S&J - Sugar and Jaggery

Fig.1. Food intake of Children as percentage of RDA

Table 23. Mean nutrient intake of children in comparison with RDA

Nutrients	RDA	Mean nutrient intake (g)					
		SSL	't' value	ESL	't' value	NSL	't' value
Energy (Kcal)	1950	2037.62 (104.5)	2.89*	1975.9 (101.3)	0.36 NS	2069.90 (106.1)	2.83*
Fat (g)	25	61.70 (246.8)	5.00**	85.28 (341.12)	31.40 NS	72.70 (290.8)	8.57**
Protein (g)	41	56.60 (138.0)	10.55**	59.80 (145.9)	5.79**	52.90 (129.0)	3.14*
Calcium (mg)	400	862.70 (215.7)	13.03**	775.10 (193.8)	7.36**	782.30 (195.6)	6.08**
Iron (mg)	26	28.60 (110.0)	0.51 NS	26.40 (101.50)	0.05 NS	34.10 (131.2)	1.27 NS
Vitamin A (mcg)	600	841.65 (140.3)	11.93**	768.8 (128.1)	9.41**	778.60 (129.8)	9.47**
Thiamine (mg)	1	1.40 (140.0)	1.73 NS	0.90 (90.0)	0.26 NS	0.90 (90.0)	0.26 NS
Riboflavin (mg)	1.2	1.60 (133.3)	2.80*	1.30 (108.3)	0.55 NS	1.00 (76.9)	6.40**
Niacin (mg)	13	13.20 (101.5)	0.16 NS	14.90 (114.6)	1.37 NS	13.70 (105.4)	0.45 NS
Vitamin C (mg)	40	139.10 (347.8)	3.48*	126.50 (316.3)	3.96*	146.00 (365.0)	5.87**

** Significant at 1 per cent level; * Significant at 5 per cent level; NS - Not significant; Number in parentheses are percentage of RDA



Ene - Energy	Vit.A - Vitamin A
Fat - Fat	Thia - Thiamine
Pro - Protein	Ribo - Riboflavin
Ca - Calcium	Nia - Niacin
Ir - Iron	Vit.C - Vitamin C

Fig.2. Nutrient intake of children as percentage of RDA

Table 24. Mean anthropometric measurements of children (7-9 years) before and after the supplementary study

Anthropometric measurements	SSL (n=50)			ESL (n=50)			NSL (n=50)		
	Before	After	't' value	Before	After	't' value	Before	After	't' value
Body weight (kg)	18.7	19.4	3.89**	22.5	21.7	3.62**	26.7	22.2	0.35^{NS}
Height (cm)	115.9	122.6	10.30**	127.8	130.3	13.03**	129.6	132.0	4.08**
MUAC (cm)	14.9	18.65	9.59**	16.6	19.1	0.08^{NS}	15.8	17.25	4.38**

n = number of children
** Significant at 1 per cent level
NS - Not significant

compared to RDA. Regarding pulses, the consumption was found to be high when compared to RDA in all the groups and this difference was found to be significant also. The consumption of green leafy vegetables was also significantly low in all the groups when compared to RDA. Consumption of food groups such as other vegetables, roots and tubers, fleshy foods and sugar and jaggery were not significantly higher than the RDA. Though the consumption of milk and milk products was lower in all groups, this was significantly lower in NSL group only (Fig.1).

Table 23 presents the details regarding the intake of nutrients by the children.

The results indicate that the intake of energy, fat protein, calcium, iron, vitamin A, niacin and vitamin C, were higher than the recommended allowances, in all groups. Statistical analysis revealed that the results were significant, except for energy in ESL and also for iron and niacin in all groups. The intake of thiamine was not significantly higher than the RDA in all groups. Riboflavin intake was higher in SSL and ESL groups and lower in NSL group (Fig.2).

4.5.2 Arthropometric measurements of children

Anthropometric measurements namely body weight, height and mid upper arm circumference of the children in SSL, ESL and NSL categories were recorded before and after the supplementary study and the details are presented in Table 24.

As furnished in the table, with regard to the mean body weight, an increase by 0.7 kg was observed in the SSL group, after the supplementary study. In both ESL and NSL groups, a decrease in the mean body weights, by 0.8 and 4.5 kg, respectively, was observed. A positive increment was observed in the mean values

Table 25. Comparison of mean weights, heights and MUAC with Indian standards (Vijayaraghavan *et al.*, 1971 and 1974)

Anthropometric measurements	Indian standards		n=150											
			SSL				ESL				NSL			
			BS	't' value	AS	't'value	BS	't' value	AS	't' value	BS	't' value	AS	't' value
Body weight (kg)	Boys	26.96	19.1	10.25**	19.8	9.02**	24.0	2.95**	23.3	2.05*	28.6	1.43^{NS}	22.2	6.47**
	Girls	26.75	18.6	13.75**	19.0	13.45**	21.0	7.19**	20.1	13.55**	24.8	2.25*	22.1	6.13**
Height (cm)	Boys	128.27	115.7	8.95**	122.4	4.46**	129.8	1.08^{NS}	132.1	2.74*	131.4	2.35*	134.1	4.24**
	Girls	127.65	116.0	12.15**	122.8	4.72**	125.7	0.38^{NS}	128.5	1.004^{NS}	127.7	0.05^{NS}	129.9	2.27*
MUAC (cm)	Boys	17.54	14.8	6.85**	18.8	3.73**	16.91	2.05^{NS}	16.90	2.09*	16.2	4.53**	17.2	0.96^{NS}
	Girls	17.85	14.9	4.24**	18.5	2.41*	16.3	2.73*	21.3	16.3**	15.5	7.24**	17.3	0.58^{NS}

BS - Before supplementation; AS - After supplementation; n = number of total children

* Significant at 5% level; ** Significant at 1% level; NS = Not significant

for height in SSL, ESL and NSL groups by 6.7 cm, 2.5 cm and 2.4 cm, respectively. With regard to the mean MUAC values, after the study period, an increase was indicated in SSL group by 3.75 cm and in both ESL and NSL groups, by 2.5 cm and 1.45 cm, respectively.

Statistical analysis revealed that the increments in the mean body weight, height and MUAC in the SSL group after the study was significant, when compared to the initial values. In ESL group, there was an increase in the mean values of height and MUAC after the study period, with existing school lunch; but this increase was not found to be statistically significant for MUAC. With regard to body weight, a decrease was observed after the study period and this decrease was found to be statistically significant.

In NSL group, an increase in the mean values of height and MUAC was observed after the study period, which was statistically significant, when compared to the initial values. But in the case of mean body weight, after the study period, there was no statistically significant change.

Anthropometric measurements of school children (7-9 age group) before and after the study were compared with Indian standard values (Vijayaraghavan *et al.*, 1971 and 1974).

As shown in Table 25, with regard to body weight, both before and after the study period, boys of SSL group had significantly lower values than the standards; though an increase in body weight was observed after the study period. In the case of girls also, similar result was obtained. Among boys of ESL group, before the study period, the mean value was significantly lower than the standards. After the study period, a further decrease in body weight was observed. Girls of ESL group too showed a similar trend. In NSL group, the mean body weight of boys,

before the study period was slightly higher than the standards; though the difference was not significant. But after the study period there was a drastic reduction in the same, which was significant. Mean body weight of girls of NSL group, before and after the study period, were significantly lower than the Indian standards.

With regard to mean height, in both boys and girls of SSL group, though an increase was noticed after the study period, the values were significantly lower than the standards. In the case of boys of ESL group, before the study period, the mean height value was higher than the standards, but the value was not statistically significant. But the same became significant after the study period. With regard to mean height in girls of ESL group, both before and after the study period, no significantly higher value than the standards was noticed. In the case of boys of NSL group, the mean height was significantly higher than the Indian standards, both before and after the study period. With regard to the girls of the same group, although the mean height was not significantly higher than the standards; it became significant after the study period. Thus all groups registered an increase in height after the study period; though the rate of increase in SSL group was higher than that of ESL and NSL groups.

In the case of MUAC, in boys of SSL group, the mean MUAC value was significantly lower than the standards before the study period, which became significantly higher than the standards after the study period. With regard to the girls of same group also, a similar result was obtained. In boys of ESL group, although before the study period, the mean MUAC value was not significantly lower than the standards, the difference became significant after the study period. With regard to girls of the same group, before the study period, the mean MUAC value was significantly lower than the Indian standards. But after the study period, it became significantly higher than the standards. In the case of both boys and girls of NSL group, although before the study period, the mean MUAC values were significantly

Table 26. Weight for age distribution of school children, Gomez *et al.* (1956) classification

Nutritional status	Weight for age % of the standard	SSL						ESL						NSL					
		BS			AS			BS			AS			BS			AS		
		B	G	T	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T
Normal	>90	2 (10)	2 (6.7)	4 (8)	19 (95)	22 (73.3)	41 (82)	7 (31.8)	3 (10.7)	10 (20)	7 (31.8)	3 (10.7)	10 (20)	9 (34.6)	6 (25)	15 (30)	7 (26.9)	3 (12.5)	10 (20)
Grade I - malnutrition	76-90	4 (20)	3 (10)	7 (14)	1 (5)	2 (6.7)	3 (6)	12 (54.6)	10 (35.7)	22 (44)	10 (45.5)	8 (28.6)	18 (36)	10 (38.5)	13 (54.2)	23 (46)	9 (34.6)	13 (54.2)	22 (44)
Grade II - malnutrition	61-75	10 (50)	18 (60)	28 (56)	-	6 (20)	6 (12)	3 (13.6)	12 (42.9)	15 (30)	4 (18.2)	13 (46.4)	17 (34)	7 (26.9)	5 (20.8)	12 (24)	9 (34.6)	7 (29.1)	16 (32)
Grade III - malnutrition	≤60	4 (20)	7 (23.3)	11 (22)	-	-	-	-	3 (10.7)	3 (6)	1 (4.5)	4 (14.3)	5 (10)	-	-	-	1 (3.9)	1 (4.2)	2 (4)
Total		20 (100)	30 (100)	50 (100)	20 (100)	30 (100)	50 (100)	22 (100)	28 (100)	50 (100)	22 (100)	28 (100)	50 (100)	26 (100)	24 (100)	50 (100)	26 (100)	24 (100)	50 (100)

BS - Before supplementation; As - After supplementation
B - Boys; G - Girls; T - total
Number in parentheses are percentage

F value between SSL and ESL - 3.0235
F value between SSL and NSL - 3.9593
F value between ESL and NSL - 1.3095

lower than the Indian standards; after the study period, the same were not significant.

The most common combination of measurements to find out the prevalence of malnutrition among children are weight for age, height for age and weight/height^2. Observations on these data were interpreted according to these combinations and are presented below.

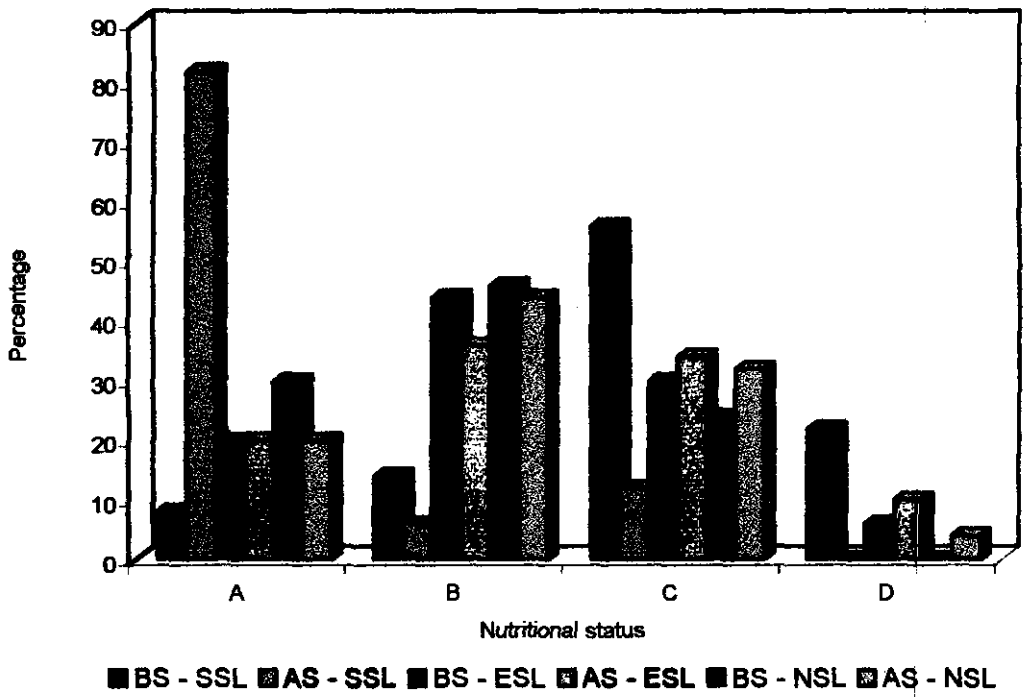
4.5.2.1 Weight for age

Based on the weight for age, the children of the SSL, ESL and NSL groups, before and after the study period were categorized into different grades of malnutrition and are furnished in Table 26.

The table indicates that, as per the classification suggested by Gomez *et al.* (1956), in the SSL group, only 8 per cent children were having normal nutritional status which increased to 82 per cent after the study period. In the ESL group, no change was observed in the nutritional status, after the study period. In this group, 20 per cent of children had normal nutritional status. Thirty per cent of the children in the NSL category had normal nutritional status before the study period, which declined to 20 per cent, when assessed after the study period.

A decrease in the percentage of children having grade I malnutrition by five per cent was observed, after the supplementary study period, in both the SSL and ESL categories. In NSL group also, a reduction in the percentage of children with grade I malnutrition was recorded after the study period (2 per cent).

Fifty six per cent of children in SSL category had grade II malnutrition, which was reduced to 12 per cent after the supplementary study. On the contrary, in both ESL and NSL groups, the percentage of children with grade II malnutrition had increased after the study period.



BS - Before supplementation
AS - After supplementation

A - Normal
B - Grade I Malnutrition
C - Grade II Malnutrition
D - Grade III Malnutrition

Fig.3. Nutritional status of school children on the basis of weight for age before and after the study period

Table 27. Weight for age distribution of boys in SSL group before and after the study period

Before \ After	Normal	Grade I - malnutrition	Grade II - malnutrition	Grade III - malnutrition	Total
Normal	2	-	-	-	2 (10)
Grade I - malnutrition	3	1	-	-	4 (20)
Grade II - malnutrition	10	-	-	-	10 (50)
Grade III - malnutrition	4	-	-	-	4 (20)
Total	19 (95)	1 (5)	-	-	20 (100)

Number in parentheses are percentage

Table 28. Weight for age distribution of girls in SSL group before and after the study period

Before \ After	Normal	Grade I - malnutrition	Grade II - malnutrition	Grade III - malnutrition	Total
Normal	2	-	-	-	2 (6.7)
Grade I - malnutrition	3	-	-	-	3 (10)
Grade II - malnutrition	10	2	6	-	18 (60)
Grade III - malnutrition	7	-	-	-	7 (23.3)
Total	22 (73.3)	2 (6.7)	6 (20)	-	30 (100)

Number in parentheses are percentage

Table 29. Weight for age distribution of boys in ESL group before and after the study period

Before \ After	Normal	Grade I - malnutrition	Grade II - malnutrition	Grade III - malnutrition	Total
Normal	7	-	-	-	7 (31.8)
Grade I - malnutrition	-	10	1	1	12 (54.6)
Grade II - malnutrition	-	-	3	-	3 (13.6)
Grade III - malnutrition	-	-	-	-	-
Total	7 (31.8)	10 (45.5)	4 (18.2)	1 (4.5)	22 (100)

Number in parentheses are percentage

None of the children in the SSL group suffered from grade III malnutrition after the study period, though 22 per cent in this group had the same, before the supplementary study. In both ESL and NSL categories, an increase in the percentage of children with grade III malnutrition, by four per cent was noticed, when assessed after the study period (Fig.3). Analysis of variance done indicated that after the study period, children of SSL group had better nutritional status than those of ESL and NSL groups, with regard to body weight. The ANOVA is given in Appendix XI.

Table 27 gives an account of the weight for age distribution of boys of SSL group, before and after the study period.

As is clear from the table, of the 20 boys of SSL group, only two were normal before supplementation with soya grits. The remaining 18 had malnutrition of different grades. But after supplementation, 19 of them were normal and only one boy had grade I malnutrition. In other words, there was a definite improvement in the nutritional status of boys, when soya grits were supplemented in the school lunch programme.

Table 28 furnishes the details on the weight for age distribution of girls of SSL group, before and after the study period.

As is evident from the table, in the case of girls in the SSL group also, the effect of soya grit supplement in the school lunch was evident similar to the case of boys.

Table 29 gives an account of the weight for age distribution of boys in ESL group, before and after the study period.

Table 30. Weight for age distribution of girls in ESL group before and after the study period

Before \ After	Normal	Grade I - malnutrition	Grade II - malnutrition	Grade III - malnutrition	Total
Normal	3	-	-	-	3 (10.7)
Grade I - malnutrition	-	8	1	1	10 (35.7)
Grade II - malnutrition	-	-	12	-	12 (42.9)
Grade III - malnutrition	-	-	-	3	3 (10.7)
Total	3 (10.7)	8 (28.6)	13 (46.4)	4 (14.3)	28 (100)

Number in parentheses are percentage

Table 31. Weight for age distribution of boys in NSL group before and after the study period

Before \ After	Normal	Grade I - malnutrition	Grade II - malnutrition	Grade III - malnutrition	Total
Normal	7	1	-	1	9 (34.6)
Grade I - malnutrition	-	8	2	-	10 (38.5)
Grade II - malnutrition	-	-	7	-	7 (26.9)
Grade III - malnutrition	-	-	-	-	-
Total	7 (26.9)	9 (34.6)	9 (34.6)	1 (3.9)	26 (100)

Number in parentheses are percentage

Table 32. Weight for age distribution of girls in NSL group before and after the study period

Before \ After	Normal	Grade I - malnutrition	Grade II - malnutrition	Grade III - malnutrition	Total
Normal	3	2	1	-	6 (25)
Grade I - malnutrition	-	11	1	1	13 (54.2)
Grade II - malnutrition	-	-	5	-	5 (20.8)
Grade III - malnutrition	-	-	-	-	-
Total	3 (12.5)	13 (54.2)	7 (29.1)	1 (4.2)	24 (100)

Number in parentheses are percentage

As is evident from the table, before the study period, seven boys had normal nutritional status. The remaining 12 had grade I malnutrition and three had grade III malnutrition. After the study period also, only seven boys were normal. The rest of the boys had malnutrition of different grades, including one of boy with grade III malnutrition.

Table 30 furnishes the details on the weight for age distribution of girls in ESL group, before and after the study period.

As is clear from the table, in the case of girls in ESL group, the result was similar to that of boys. No change was observed in the number of girls with normal nutritional status, after the study period. The number of girls with grade I and grade II malnutrition were eight and thirteen respectively, after the study period. The number of girls with grade III malnutrition increased from three to four.

Table 31 gives an account of weight for age distribution of boys in NSL group, before and after the study period.

From the table, it is clear that the number of boys with normal nutritional status decreased from nine to seven, after the study period. Though there was a decrease the number of boys with grade I malnutrition, the number of boys with grade II malnutrition increased. One boy, who had normal nutritional status before the study period, had malnutrition of grade III after the study period.

Table 32 gives the details on the weight for age distribution of girls in NSL group, before and after the study period.

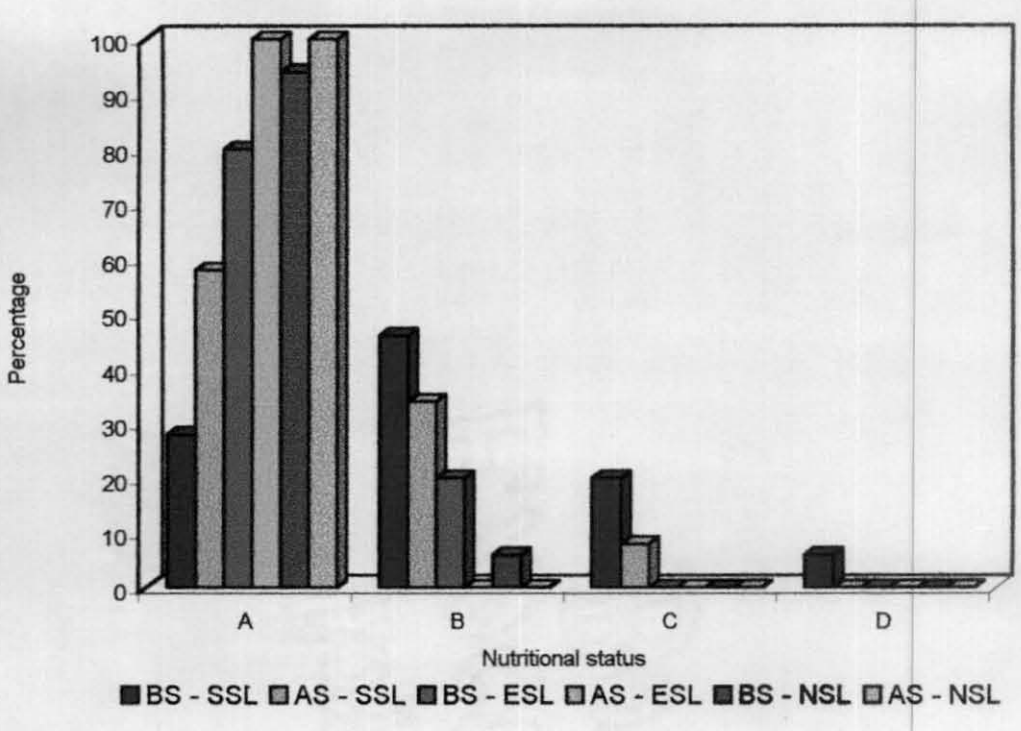
As is furnished in the table, the number of girls with normal nutritional status reduced from six to three. The number of girls with grade I malnutrition remained unchanged. An increase was observed in the number of girls with grade II malnutrition. After the study period, one girl had grade III malnutrition.

Table 33. Height for age distribution of school children - Waterlow's (1972) classification

Nutritional status	Height for age % of the standard	SSL						ESL						NSL					
		BS			AS			BS			AS			BS			AS		
		B	G	T	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T
Normal	>95	6 (30)	8 (26.7)	14 (28)	13 (65)	16 (53.3)	29 (58)	19 (95)	21 (75)	40 (80)	22 (100)	28 (100)	50 (100)	25 (96.2)	22 (91.7)	47 (94)	26 (100)	24 (100)	50 (100)
Marginal malnutrition	90-95	8 (40)	15 (50)	23 (46)	4 (20)	13 (43.3)	17 (34)	3 (5)	7 (25)	10 (20)	-	-	-	1 (3.8)	2 (8.3)	3 (6)	-	-	-
Moderate malnutrition	85-90	4 (20)	6 (20)	10 (20)	3 (15)	1 (3.3)	4 (8)	-	-	-	-	-	-	-	-	-	-	-	-
Severe malnutrition	<85	2 (10)	1 (3.3)	3 (6)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		20 (100)	30 (100)	50 (100)	20 (100)	30 (100)	50 (100)	22 (100)	28 (100)	50 (100)	22 (100)	28 (100)	50 (100)	26 (100)	24 (100)	50 (100)	26 (100)	24 (100)	50 (100)

BS - before supplementation; AS - after supplementation
B - Boys; G - Girls; T - Total
Number in parentheses are percentage

F value between SSL and ESL = 6.4139
F value between SSL and NSL = 1.1272
F value between ESL and NSL = 7.2296



BS - Before supplementation
AS - After supplementation

A - Normal
B - Marginal Malnutrition
C - Moderate Malnutrition
D - Severe Malnutrition

Fig.4. Nutritional status of school children on the basis of height for age before and after the study period

4.5.2.2 Height for age

The height for age distribution of school children of SSL, ESL and NSL groups, based on Waterlow's (1972) classification is shown in Table 33.

The above table reveals a 30 per cent increase in children with normal nutritional status, after the supplementary study period in SSL group, 20 per cent increase in ESL and six per cent increase in NSL group. Children with marginal malnutrition reduced from 46 per cent to 34 per cent in SSL, from 20 per cent to nil in ESL and from six per cent to nil in NSL group. None in either ESL or NSL groups had moderate and severe malnutrition, before and after the study period. In the SSL category, the percentage of children with moderate and severe malnutrition reduced by twelve per cent and six per cent, respectively, after supplementation with soya grits (Fig.4). Analysis of variance test (Appendix XI) indicated that, though all groups had positive increments regarding height for age after the study period, the change in SSL group was more significant than the changes in the ESL and NSL groups.

Information regarding the height for age distribution of boys of SSL group, before and after the study period is given in Table 34.

Table 34. Height for age distribution of boys in SSL group before and after the study period

Before \ After	Normal	Marginal malnutrition	Moderate malnutrition	Severe malnutrition	Total
Normal	6	-	-	-	6 (30)
Marginal malnutrition	4	4	-	-	8 (40)
Moderate malnutrition	1	-	3	-	4 (20)
Severe malnutrition	2	-	-	-	2 (10)
Total	13 (65)	4 (20)	3 (15)	-	20 (100)

Number in parentheses are percentage

As the table indicates, of the four boys with moderate malnutrition, supplementary diet could overcome the malnutrition in one child only. The other three remained under moderate malnutrition. But of the eight boys who had marginal malnutrition, supplementary diet could take four of them out of deficiency.

Details on the height for age distribution of girls of SSL group, before and after the study period are given in Table 35.

Table 35. Height for age distribution of girls in SSL group before and after the study period

Before \ After	Normal	Marginal malnutrition	Moderate malnutrition	Severe malnutrition	Total
Normal	8	-	-	-	8 (26.7)
Marginal malnutrition	2	13	-	-	15 (50)
Moderate malnutrition	5	-	1	-	6 (20)
Severe malnutrition	1	-	-	-	1 (3.3)
Total	16 (53.3)	13 (43.4)	1 (3.3)	-	30 (100)

Number in parentheses are percentage

From the above table, out of the 15 marginally malnourished girls, the supplementary diet could make two girls normal. Of the six moderately malnourished girls, five overcame deficiency. There were no girls with severe malnutrition after the study.

Table 36 gives the details on height for age distribution of boys in ESL group, before and after the study period.

Table 36. Height for age distribution of boys in ESL group before and after the study period

Before \ After	Normal	Marginal malnutrition	Moderate malnutrition	Severe malnutrition	Total
Normal	19	-	-	-	19 (95)
Marginal malnutrition	3	-	-	-	3 (5)
Moderate malnutrition	-	-	-	-	-
Severe malnutrition	-	-	-	-	-
Total	22 (100)	-	-	-	22 (100)

Number in parentheses are percentage

As is clear from the table, out of 22 boys although three boys had marginal malnutrition before the study period, all the boys became normal, after the study period.

Table 37 furnishes the details on height for age distribution of girls in ESL group, before and after the study period.

Table 37. Height for age distribution of girls in ESL group before and after the study period

Before \ After	Normal	Marginal malnutrition	Moderate malnutrition	Severe malnutrition	Total
Normal	21	-	-	-	21 (75)
Marginal malnutrition	7	-	-	-	7 (25)
Moderate malnutrition	-	-	-	-	-
Severe malnutrition	-	-	-	-	-
Total	28 (100)	-	-	-	28 (100)

Number in parentheses are percentage

The table indicates that, with regard to height for age distribution, the girls in ESL group had a result similar to that of the boys in the same group. After the study period, all the 28 girls had normal nutritional status.

Table 38 gives an account of height for age distribution of boys in NSL group, before and after the study period.

Table 38. Height for age distribution of boys in NSL group before and after the study period

Before \ After	Normal	Marginal malnutrition	Moderate malnutrition	Severe malnutrition	Total
Normal	25	-	-	-	25 (96.2)
Marginal malnutrition	1	-	-	-	1 (3.8)
Moderate malnutrition	-	-	-	-	-
Severe malnutrition	-	-	-	-	-
Total	26 (100)	-	-	-	26 (100)

Number in parentheses are percentage

As is evident from the table, before the study period, out of the 26 boys in NSL group, only one boy had marginal malnutrition. All the rest had normal nutritional status. After the study period, all the 26 boys became normal.

Table 39 gives the details on height for age distribution of girls in NSL group, before and after the study period.

Table 39. Height for age distribution of girls in NSL group before and after the study period

Before \ After	Normal	Marginal malnutrition	Moderate malnutrition	Severe malnutrition	Total
Normal	22	-	-	-	2 (91.7)
Marginal malnutrition	2	-	-	-	2 (8.3)
Moderate malnutrition	-	-	-	-	-
Severe malnutrition	-	-	-	-	-
Total	24 (100)	-	-	-	24 (100)

Number in parentheses are percentage

The table indicates that, in the case of girls of the NSL group, the result was similar to that of the boys in the same group. After the study period, no girl had any type of malnutrition.

Anthropometric ratios were worked out using the data and weight/height^2 ratio as suggested by Rao and Singh (1970) is presented in Table 40.

As revealed from the table, with regard to the percentage of total children having normal nutritional status, in both SSL and ESL categories, an increase by 46 per cent and four per cent, respectively, was noticed, after the supplementary study period. On the contrary, the percentage of normal children reduced from 14 per cent to four per cent in NSL group.

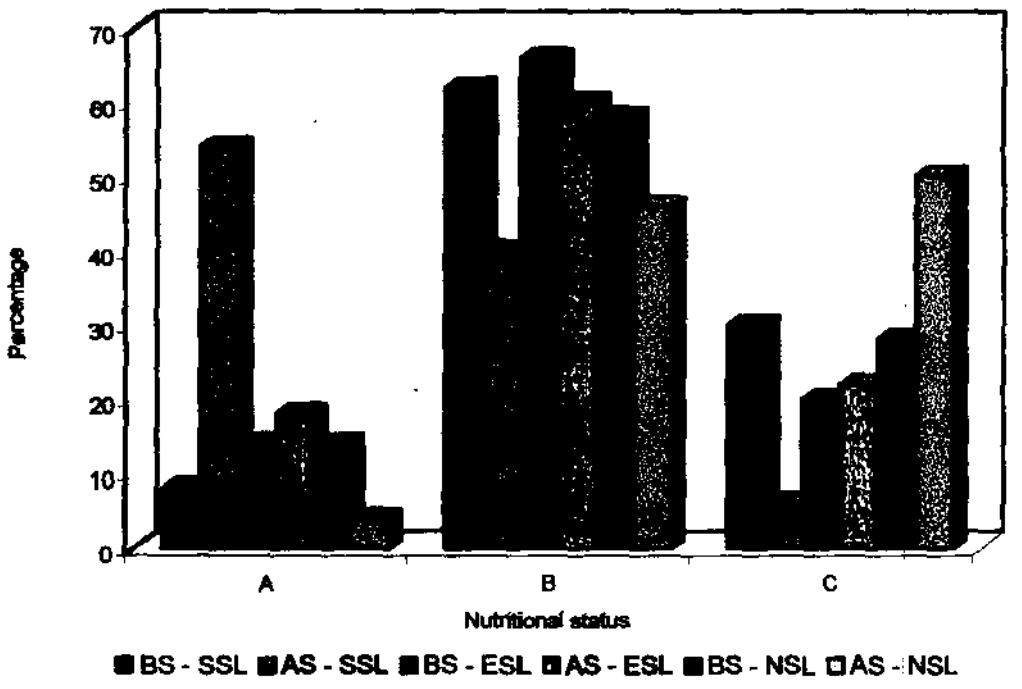
The percentage of children with moderate malnutrition decreased in SSL, ESL and NSL groups, by twenty two per cent, six per cent and twelve per cent, respectively.

Table 40. Distribution of school children by nutritional status - weight/height^2 ratio (Rao and Singh, 1970)

Nutritional status	Weight/ height^2 (kg/cm^2)	SSL						ESL						NSL					
		BS			AS			BS			AS			BS			AS		
		B	G	T	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T
Normal	>0.0015	1 (5)	3 (10)	4 (8)	10 (50)	17 (56.7)	27 (54)	6 (27.3)	1 (3.6)	7 (14)	5 (22.7)	4 (14.3)	9 (18)	3 (11.5)	4 (16.7)	7 (14)	1 (3.8)	1 (4.2)	2 (4)
Moderate malnutrition	0.0013-0.0015	14 (70)	17 (56.7)	31 (62)	10 (50)	10 (33.3)	20 (40)	14 (63.6)	19 (67.9)	33 (66)	14 (63.6)	16 (57.1)	30 (60)	15 (57.7)	14 (58.3)	29 (58)	10 (38.5)	13 (54.2)	23 (46)
Under nutrition	<0.0013	5 (25)	10 (33.3)	15 (30)	-	3 (10)	3 (6)	2 (9.1)	8 (28.5)	10 (20)	3 (13.7)	8 (28.6)	11 (22)	8 (30.8)	6 (25)	14 (28)	15 (57.7)	10 (41.6)	25 (50)
Total		20 (100)	30 (100)	50 (100)	20 (100)	30 (100)	50 (100)	22 (100)	28 (100)	50 (100)	22 (100)	28 (100)	50 (100)	26 (100)	24 (100)	50 (100)	26 (100)	24 (100)	50 (100)

BS - Before supplementation; AS - After supplementation
B - Boys; G - Girls; T - total
Number in parentheses are percentage

F value between SSL and ESL - 3.8661
F value between SSL and NSL - 1.4384
F value between ESL and NSL - 2.6878



BS - Before supplementation
AS - After supplementation

A - Normal
B - Moderate Malnutrition
C - Undernutrition

Fig.5. Nutritional status of school children on the basis of weight/height^2 before and after the study period

A reduction by 24 per cent was observed in the percentage of undernourished children in the SSL group, after the supplementary study, while in both ESL and NSL categories, an increase by two per cent and twenty two per cent, respectively, were observed in the undernourished group (Fig.5). The statistical analysis using analysis of variance technique revealed that (Appendix XI) with regard to weight/height^2 ratio, the SSL group children had more significant increment than ESL and NSL group children, when assessed after the study period.

Distribution of boys of SSL group, according to weight/height^2 ratio, before and after the study period, is given in Table 41.

Table 41. Distribution of boys in SSL group, based on weight/height^2 ratio before and after the study period

Before \ After	Normal	Moderate malnutrition	Under nutrition	Total
Normal	1	-	-	1 (5)
Moderate malnutrition	4	10	-	14 (70)
Under nutrition	5	-	-	5 (25)
Total	10 (50)	10 (50)	-	20 (100)

Number in parentheses are percentage

From the table it is clear that, the soya supplemented diet could increase the number of boys with normal nutritional status from one to ten. From 14, the number of boys with moderate malnutrition in SSL group was reduced to 10. A

definite improvement in the nutritional status of boys in SSL group was observed and none was undernourished after the study period.

Distribution of girls of SSL group, according to weight/height^2 ratio is given in Table 42.

Table 42. Distribution of girls in SSL group, based on weight/height^2 ratio before and after the study period

Before \ After	Normal	Moderate malnutrition	Under nutrition	Total
Normal	3	-	-	3 (10)
Moderate malnutrition	7	10	-	17 (56.7)
Under nutrition	7	-	3	10 (33.3)
Total	17 (56.7)	10 (33.3)	3 (10)	30 (100)

Number in parentheses are percentage

The table shows that, in the case of girls in SSL group also, the result was similar to that of the boys of the same group. Through soya supplementation, the number of girls with normal nutritional status was increased from three to seventeen. The soya supplemented diet decrease the number of moderately malnourished girls from 17 to 10 and that of under nourished from ten to three.

Table 43 furnishes the details on distribution of boys in ESL group, based on weight/height^2 ratio, before and after the study period.

Table 43. Distribution of boys in ESL group, based on weight/height^2 ratio before and after the study period

Before \ After	Normal	Moderate malnutrition	Under nutrition	Total
Normal	5	-	-	5 (27.3)
Moderate malnutrition	-	13	1	14 (63.6)
Under nutrition	-	-	2	2 (9.1)
Total	5 (22.7)	14 (63.6)	3 (13.7)	22 (100)

Number in parentheses are percentage

As the table indicates in boys of ESL group, out of six boys with normal nutritional status, only five had the same after the study period. The number of boys with moderate malnutrition remained unchanged. From two, the number of boys with under nutrition increased to three, after the study period.

Table 44 furnishes the details on distribution of girls in ESL group, based on weight/height^2 ratio, before and after the study period.

Table 44. Distribution of girls in ESL group, based on weight/height^2 ratio before and after the study period

Before \ After	Normal	Moderate malnutrition	Under nutrition	Total
Normal	1	-	-	1 (3.6)
Moderate malnutrition	3	16	-	19 (67.9)
Under nutrition	-	-	8	8 (28.5)
Total	4 (14.3)	16 (57.1)	8 (28.6)	28 (100)

Number in parentheses are percentage

The table indicates that, after the study period, the number of girls with normal nutritional status increased from one to four. The number of girls with under nutrition remained unchanged; although a decrease was noticed in the number of girls with moderate malnutrition.

Table 45 gives an account of distribution of boys in NSL group, based on weight/height^2 ratio, before and after the study period.

Table 45. Distribution of boys in NSL group, based on weight/height^2 ratio before and after the study period

Before \ After	Normal	Moderate malnutrition	Under nutrition	Total
Normal	1	2	-	3 (11.5)
Moderate malnutrition	-	8	7	15 (57.7)
Under nutrition	-	-	8	8 (30.8)
Total	1 (3.8)	10 (38.5)	15 (57.7)	26 (100)

Number in parentheses are percentage

As is evident from the table, after the study period, the number of boys with normal nutritional status decreased from three to one. A decrease in the number of boys with moderate malnutrition was observed; though the number of boys with under nutrition increased from eight to fifteen, after the study period.

Table 46 furnishes the details on distribution of girls in NSL group, based on weight/height^2 ratio, before and after the study period.

Table 46. Distribution of girls in NSL group, based on weight/height^2 ratio before and after the study period

Before \ After	Normal	Moderate malnutrition	Under nutrition	Total
Normal	1	2	1	4 (16.7)
Moderate malnutrition	-	11	3	14 (58.3)
Under nutrition	-	-	6	6 (33.3)
Total	1 (56.7)	13 (33.3)	10 (10)	24 (100)

Number in parentheses are percentage

As indicated in the table, in the case of girls of NSL group, after the study period, the result was similar to that of boys of the same group, with regard to weight/height^2 ratio. The number of girls with normal nutritional status and moderate malnutrition reduced, while number of girls with under nutrition increased.

4.5.2.3 Mid upper arm circumference (MUAC)

Observations of the mid upper arm circumference of the children were interpreted according to Gopaldas and Sheshadri (1987) classification and is presented in Table 47.

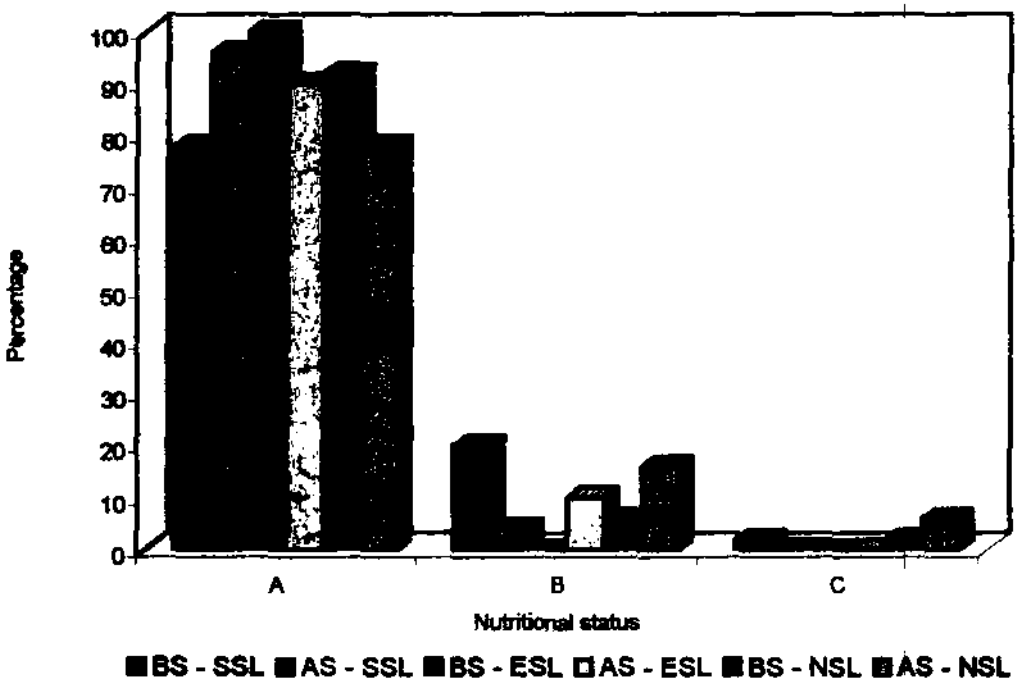
As revealed in the table, an increase was observed in the percentage of children with normal nutritional status in the SSL group, by 18 per cent, after the study period. In the case of ESL and NSL categories, a reduction was noticed by 10 per cent and 14 per cent, respectively, in the normally nourished group after the study.

Table 47. Distribution of school children based on MUAC - Gopaldas and Sheshadri (1987)

Nutritional status	MUAC (cm)	SSL						ESL						NSL					
		BS			AS			BS			AS			BS			AS		
		B	G	T	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T
Normal	>13.5	17 (85)	22 (73.3)	39 (78)	20 (100)	28 (93.3)	48 (96)	22 (100)	28 (100)	50 (100)	19 (86.4)	26 (92.9)	45 (90)	24 (92.3)	22 (91.6)	46 (92)	20 (76.9)	19 (79.2)	39 (78)
Moderate malnutrition	12.5-13.5	3 (15)	7 (23.3)	10 (20)	-	2 (6.7)	2 (4)	-	-	-	3 (13.6)	2 (7.1)	5 (10)	2 (7.7)	1 (4.2)	3 (6)	6 (23.1)	2 (8.3)	8 (16)
Severe malnutrition (6)	<12.5	-	1 (3.3)	1 (2)	-	-	-	-	-	-	-	-	-	-	-	1 (4.2)	1 (2)	-	3 (12.5)
Total		20 (100)	30 (100)	50 (100)	20 (100)	30 (100)	50 (100)	22 (100)	28 (100)	50 (100)	22 (100)	28 (100)	50 (100)	26 (100)	24 (100)	50 (100)	26 (100)	24 (100)	50 (100)

BS - before supplementation; AS - after supplementation
B - Boys; G - Girls; T - Total
Number in parentheses are percentage

F value between SSL and ESL = 1.2964
F value between SSL and NSL= 2.1090
F value between ESL and NSL= 1.6268



BS - Before supplementation
AS - After supplementation

A - Normal
B - Moderate Malnutrition
C - Severe Malnutrition

Fig.6. Nutritional status of school children on the basis of MUAC before and after the study period

A reduction from 20 per cent to 4 per cent was observed, in the percentage of children having moderate malnutrition in SSL group; whereas in ESL and NSL groups, an increase was observed by 10 per cent in the group with moderate malnutrition. After the study period, except for 6 per cent of children in the NSL group, none in either SSL or ESL categories registered as having severe malnutrition (Fig.6). Analysis of variance done(Appendix XI) indicated that after the study period, children of SSL group had more positive increment than those of ESL and NSL groups, with respect to MUAC.

Details regarding the distribution of boys in SSL group, according to MUAC, before and after the study are furnished in Table 48.

Table 48. Distribution of boys in SSL group, based on MUAC before and after the study period

After / Before	Normal	Moderate malnutrition	Severe malnutrition	Total
Normal	17	-	-	17 (85)
Moderate malnutrition	3	-	-	3 (15)
Severe malnutrition	-	-	-	-
Total	20 (100)	-	-	20 (100)

Number in parentheses are percentage

As shown in the table, of the 20 boys in SSL group, 17 were normal and the remaining had moderate malnutrition, before the study period. But with the help of soya supplementation, all the boys became normal.

Table 49 furnishes the details regarding the distribution of girls in SSL group, according to MUAC, before and after the study.

Table 49. Distribution of girls in SSL group, based on MUAC before and after the study period

Before \ After	Normal	Moderate malnutrition	Severe malnutrition	Total
Normal	22	-	-	22 (73.3)
Moderate malnutrition	6	1	-	7 (23.3)
Severe malnutrition	-	1	-	1 (3.3)
Total	28 (93.3)	2 (6.7)	-	30 (100)

Number in parentheses are percentage

The above table indicates that, out of the 30 girls in SSL group, before the study period, 22 had normal nutritional status, seven had moderate malnutrition and one had severe malnutrition. Through soya supplementation, a definite improvement was brought about, as evidenced by an increase in the number of girls with normal nutritional status and a decrease in the number of malnourished. After the study period, none had severe malnutrition.

Table 50 gives an account of distribution of boys in ESL group, based on MUAC, before and after the study period.

Table 50. Distribution of boys in ESL group, based on MUAC before and after the study period

Before \ After	Normal	Moderate malnutrition	Severe malnutrition	Total
Normal	19	3	-	22 (100)
Moderate malnutrition	-	-	-	-
Severe malnutrition	-	-	-	-
Total	19 (86.4)	3 (13.6)	-	22 (100)

Number in parentheses are percentage

As is clear from the table, out of the 22 boys in ESL group none was malnourished before the study period. But after the study period, three boys became moderately malnourished. But no boy had severe malnutrition, after the study period.

Table 51 indicates the distribution of girls in ESL group, based on MUAC, before and after the study period.

Table 51. Distribution of girls in ESL group, based on MUAC before and after the study period

Before \ After	Normal	Moderate malnutrition	Severe malnutrition	Total
Normal	26	2	-	28 (100)
Moderate malnutrition	-	-	-	7
Severe malnutrition	-	-	-	-
Total	26 (92.9)	2 (7.1)	-	28 (100)

Number in parentheses are percentage

As given in the table, in the case of girls in the ESL group, the result was similar to that of boys of the same group. Out of the 28 girls with normal malnutrition, two girls became moderately malnourished. Among girls also, none was severely malnourished either before or after the study period.

Table 52 furnishes the details on the distribution of boys in NSL group, based on MUAC, before and after the study period.

Table 52. Distribution of boys in NSL group, based on MUAC before and after the study period

Before \ After	Normal	Moderate malnutrition	Severe malnutrition	Total
Normal	20	4	-	24 (92.3)
Moderate malnutrition	-	2	-	2 (7.7)
Severe malnutrition	-	-	-	-
Total	20 (76.9)	6 (23.1)	-	26 (100)

Number in parentheses are percentage

As the table indicates, in boys of NSL group, of the 26 boys, 24 had normal nutritional status and the remaining two had moderate malnutrition, before the study period. After the study period, only 20 boys had normal nutritional status and the rest had moderate malnutrition. However, no boy had severe malnutrition.

Table 53 gives an account on distribution of girls in NSL group, based on MUAC before and after the study period.

Table 53. Distribution of girls in NSL group, based on MUAC before and after the study period

Before \ After	Normal	Moderate malnutrition	Severe malnutrition	Total
Normal	19	2	1	22 (91.6)
Moderate malnutrition	-	-	1	1 (4.2)
Severe malnutrition	-	-	1	1 (4.2)
Total	19 (79.2)	2 (8.3)	3 (12.5)	24 (100)

Number in parentheses are percentage

As is clear from the table, before the study period, of the 24 girls in NSL group, 22 had normal nutritional status and one each had moderate and severe malnutrition. After the study period, only 19 girls had normal nutritional status and from one, the number of girls with moderate a severe malnutrition increased to two and three, respectively.

4.5.3 Clinical examination of children

All the children in the three groups were clinically examined for manifestations of any type of physical ailments, before and after the supplementary study period. The results are presented in Table 54.

Table 54. Manifestation of clinical symptoms before and after the study

Type of clinical symptoms	SSL		ESL		NSL	
	B	A	B	A	B	A
Phrynoderma	-	-	-	-	1 (2)	2 (4)
Dentral caries	45 (90)	47 (94)	44 (88)	45 (90)	41 (82)	41 (82)
Mottled enamel	-	-	-	-	3 (6)	3 (6)
Beading of ribs	-	-	-	-	-	-
Goitre	-	-	-	-	1 (2)	-
Anaemia	5 (10)	3 (6)	6 (12)	5 (10)	4 (8)	4 (8)
Total	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)	50 (100)

B - before the study period; A - after the study period
Number in parentheses are percentage

As is evident from the table, in the SSL group, only dental caries and anaemia were prevalent among the children. After the supplementary study, the percentage of children with dental caries increased by four per cent; where as those with anaemia decreased by four per cent.

In the ESL category also, dental caries and anaemia were the main clinical manifestations observed and the percentage of children with dental caries increased from 88 per cent to 90 per cent and those with anaemia reduced from 12 per cent to 10 per cent.

Phrynoderma, dental caries, mottled enamel, goitre and anaemia were present among children of NSL group. After the study period, a two per cent increase in the percentage of children with phrynoderma and a two per cent decrease in the percentage of children with goitre were observed.

DISCUSSION

5. DISCUSSION

5.1 Socio-economic background of the families

The sample selected for the study consisted of three groups of children in the age group seven to nine years. Each group had 50 children. First group consisted of the children with the soya supplemented lunch (SSL), the second, the group with the existing school lunch (ESL) and the third group with no school lunch (NSL).

Socio-economic details of the families are important factors, having great impact on the nutritional status of school children (Saxena, 1986; Vijayalakshmi and Rao, 1988 and Ghosh, 1997).

In the present study, majority of the families were christians (50, 38 and 50 per cent in SSL, ESL and NSL groups, respectively), followed by Hindus. Muslim families were found to be a minority in SSL and NSL groups (12 and 8%); whereas in ESL group, 28 per cent of the families were Muslims.

Most of the families in SSL and NSL groups belonged to forward community (54%), whereas, 46 per cent of the families in ESL group belonged to other backward class community. Regarding the type of family system, the present study indicated that, 78, 66 and 80 per cent families in the SSL, ESL and NSL categ[redacted] followed nuclear family system. Urbanization and changes in social values might have brought about this phenomenon in the family structure of modern societies. Saxena (1986) found that nuclear families were better than the joint families in health and development. Similar findings were also reported by Gupta (1976), Shyu (1980) and UNICEF (1984).

Size of the family is a prominent factor in deciding the nutritional status of the child, 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 Tuncbilek *et al.*, 1995). The present study indicated that, majority of the families in the SSL, ESL and NSL categories had only upto four members. None in the three groups had more than eight members in the family.

The present study also revealed that more than half of the families in the three categories had two adult members with two children. This finding is in line with the observations made by NNMB (1984) in Kerala which reported that, small family norm was getting high practice even among low income groups. Studies conducted by Gopalan (1988), Cherian (1992), Jayanthakumari (1993) and Udaya (1996) also revealed the same family pattern in Kerala.

Education is considered to be a catalyst of change and its role in the process of national development cannot be overemphasized (Manorama Year Book, 1996). The present study revealed that majority of the parents in SSL, ESL and NSL categories had high school education. This finding coincides with reports of Census of India (1991) and Manorama Year Book (1996) in which it was indicated that, Kerala is the most literate state with highest literacy rate of 89.81 per cent. The female population of the three groups also had better educational level, which is very important, since the level of education of mothers, according to UNICEF (1991), affected the nutritional status of young children.

Majority of the fathers of index children in SSL, ESL and NSL groups were casual labourers. Above 90 per cent of mothers in the three groups were unemployed. This is in contrast to the modern concept of literate women being employed outside their homes.

The monthly income of more than half of the families in the three groups was below Rs.2000/-. This is live with the observations of Karuna (1993) and Verma, (1996), who had reported that the mean monthly income of the casual labourer families ranged between Rs.1000/- to Rs.3000/- in Kerala.

Monthly expenditure pattern showed that most of the families in SSL, ESL and NSL groups spent between 30 and 60 per cent of their monthly income on food. About 22 per cent of the families in SSL and 18 per cent in ESL spent more than 60 per cent of their income for food. The expenditure pattern of the families with respect to food is in line with the study conducted by Rai and Sarup (1995) who found that in Kerala, 62.15 per cent of the total income was spent for food by the rural families.

The present study also reported that less than 10 per cent of the monthly income was spent on clothing, shelter, rent, transportation, education, entertainment, health, savings, own expenses, repayment of loans, kuries, fuel, water etc. The same pattern was observed by Prema (1983), Usha *et al.* (1990), Augustine (1993), Karuna (1993) and Rai and Sarup (1995), in their Kerala studies.

The statistical analysis indicated that no significant difference existed in the expenditure pattern between SSL, ESL and NSL groups.

More or less satisfactory living conditions were observed in the families of SSL, ESL and NSL groups. Majority had their own houses with three to five rooms. Most of the houses in all the groups were thatched, built with brick walls and having separate kitchen. Drinking water source for most of the families (above 50%) in all the groups was from their own wells. Lavatory facilities and open drainages were found in more than 90 per cent of the families in the three groups. More than 80 per cent of the families in the three groups had electric connections in their houses. Majority of the families (70, 68 and 74 per cent in SSL, ESL and NSL) resorted to public conveyance as their means of transportation. Recreational facility for majority of the families was watching television and more than 60 per cent of the families in all the groups owned a television.

5.2 Details of the index children

Majority of the children were girls in SSL (60%) and ESL (56%) categories, while in the NSL group 52 per cent were boys. Most of the children in SSL, ESL and NSL groups were between seven and eight years of age. More than 70 per cent of children in all the groups had normal birth weight. This may be due to the high rate of literacy among the mothers in Kerala, who take proper care of themselves during pregnancy. Majority of children were of second birth order in all the groups. As reported by the mothers, in more than 90 per cent of the children there was no occurrence of serious childhood diseases, except for common cold and fever.

All the children in SSL, ESL and NSL categories had taken the full immunization schedule completely. Health care facilities provided by the primary health centres of the locality were utilized by majority of the families. The same health indices of Kerala children were observed by Kutty (1990) who revealed that Kerala occupied a unique position in the World's public health map, especially with regard to child survival statistics. The comparatively better educational status of Kerala women and the greater status they have always enjoyed in the society might have contributed towards better child survival.

5.3 Food consumption pattern of the families

All the families surveyed were non-vegetarians and all of them followed a three-meals-a day pattern, consisting of breakfast, lunch and supper. This finding is in line with the results of the studies conducted by Karuna (1993), Udaya (1996) and Shyna (1996) who had reported a pattern of three-meals-a day among the households of Kerala.

This study had indicated that majority of the families spent 30-60 per cent of their income on food. In this income distribution for food, majority of the

families in the three groups spent 30-50 per cent on cereals. This is in accordance with the results of the studies conducted by Sujatha (1990) and Ranganathan (1996), who had reported that, for majority of the casual labourer families in Trivandrum district, 26-50 per cent of their food expenditure was on cereals.

For pulses, green leafy vegetables, roots and tubers, other vegetables, fruits, milk and milk products, nuts and oil seeds and spices and condiments, majority of the families in SSL, ESL and NSL groups spent less than 10 per cent of their food expenditure. Statistical analysis indicated that significant difference existed between the families of three groups, only on the expenditure pattern on green leafy vegetables, fruits and fleshy foods.

Foods like cereals, other vegetables, fats and oils and sugar and jaggery were the most frequently consumed food items (score above 75%) by majority of the families in all the groups. This shows that their daily diet mainly comprised of the staple rice, other vegetables for curry preparation and coconut oil, used for seasoning the curries. The daily use of sugar was also observed, the source of which was mainly tea.

Medium frequently used foods (score 50-75%) were observed to be pulses, roots and tubers, milk and milk products and meat and fish by all the families. This indicates the consumption of the above food groups, two to three times a week. All the families were with non-vegetarian food habits. But daily consumption of non-vegetarian foods was not observed, the reason being their high cost. The families in ESL and NSL groups included green leafy vegetables on a weekly basis; whereas families in SSL group consumed green leafy vegetables only occasionally. Less frequently used foods (score below 50%) identified in majority of the families in the three groups were fruits, eggs and bakery items.

Though all the families in SSL, ESL and NSL groups were habitual non-vegetarians, foods prepared during different occasions, differed. For celebrating birth days, majority of the families in SSL and NSL opted vegetarian dishes; while majority in ESL prepared non-vegetarian dishes. During the death of any family member only vegetarian foods were prepared by all the families as a sign of mourning, in all three groups. marriage in the family was celebrated by preparing non-vegetarian food items, like biriyani, meat, fish or egg preparations etc. by SSL (56%), ESL (62%) and NSL (58%) groups. During religious festivals, feasts and other special occassions, majority in SSL and NSL prepared non-vegetarian foods; while most families in ESL opted for vegetarian dishes.

5.4 The existing school lunch programmes

As reported by the mothers, in the SSL group majority of the children (74%) had been participating in the school lunch programme for two to four years. In the ESL group, 40 per cent of the children had been participating in the school lunch programme for one to two years and 36 per cent, for two to four years. All the mothers in the two groups opined that the quantity of the food served at the school was sufficient. Majority of mothers in SSL and ESL were of the opinion that the food given at the school was nourishing to the body. In the SSL group, 98 per cent of the mothers said that the type of the food given at the school was good and the children liked the taste of the food served. In the ESL group, 94 per cent of the mothers had good opinion about the food served and 88 per cent of the mothers reported that the children liked the taste of the food served. About 12 per cent of the children in ESL group did not like the taste of the food served at the school.

All the mothers agreed that good cleanliness was observed regarding the cooking practices, utensils, cooking and eating place, water and storage facilities. 72 per cent of the mothers in both groups were ignorant about the body of implementation of the school lunch programme.

Information collected from the teachers regarding the school lunch programme indicated that enrollment of children in the programme is mainly based on the financial status of the family, which is a government policy. All the teachers agreed that the expenses (except the cost of food materials) such as cost of vessels for preparation and the cost of oil and seasoning etc. are mainly met from PTA funds. Regarding fuel expenditure, majority of the teachers reported that it was mainly met by the teachers themselves and also collected from local people.

5.5 Organoleptic studies with soya grit / chunks

Soya grits and soya chunks at different supplementary levels with green gram were evaluated in terms of organoleptic qualities, nutritional composition and cost. The results indicated that, soya grits at 20 per cent replacement level was the most acceptable one, in terms of appearance, colour, flavour, texture and taste. Though soya grits at 10 per cent replacement level differed only slightly from 20 per cent according to organoleptic evaluation, the latter had better nutritive quality especially with regard to protein content than the former. Regarding the acceptability of soya chunks, it was found that soya chunks at 10 per cent replacement level got the maximum mean score of 14.32. Compared to chunks, grits were better accepted by all, because of its size and its suitability to blend well with the existing green gram served in the school lunch. Hence grits at 20 per cent replacement level was selected as the supplementary diet.

The cost of green gram and soya grits at 20 per cent replacement level, which was selected as the supplementary diet revealed that, 30 g of green gram supplied through the existing lunch programme at schools, for each child per day, cost 65 paise, whereas for soya supplemented lunch (20% level) it comes to 85 paise per child. Hence soya supplementation in school lunch is costly, compared to the existing school lunch with green gram.

Nutritive composition of soya replaced lunch was compared with the existing school lunch, consisting of only green gram. The results indicated that, in soya supplemented school lunch, there is an increase in the nutrients like protein, calcium, iron, thiamine and riboflavin. But a decrease in energy and carotene was observed. Since soya grits is a defatted material, its total energy content is less; hence the reduction observed in energy in the soya supplemented school lunch.

5.6 Nutritional status of children

Actual food and nutrient intake

The cereal consumption in the groups was found to be low in all the groups when compared to RDA, though the values were not statistically significant. Pulse consumption was found to be significantly high in all groups when compared to RDA. The consumption of green leafy vegetables was also significantly low in all the groups. This is in tune with the findings of Sujatha (1990) and Ranganathan (1996), who had reported about the lower consumption of green leafy vegetables among Kerala households. Food groups such as other vegetables, roots and tubers, milk and milk products, fleshy foods and sugar and jaggery were found to be adequate.

Regarding nutrient consumption, the intake of energy, fat, protein, calcium, iron, vitamin A, main and Vitamin C was higher than the recommended allowances in all the groups. This observation is in contrast with the findings of Silva and Da-Silva (1995) who reported that food consumption was insufficient to meet the requirements of children of eight years or older in the developing countries.

Anthropometric measurements

Anthropometric measurements such as height, weight and other measurements are classical tools for the assessment of nutritional status. The following anthropometric measurements are made in nutrition surveys like height,

weight, head circumference, arm circumference and chest circumference (Gibson, 1990; Carlier and Cecile, 1991 and Kceskoslermans, 1994).

In the present study also, anthropometric measurements such as body weight, height and mid upper arm circumference of children were taken, before and after the study period. The mean body weight, height and MUAC of children in SSL group had increased by 0.7 kg, 6.7 cm and 3.75 cm respectively, after the soya supplementation. This is in tune with the findings of Vaidehi and Rathnamani (1990), Sailakshmi (1995) and Andrews (1997), who had observed that a soyabean product produced satisfactory rates of growth in children in terms of gain in body weight. In ESL and NSL groups, a reduction was observed in body weight after the study period.

For interpretation of anthropometric data, it has to be compared with standards. In the present study also, the data were compared with Indian standards as suggested by Vijayaraghavan *et al.* (1971 and 1974).

In SSL group, with regard to body weight, in both boys and girls, the mean values were significantly lower than the standards before the study period. However, after the study period, the values became significantly higher than the standards. In ESL group, in both boys and girls, the mean body weight was significantly lower than the Indian standards, before and after the study period. In the case of boys and girls of NSL group, after the study period, the mean body weight was significantly lower than the standards. The result indicates a positive effect of soya replaced luch on the weight gain in children. Body weight gain is the simplest reproducible anthropometric measurement for the evaluation of nutritional status of young children (Rao and Vijayaraghavan, 1996). The positive effect in SSL group may be due to the presence of good quality protein in soya.

With regard to height, although an increase was observed in the mean values in both boys and girls of SSL group after the study period, the values were significantly lower than the standards. Im boys of ESL group, the mean height was higher which was not statistically significant. But after the study period in increase in height was significant. In the case of girls of the same group also, the increase in height was not statistically significant when compared to standards. With regard to mean height values for both boys and girls of NSL group, both before and after the study period, the values were significantly higher than the standards. The increase in height in all the groups may be attributed to their age (seven to nine years), which is a period of rapid growth. But the results indicated that the rate of increase in height was greater in SSL group than in the ESL and NSL groups.

With regard to mean MUAC, in both boys and girls of SSL group, the mean values became significantly higher than the standards after the study period. In ESL group, the mean MUAV value for boys showed a reduction and became significanlty lower than the standards, after the study period. But in girls of the same group, the mean MUAC value became significantly higher than the standards, after the study period. With regard to the boys and girls of NSL group, the mean MUAC values were significantly lower than the Indian standards before the study period, which showed no significant change after the study period.

The weight for age has been used as an index of malnutrition which reveals current nutritional status (Sathy *et al.*, 1991; Lucas, 1992 and Narins, 1992). The present study revealed an increase in the percentage of children with normal nutritional status (by 74%) and a decrease in grade I, grade II and grade III malnutrition in the SSL category after the supplementary study period. This is in line with the findings of Mazilli (1988), Sailakshmi (1995) and Andrews (1997) who revealed that children attain better nutritional status after soya supplementary feeding trial.

The distribution of boys of SSL group according to weight for age revealed that, the number of boys having normal nutritional status increased from two to ninteen after supplementation with soya grits in the noon school lunch. Only one boy had grade I malnutrition after the study, while the number was four before the study. None had grade II and III malnutrition, after the study.

The distribution of girls in soya supplemented group showed that the number of girls with normal nutritional status increased from two to twenty two. Although a reduction was observed in the percentage of girls with grade I and grade II malnutrition, the rate was not as that of the boys. This is in line with the findings of Singh *et al.* (1987), who observed a higher rate of malnutrition among girls, when compared to boys.

In the ESL and NSL groups not much positive increments were noticed, regarding weight for age distribution. In the case of boys in ESL group, the number of boys with normal nutrition status remained unchanged; though boys having malnutrition of different grades were also prevalent, after the study period. In the case of girls in the ESL group, a similar trend was observed. In both boys and girls of NSL group, the number of children with normal nutritional status reduced, after the study period. This reveals that the current nutritional status of both boys and girls in the soya supplemented group was better than the nutritional status of children in the existing school lunch group.

Height for age profile shows the state of chronic malnutrition or stunting in children (Gopaldas and Sheshadri, 1987). The results of the present study indicated that, as in the case of weight for age profile, with regard to height for age also, an increase in the percentage of children with normal nutritional status was found in the SSL (by 30%) after the study. Similar results were obtained by Sailakshmi (1995) and Andrews (1997) who reported that, on completion of the feeding trial with soya in children, more than 30 per cent of children shifted from

severe malnourishment to moderate malnutrition. In the ESL category,increase in the percentage of children with normal nutritional status was less when compared to SSL group.

Distribution of boys of SSL group, according to height for age, before and after the study revealed that number of boys having normal height for age increased from six to thirteen. A decrease was noticed in boys with marginal and moderate malnutrition. No boys had severe malnutrition after the supplementaction. In girls also, similar results were observed. This may be due to the positive effect of soya supplementation. In both boys and girls of ESL group, after the study period, all came under the group with normal nutrtional status. In the case of NSL group, a similar result was observed among both boys and girls. This increase in height in all groups may be attributed to the age factor.

Weight/height^2 ratio, applied in the present study, as suggested by Rao and Singh (1970) revealed that, children with normal nutritional status increased in the SSL and ESL groups, with SSL showing a greater degree of increase. In contrast to this, a reduction in children with normal nutritional status was observed by 10 per cent in NSL group. Children with marginal and moderate malnutrition decreased in the SSL group.

Distribution of boys and girls in SSL group, according to weight/height^2 indicated that the number of boys and girls having normal nutritional status in both increased from one to ten and three to seventeen, respectively. At the end of the study period, none of the boys and only three girls were undernourished. Similar findings were observed by Sailakshmi (1995), who had reported that majority of the children had attained better health status, in terms of weight/height^2 ratio, after a soya supplementary feeding trial.

In both boys and girls of ESL group, after the study period, the number with normal nutritional status reduced. In boys and girls of NSL group a similar result was obtained; although the number of severely malnourished boys and girls increased in NSL group.

Mid upper arm circumference (MUAC) is a close indicator of general nutritional status. Since arm is composed of muscle and fat, any change in muscle and fat due to malnutrition is usually reflected in arm circumference. In the present study, classification of children according to MUAC indicated that, in the SSL group, the percentage of children, with normal nutritional status increased from 78 per cent to 96 per cent, after soya supplementation. None was moderately or severely malnourished in the same category, after the study period. On the other hand, in the ESL and NSL groups, the number of children with normal nutritional status decreased after the study period.

In both boys and girls in SSL group, at the end of the supplementary study with soya grits at 20 per cent replacement level, none was moderately or severely malnourished, in terms of MUAC. From the above observations, it can be concluded that, there was only a few cases of severe grade malnutrition among school 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 per cent to 2.66 per cent by 1975 to 1990. With regard to MUAC, in both ESL and NSL groups, the number of boys and girls with normal nutritional status decreased after the study period, the rate of decrease being higher in NSL group.

In general, the pattern of growth of children in SSL group showed that, more children came to the normal group from the marginally malnourished group and also from the moderately malnourished group to the marginal group. In both groups with nutritional supplementation (SSL and ESL), in soya supplemented

group, there was no children with grade III malnutrition after the study period and in the existing school lunch group, children with grade III malnutrition increased from six to ten per cent after the study. The absence of grade III malnutrition in soya supplemented group may be due to the high quality protein supplied through soya grits. This reveals the advantage of any supplementary feeding programme in schools and even in that, foods rich in good quality protein draws attention.

Clinical examination

Clinical examination is considered to be an important part of nutritional assessment and gives direct information on signs and symptoms of dietary deficiencies prevalent (Swaminathan, 1986). Hence this was conducted before and after the study period in all groups.

The most common nutritional deficiency disease observed among children was anaemia, which got reduced from ten to six per cent in SSL group and from 12 to 10 per cent in ESL group. After the study period a two per cent increase in the percentage of children with phrynoderma was observed in NSL group. Dental caries was observed in most of the children irrespective of the groups and it even increased after the study period. This is mainly due to the poor oral hygiene of the children.

SUMMARY

6. SUMMARY

The present study was carried out to find out the nutritional and health impact of substituting green gram by soya products in school lunch programme in Thrissur district. It was conducted among 150 randomly selected school children (7-9 age group), 50 each from the three groups i.e., soya supplemented lunch (SSL), existing school lunch (ESL) and no school lunch (NSL).

Nuclear family system with up to four members in the family was found in most of the families. Majority of the parents in the three groups were educated and their housing conditions and living facilities were found to be satisfactory.

Majority of the fathers in the three groups were casual labourers, earning up to Rs.2000 per month. More than 90 per cent of mothers were unemployed. A greater part of the monthly income was spent on food in the three groups. No significant difference existed in the expenditure pattern among SSL, ESL and NSL groups.

Dietary habits of the families indicated that all families covered in the survey were non-vegetarians. Monthly expenditure pattern on different food items revealed that significant difference existed among the three groups, with regard to the expenditure on green leafy vegetables, fruits and fleshy foods. Frequency score on different food items consumed revealed that, in all the three groups, cereals, other vegetables, fats and oils and sugar and jaggery were the most frequently used items.

Among the index children, majority in the SSL, ESL and NSL groups were females, having normal birth weight. Above 85 per cent in each category had taken the immunization course completely.

Information on the existing school lunch programme, from the mothers revealed that enough food was given at school, the food given was nourishing and

the type of food, storage facilities, cleanliness etc. were of good standard. As reported by the teachers, the expenses such as the cost of vessels and the cost of oil for seasoning etc. are met from PTA funds and the fuel expenditure was mainly met by the teachers themselves.

Soya grits at 20 per cent replacement level was the most acceptable combination in terms of organoleptic and nutritive qualities. Hence this combination was selected as the supplementary diet. It was also observed that soya supplementation in school lunch is costly compared to the existing school lunch with green gram. Nutrients like protein, calcium, iron, thiamine and riboflavin were more in soya supplemented lunch.

The mean food intake of the children in comparison with recommended allowances suggested by ICMR (1989) showed that, intake of green leafy vegetables in the three groups was significantly lower than the RDA. Consumption of fruits and fleshy foods was below the recommended level in SSL and that of fruits was lower in ESL group.

The mean intake of different nutrients in comparison with RDA revealed that except for thiamine in ESL and NSL groups as well as riboflavin in NSL group, the intake of all the other nutrients were above the RDA in all three groups.

The anthropometric profile of children before and after the study with regard to the mean body weight, revealed an increase by 0.55 kg in SSL group. In both ESL and NSL categories, reduction in mean body weight was observed by 0.8 kg and 4.5 kg, respectively. Positive increments were noticed in mean MUAC in all the groups after the study period. With regard to mean height also all the groups recorded an increase after the study period.

The weight for age distribution of school children according to Gomez *et al.*(1956) classification indicated that, the nutritional status with regard to the body weight has improved in SSL after the supplementation. Based on Waterlow's classification, the heights were compared and SSL group had a 30 per cent increase in the number of children with normal nutritional status, when compared to twenty per cent in ESL and six per cent NSL groups.

Regarding MUAC also, the distribution of children was such that, after soya supplementation 96 per cent of children in SSL group came under the normal group. In ESL group, after supplementary study period, 16 per cent of children came under moderately malnourished group; but no one with severe malnutrition was observed. In the case of NSL group, severe malnutrition increased from two to six per cent, after the study period. The degree of growth retardation as analysed by weight/height^2 ratio revealed that, children with normal nutritional status increased in the SSL and ESL groups with SSL showing a greater degree of increase. Statistical analysis revealed that level of positive increment in SSL group was more significant than that of the other groups, regarding body weight, height, weight/height^2 and MUAC.

The most common nutritional deficiency disease observed among children was anaemia, which got reduced from ten to six per cent in SSL group and from 12 to 10 per cent in ESL group. A two per cent increase was observed in NSL group with regard to phrynoderma. Dental caries was observed in most of the children irrespective of the groups and it even increased after the study period. This is mainly due to poor oral hygiene of the children.

The data on 20 per cent soya grits incorporation in noon meal indicated that this has a beneficial effect with regard to the growth of school children. There was better weight gain and height increment, when 20 per cent soya grits was substituted in the noon meal, instead of green gram. The high protein content of

soya grits, the ease with which it blends in the noon meal and its acceptability by the children makes the soya grits an easy vehicle to enhance the dietary protein intake and in bringing about better growth and development among school children.

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APPENDICES

APPENDIX-I

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

1. Name of the family :

2. Address :

3. Place of survey : 1) Block
   2) Panchayath

4. Name and age of the respondent :

5. Type of family : Joint/Nuclear

6. Family size : Adults Children

7. Religion : Hindu Christian Muslim

   a) Forward caste
   b) SC
   c) OBC

9. Educational level

	Illiterate	LPS	UPS	High school	College
Father					
Mother					

9. Occupational status
   Head of the family - father :
   mother :
   others (specify) :

10. Total income (Rs./month) :

    Any other source of income :

    Total : /month

11. Details of housing condition :
    a) Type of house : 1 room/2 rooms/3-4 rooms/
    6-8 rooms/8 and more
    b) Type of roof : Thatched/Tiled/Concrete
    c) Structure of the house : Mud-built/brick-built/single/double storeyed

12. Details of ownership
    a) Staying in own house : Yes/No
    b) Staying in rented house : Yes/No

13. Other characteristics
    a) Specific kitchen : Yes/no
    b) 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/ River

    d) Lavatory facilities : Yes/No
    Own latrine/public latrine/open field

    e) Drainage facilities : Yes/No

    f) Electricity facilities : Yes/No

    g) Information source utilisation of 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

6) Morbidity pattern of index child (details of epidemic that had affected your child during the past one year)

No.	Disease	At what age	Treatment
1	Diarrhoea and Vomiting		
2	Measles		
3	Chickenpox		
4	Mumps		
5	Fever		
6	Jaundice		
7	Respiratory diseases		
8	Others		

7) Participation in feeding programmes

Ist child :
IInd child :
IIIrd child :
IVth child :

8) When anybody in your family is sick, do you make use of health centres? : Yes/No

If yes, which one? :
1. Hospital
2. Dispensary
3. Maternal and Child Health Center
4. Ayurvedic
5. Homoeo
6. Others

9) How far is the nearest Health Centre from home? : ..... km

14 - Monthly expenditure pattern

Sl.No.	Item	Expenditure/month
1	Food	
2	Clothing	
3	Shelter	
4	Rent	
5	Transport	
6	Education	
7	Entertainment	
8	Health	
9	Savings	
10	Own expenses	
11	Repayment of loans	
12	Kuries	
13	Others (fuel, water, etc.)	

Details regarding index child : Male/Female
Age

1) Did any child die : Yes/No
If yes

2) Birth weight of index child :

Birth order of index child : First/Second/Third/Fourth/Fifth/Sixth

3) i) Did your child get any serious illness after birth : Yes/No

4) Does it occur frequently? : Yes/No

5) Immunisation details : Complete/partially complete/Not taken

APPENDIX-II

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

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

No.	Item	Price percentage of food expenditure
1	Cereals	
2	Pulses	
3	Green leafy vegetables	
4	Roots and tubers	
5	Other vegetables	
6	Fruits	
7	Milk and milk products	
8	Fleshy foods	
9	Nuts and oil seeds	
10	Spices and condiments	
11	Others	

8. Frequency of use of different food materials

Sl.No.	Foods	Frequency of use				Occasionally	Never
		Daily	Weekly				
			Once	Twice	Thrice / Four times		
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	Fate and oils						
12	Sugar and Jaggery						
13	Bakery items						

9. Do you produce any food at home? : Yes/No
If yes,

Sl.No.	Item	Quantity produced	Quantity sonsumed	Quantity sold	Profits obtained
1					
2					
3					

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

11. Do you prepare different foods on special occasions? : Yes/No

If yes,

Occasion	Food prepared
Birthday	
Marriage	
Death	
Festivals	
Feasts	
Others	

12.a) Is there any supplementary feeding programme present in your locality : Yes/No/Not known

If yes, name the programme : 1. School lunch
2.
3.

b) Do you participate in that? : Yes/No

c) If yes, from when did you get information about this : 1. Friends/Neighbours
2. Newspaper
3. Television
4. Radio

d) Do you get any benefits from this programme? : Yes/No

e) If yes, what are the benefits you get from this programme : 1. Food
2. Medicine
3. Immunization
4. Education

f) Does your child participate in this programme : Yes/No

g) If yes, what are the benefits he/she is getting : 1. Food
2. Medicine
3. Immunization
4. Education

h) If no, what is the reason? :

i) Are you satisfied with these programmes : Yes/No

APPENDIX-III

DETAILS REGARDING THE EXISTING SCHOOL LUNCH FROM THE MOTHER OF THE INDEX CHILD

1.	Name of the interviewee	:	
2.	Occupation	:	
3.	House address	:	
4.	Name of the child	:	
	Male /female	:	
5.	Age of the child	:	
6.	Name of the school	:	
7.	Class		
8.	Since how many months is your child participating in the programme?	:	
9.	How many days in a week does your child generally eat the school meal?	:	a) Seldom b) Sometimes 3 to 4 days c) Regularly
10.	Is enough food being given to him in the school?	:	Yes/No
11.	Do you feel the food served is nutritious?	:	Yes/No
12.	Does your child discuss the food served to him in the school with you?	:	Yes/No
13.	What do you feel about the following?		
	Type of food	:	
	Storage facilities	:	
	Cleanliness	:	
	Cooking utensils	:	

Eating place :

Water facilities :

Cooking place :

14. Do you know who implemented: this programme and who is financing it?

15. Why did you include your child in the programme? :

16. Does your child like the taste of the food given? : Yes/No

17. How many meals are taken by the child on a school day : Morning Evening Night

18. Is there any parents meeting conducted in the school : Yes/No
If yes, how often and what do you discuss :

19. If the programme is discontinued, will you allow your child to attend the school regularly? :

20. If another type of food item is given will you allow your child to eat it : Yes/No
Given reasons :

21. Give your suggestions for the improvement of the programme :

22. What are the changes you observe in your child after participating in the programme?

Sl.No.	Changes	Before	After
1	Growth		
2	Health		
3	Academic activities		
4	Playing habits		
5	Frequent illness		
6	Activeness		

APPENDIX-IV

DETAILS REGARDING THE EXISTING SCHOOL LUNCH PROGRAMME FROM THE TEACHER

1. Name of the teacher :
   Male/Female :

2. Name of the school :

3. Post and class :

4. When did the school lunch programme start in your school? :

5. When did you take in-charge of the programme? :

6. Who implemented this programme and who is financing it? :

7. What are the foods given to the children? :

8. What is the basis for the enrollment of a child in this programme? :

10. If no, how are you meeting the expenses satisfactorily :

11. How many employees are there for this programme? :

12. i) What is the source of fuel, water, etc.? :

    ii) Who gives the utensils for cooking the foods? :

13. How many days in a week do the children get the school meal? :

14. Is enough food being given to the children? :

15. What is the minimum quantity of the meal given to each child? :

16. Do you give a second serving? :

17. Do the children like the taste of the food given? :

18. Do you have any PTA meetings to discuss the programme? : Yes/No

19. What is the general opinion of the parents about this programme? :

20. What are the changes you observe in your child after participating in the programme?

Sl.No.	Changes	Before	After
1	Growth		
2	Health		
3	Academic activities		
4	Playing habits		
5	Absence due to illness		
6	Activeness		

APPENDIX-V(a)

FAMILY AND INDIVIDUAL FOOD CONSUMPTION SURVEY - WEIGHMENT METHOD

Name of the investigator :

Name of the Head of the family :

Name of the subject :

Age of the subject :

Serial No. :

Address :

Date :

Food consumption

Name of the meal	Method	Weight of total raw ingredients used by the family (g)	Weight of total cooked food consumed by the family (g)	Amount of cooked food consumed by the family (g)	Raw equivalents used by the individuals

APPENDIX-V(b)

FAMILY AND INDIVIDUAL FOOD CONSUMPTION SURVEY - WEIGHMENT METHOD

Family No. Name of the Head of the family : Date:

Village : District : State:

Age and sex composition of those who have part taken in the meal

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

Cereals

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

Pulses

7. Beangal gram
8. Black gram
9. Red gram
10. Soyabean
11. Greengram
12. Others

Leafy vegetables
Other vegetables
Roots and tubers

13. Carrot
14. Onion
15. Beet root
16. Tapioca

17. Potato
18. Sweet potato
19. Yam
20. Others

Nuts and oil seeds

21. Cashewnut
22. Coconut, dry
23. Coconut, fresh
24. Groundnut
25. Others

Spices and condiments
Fruits

26. Amla
27. Apple
28. Banana, ripe
29. Lime and orange
30. Mango, ripe
31. Watermelon
32. Papaya, ripe
33. Tomato, ripe
34. Others

Fish

35. Fish, fresh
36. Fish, dry

Other flesh foods

37. Meat
38. Chicken
39. Liver
40. Egg

Milk and milk products

41. Milk
42. Curds
43. Butter milk
44. Skimmed milk
45. Cheese

Fats and oils

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

Other food stuff

50. Biscuit, sweet
51. Biscuit, salt
52. Bread, white
53. Sugar
54. Jagery
55. Pappad
56. Sago
57. Farex
58. Amul

APPENDIX-VI

SCORE CARD FOR ORGANOLEPTIC EVALUATION OF SOYAGRIT/CHUNK

Name & address:

Date :

		1	2	3	4	5	6	7	8
Appearance									
Very good	5								
Good	4								
Fair	3								
Satisfactory	2								
Poor	1								
Colour									
Very good	5								
Good	4								
Fair	3								
Satisfactory	2								
Poor	1								
Flavour									
Very good	5								
Good	4								
Fair	3								
Satisfactory	2								
Poor	1								
Texture									
Very good	5								
Good	4								
Fair	3								
Satisfactory	2								
Poor	1								
Taste									
Very good	5								
Good	4								
Fair	3								
Satisfactory	2								
Poor	1								

Signature
Name & Address

APPENDIX-VII

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

ANTHROPOMETRY:

Height (cm) : Arm circumference (cm) :
Weight (cm) : Fat fold at triceps (mm) :

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

APPENDIX-VIII

ANOVA on the monthly expenditure pattern on different items

FOOD

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	51.593	25.797	0.196	
Within	147	19385.995	131.878		
Total	149	19437.588			

CLOTHING

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	1.182	0.591	0.194	
Within	147	447.774	3.046		
Total	149	448.956			

SHELTER

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	0.329	0.164	0.110	
Within	147	220.127	1.497		
Total	149	220.456			

RENT

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	4.839	2.419	0.115	
Within	147	3083.753	20.978		
Total	149	3088.592			

TRANSPORTATION

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	2.974	1.487	0.537	
Within	147	407.243	2.770		
Total	149	410.217			

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	11.526	5.763	0.812	
Within	147	1043.866	7.101		
Total	149	1055.391			

EDUCATION

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	0.242	0.121	0.044	
Within	147	406.876	2.768		
Total	149	407.117			

HEALTH

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	0.845	0.422	0.127	
Within	147	489.255	3.328		
Total	149	490.100			

SAVINGS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	16.706	8.353	0.488	
Within	147	2518.286	17.131		
Total	149	2534.991			

OWN EXPENSES

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	27.292	13.646	0.821	
Within	147	2443.602	16.623		
Total	149	2470.894			

REPAYMENT OF LOAN

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	77.464	38.732	0.183	
Within	147	31126.730	211.746		
Total	149	31204.194			

KURIES

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	18.483	9.242	0.336	
Within	147	4048.160	27.539		
Total	149	4066.643			

OTHERS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	62.707	31.353	0.559	
Within	147	8242.906	56.074		
Total	149	8305.613			

APPENDIX-IX

ANOVA on monthly expenditure pattern on different food items

CEREALS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	27.897	13.948	0.157	
Within	147	13030.413	88.642		
Total	149	13058.309			

PULSES

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	21.476	10.738	0.893	
Within	147	1767.195	12.022		
Total	149	1788.671			

GREEN LEAFY VEGETABLES

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	0.090	0.045	0.022	
Within	147	309.288	2.104		
Total	149	309.378			

ROOTS AND TUBERS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	3.185	1.592	0.375	
Within	147	623.555	4.242		
Total	149	626.740			

OTHER VEGETABLES

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	704.756	352.378	2.357	0.0983
Within	147	21978.492	149.514		
Total	149	22683.248			

FRUITS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	325.501	162.751	7.224	0.0010
Within	147	3311.918	22.530		
Total	149	3637.420			

MILK AND MILK PRODUCTS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	7.030	3.515	0.075	
Within	147	6884.913	46.836		
Total	149	6891.943			

FLESHY FOODS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	4.245	2.123	0.051	
Within	147	6064.179	41.253		
Total	149	6068.424			

NUTS AND OIL SEEDS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	1.955	0.978	0.247	
Within	147	582.387	3.962		
Total	149	584.343			

SPICES AND CONDIMENTS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	0.568	0.284	0.407	
Within	147	102.664	0.698		
Total	149	103.232			

OTHERS

	Degree of freedom	Sum of squares	Mean squares	F value	Prob
Between	2	4.060	2.030	0.079	
Within	147	3782.330	25.730		
Total	149	3786.391			

APPENDIX-X

FORMULA FOR CALCULATION OF FOOD FREQUENCY SCORE

Based on the frequency of use of different food groups in the daily diet of the surveyed families, food use frequency scores were calculated as suggested by Reaburn *et al.* (1979). The formula used for the calculation is given below:

$$\text{Percentage of total score} = \frac{R_1S_1 + R_2S_2 + \ldots\ldots\ldots\ldots\ldots + R_nS_n}{n}$$

S_n = Scale of rating
R_n = Percentage of respondents selecting a rating
n = maximum scale rating

APPENDIX-XI

ANOVA on difference in body weight, height, weight/height^2 ratio and MUAC before and after the study, between SSL, ESL and NSL groups

BODY WEIGHT

	Degree of freedom	Sum of squares	Mean squares	F value	Prob	CD
Between	2	62.573	31.287	0.870	0.000	0.582
Within	147	309.295	2.104			
Total	149	371.868				

HEIGHT

	Degree of freedom	Sum of squares	Mean squares	F value	Prob	CD
Between	2	223.463	111.732	13.246	0.000	1.136
Within	147	1240.010	8.435			
Total	149	1463.473				

WEIGHT/HEIGHT^2

	Degree of freedom	Sum of squares	Mean squares	F value	Prob	CD
Between	2	6.567	3.284	3.006	0.0526	0.416
Within	147	160.601	1.093			
Total	149	167.169				

MUAC

	Degree of freedom	Sum of squares	Mean squares	F value	Prob	CD
Between	2	39.529	19.765	28.869	0.000	0.333
Within	147	100.640	0.685			
Total	149	140.170				

NUTRITIONAL AND HEALTH IMPACT OF SUBSTITUTING GREENGRAM BY SOYA PRODUCTS IN SCHOOL LUNCH PROGRAMME IN THRISSUR DISTRICT

By

N. LATHA DEVI

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Science in Home Science

(FOOD SCIENCE & NUTRITION)

Faculty of Agriculture

Kerala Agricultural University

DEPARTMENT OF HOME SCIENCE

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR - 680 656

Kerala, India

2000

ABSTRACT

The present study, entitled 'Nutritional and health impact of substituting green gram by soya products in school lunch programme in Thrissur district' was conducted among 150 school children, who were randomly selected, 50 each from three groups viz., soya supplemented lunch (SSL), existing school lunch (ESL) and no school lunch (NSL). The socio-economic details inferred through the survey were found to be satisfactory. Nuclear families with better housing facilities and good educational level were the striking features observed. Most of the fathers were casual labourers. Monthly income in most of the families was up to Rs.2000 in all groups. Most of the families owned their own houses.

Food consumption survey revealed that all were habitual non-vegetarians. Cereals, other vegetables, fats and oils and sugar and jaggery were the most frequently used food items. Dietary profile of school children revealed that intake of all the food items, except green leafy vegetables met the daily requirement and all the nutrients except thiamine and riboflavin were above the RDA in all the groups.

Majority of the mothers were having positive opinion about the school lunch programme. Most of the teachers opined that except for food materials, no other financial support for school lunch programme is obtained from the government.

Evaluation of defatted soya products at different replacement levels with green gram showed that, soya grits at 20 per cent replacement level was the most acceptable combination in terms of organoleptic and nutritive qualities.

Assessment of nutritional status after the study period revealed that, significant difference existed between the three groups with regard to body weight,

height and MUAC, with SSL having more significant positive increment in body weight, height, weight/height^2 and MUAC.

The most common nutritional deficiency disease observed among children was anaemia, which got reduced in SSL and ESL groups. Dental caries was observed in most of the children irrespective of the groups.