

**IMPACT OF RAGI BASED FOOD SUPPLEMENT  
ON THE NUTRITIONAL STATUS OF SELECTED  
PRESCHOOL CHILDREN**

By  
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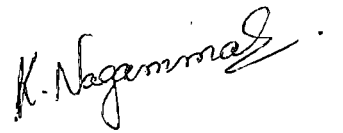
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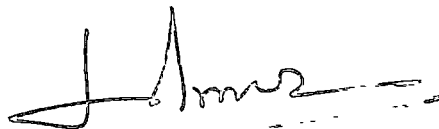
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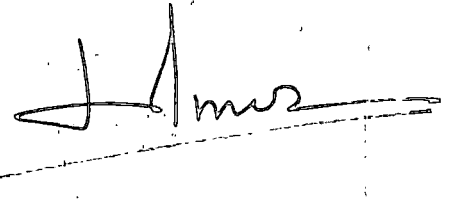
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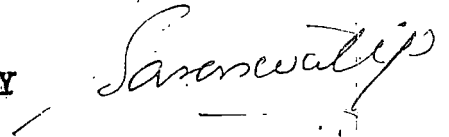
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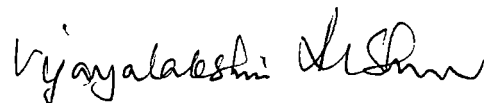
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# INTRODUCTION



## INTRODUCTION

The child is the father of man and foundation of a strong healthy adult is laid down during childhood. For a strong and healthy nation, children must have good health and intellect. Good nutrition is of paramount importance to determine the normal growth and development of the individual. According to UNICEF report (1987) on the state of world's children of the 14.5 million infants and children in the world currently dying each year, nearly 5 million are above the age of one. It was also reported that the under 5 mortality rate in the year 1985 in India is 158.

Preschoolers in India constitute 15 per cent of the total population. The overall current infant mortality in our country according to 1980 census in rural population is 46.1 and in urban population it is 22.2 (Ministry of Welfare, 1985). In Kerala, Infant mortality rates, 1984 based on sample registration system in rural area it is 29 and in urban area it is 27 (Ministry of Home Affairs, 1986).

Childhood is the period of rapid growth and children below the age of five years are considered to be the most vulnerable from the nutrition stand point and malnutrition is one of the major public health, nutritional problems of rural preschool children in India (Bhat and Umapathy, 1986).

The existence of the problems of malnutrition and undernutrition pose a threat to the growth of the children and the national development. According to a report by NIN (1982) the percentage distribution of severely undernourished preschool children in Kerala is 4.8 per cent. Cravito (1981) suggested that malnutrition at the community level is a man-made disorder characteristic of the underprivileged segments of society.

Results of a nationwide survey conducted by ICMR have shown that diets consumed by rural preschool children are inadequate with respect to energy, iron, vitamin A and some of the B complex vitamins (ICMR, 1974). This problem can be eradicated by suitable supplementary feeding programme as a major type of nutritional intervention programme during the weaning period (Srikantia, 1983) and hence programmes for improving the health status of preschool children actively involving the community are essential and there is an imperative and urgent need to produce indigenous supplementary foods suitable to Kerala condition.

Among different cereals, ragi is reported to be a suitable supplementary food to eradicate nutritional problems among preschoolers (Devadas et al., 1984).

Hence the present study is taken up with the following objectives.

1. To assess the dietary habits of selected preschool children attending balawadi in the adopted village.
2. To develop suitable recipes for the preschool children based on the supplementary food prepared with ragi.
3. To assess the effect of such supplementary feeding on the nutritional status of selected preschool children.

# REVIEW OF LITERATURE

## REVIEW OF LITERATURE

India is the second most populous and seventh largest country in the world (National Institute of Public Cooperation and Child Development, 1984). One of the salient features of our country is that it has a sizable proportion of young population. According to 1981 estimate, there were about 121 million children in the age group of 0 - 6 years constituting about one sixth of the total population where 89.7 per cent belong to rural areas. Baswaran et al. (1976) states that preschoolers constitute about 15 per cent of the total population.

Shukla (1982) reveals that the over-all child mortality in our country is the highest in the world being 18.7 per cent of all deaths. In India, young children remain the most vulnerable group in the population with 40 per cent of all deaths occurring in 0 - 4 age groups (Kakker et al., 1987). Mortorell and Klein (1980) have reported that the mortality rates as well as the incidence of infectious diseases and severe malnutrition are high in infants and young children in developing countries.

Vijayalakshmi et al. (1975) has listed the causes for malnutrition in preschool children as low intake of nutrients, low income, lack of knowledge, infections, improper selection and preparation of foods, poor weaning practises and faulty food beliefs. According to Taylor and Taylor (1976) the main causes for malnutrition are lack of employment, agricultural factors, economic factors, cultural factors, inadequate health and nutritional services, physiological factors, levels of activity and infections.

Caliendo et al. (1977) conducted a study among pre-school children of NewYork city and results of the study indicate that the quality of diet of young children was influenced by sex, ordinal position of the family, mothers' employment status, education and nutritional knowledge.

Ifekunigwe (1978) has listed the main determinants which influence the nutritional status of the community. In addition to poverty, land tanure and land fertility, low family income, large family size, high cost and scarcity of protein rich foods, inadequate distribution and marketing systems intra familial food distribution which is unfavourable to children, food customs and taboos, poor education and literacy level of the parents etc. were found to be important.

Sharma (1979) has reported that the socio economic factors play an important role in the occurrence of malnutrition and included poor health of the mother, poverty, scarcity of nutritious foods at the critical stages of growth and development, ignorance, socio cultural factors such as weaning taboos and prejudices, discrimination against girls and faulty cooking practises.

Shah (1979) has decided that the main factors which leads to malnutrition among young children include late introduction of semi solid food during infancy, diluted supplementary feeding, daily wage earning of mothers nuclear and large families, shorter intervals between two pregnancies, jobless period of parents, preferencial care of the boys and poor antinatal care.

Luwang (1980) conducted a study among 508 preschool children of seven villages in Manipur and found that the occurrence of protein energy malnutrition was not due to birth order, but age, sex and religion of the children had significant association.

Shukla (1982) has stated that the main causes for malnutrition in India include nonavailability of foods, poverty, population growth, customs, conditioning which influences socio economic status like castes, false socio economic status, education, influence of industrialisation urbanisation and modernisation.

Banik et al. (1970) had revealed that the children from relatively higher socio economic status were heavier and taller from birth upto five years. They had also stated that adverse socio economic status caused more damaging effect on weight than height.

According to Cameron and Hofvander (1971) most of the children in developing countries had moderate to severe malnutrition during transition from breast feeding to adult diet owing to the combined effect of inadequate diet and infection. Results of the survey conducted by Jwani (1978) indicated that nutritional problems were very common in infants and young children of Asian migrants.

Djazafery et al. (1983) found that 75 per cent of the rural Iranian children suffered from mild to severe forms of protein energy malnutrition mostly during 2 - 3 years of age and the girls were the worst affected when compared to boys.



Perez - Gil and Cifuenker (1987) when studied the nutritional status of 89 preschool children from a rural region in the Sierra Norke de Puelha, Mexico, 21 were normal, 29 showed slight malnutrition, 31 showed moderate malnutrition and eight showed grave malnutrition.

Views of Ghosh (1980) in this matter was that malnutrition and undernutrition were the important underlying causes of mortality in this country.

Vast majority of the common diseases and malnutrition syndrome like marasmus, kwashiorker and under nutrition were observed to occur predominantly in preschool children (Raju et al. (1970).

UNICEF (1984) had reported that the child mortality rate in the year 1985 in India is 158. In India during 1980-84 33 per cent and five per cent of children under five were suffering from moderate and severe malnutrition respectively.

Khandekar (1976) had found that the percentage of malnourished children in Bombay was highest in low income medium sized households than in large sized households with high income.

According to Satapathy et al. (1984) in lower socio economic groups in Berhampur in South Orissa, 42 per cent of the children were undernourished due to poor quality food and delayed weaning.

Shrivastava et al. (1970) conducted a study among 1000 rural preschool children from seven villages of the district of Jabalpur in Madhya Pradesh. They had reported that the incidence of marasmus (4.5 per cent) was higher than Kwashiorkor (3.9 per cent) among these children. The results of the survey also reported among various nutritional disorders prevalent vitamin B complex deficiency was the least.

Similar trend in the results of the survey conducted by Chaudhuri and Ramakrishnan (1973) was also shown in the rural preschool children of West Bengal. But among the vitamin deficiency disorders vitamin B complex deficiency was found to be highly prevalent and vitamin D deficiency was the least.

A nutritional survey conducted by Gupta and Bhandari (1973) around Udaipur indicated that 30 per cent of the rural preschool children had one or more of nutritional deficiencies

The incidence of marasmus (7.3 per cent) was more than that of Kwarshiorkor (3.1 per cent). Signs of vitamin A deficiency were more prevalent in tribal children than in non tribal children. Rickets and anemia were found in both the groups.

Chaudhuri (1975) reported that the incidence of marasmus (1.83 per cent) was more than that of Kwarshiorkor and the incidence of vitamin A and B complex deficiency ranged from 0.3 to 25 per cent. He had also found the active rickets in children aged 1-3 years and 28 per cent of them were found to be suffering from anaemia and 30 per cent from worm infestations.

A survey conducted in South India showed that about one per cent of children aged one to five years showed signs of Kwarshiorkor, two per cent of marasmus, 3.5 per cent of vitamin deficiency diseases and five per cent anemia (Swaminathan, 1974).

Easwaran et al. (1976) studied the incidence of malnutrition among the preschool children in Coimbatore city in Tamil Nadu and found that the protein energy malnutrition was more among these children followed by vitamin A deficiency.

In Coimbatore, Geetha (1986) conducted survey and reported that protein energy malnutrition was present in 44 per cent of the children. She also found that Iron deficiency anemia and vitamin A deficiency were widely prevalent.

Devadas et al. (1983) reported that 16 per cent of the preschool children in Coimbatore city suffered from protein energy malnutrition, 15 per cent had vitamin A deficiency and 11 per cent were anemic. Acute gastroenteritis and dysentery were the predominant nutritional diseases prevalent among these malnourished children.

Devadas and Jaya (1986) conducted a study of 18497 preschool children attending an outpatient department of a hospital in Coimbatore in Tamil Nadu. The result of the survey indicated that 49 per cent had protein energy malnutrition, 7.5 per cent had vitamin A deficiency 15.9 per cent had respiratory infections and 15.6 per cent had gastroenteritis.

Ali (1982) reported that among Hill Bhuniyas of Orissa, protein energy malnutrition was in the form of Odema, muscle wasting and moon face in children. He had also reported that vitamin A deficiency was generally found in

the form of conjunctival Xerosis, Keratomalacia and bitot spots, while riboflavin deficiency was in the form of angular stomatitis, cheilosis, glossitis, and magenta tongue and vitamin C deficiency was in the form of spongy gums and vitamin D was in the form of active or healed rickets in children.

Chodpdar and Mishra (1980) among school children in a rural area of Western Orissa found that the common causes of morbidity were vitamin B complex deficiency (42.9 per cent) vitamin A deficiency (28.6 per cent), anaemia (25.7 per cent) upper respiratory infections (22.1 per cent), gastro - intestinal tract disorders (8.7 per cent) and dental diseases (8.5 per cent).

According to Patodi et al. (1976) in rural and urban community near Indore 18.4 per cent and 12.8 per cent of the infants respectively showed signs of nutritional deficiencies of protein, calcium, iron and B complex vitamins after the age of six months.

Semwal et al. (1986) studied and found in Delhi urban slums 45.1 per cent and 47.2 per cent of the children at one and two years of age were undernourished.

Shah and Udani (1977) stated that malnutrition, severe anaemia, acute gastroenteritis and bronchopneumonia were the main causes of mortality.

Darwish et al. (1978) when studied the nutritional status of the preschool children attending the day care centres in Alexandria observed that mild forms of protein energy malnutrition were prevalent among 26.6 per cent of the total number of children studied. The proportion of malnourished aged five years was more than double to that of children aged three years.

Tomar and Shrivastava (1980) conducted a survey of 314 children in industrial area of Gwalior and results of the survey threw light on the presence of skin and hair changes (31.6 per cent), Vitamin A deficiency (29.4 per cent) and Vitamin D deficiency (3.2 per cent).

Gupta and Walia (1980) stated that the episodes of illness were significantly higher in the 0-5 years age group as compared to those aged more than five years. According to these authors, the main causes of morbidity were skin infections, respiratory infections, diarrhoeal diseases, fever, eye infection and ear discharge.

Among various parameters of nutritional status, anthropometry is relatively more specific and sensitive enough for purposes of monitoring and evaluating.

Osifo et al. (1975) found that measurements of mid arm circumference was the simplest and fastest method for detecting protein energy malnutrition in preschool children. They also reported that accurate results were got when a combination of this method with weight and height were made.

Hamill et al. (1979) stated anthropometry as an effective and frequently used child health and nutrition screening procedure. Campbell (1980) had reported that weight for age is the most commonly used indicator.

~~Classification and Indicators~~  
Rao et al. (1981) stated the relative importance of combination of anthropometric measurements and indices which gave good discrimination between normal children and those with body weight deficits. They reported that the use of weight/height was better to diagonalise different forms of malnutrition.

Anderson (1979) had reported that weight for height appeared to be the best single anthropometric indicator of current nutritional status in preschool children. Since this might provide a useful cut off points for defining malnutrition.

Seth et al. (1981) after conducting a study among 16 children reported that height was a measure of long standing nutritional deprivation.

In countries with high rates of protein energy malnutrition the arm circumference measure can also serve as an accurate nutritional status index (Anderson, 1979).

Weight for age, weight for height and height for age are the common anthropometric measurements which will indicate the nutritional status and can be compared internationally (WHO, 1983).

After conducting studies in rural Guatemala on pre-school children Delgado et al. (1983) reported that arm circumference could be used to detect malnutrition (as by weight for age) but it was of limited validity when used to detect acute or chronic protein energy malnutrition. They had also reported that weight for age had a greater specificity and sensitivity than arm circumference.

Bharadwaj et al. (1983) recommended the use of coloured tape with red colour for mid arm circumference for measurement less than 13.5 cm and green colour for 13.5 cm and above as a single and best age independent



indicator of protein energy malnutrition in preschool children in child welfare programme. This indicator is now used in integrated child development scheme projects along with weight for age and height for age charts.

Patel (1980) had stated that all preschool children with arm circumference less than 14.5 cms could be assessed as being potentially or actually malnourished and in need of special care.

Davidson et al. (1975) found that clinical examination for signs of malnutrition was relatively cheap and easy to organise and it did not require elaborate apparatus or reagents.

Park and Park (1981) reported that the clinical examination was the most essential part of all nutritional surveys and it was also the simplest, the most practical and the soundest means of ascertaining the nutritional status of a group of individuals.

Sharma and Mahajan (1987) stated that it was of utmost importance to have some biochemical measure since the diagnosis and prognosis of protein calorie malnutrition was often difficult to assess on clinical grounds alone.

However according to park and park (1981) biochemical tests were considered to be time consuming and could be applied on a large scale even though they were useful in diagnosing specific diseases. They had also stated that the biochemical tests might help to prove or disprove the questions raised by a clinical examination.

Tanksale (1980) had concluded that biochemical studies were useful in detecting the malnutrition condition in early stages or in the subclinical stages before symptoms became apparent.

Pekkarinen (1970) had stated that the main aim of a dietary survey was to continuously assess the diets of the population groups or individuals for its possible deficiency and faults. He had listed different forms of surveys as food balance sheets, weighment method, interview method, questionnaire method and collection of food samples for chemical analysis. He had also stated that among these various methods chemical analysis were reported to give accurate results eventhough they were the costliest and time consuming method.

Sundarraaj et al. (1971) had stated that the weighment method was used to compare the data collected with the method of consumption coefficients and they concluded that for a

large community consumption coefficient were useful but for the assessment of individual intakes, the coefficient method was not advisable.

Osancova et al. (1972) found that three day alternate method of diet record gave the calculated intake most closely related to the seven day inventory method.

Flores et al. (1973) preferred the use of daily record of the foods for three days combined with 24 hours recall method for the dietary assessment of children because the values differed significantly for calcium, betacarotene and vitamin A and B with one day method.

Grewal et al. (1974) after conducting a dietary survey in Madhya Pradesh stated that the results of the one day questionnaire method differed mostly from the results by weighment survey and variation between children, fell as survey period increased. They concluded that a three day questionnaire method checked by weighing a subsample, seemed practical and accurate for the purpose of any proposed survey.

Rao (1975) concluded that weighing food for any one or two days chosen at random from seven day weighing was as efficient as the seven day weighment survey.

After comparing questionnaire and weighing method in surveys Tilve (1978) found that the questionnaire method yielded based estimates but showed true variation between individuals. Individual intake could be obtained accurate by actual weighing of food items consumed.

Martin and Beal (1978) had stated that the nutritional intake had long term effects on the physical growth and physiological state so that it could be ideal to know the intake of individual from consumption. They also reported that information could be obtained on the diets of individuals or groups by interviews or self recording by estimation of amounts or weighing of food from one day to several months.

Based upon the physiological needs of the family members the share of the preschool children in the dietaries in terms of adult male unit was estimated by Rao et al. (1980) and the results of the study indicated that for the accurate estimation of a preschool child's nutrient intake adjustments for the age of child, percapita income of the family and the nutrient intake of the family were found to be more appropriate.

Nelson and Nettleton (1980) described a diet survey method in which the total food available to the family was weighed as preparation or serving and its distribution

between family members was recorded in household measures. The method gave data on intake of each person with an accuracy approaching that of a survey by weighing the food of each person.

According to Sundarraaj et al. (1971) for the assessment of individual intakes weighing method was the method of choice. Raina and Sharma (1980) had reported that the actual weighing of food was accurate but it took long time and needed the cooperation of the respondents.

For nutrition and health assessment of a community, Martin and Beal (1978) listed the important sources of information which included census figures on age distribution, birth rate, morbidity and mortality statistics, hospital records and data from health and welfare agencies.

Pushpamma and Devi (1979) reported that majority of the population in India consumed a combination of cereal or millet with legume. They also reported that the proportion of legume consumed was much less than the amount required to enhance the protein quality of a mixture of cereal, millet and legume.

Sundarraaj (1972) had stated that the diet of the preschool children in Tamil Nadu were found to have adequate proteins. However the calorie intakes were found to be low, the calcium intakes was also lower than the recommended allowances specified for this group.

An evaluation of the on-going supplementary feeding programme was conducted by Puri et al. (1984) with references to their diet and mental development. They had reported that the home diet of all children were found to be highly deficient in all nutrients especially calories and proteins.

Ali (1982) reported from a survey carried out in tribal areas of Orissa that the diets of majority of the households were quantitatively as well as qualitatively deficient.

Singh and Sidhu (1980) revealed the nutritional data on 150 Rajput boys aged 4-20 years showed that their calorie intakes were lower at all ages than the recommended daily allowances for Indian boys by about 200-300 calories. At 4-6 years the calorie intakes were lower than the recommended daily allowance by 17 per cent.

Chawla and Puri (1983) had stated that the intake of all the children were below recommended allowances where cereals predominated in the diet which lack in protective foods like pulses and legumes, meats, eggs, green leafy vegetables and fruits. They also reported that the diet was deficient in all the nutrients.

Taha (1979) had stated that in a study conducted in Gezira, the average food consumption was found to be adequate except for the slight deficiency in energy intake. He had also reported that Sudanese did not practise supplementary feeding and the infants were in a prolonged period of under-nutrition until they were old enough to be weaned abruptly on-to the family diet. He concluded that although income was found to be the major factor determining the nutritional status, other significant factors were weaning practises and immunization against diseases.

Munz and Lertzmann (1982) studied about the dependence of nutritional status of preschool children on the weaning practice, socio economic situation and the number of children in the family and it was found that even for a good socio economic situation a negetive influence on the nutritional status could be shown for families with large number of children and a short nursing period.

Sai (1981) denoted that income levels were of considerable importance to food intake. He had also stated that water sanitation and health services are intimately related to nutritional status.

Pushpamma and Devi (1979) had stated that in the low income population children were fed by a small quantity of adult diet. They had also reported that no effort was made to cook separate food for children.

Bhat and Dahiya (1985) had observed that all the children of 4-5 years of age were given ordinary home diet and no special food was prepared for them.

Rao and Satyanarayana (1974) conducted a study on the nutritional status of the tribal preschool children of Andhra Pradesh and reported that the average intakes of energy, calcium, iron and vitamins were below the recommended daily allowances.

Ragi is a poor man's millet popular in central and southern parts of India and the average production of ragi in Kerala is 1.1 thousand tones in the year 1985-86 (Saini and Sharma, 1986).



Ragi and rice form the staple food of the low income groups of different parts of India (Narayanaswamy et al., 1972).

Sahu (1987) conducted a survey on the popularity of small millets in three tribal districts of Orissa and revealed that most of the tribals used millets as the staple items of their diets and ragi, the finger millet was the most popular followed by small millet and little millet.

According to Devadas et al. (1977) ragi porridge is a popular staple food preparation among the low income groups of coimbatore city.

Ragi is reported to be a popular item as a basic ingredients in the weaning food (ICMR, 1984). According to Rao (1986) ragi is the best millet suited for weaning food being rich in calcium, iron, B vitamins and proteins.

Shukla et al. (1986) revealed that ragi and its products can be introduced in other parts of the country for preparation of low cost ready to eat nutritious products at Household level.

Significant increase in PER were observed when poor ragi diet is supplied with low cost protein foods at 10-20 per cent level or with skim milk powder (Narayanaswamy et al., 1972).

Hemamalini et al. (1980) had stated that the growth promoting value of sprouted ragi was much higher than that of whole ragi since the phytic acid content was decreased upon sprouting. They had also reported that ragi flour and sprouted ragi flour could be recommended for children especially belonging to low socio economic groups because ragi besides being a cheap is a rich source of calcium and good source of protein.

Rao and Deosthale (1983) reveals that the availability of iron and zinc in millets can be improved several folds on malting mainly due to the reduction in phytin.

Solanki (1986) reported that the chemical changes in malting enhance the nutritive quality through action of amylases and proteases as well as bring about an increase in vitamins and moreover, trypsin inhibitor are reportedly broken down.

Desikachar (1980) reported that malting greatly reduces the viscosity of a product there by leading to increased nutrient or calorie-dense per unit volume ingested.

Shrivastava and Bajpai (1980) observed that legumes constitute an important source of dietary protein of large segments, of the world's population particularly in those countries in which the consumption of animal protein is limited by its non availability or is denied because of religious or cultural factors.

All legumes are consumed only after they have been subjected to some form of processing such as heating, roasting, soaking, sprouting, autoclaving etc. All these methods are known to improve their palatability, after digestability, decrease antinutritional factors and convert vital constituents of pulse into simpler compounds which are ultimately beneficial nutritionally (Chandrasekhar et al., 1981).

Soni et al. (1978) reported that soaking of pulses in water was found to lower the anti tryptic activity.

About 30 per cent reduction in the trypsin inhibitor activity during germination in greengram was observed by Haider, (1981). He also investigated the effect of various processing treatments on the trypsin inhibitors eight greengram cultivars and the maximum destruction of trypsin inhibitor using dry heat was 43.6 per cent.

According to Salunkhe (1982) considerable losses of oligosacchrides occurred in the traditional processes such as germination, soaking, cooking and autoclaving of legumes.

Jaya et al. (1979) studied that germinated legumes produce less flatulus compared to the ungerminated.

Swaminathan (1977) had stated that supplementary feeding programme had always been one of the basic measures adopted for raising the level of nutritional status of vulnerable segments of the population of India. According to him beneficieries selected for such welfare programmes were mostly preschool children belonging to low-socio economic group.

Chandrasekar (1980) had speeched supplementary foods for infants and small children should be easily digested, nutritionally adequate and free of food toxins.

Patel et al. (1980) concluded that mild malnutrition can be corrected with appropriate nutritional supplementation. Kardonsky et al. (1981) had reported that the supplementary feeding programme in day care centres appeared to compensate for deficiencies in the nutritional status of socially and economically deprived children.

Swanberg and Shipley (1975) had reported that the nutrition programmes that are not income generating still had a potential for creating significant nutritional impacts.

Beaton and Ghassemi (1982) reported that the important and direct effect of supplementary feeding programme considered was the reduction in the mortality and morbidity in the preschool children.

Kielman (1982) had reported that the nutritional supplementation to preschool children significantly reduced the mortality in this age group especially those of the weaning age and might significantly lower the malnutrition prevalence.

The main objective of food distribution programmes for preschool age children was to improve nutritional status or to prevent nutritional deterioration (FAO, 1985).

Berg (1981) believed that the supplementary feeding programmes and food for work programmes were beneficial and should be encouraged.

Blumenfeld et al. (1981) stated that maternal and child health programmes succeeded, targetting to the malnourished children.

Chandrasekar et al. (1981) had stated that in countries like India where a starchy cereal is a staple food a large increase in legume supplies an assurance of its consumption in proper form would be the solution to the basic problem of malnutrition.

According to Davidson et al. (1975) a combination of pulse and cereal proteins may have a nutritive value as good as animal proteins.

Gopaldas et al. (1982) had reported that malted ragi:green-gram mixes were found to be nutritionally superior to malted wheat:bengalgram mixes in weanling rat.

Brandtzaeg et al. (1981) made a comparative study of a raw flour mix of ragi and greengram in the ratio of 70:30 for differences in physico-chemical, chemical and biological properties and reported the malted mix was far less viscous than the raw powder mix.

Rao et al. (1969) reported that the protein rich biscuits if supplied through the village shops could be easily acceptable and practical means of improving the supply of proteins and calories to children.

Jayaram (1980) stated that the cost of foods were influenced by its shelf life and type of packaging used. He had also explained that processing by way of toasting, baking or drying might provide longer shelf life and would eliminate certain undesirable characters of raw materials. According to him tins were notable packaging material being cheap and could be recycled.

According to Swaminathan et al. (1970) when a supplementary feeding of wheat flour (30 g) green gram (20 g) groundnut (8 g) and sugar and jaggery (20 g) were given the clinical and anthropometric examinations indicated that the programme had subsequently improved the nutritional status of the children.

Mortorell, Klein and Delgado (1980) had reported that greater supplement intake was clearly associated with better growth in height, weight and head circumference.

Kaur and Bhatt (1979) had reported that the diets of preschool children when supplemented with snack providing 285-323 K. calories, 4.7 - 9.9 g protein and 3.7 - 19.9 mg of iron for six days a week for six months, it was found

that the experimental group had an improved clinical picture at the end of the feeding trial. Increase in heights and weights, arm circumference and Haemoglobin level of the experimental group were significantly higher than those of the control group.

Chandha (1980) had stated that when preschool children in slum areas of Calcutta were given a glass of milk daily and a meal of khichdi made from soya fortified bulgar which provided 312-439 K. cals and 18-24 g of protein and assessed after nine months it was found that the number of children in the third degree malnutrition decrease after participation in the programme.

Conyne et al. (1979) reported that the mean body weight of those attending preschool feeding programmes was greater than the non attending group significantly for girls and not for boys.

Reddy (1979) had reported that iron supplementation to preschool children resulted in a significant increase in their haemoglobin levels at the end of one year.



On behalf of the National School feeding in Kenya a comparative study was made on the effort of school meals on nutritional state and the result indicated that the deficiency signs like hair dyspigmentation and goitre were common in the group without supplementary feeding. But this was no significant difference in Haemoglobin levels and body measurements related to height were similar for both groups (Pieters, 1977).

Rao and Naidu (1977) after comparing two groups of children concluded that those who were most severely malnourished benefited the most from the nutritional supplementation programme. They also found that the nutritional dwarfs could have a chance to become normal.

Rutmen et al. (1977) reported that 28 per cent calories and 140 per cent of protein when given to preschool children for six months, there was an improvement rate of 30 per cent in slightly malnourished cases and 60 per cent in severely malnourished cases. It was concluded that the supplementary feeding had a positive net effect on the development of the beneficiaries.

# **MATERIALS AND METHODS**

## MATERIALS AND METHODS

A study on the impact of ragi based food supplement on the nutritional status of the preschool children was undertaken with the following objectives:

1. To assess the dietary habits of selected preschool children attending balawadi in the adopted village.
2. To develop suitable recipes for the preschool children based on the supplementary food prepared with ragi.
3. To assess the effect of such supplementary feeding on the nutritional status of selected preschool children.

The study consisted of the following steps:

1. Selection of the balawadi and sample children.
2. Identifying suitable indigenous ingredients for the formulation of ragi based food supplement.
3. Formulation and standardisation of recipe with ragi based food supplement.
4. Selection of the child beneficiaries.

5. Conduct of the supplementary feeding.

6. Evaluation of the supplementary feeding programmes by assessing the nutritional status of the child beneficiaries of the supplementary feeding programme.

1. Selection of balawadi and sample children

(a) Selection of balawadi:

A list of balawadies available at a radius of eight kms of the campus was prepared. There were eight balawadies under the Kalliyor panchayat. Accessibility of balawadi to the university personnel, regularity in attendance in the balawadi, socio-economic background of the preschool children attending these balawadies were the major criteria used for the selection of the balawadi from the eight balawadies. Palapoor balawadi was selected because of the following reasons.

- 1) Regularity in the attendance of children in this balawadi.
- 2) This balawadi was located in Kalliyor which is an adopted village of the Kerala Agricultural University.
- 3) Positive reaction of the teacher and parents to the supplementary feeding programme suggested by the College.

Fig. 1. Experimental group.



- 4) This balawadi was within the walking distance of the University campus.
- 5) Most of the children attending this balawadi were from low income families.

(b) Selection of samples:

Sixty five preschool children were participating in the balawadi at Palapoor during the period of the study. Anthropometric measurements such as height and weight and haemoglobin level of all the children attending this balawadi were monitored. Regularity in attendance and similarity in socio economic background and health conditions were assessed and children who were in a comparable stage were selected for the study. 40 children attending anganwadi acted as Experimental group (Fig.1) and 20 children of the same socio-economic background of the same area acted as control. The initial determination related to anthropometric measurements of the children are presented in Appendix - I.

2. Identifying suitable indigenous ingredients for the formulation of ragi based food supplement.

(a) Nutrient composition of the food supplement:

The present study was planned to supplement an indigenous food mixture which was composed of ragi, greengram,

butter, skim milk, sesame, ground nut and sugar which were expected to function as energy rich supplement and protein and fat rich supplement. These food articles were selected for the formulation of the food mixture because of the following reasons.

i) Ragi was selected as a basic material in the food supplement because it was reported to be poor man's millet popular in central and southern parts of India. When compared with other cereals available in the market ragi was reported to be cheaper also.

ii) Green gram, bengalgram and redgram dhal were selected as the protein component since this food article in the right proportion with cereal could ensure an adequate supply of good quality protein. A combination of pulse and cereal proteins were expected to have a nutritive value more or less comparable to animal proteins (Desikacher, 1983 and Davidson et al., 1975). Moreover Deosthale (1982) had reported that among pulses greengram is richer in protein, minerals and vitamins. This justified the inclusion of greengram.

iii) Butter was selected as the fat component of the food supplement since this food article might enhance the flavour, taste and acceptability of the food supplement

formulated, give satiety value and is the concentrated source of calories (Rajalakshmi, 1974).

iv) Sugar was chosen as the energy component as it functioned as a concentrated source of energy. This food article was included in the food supplement since it might act as a preservative, increasing the shelf life of the product when stored.

v) Skim milk powder was selected for its protein content. The supplementation of which could increase the nutritive value and make them nutritionally complete (Desikacher, 1983).

vi) Among oilseeds sesame is very commonly cultivated in the country. The annual production of sesame in India during the year 1985-86 was 520.7 thousand tonnes and it was 3.6 thousand tonnes in Kerala (Food digest, 1986). Sesame protein can constitute a valuable supplement to pulse protein which contains adequate amount of lysine but are deficient in sulphur containing amino acids. Hence sesame was selected as a supplement.

vii) Groundnut was selected as the fat component of the food supplement.



3. Formulation and standardisation of recipe with ragi based food supplement.

(a) Nutrient composition of the food supplement:

Standardisation of recipe is essential strive for high quality products (Crusius, 1984).

In order to find out a proper supplementary mixture, various combinations of food using the above food ingredients such as ragi, greengram, bengalgram, redgram dhal, butter, groundnut, sesame, sugar and skimmilk powder were worked out during this standardisation procedure. 12 combinations were formulated. Their composition, cost/100 g and calories and proteins/100 g is given in table 1 below:

Table 1. Composition, cost and calories and proteins for the combinations formulated.

Sl. No.	Formula	Composition in g	Cost/100 g	Calories/100 g	Protein/100 g
1	2	3	4	5	6
1.	Ragi	30		98	2.2
	Greengram	10		33	2.4
	Skim milk powder	25		89	9.5
	Butter	10		73	-
	Sugar	25	1.94	100	-
				393	14.1

1	2	3	4	5	6
2.	Ragi	30		98	2.2
	Sesame	10		56	1.8
	Skim milk powder	25		89	9.5
	Butter	10		73	-
	Sugar	25	2.05	100	-
				---	---
				416	13.5
				---	---
3.	Ragi	30		98	2.2
	Groundnut	10		57	2.6
	Skim milk powder	25		89	9.5
	Butter	10		73	-
	Sugar	25	2.02	100	-
				---	---
				417	14.3
				---	---
4.	Ragi	30		98	2.2
	Greengram	10		33	2.4
	Sesame	10		56	1.8
	Skim milk powder	15		54	5.7
	Butter	10		73	-
	Sugar	25	1.72	100	-
				---	---
				414	12.1
				---	---
5.	Ragi	30		98	2.2
	Greengram	10		33	2.4
	Ground nut	10		57	2.6
	Skim milk powder	15		54	5.7
	Butter	10		73	-
	Sugar	25	1.69	100	-
				---	---
				415	12.9
				---	---
6.	Ragi	30		98	2.2
	Groundnut	10		57	2.6
	Sesame	10		56	1.7
	Skim milk powder	15		54	5.7
	Butter	10		73	-
	Sugar	25	1.80	100	-
				---	---
				438	12.3
				---	---

1	2	3	4	5	6
7.	Ragi	30		98	2.2
	Bengalgram	10		36	1.7
	Skim milk powder	25		89	9.5
	Butter	10		73	-
	Sugar	25	1.95	100	-
				---	---
				396	13.4
				---	---
8.	Ragi	30		98	2.2
	Bengalgram	10		36	1.7
	Groundnut	10		57	2.6
	Skim milk powder	15		54	5.7
	Butter	10		73	-
	Sugar	25	1.70	100	-
				---	---
				418	12.2
				---	---
9.	Ragi	30		98	2.2
	Bengalgram	10		36	1.7
	Greengram	10		33	2.4
	Skim milk powder	15		54	5.7
	Butter	10		73	-
	Sugar	25	1.62	100	-
				---	---
				394	12.0
				---	---
10.	Ragi	30		98	2.2
	Bengalgram	10		36	1.7
	Sesame	10		56	1.8
	Skim milk powder	15		54	5.7
	Butter	10		73	-
	Sugar	25	1.73	100	-
				---	---
				417	11.4
				---	---
11.	Ragi	30		98	2.2
	Bengal gram	10		36	1.7
	Green gram	10		33	2.4
	Ground nut	10		57	2.6
	Skim milk powder	5		18	1.9
	Butter	10		73	-
	Sugar	25	1.37	100	-
				---	---
				415	11.8
				---	---

1	2	3	4	5	6
12.	Ragi	30		98	2.2
	Red gram dhal	10		34	2.2
	Skim milk powder	25		89	9.5
	Butter	10		73	-
	Sugar	25	1.96	100	-
				394	13.9

The amino acid composition of these combinations was worked out using the food composition table of ICMR (1982). The amino acid composition of these combinations are presented in Appendix - II.

The protein content, Amino acid profile, cost and availability of ingredients and acceptability of the food mixture were the major criteria used to judge the suitability of the food mixtures standardised. Hence, out of the twelve combinations evolved, six were selected and formulated.

(b) Preparation of the components of food supplements:

For the preparation of the food supplement, good quality ragi was purchased from the local market and was cleaned to remove all the impurities. The cleaned ragi was soaked in water for 24 hours and germinated for 48 hours.

The germinated ragi was dried in shade. When the grain was completely dry it was roasted slightly and then powdered and sieved following the procedure recommended by Snehalatha (1985).

Greengram obtained from the local market was cleaned of impurities, washed in water and soaked for 12 hours. It was then sprouted following the procedure recommended by Rajalakshmi (1974). The soaked grains were tied in a moist cloth, kept on a plate and covered with a large inverted pan so as to keep the temperature uniform. The germinated grain was then dried in the sun, roasted, milled and sieved.

Malting of ragi and sprouting of greengram were adopted because they internally help partial pre-digestion of the starch and proteins, reduce the viscosity and the phytase hydrolyses the phytin to available phosphate (Desikachar, 1983). Deosthale (1982) reported that during soaking and germination several enzyme systems become active and bring about profound changes in the nutritive value of the pulses. Even after 24 hours of germination, vitamin C which is practically absent in the dry seeds of legumes increase in significant amounts (Prabhavathi and Rao, 1979). Similarly 2-3 folds increases in the concentration of folic acid and B group vitamins takes place in germinated grains than in raw pulses (Babu, 1976).

On the other hand antinutritional factors such as phytate (Reddy, et al., 1978) and inhibitors of trypsin are inactivated (Subhalaxmi, et al., 1976). Rao and Deosthale, (1982) have shown that by soaking in water for 24 hours about 24 per cent of tannin and by germinating for 24 to 48 hours, 20 to 25 per cent of tannin is lost from greengram. Studies on flatulence factors of the legumes have shown that during 24 hours germination, the concentration of oligosaccharides gets reduced to 50 per cent of the initial value (Rao and Balavady, 1978). Germinated legumes therefore appear to be less flatulus than the raw grains.

Good quality sesame was purchased from the local market and was cleaned to remove all the impurities. It was then dried, roasted and powdered.

Groundnut was purchased from the local market, skin removed, roasted and powdered. Both greengram and groundnut were sieved and stored separately in plastic containers.

Skim milk and butter were also purchased from the local market, the day before the preparation. Butter was kept in the refrigerator until use.

The procedure for recipe standardisation began with the process of recipe modification or adjustment (Tolve, 1984). As a first step, sources of recipe such as standard cookery books, journals, magazines etc. were referred.

(c) Selection of recipes:

From the literature, recipe on biscuit was selected because of the following reasons.

1. Children generally have special affinity for baked products like biscuits.
2. Compared to many other recipes, biscuits have better shelf life.

Six types of ragi biscuits were formulated using different proportions of various ingredients like ragi flour, groundnut, sesame, greengram, butter, skim milk powder and sugar. Details are presented in Appendix III.

(d) Tests conducted to select the recipe:

Prior to the standardisation of recipe with the selected form, quantity and cost of food ingredients included in the formulae were assessed by estimating percentage preparation loss, cost of food ingredients as purchased and percentage yield.

i) AP wt was the weight of the food ingredients as purchased while the edible portion of the ingredients included in the formulae was EP wt. The preparation loss and the percentage preparation loss were calculated using the following formulae.

$$\% \text{ preparation loss} = \frac{\text{AP wt} - \text{EP wt}}{\text{AP wt}} \times 100$$

ii) Cost of the edible portion of the ingredients used was calculated using the formulae.

$$\text{Cost of the edible portion} = \frac{\text{Total cost}}{\text{EP wt}}$$

iii) The percentage yield of the recipe will be influenced by the time and temperature used for baking. Here the formulae is

$$\% \text{ yield of the recipe} = \frac{\text{Cooked weight}}{\text{weight before cooking}} \times 100$$

(e) Recipes evolved:

Recipes were standardised for consistent quality production with reference to nutritional quality, availability and cost of various ingredients, suitability for clientele in selecting and preparing the recipe. Final screening of the formulae was based on the quantity of the protein.



(f) Standardisation of recipe:

Ragi biscuit was standardised according to the procedure recommended by Vaidehi et al., (1985) and the procedure is given in Appendix IV.

(g) Assessing the acceptability of selected recipe:

Acceptability trials of the selected recipe were conducted at the laboratory level. A series of acceptability trials were carried out at the laboratory with the selected panel of judges. The panel members were selected from a group of 30 healthy women in the age group of 19 - 30. Triangle test was employed to select the panel members.

The procedure for the triangle test and the evaluation card used for the triangle test is presented in Appendix V. From the thirty women who participated in the triangle test, ten women were selected as judges for the present acceptability.

The acceptability trials on the panel members were done using the scoring method. A score card developed for the study is presented in Appendix VI.

The major quality attributes included in the score card were appearance, flavour, texture, taste and overall acceptability on a five point hedonic scale. Each of the above mentioned quality was assessed by a five point rating scale. The judges were requested to taste the second sample after washing their mouths. Each quality was assessed by the panel members after testing the same sample several times if needed. The panel members were permitted to take their own time and judge the samples leisurely. The testing was conducted in the afternoon between 3 - 4 pm, since this time was considered as the ideal time for conducting the acceptability studies (Swaminathan, 1974). The Panel members were requested to give scores based on two sets of response, the first giving preference rank and the second an assessment of sensory qualities.

(h) Mass production of ragi biscuits:

One ragi biscuit was reported to have nine gram supplying 36 K Calories and 1.3 g of protein. The three ragi biscuits used as the food supplement were expected to have 3.8 g of protein. Since forty children were included in the experimental group, 120 biscuits were required daily.

#### 4. Selection of the child beneficiaries.

Dietary habits of the child beneficiaries of the study was assessed through socio-economic survey, food consumption survey and food weighment studies. The schedule used to collect socio-economic and food consumption survey is presented in Appendix VII. The schedule used for food weighment survey is presented in Appendix VIII.

The data for the socio-economic and food consumption survey were collected from 150 families through interview method visiting each household. Data related to the behavioural problem of the preschool children was also collected from the parents as well as from the teachers.

As the selected area was rural, the food weighment survey was conducted for one day. Raw as well as cooked food used on that day by the family was recorded. All the food items the child ate as well as wasted throughout the day at home as well as in the anganwadi centre was weighed and recorded. The plate waste was also taken into account. These data were collected from ten children five each from control and experimental groups.

5. Conduct of the supplementary feeding programme.

The supplementary feeding was conducted for six months. The food intake and plate waste were recorded daily. Records of daily attendance and food intake were also maintained.

- i) Anthropometric measurements were taken for all the children. The height, weight, arm circumference, chest and head measurement were taken every month during the study.
- ii) Clinical assessment for all the children were carried out with the help of a qualified physician at the beginning and end of the study to ensure the normal health of the subject and modified ICMR clinical assessment form was used for this purpose.
- iii) Biochemical evaluation: The blood haemoglobin level was analysed. This was carried out by cyanmet haemoglobin method before and after the feeding programme.

6. Evaluation of the supplementary feeding programme by assessing the nutritional status of the children in anganwadi.

Nutritional status of the preschool children was assessed to study the impact of supplementary feeding conducted among 40 preschool children for six months period. Following methods were used to assess the nutritional status, i. Anthropometric studies, ii. clinical examination and iii. biochemical studies.

i) Anthropometric studies:

Anthropometric study is chosen since this is considered as one of the most practical field techniques for the quantitative assessment of the nutritional status of children (Trowbridge, 1979). Easwaran and Devadas (1986) had stated that the relation between anthropometric measurement and nutritional deficiencies are to be mainly used to assess the nutritional status where clinical facilities are limited.

The height of preschool children is measured and the height is a measure of long standing nutritional status. The procedure is presented in Appendix IX.

Fig. 2. Measurement of weight



Fig. 3. Measurement of chest circumference



The weight of children were weighed wearing very light cloths. The weight was measured using the spring balance available at the Anganwadi itself (Fig.2). The procedure is presented in Appendix X.

The head circumference was measured with a narrow flexible nonstretch tape made of fiberglass. Head circumference is related mainly to brain size and to a small extent to the thickness of the scalp tissues and skull. It is a procedure in pediatric practise to detect the pathological conditions. The procedure by which the head circumference is taken is presented in Appendix XI.

The flexible non-stretch fibre glass tape was used to measure the chest of the child at nipple line (Fig.3). The average of the inspired and expired chest measurement to the nearest 0.1 cm is taken as the chest measurement.

Mid arm circumference was measured to the nearest 0.1 cm with a fibre glass tape by placing gently but firmly round the limb to avoid compression of the soft tissues. The left arm was measured while hanging at its mid point.



4. Collection of blood for haemoglobin estimation



ii) Clinical examination:

The presence or absence of clinical deficiency symptoms attributed to malnutrition was assessed by a qualified physician from the adjacent primary health centre in the broad day light. The schedule suggested by National Institute of Nutrition for clinical survey was used for preparing the performa. The schedule used for the survey is presented in Appendix XII.

iii) Bio chemical studies:

Under the biochemical studies the haemoglobin estimation (Fig.4) of the preschool children was conducted by cyanmet haemoglobin method. Details of the method is given in Appendix XIII.

## **RESULTS**

## RESULTS

A study on the impact of ragi based food supplement on the nutritional status of the selected preschool children is an assessment of:

- A. the dietary habits of selected preschool children attending balawadi
- B. the acceptability of a supplementary food prepared with ragi and
- C. the effect of ragi based supplementary food on the nutritional status of selected preschool children.

### A. THE DIETARY HABITS OF SELECTED PRESCHOOL CHILDREN ATTENDING BALAWADI

The dietary habits of the preschool children attending anganwadi were determined by conducting a survey on 'ecological and socio-economic data of the families'. The survey was conducted in five villages of the Kalliyoor panchayat namely Palapoor, Poonkulam, Kakkamoola, Thetrivila and Kannikakutri. Actual food consumption pattern of the selected preschool children was conducted.

One hundred and fifty families were surveyed and the results of the study are presented under the following headings.

1. Socio-economic conditions of the families
2. Personal characteristics of the families
3. Personal home production of food by the families
4. Food consumption pattern of the families
5. Health condition of the family members
6. Details regarding the preschool children

Actual food consumption pattern of the children was conducted in a subsample of ten families and the results are presented under:

7. Dietary intake of preschool children

1. Socio-economic condition of the families

Socio-economic condition of the families cover particulars related to religion and caste, type of families, housing conditions, physical facilities such as potable water and disposal of waste and excretes.

Table 1.1. indicates the religion and caste particulars of the families.

Table 1.1. Religion and caste particulars of the families

Religion and caste	Number	Percent
<u>Religion</u>		
Hindu	112	74.67
Christian	38	25.33
Total	150	100.00
<u>Caste</u>		
Forward Caste	1	0.67
Backward caste	113	75.33
Scheduled Caste/Tribe	36	24.00
Total	150	100.00

As revealed in table 1.1, 74.67 per cent are hindus and 25.33 per cent are christians. Caste particulars of the families reveales that 75.33 per cent and 24 per cent belong to backward community and scheduled caste/tribe respectively.

Details related to the type of the families are presented in table 1.2.

1.2. Type of the families surveyed.

Type and size	Number	Per cent
<u>Type</u>		
Nuclear families	110	74.00
Joint families	39	26.00
Total	150	100.00
<u>Size</u>		
Small families	56	37.33
Medium families	70	46.67
Large families	24	16.00
Total	150	100.00

As revealed in the table, 74 per cent of the families surveyed are nuclear families and 26 per cent are joint families.

On the basis of the family size the families are classified into three groups namely small, medium and large families, as per the guidelines of Devadas *et al*, 1975. As revealed in the table only 16 per cent of the families surveyed were considered to be large families.

Table 1.3 represents the housing condition of the families.

Table 1.3. Housing condition of the families

Housing condition	Number	Per cent
<u>Possession of house</u>		
Own	149	99.33
Rent	1	0.67
Total	150	100.00
<u>Type of house</u>		
Tiled	26	17.33
Thatched	120	80.00
Terraced	24	2.67
Total	150	100.00

As revealed in table 1.3, majority of families are found to possess small houses, thatched usually 99.33 per cent of families possess their own houses. 2.67 per cent live in terraced houses.



The drinking water facilities are presented in table 1.4.

Table 1.4. Drinking water facilities of the families

Source	Per cent	Distance from house	Per cent
Public well	16.00	In the premises	42.00
Private well	34.66	Approximately $\frac{1}{2}$ km	41.33
Public tap	19.33	Approximately 1 km	14.67
Private tap	4.00	Approximately $1\frac{1}{2}$ km	2.00
Public tank	0.67		
Neighbourhood well	18.00		
Ponds	0.67		
2-3 sources	6.67		
Total	100.00	Total	100.00

As revealed in table 1.4, 34.66 per cent of the families have private wells and 18 per cent use neighbourhood private well. 42 per cent of the families surveyed have these facilities in the premises, of their houses, while 41.33 per cent have to walk approximately  $\frac{1}{2}$  km to collect water. The remaining families have to walk more for the same.

Table 1.5 presents the data regarding the persons who were responsible for collecting water for drinking purposes.

Table 1.5. Persons responsible for collecting water.

Person responsible	Number	Per cent
Mother	76	50.67
Father	2	1.33
Elder brother/Sister	1	0.67
Elder relatives	1	0.67
Father and mother	41	27.33
Mother with elder brother/sister	6	4.00
Mother with elder relatives	15	10.00
Others	8	5.33
Total	150	100.00

Among 50.67 per cent of the families mother alone is responsible for collecting water but in few families, mother is assisted by father (27.33 per cent), elder brother/sister (4 per cent) and elder relatives (10 per cent).

Time spent for collecting water is presented in table 1.6.

Table 1.6. Time spent for collecting water.

Time spent ( in hours)	Number of families	Per cent
0 - $\frac{1}{2}$	15	10.00
$\frac{1}{2}$ - 1	27	18.00
1 - $1\frac{1}{2}$	28	18.67
$1\frac{1}{2}$ - 2	30	20.00
2 - $2\frac{1}{2}$	31	14.00
$2\frac{1}{2}$ - 3	20	13.33
3 - $3\frac{1}{2}$	9	6.00
Total	150	100.00

As revealed in table 1.6, 10 per cent of the families spend a minimum of half an hour per day whereas 6 per cent of the families spend a maximum of 3 to  $3\frac{1}{2}$  hours for collecting water. The reason suggested for such a drudgery is the non co-operation of the neighbours, drying up of wells and non functioning of public taps.

Next to drinking water facilities a major problem faced by the families are latrine facilities. This indirectly reflects the hygienic practises prevalent among them and the details are presented in table 1.7.

Table 1.7. Latrine facilities of the families.

Facility	Number of families	Per cent	Location of flush out	Number	Per cent
Flush out	47	31.33	Premises	22	46.8
Open place	103	68.67	Less than $\frac{1}{2}$ km	25	53.2
Total	150	100.00	Total	47	100.00

Table 1.7 reveals that only 31.33 per cent of households are in the habit of using 'flush outs' for this purpose. Among these families only 46.8 per cent have this facility in their homes while 53.2 per cent are utilising the public facility. About 68.67 per cent of the families are using open field for this purpose.

Preference of families to "flush outs" over 'open field' was tested and such details are furnished in table 1.8.

Table 1.8. Usage of flush out by the families.

Habit of using flush outs	Per cent	Household members who were not using	Per cent
Yes	42.55	Children - Afraid	88.89
No	57.45	Male adults - Don't like	11.11
Total	100.00		100.00

As revealed in table, a major factor which determines the actual use of 'flush outs' by the families are actual possession. Out of 22 families who possessed this facility, 20 families are in the habit of using this. Another notable point in this regard is that among the families who are not using regularly latrine facilities, children and adult males are found to show indifference to such group while children below the age of six refuse to use latrine facility because they are afraid. Adult males prefer 'open field' to 'flush out' facilities.

## 2. Personal characteristics of the family members

Personal characteristics such as size and composition of the family, physiological condition and literacy level of the family members, economic and occupational status of the families etc. are studied and presented.

Details regarding the size of the families are given in table 2.1.

Table 2.1. Details of the size of the families

Size of the families	Number	Per cent
1a + 2c	1	0.67
2a + 1c	5	3.33
2a + 2c	52	34.66
2a + 3c	40	26.66
2a + 4c	8	5.33
2a + 5c	1	0.67
2a + more than 5c	1	0.67
3a + 1c	1	0.66
3a + 2c	11	7.33
3a + 3c	1	0.67
3a + 4c	3	2.00
3a + 5c	2	1.33
3a + more than 5c	1	0.67
4a + 1c	1	0.67
4a + 2c	6	4.00
4a + 3c	2	1.33
4a + 4c	1	0.67
5a + 1c	2	1.33
5a + 2c	1	0.67
5a + 3c	1	0.67
5a + 4c	1	0.67
5a + 5c	1	0.67
More than 5a + 1 c	2	1.33
More than 5a + 2c	1	0.67
More than 5a + 3c	3	2.00
More than 5a + 4c	1	0.67
Total	150	100.00

a = adult

c = children

Table 2.1 reveals that 34.66 per cent of the families have 2 adults and 2 children and 26.66 per cent of the families have 2 adults and 3 children.

Table 2.2 indicates the age wise distribution of the family members.

Table 2.2. Age-wise distribution of the members of the household surveyed.

Age distribution (in years)	Number of members	Per cent
0 - $\frac{1}{2}$	7	0.91
$\frac{1}{2}$ - 1	3	0.39
1 - 2	34	4.41
2 - 3	33	4.28
3 - 4	68	8.81
4 - 6	147	19.04
6 - 9	46	5.96
9 - 12	20	2.59
12 - 15	13	1.68
15 - 18	12	1.55
Adult man	194	25.13
Adult woman	195	25.25
Total	772	100.00

There are 772 members in 150 families surveyed. As depicted in table, 19.04 per cent belong to the age group of 4 to 6 years and 8.81 per cent are between the age of 3 to 4 years. Adult females constitute 25.25 per cent and adult males constitute 25.13 per cent of the total population surveyed.

Table 2.3 reveals the physiological condition of the families.

Table 2.3. Physiological condition of the families.

Physiological condition of the family members	Number	Per cent
Preschool children	172	22.28
Pregnant mother	13	1.68
Nursing mother	26	3.37
Total	211	27.33

Table 2.3 reveals that in the 150 families surveyed, there are 172 preschool children, 13 pregnant mothers and 26 nursing mothers.



Table 2.4 represents the literacy level of the family members.

Table 2.4. Literacy level of the family members.

Literacy level	Members*	Number	Per cent
Illeterate	Male	72	14.17
	Female	69	13.58
Can read Malayalam	Male	19	3.74
	Female	10	1.97
Can write Malayalam	Male	17	3.35
	Female	25	4.92
Primary school level	Male	38	7.48
	Female	55	10.83
Middle school level	Male	38	7.48
	Female	31	6.10
High School level	Male	67	13.19
	Female	58	11.42
College level	Male	2	0.39
	Female	7	1.38
Total		508	100.00

\* Children below six years are not included except 28 children who are already attending primary school.

Table 2.4 reveals that 27.75 per cent of the population surveyed (excluding children below six years and not attending primary school) are illiterate of which 14.17 per cent are males and 13.58 per cent are females. Table also reveals that 24.61 per cent of people are educated upto high school level of which 13.19 per cent are females and 11.42 per cent males.

Table 2.5 represents the economic status of the families in which monthly average income is presented.

Table 2.5. Economic status of the families.

Monthly income (Rs)	Number of families	Per cent
0 - 200	6	4.00
201 - 400	67	44.67
401 - 600	46	30.67
601 - 800	14	9.33
801 - 1000	8	5.33
1001 - 1200	5	3.33
1201 - 1400	1	0.67
1401 - 1600	3	2.00
Total	150	100.00

As depicted in table 2.5, 79.34 per cent of the families came under poverty line. The occupational status of the family members with reference to various employment are taken up. This includes Agricultural occupation, business, Government job and daily labour.

Table 2.6. Occupational status of the families.

Occupational status	Number	Per cent
Marginal farmer	1	0.67
Private business	5	3.33
Coolies	99	66.00
Government job	10	6.67
Others	4	2.67
2 - 3 jobs*	26	17.33
4 - 5 jobs*	5	3.33
Total	150	100.00

\* Includes occational farming and working as coolies, business and odd jobs etc.

The table reveals that majority are working as marginal farmers or agricultural labourers. Very few families are subsisting on full time agricultural occupation, business and

Government job. Other jobs not listed in the table included tailor, driver and get income as rent from shop and a house.

Table 2.7 indicates the frequency of exposure to different media by the families.

Table 2.7. Frequency of exposure to different media by the family members.

Media	Nil		Daily		Twice/ week		Weekly		Twice/ month		Monthly		Occasio- nally	
	Num	Per	Num	Per	Num	Per	Num	Per	Num	Per	Num	Per	Num	Per
	ber	cent	ber	cent	ber	cent	ber	cent	ber	cent	ber	cent	ber	cent
Newspaper	118	78.67	1	0.67	6	4	8	5.33	2	1.33	-	-	15	10.00
Magazine	104	69.33	-	-	9	6	34	22.67	-	-	2	1.33	1	0.67
Cinema	137	91.33	-	-	-	-	3	2.00	1	0.67	6	4.00	3	2.00
T.V.	107	71.33	1	0.67	-	-	40	26.67	-	-	-	-	2	1.33
Training programme	149	99.33	-	-	-	-	-	-	-	-	-	-	1	0.67
Radio	80	53.33	61	40.67	-	-	-	-	-	-	-	-	9	6.00

As revealed in table 2.7, media like newspaper, magazine, cinema, T.V., training programmes and radio are not used effectively by these families.

### 3. Personal home production of food by the families.

Data regarding home production of foods of both animal or vegetable origin were collected and presented. This includes the number of families responsible for home production, quantity of food products available, quantity used or sold by them and income from the home produced food products.

Table 3.1 furnishes details related to home production of food.

Table 3.1. Home production of food.

Home production	Number of families	Per cent
Yes	66	44
No	84	56
Total	150	100

As revealed in table 3.1, 56 per cent of the households have no home production of food whereas 44 per cent of the families are interested to have this.

Table 3.2 furnishes further details regarding the families engaged in production of various food crops.

Table 3.2. Families engaged in home production.

Foods production	Number of families	Per cent
Products of animal food	19	12.67
Products of plant food	28	18.66
Products of both plant and animal food	19	12.67
Total	66	44.00

As revealed in table 3.2, 19 per cent of families are interested to produce foods of animal origin at the household level while 28 per cent of the families produced foods of plant origin. Another 19 per cent of the families are interested in the home production of foods of animal and plant origin.

The average quantity of the foods produced by the families per month are presented in table 3.3.

Table 3.3. Average quantity of food products produced.

Food Produced	Number of families	Total quantity produced/month	Average quantity produced/month
Coconut	44	1100 (in nos.)	25 (in nos.)
Tapioca	7	35 (in kg)	5 (in kg)
Milk	10	1348.5(in l)	134.85 (in l)
Egg	30	1059 (in nos)	35.3 (in nos)

The major food crops produced at the household level are coconut, tapioca, milk and egg. Among the food crops coconut is found to be the most common one, followed by egg, milk and tapioca.

Details regarding the usage and sale of the food products produced in the family are furnished in table 3.4.

Table 3.4. The usage and sale of the food products.

Food product	Families used		Families used as well as sold		
	Numbers	Quantity used/month	Number	Quantity used	Quantity sold
Coconut (in nuts)	28	632	16	308	160
Tapioca (in kg)	4	12	3	14	9
Milk (in l)	-	-	10	130	1218
Egg (number)	2	34	28	168	857

As revealed in the table, milk is sold out in large quantities by the families. This trend is found in decreasing order in egg, coconut and tapioca.

Table 3.5 furnishes the income obtained from the home produced products.

Table 3.5. Income from the home produced products.

Food products	Number of families selling the products	Income (in rupees) per month	Average income (in rupees) per month
Coconut	16	395/-	24.69/-
Tapioca	3	12/-	4/-
Milk	10	5481/-	548.1/-
Egg	28	642.75/-	22.96/-

Table 3.5 reveals that more income is obtained by selling milk followed by egg and coconut.

#### 4. Food consumption pattern of the families.

Food consumption pattern of the families are assessed by determining the monthly expenditure pattern, the frequency of use of various foods by these families, meal pattern of the families etc.



Table 4.1. Monthly expenditure pattern of the families

Expenditure per month (in ruppes)	Food		Clothing		Shelter		Health		Education		Travel		Gifts		Cere- monies		Recre- ation		Repaying loan	
	num ber	per cent	num ber	per cent	num ber	per cent	num ber	per cent	num ber	per cent	num ber	per cent	num ber	per cent	num ber	per cent	num ber	per cent	num ber	per cent
0 - 10	-	-	28	18.67	28	18.67	85	56.61	47	31.33	55	36.67	27	18.00	103	68.67	41	27.33	14	9.33
11 - 20	-	-	55	36.61	71	47.33	36	24.00	19	12.67	43	28.66	58	38.67	37	24.67	8	5.33	20	13.33
21 - 30	-	-	34	22.67	32	21.33	21	14.00	8	5.33	20	13.33	52	34.67	6	4.00	-	-	8	5.33
31 - 40	-	-	3	2.00	6	4.00	1	0.67	3	2.00	3	2.00	2	1.33	2	1.33	-	-	3	2.00
41 - 50	-	-	19	22.66	2	1.33	3	2.00	10	6.67	11	7.33	8	5.33	-	-	-	-	3	2.00
51 - 60	-	-	1	0.67	2	1.33	-	-	1	0.67	12	8.00	-	-	-	-	-	-	-	-
61 - 70	-	-	-	-	1	0.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71 - 80	-	-	3	2.00	2	1.33	1	0.67	-	-	1	0.67	-	-	-	-	-	-	1	0.67
81 - 90	-	-	6	4.00	1	0.67	1	0.67	-	-	1	0.67	-	-	-	-	-	-	-	-
91 - 100	-	-	1	0.67	-	-	2	1.33	-	-	4	2.67	-	-	-	-	-	-	-	-
More than 100	150	100	-	-	1	0.67	-	-	-	-	-	-	-	-	-	-	-	-	4	0.67
Nil	-	-	-	-	4	2.67	-	-	62	41.33	-	-	3	2.00	2	1.33	101	67.33	99	66.00
Total	150	100	150	100	150	100	150	100	150	100	150	100	150	100	150	100	150	100	150	100

Table 4.1 represents the monthly expenditure pattern of the family.

As revealed in table 4.1 expenditure incurred for clothing, shelter, health, education, travel, gifts, ceremonies and recreation are comparatively less. It also revealed that major share of income was spent on food.

Since major portions of the income was spent for food, the expenditure pattern for food was further analysed and the details are presented in table 4.2.

Table 4.2. Monthly expenditure for food per month

Monthly expenditure for food (in rupees)	Number of families	Per cent
0 - 100	Nil	--
101 - 200	27	18.00
201 - 300	66	44.00
301 - 400	27	18.00
401 - 500	16	10.67
501 - 600	8	5.33
601 - 700	4	2.67
701 - 800	2	1.33
Total	150	100.00

Table 4.2 reveals that the expenditure pattern for 44 per cent of the families surveyed were in the range of Rs.201 - 300 per month. It also reveals that 80 per cent of the families spent less than Rs.400 per month for their food.

Details regarding the savings made by the families per month were calculated and presented in table 4.3.

Table 4.3. Savings per month by the families.

Savings per month (in rupees)	Number of families	Per cent
0 - 40	27	18.00
41 - 80	11	7.33
81 - 120	4	2.66
121 - 160	-	-
161 - 200	4	2.66
201 - 240	-	-
241 - 280	1	0.67
281 - 320	1	0.67
Nil	102	68.00
Total	150	100.00

As revealed in table 4.3, 68 per cent of the families were not able to save any money from the income they had and very few families were able to save something.

Table 4.4 represents the frequency of use of different food materials in the families.

Table 4.4. Frequency of use of different food materials.

Food items	Daily		More than thrice/week		Less than thrice/week		Once in a week		Once in a month		Occasionally		Nil	
	Num ber	Per- cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<u>Cereals</u>														
Rice	150	100.00	-	-	-	-	-	-	-	-	-	-	-	-
Wheat	4	2.67	33	22	35	23.33	35	23.33	7	4.67	6	4.00	-	-
Rava	1	0.66	7	4.67	6	4.00	16	10.67	5	3.33	4	2.67	-	-
<u>Pulses</u>														
Redgram dhal	7	4.67	13	8.67	41	27.33	21	14.00	19	12.67	3	2.00	-	-
Greengram dhal	-	-	29	19.33	34	22.67	48	32.00	11	7.33	5	3.33	-	-
Blackgram dhal	-	-	23	15.33	24	16.0	42	28.00	5	3.33	4	2.67	52	34.67
<u>Oil seeds and nuts</u>														
Coconut	150	100.00	-	-	-	-	-	-	-	-	-	-	-	-
Ground nut	5	3.33	25	16.67	10	6.67	43	28.67	19	12.67	14	9.33	34	22.66
<u>Roots and tubers</u>														
Tapioca	37	24.67	62	41.33	17	11.33	26	17.33	8	5.34	-	-	-	-
Potato	-	-	7	4.67	15	10.00	32	21.33	7	4.67	30	20.00	59	39.33
Colacasia	-	-	40	26.67	23	15.33	19	12.67	8	5.33	6	4.00	54	36.00
Yam	1	0.67	21	14.00	27	18.00	26	17.33	4	2.67	59	39.33	59	39.33
Colias	2	1.33	8	5.33	22	14.67	14	9.33	7	4.67	13	8.67	84	56.00

Table 4.4 (Contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<u>Other vegetables</u>															
Banana		1	0.67	35	23.33	29	19.33	26	17.33	13	8.67	18	12.00	28	18.67
Ladies finger		2	1.33	30	20.00	15	10.00	33	22.00	27	18.00	32	21.33	11	7.34
Brinjal		9	6.00	32	21.33	20	13.33	44	29.34	6	4.00	31	20.67	8	5.33
Drumstick		2	1.33	10	6.67	48	32.00	32	21.33	13	8.67	34	22.67	11	7.33
Cucumber		3	2.00	22	14.67	24	16.00	36	24.00	26	17.33	12	8.00	27	18.00
Snake gourd		2	1.33	27	18.00	22	14.67	37	24.67	13	8.67	31	20.66	18	12.00
Bitter gourd		1	0.67	19	12.67	13	8.67	14	9.33	9	6.00	4	2.67	90	60.00
Others		4	2.67	27	18.00	29	19.33	45	30.00	42	28.00	3	2.00	3	2.00
<u>Green leafy vegetables</u>															
Drumstick		2	1.33	36	24.00	14	9.33	20	13.33	7	4.67	14	9.33	57	38.00
Amaranth		2	1.33	38	25.33	23	15.33	26	17.33	11	7.34	9	6.00	41	27.33
Cabbage		1	0.66	22	14.67	19	12.67	15	10.00	4	2.67	12	8.00	77	51.33
<u>Fruits</u>															
Banana		2	1.33	30	20.00	16	10.67	27	18.00	45	30.00	28	18.67	2	1.33
Plantain		10	6.67	51	34.00	22	14.67	27	18.00	11	7.33	25	16.67	4	2.66
<u>Milk and its products</u>															
Milk		82	54.67	13	8.67	9	6.00	-	-	-	-	-	-	46	30.66
Butter milk		48	32.00	-	-	-	-	18	12.00	-	-	-	-	76	50.67
Curd		22	14.67	-	-	-	-	2	1.33	-	-	6	4.00	120	80.00
<u>Flesh foods</u>															
Meat		-	-	-	-	-	-	18	12.00	20	13.33	100	66.67	12	8.00
Fish		130	86.67	12	8.00	-	-	2	1.33	3	2.00	3	2.00	-	-
Egg		5	3.33	24	16.00	9	6.00	27	18.00	14	9.33	30	20.00	41	27.34
<u>Miscellaneous</u>															
Palm oil		126	84.00	4	2.67	1	0.67	5	3.33	2	1.33	5	3.33	7	4.67
Sugar		144	96.00	4	2.67	-	-	2	1.33	-	-	-	-	-	-
Jaggery		-	-	-	-	-	-	20	13.33	24	16	39	26	67	44.67

It reveals that rice and coconut are the two food items which are used daily by all families. 74 per cent of the families do not use rava at all and 86.67 per cent use meat, very occasionally. Foods like curd, yam, black gram, dhal, bitter gourd are not popular among many of the families.

Table 4.5 explains the frequency of cooking of different food articles for a day.

Table 4.5. Frequency of cooking of different food articles.

Food articles	Once/day		Twice/day		Thrice/day		Nil	
	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
Cereals	106	70.67	42	28.00	2	1.33	-	-
Pulses	128	85.33	12	8.00	-	-	10	6.67
Green leafy vegetables	141	94.00	-	-	-	-	9	6.00
Other vegetables	127	84.67	23	15.33	-	-	-	-
Roots & tubers	143	95.33	7	4.67	-	-	-	-
Oil seeds & nuts	102	68.00	46	30.67	-	-	-	-
Flesh food	134	89.33	16	10.67	2	1.33	-	-
Milk and its products	98	65.33	12	8.00	-	-	40	26.67



Table 4.6 reveals that three meals a day were found to be the common meal pattern of the families. There was no significant difference in the meal pattern of the adult male or adult female or adolescent. However preschool children were reported to be given meals 4 or 5 times daily including the two feeding from Anganwadi. School going children and small children below three years were found to get special attention.

Table 4.7 represents the details related to the pattern of serving meals by the families.

Table 4.7. Meal serving pattern of the families.

Meal serving pattern	Number	Per cent
Meals taken together	47	31.33
First by the head	30	20.00
First by male members	7	4.67
First by the children	23	15.33
Last by the housewife	16	10.67
No such rules	27	18.00
Total	150	100.00



Table 4.7 reveals that in 31.33 per cent of the families, meals were taken together while in 20 per cent of the families, meals were served to the head first and in 10.67 per cent of families, the housewife take food only after feeding all the family members while in 15.33 per cent of families food is taken by the children first.

Culinary practises of the families related to preparation of dry food articles such as cereals, pulses, fruits, vegetables etc. were collected and details are given in table 4.8 and 4.9.

Table 4.8. Preparation of dry food articles prior to cooking.

Cleaning	Number	Per cent	Washing	Number	Per cent
1.Cleaning/ winnowing washing and drying	20	13.33	Once	63	42
2.Cleaning/ winnowing and washing just before cooking	55	36.67	Twice	84	56
3.Washing alone just before cooking	75	50.00	Thrice	3	2
Total	150	100.00		150	100

As revealed in table 4.8 only 13.33 per cent of the families pay attention to clean, wash or dry immediately after purchasing. More than half of the housewives are in the habit of washing rice twice before cooking.

Table 4.9. Preparation of fresh food articles.

Preparation	Number	Per cent
1. Washing soon after purchase	53	35.33
2. Washing just before using	93	62.00
3. No washing at all	4	2.67
Total	150	100.00

Table 4.9 reveals that 35 per cent of the housewives were in the habit of washing fruits and vegetables immediately after purchase while 62 per cent were in the habit of washing these food usually before use.

Table 4.10 represents different methods employed for cooking different food items.

Table 4.10. Different methods employed for cooking.

Foods	Boiling & straining		Absorbing		Steaming		Frying	
	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
<u>Cereals</u>								
Rice	150	100.00	2	1.33	103	68.67	129	66.00
Wheat	26	17.33	-	-	96	64.00	96	64.00
Rava	30	20.00	-	-	20	13.33	26	17.33
<u>Pulses</u>								
Redgram dhal	80	53.33	24	16.00	61	40.67	51	34.00
Blackgram dhal	12	8.00	-	-	95	63.33	53	35.33
Greengram dhal	97	64.67	-	-	32	21.33	65	43.33
<u>Oil seeds &amp; nuts</u>								
Coconut	150	100.00	73	48.67	71	47.33	150	100.00
Ground nut	69	46.00	-	-	10	6.67	84	56.00
<u>Roots and tubers</u>								
Tapioca	106	70.67	-	-	19	12.67	73	48.67
Potato	47	31.33	11	7.34	36	24.00	88	58.67
Colacasia	35	23.33	-	-	19	12.67	15	10.00
Yam	31	20.67	-	-	6	4.00	48	32.00
Colias	11	7.34	-	-	24	16.00	28	18.67
<u>Other vegetables</u>								
Banana	103	68.67	-	-	13	8.67	89	59.33
Ladies finger	77	51.33	-	-	13	18.67	78	52.00
Brinjal	100	66.67	-	-	12	8.00	88	58.67
Drumstick	43	28.67	-	-	13	8.67	33	22.00
Cucumber	40	26.67	-	-	25	16.67	35	23.33
Snake gourd	69	46.00	-	-	10	6.67	55	36.67
Bitter gourd	50	33.33	-	-	-	-	42	28.00
Others	85	56.66	-	-	17	11.33	52	34.67
<u>Green leafy vegetables</u>								
Drumstick	55	36.67	2	1.33	41	27.33	44	29.33
Amaranth	55	36.67	7	4.67	14	9.33	47	31.33
Cabbage	27	18.00	-	-	28	18.67	27	18.00
<u>Flesh food</u>								
Meat	84	56.00	2	1.33	-	-	97	64.67
Fish	123	82.00	-	-	32	21.33	82	54.67
Egg	60	40.00	-	-	25	16.67	62	41.33
<u>Milk</u>								
Milk	104	69.33	-	-	-	-	-	-

As revealed in table 4.10, boiling is found to be the most common method of cooking followed by frying and steaming.

Storage methods adopted by the families are presented in table 4.11.

Table 4.11. Different methods of storing foods.

Food stuff	As such		As flour		Sun dried		Immersed		Fried	
	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent
Cereals	85	56.67	97	64.67	18	12.00	-	-	53	35.33
Pulses	73	48.67	17	11.33	14	9.33	-	-	-	-
Green leafy vegetables	-	-	-	-	-	-	13	8.67	-	-
Other vegetables	77	51.33	65	43.33	-	-	32	21.33	48	32.00
Fruits	61	40.67	-	-	-	-	-	-	-	-
Flesh foods	-	-	-	-	-	-	-	-	24	16.00
Roots & tubers	129	86.00	32	21.33	22	14.67	-	-	-	-
Milk & milk products	98	65.33	-	-	-	-	-	-	-	-

As revealed in table 4.11, the dry foods as well as perishable foods are stored as such. Dry foods are stored as such or raw, as flour, or roasted flour. Vegetables especially banana are immersed in water and stored. Banana is also dried and powdered and stored as flour.

Different periods of storage of various food stuffs are presented in table 4.12.

Table 4.12. Period of storing foods.

Food stuff	Immediately used		One day		2-4 days		Upto one week		Upto one month		No Storage	
	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent
Cereals	38	25.33	14	9.34	24	16.00	69	46.00	5	3.33	-	-
Pulses	44	29.33	20	13.33	46	30.67	28	18.67	2	1.33	10	6.67
Green leafy vegetables	74	49.33	-	-	67	44.67	-	-	-	-	9	6.00
Other vegetables	58	38.67	34	22.67	54	36.00	4	2.66	-	-	-	-
Roots & tubers	78	52.00	27	18.00	38	25.33	7	4.67	-	-	-	-
Fruits	43	28.67	64	42.66	43	28.67	-	-	-	-	-	-
Milk & milk products	16	10.67	33	22.00	-	-	-	-	-	-	101	67.33
Flesh food	132	88.00	18	12.00	-	-	-	-	-	-	-	-

The table 4.12 indicates that majority of the families are not in the habit of storing food articles for a long period. Dry food articles like cereals and pulses are stored for one month while perishable foods like fruits, vegetables, green leafy vegetables etc are stored upto 4 days. Milk and flesh foods are used immediately or kept for a day after cooking.

Table 4.13 presents different containers used for storage.

Table 4.13. Different containers used for storage.

Containers	Number of families using	Per cent
Mud pot	109	72.67
Tin	81	54.00
Glass	86	57.33
Aluminium	118	78.67
Plastic	73	48.67
Cloth	46	30.67
Earthern ware	28	18.67
Steel	84	56.00
Copper	24	16.00

Among the various types of containers, containers made of aluminium and mud are found to be the most commonly used vessels followed by glass, steel and tin containers for storage of the food stuffs.

Table 4.14 presents details regarding storage spaces. This data is presented to find out the hygienic practices prevalent among the families.

Table 4.14. Place of storage of these food items.

Place of storage	Number of families	Per cent
<u>Kitchen</u>		
Open place	76	50.67
Cupboard	20	13.33
<u>Store room</u>		
Open place	16	20.00
Cupboard	8	5.33

As revealed in table only very few families have proper facilities for storing food articles.

Table 4.15 presents details regarding the preservation of foods by the families.

Table 4.15. Foods preserved by the families.

Food stuff	Pickle		Fried and seasoned	
	Number	Per cent	Number	Per cent
Lime	99	66.00	--	--
Mango	106	70.67	--	--
Ginger	--	--	16	10.67
Amla	24	16.00	--	--
Lemon	4	2.67	18	12.00
Green pepper	7	4.67	--	--

As revealed in table 4.15 mango and lime are the most commonly preserved fruits by these families. Compared to these fruits, amla, lemon, ginger and green pepper are less popular.

Details regarding the shelf life of the foods preserved are presented in table 4.16.



Table 4.16. Shelf life of the foods preserved.

Foods	3-4 days		Upto one week		Upto two weeks		Upto one month		More than one month	
	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent
Lime	-	-	18	18.18	48	48.49	33	33.33	-	-
Mango	53	50	36	33.96	12	11.32	5	4.72	-	-
Ginger	-	-	11	68.75	5	31.25	-	-	-	-
Gooseberry	-	-	17	70.83	7	29.17	-	-	-	-
Lemon	11	50	8	36.36	3	13.64	-	-	-	-
Green pepper	-	-	4	57.14	3	42.86	-	-	-	-

This indicates that lime and mango are the foods which are preserved for long time by these families. The major reason given for this habit is that mango and lime have better shelf life compared to other food articles.

Containers used for preserving the food material are presented in table 4.17.

Table 4.17. Containers used for preservation.

Containers used	Number of families
Glass	42
Earthern ware	3
Mud pot	37
Steel vessels	16
Glass and mud pot	13
Glass and steel	11
Mud pot and steel	7

Among various types of containers used for preservation, glass is found to be the most commonly used container for preserving the foods followed by mud pot.

##### 5. Health status of the family members.

Health status of the family members was assessed by collecting information on their mor-bidity status.

Details related to the prevalence of diseases among adult members of the families are presented in table 5.1.

Table 5.1. Prevalence of diseases among adult members.

Particulars related to various diseases	Number of adult members	Per cent
Arthritis	32	8.22
Chest pain	18	4.63
Stomach pain	6	1.54
Drowsiness	5	1.29
Fever	5	1.29
Diabetes	5	1.29
Asthma	5	1.29
Ear pain and puss	4	1.03
Back pain	4	1.03
Ulcer	4	1.03
Tuberculosis	3	0.77
Diarrhoea and dysentery	2	0.51
Mental depression	2	0.51
Pressure	2	0.51
Over bleeding	2	0.51
Jaundice	2	0.51
Gas trouble	1	0.26
Nil	287	73.78
Total	389	100.00

Table 5.1 revealed that 73.78 per cent of the adults have no ailments and health problems and are found to lead a normal healthy life. 8.22 per cent of the adults have arthritis and 4.63 per cent of the adults have chest pain.

Treatments taken for the ailments were also collected and the results were presented in table 5.2.

Table 5.2. Treatments taken for various diseases.

Treatments taken	Number of adults	Per cent
Allopathy	62	60.78
Homoeopathy	5	4.90
Ayurvedic	24	23.53
Medical shop/ self medication	4	3.92
No treatment	7	6.87
Total	102	100.00

As revealed in table 5.2, allopathy is found to be popular followed by ayurvedic treatments. Only 7 per cent of the family members are reported to neglect their ailments.

Table 5.3 presents the reasons suggested for the diseases.

Table 5.3. Reasons suggested for the diseases.

Reasons suggested	Number	Per cent
Don't know	34	33.33
Genetic problem	29	28.44
Gas trouble	8	7.84
Because of old age	10	9.80
Accident	7	6.86
After operation/delivery	6	5.89
Drinking and smoking	4	3.92
Climate	2	1.96
Hot foods	2	1.96
Total	102	100.00

Table 5.3 reveals that 33.33 per cent do not know the reasons for the diseases. 28.44 per cent of the adults conclude that the diseases are due to genetic problem, while reasons given by others are mainly accidents, old age, climate, faulty food habits etc.

The morbidity status of the children are presented in table 5.4.

Table 5.4. Prevalence of diseases among children.

Diseases	Number of children affected	Per cent
Fever	82	21.41
Respiratory diseases	58	15.14
Diarrhoea and dysentery	50	13.05
Cough and cold	36	9.40
Mumps	19	4.96
Scabies	14	3.66
Hookworm	13	3.39
Chicken pox	11	2.87
Jaundice	9	2.35
Stomach pain	6	1.57
Vomitting	5	1.30
Ear pain	4	1.04
Typhoid	4	1.04
Anemia	3	0.79
Constipation	3	0.79
Arthritis	3	0.79
Poleo	3	0.79
Leg pain	2	0.52
Tuberculosis	2	0.52
Cholera	2	0.52
Lungs not in proper position	1	0.26
Frequent urination	1	0.26
Head ache	1	0.26
Nil	51	13.32
Total	383	100.00

As revealed in table, 13 per cent of the children are reported to be free of any diseases other children are found to be affected by fever (21.41 per cent), respiratory diseases (15.14 per cent) diarrhoea and dysentery (13.05 per cent) cold and cough (9.4 per cent), mumps (4.96 per cent), scabies (3.66 per cent) and chicken pox (2.87 per cent).

Table 5.5 presents the age at which the diseases generally occurred to the children.

Table 5.5. Age at which the diseases occurred.

Age group (years)	Age at which occurred	
	Number	Per cent
0 - 1	28	8.43
1 - 2	96	28.91
2 - 3	33	9.94
3 - 4	88	26.52
4 - 6	36	10.84
6 - 9	19	5.72
9 - 12	12	3.61
12 - 15	13	3.92
15 - 18	7	2.11
Total	332	100.00

As revealed in table 5.5, the children are affected by various diseases during infancy and preschool period.

Treatments taken for children are presented in Table 5.6.

Table 5.6. Treatments given to children.

Treatments	Number	Per cent
Allopathy	83	55.33
Homoeopathy	12	8.00
Ayurvedic	9	6.00
Own medication	3	2.00
Allopathy & Ayurvedic	15	10.00
Allopathy & homoeopathy	28	18.67
Total	150	100.00

Among various treatments given to children allopathy is found to be popular (55.33 per cent) followed by Homoeopathy.

Table 5.7 presents the various reasons suggested by the members for the occurrence of the diseases.



Table 5.7. Reasons suggested for the diseases.

Reasons	Number	Per cent
Don't know	59	29.5
General ill health	41	20.5
Change in climate	29	14.5
Genetic problem	41	20.5
Exposure to sun or unhealthy surroundings	30	15.0
Total	200	100.0

As revealed in table 5.7, 29.5 per cent do not know the reasons for the diseases as they are not in the habit of asking doctor the reason for illness. However major reasons suggested are ill health (20.5 per cent) genetic problem (20.5 per cent), exposure to sun or unhealthy surroundings (15 per cent) and change in climate (14.5 per cent).

Table 5.8 presents details regarding the families utilising the primary health care services.

Table 5.8. Details regarding families utilising the primary health care services.

Utilising services	Number	per cent
Yes	107	71.33
No	14	9.34
Yes and also show other doctors	29	19.33
Total	150	100.00

71.33 per cent completely depends upon the primary health care facilities. However 9.34 per cent of the families are not in the habit of utilising the PHC facilities at all. Besides PHC facilities, 19.33 per cent of the families utilises the services of doctors available locally.

Table 5.9 throws light into reasons for not utilising PHC facilities and utilising other doctors.

Table 5.9. Reasons for not using the PHC facilities.

Reason	Number	Per cent
Prefer private doctors in neighbourhood	21	48.83
Transport problem	7	16.28
Attention not adequate	8	18.60
Allergic to injection	1	2.33
Free service and better care in other hospitals	5	11.63
No preference for allopathy treatment	1	2.33
Total	43	100.00

As revealed in table, transport, lack of service facilities and preference for private doctors in neighbourhood are the major reasons for not preferring PHC facilities.

Survey regarding the food habits during special condition are given in table 5.10.



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Table 5.10. Foods given and avoided during special condition.

Condition	Foods given	Foods avoided
Infancy	Breast milk, cow's or goat milk, ragi porridge, rice porridge fruits, tea bun, vegetables, fish	Meat, egg, spiced foods.
Preschool age	All adult foods	Nil
School going age	All adult foods	Nil
Pregnant women	All foods	Papaya
Nursing women	All foods	Nil
After delivery	Certain type of fish and all other foods	Certain type of fish and gas producing foods
Old age	All adult foods	Nil

It is revealed that special care is given in infancy where along with breast milk, cow's/goat milk, ragi/rice porridge etc. are given and meat, egg and spicy foods are avoided. In all other stages of life almost all foods are given except during pregnancy and after delivery. During pregnancy papaya is avoided while after delivery for 41 days certain type of fish, pulses, potato, jack fruit etc. are avoided.

Regarding the health condition of preschool children as assumed by the mothers, details are presented in table 5.11.

Table 5.11. Health status of preschool children as assumed by the mothers.

Health condition	Number	Per cent
Not satisfactory	32	21.33
Satisfactory	112	62.00
Good.	28	16.67
Total	172	100.00

As given in table 5.11 majority of the mothers considered the health status of the preschool children as satisfactory while 21.33 per cent of the mothers felt that it is unsatisfactory. As far as 16.67 per cent of the mothers the health status of children are good.

Table 5.12 represents the reasons for the particular health status as assumed by the mothers.

Table 5.12. Reasons suggested for the health condition.

Reasons	Per cent
<u>Unsatisfactory</u>	
Problem children	44.09
Frequent attack of diseases	20.00
Improper food habits	11.82
Economic condition of families	15.00
Exposure to dirty surroundings rainfall, climate	9.09
Total	100.00
<u>Satisfactory</u>	
Occasionally affected	31.03
Less problems	41.38
Will not disturb others if affected by diseases	27.59
Total	100.00
<u>Good</u>	
Will recover quickly if at all affected	66.67
No problem	33.33
Total	100.00

As revealed in table, frequent attack of diseases (20 per cent), problem children (44 per cent), improper food habits (11.8 per cent) economic condition of the families (15 per cent) and exposure to dirty surroundings etc. (9 per cent) are reported to be the major reasons for unsatisfactory health status of preschool children. While according to the mothers who believe that the children are keeping good and satisfactory health reasons felt are less problems or no problems, only occasionally affected by diseases quick recovery and undisturbing nature of the children.

Details collected regarding immunisation status of preschool children and the reasons if not immunised are shown in table 5.13.

Table 5.13. Immunisation status of the preschool children

Whether immunised or not	Num ber	Per cent	Reasons suggested	Num ber	Per cent
Yes	148	86.05	Exposure to fever etc. at that time	22	91.67
No	24	13.95	Allergic reaction to vaccines	2	8.33
Total	172	100.00	Total	24	100.00

The immunisation status of 86 per cent of preschool children are reported to be satisfactory, 14 per cent are not immunised. The major reasons given for this are the frequent exposure to fever, diarrhoea at the time of immunisation and allergic reactions to vaccines.

#### 6. Food habits of preschool children.

Details regarding the special foods cooked and served, food preference, meal pattern of the children for three days and the behavioural problems of the children and solutions for the problems.

Table 6.1 shows the details of special foods cooked for the preschool children.

Table 6.1. Special foods cooked for the children.

Whether special foods cooked or not	Per cent
Yes	53.33
No	46.67
Total	100.00



It reveals that 53.33 per cent of children are given special foods while 46.67 per cent are not given special foods.

Types of special foods given to the preschool children are presented in table 6.2.

Table 6.2. Types of special foods cooked.

Special foods given	Families preparing special foods	
	Number	Per cent
Ragi porridge	60	75.00
Ragi porridge with milk	15	20.00
Banana porridge	24	30.00
Banana porridge with milk	18	22.50
Boiled banana	13	16.25
Avaloose podi (Rice, Coconut + jaggery)	6	7.50
Rice balls	19	23.75
Wheat balls	4	5.00
Uppuna	2	2.50
Rava kanji	4	5.00
Dhal smash	9	11.25
Vegetable smash	4	5.00
Greens soup	3	2.50
Boiled egg	7	8.75

As revealed in table 6.2, basic foods used for the preparation of special foods cooked for the preschool children are mainly ragi (95 per cent) banana (68.75 per cent) rice (31.25 per cent) wheat (5 per cent) Rava (7.5 per cent) pulses (11.25 per cent) vegetables (5. per cent) green leafy vegetables (2.5 per cent) and egg (8.75 per cent).

Table 6.3 shows the details of food stuffs used for special preparation.

As revealed in table, foods such as ragi, rice, wheat, rava, coconut, red gram dhal, milk, egg, banana, green leafy vegetables, other vegetables, sugar and jaggery were included for the special foods prepared for preschool children.

Table 6.3. Food stuffs used for special foods prepared for preschool children.

Preparation	Rice	Ragi	Wheat	Rava	Coco- nut	Red gram dhal	Milk	Egg	Banana	Green leafy vege- tables	Other vege- tables	Sugar	Jaggery
Ragi porridge		X											X
Ragi porridge with milk		X					X						X
Banana porridge									X				X
Banana porridge with milk							X		X				X
Boiled banana									X				
Avaloose podi	X				X								X
Rice balls	X				X								X
Wheat balls			X		X								X
Uppuma				X	X								
Rava kanji				X			X					X	
Dhal smash						X							
Vegetable smash											X		
Greens soup										X			
Boiled egg								X					

Table 6.4 depicts the frequency of special foods given to children.

Table 6.4. Frequency of special foods given to children.

Preparations	Twice/ day		Once/ day		Once in 2 days		Less than 3/week		Once in a week		Twice/ month		Once/ month	
	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
Ragi porridge	38	63.34	6	10.00	2	3.33	9	15.00	2	3.33	1	1.67	2	3.33
Ragi porridge with milk	3	18.75	10	62.50	1	6.25	2	12.50	-	-	-	-	-	-
Banana porridge	6	25.00	13	54.17	3	12.50	2	8.33	-	-	-	-	-	-
Banana porridge with milk	-	-	13	44.83	6	20.69	2	6.89	8	27.59	-	-	-	-
Boiled banana	-	-	3	23.08	4	30.77	2	15.38	4	30.77	-	-	-	-
Avalose podi	2	33.20	2	33.30	-	-	2	33.40	-	-	-	-	-	-
Rice balls	8	44.44	2	11.11	1	5.56	6	33.33	1	5.56	-	-	-	-
Wheat balls	-	-	-	-	2	50.00	-	-	2	50.00	-	-	-	-
Uppuna	-	-	-	-	1	50.00	-	-	1	50.00	-	-	-	-
Rava kanji	-	-	-	-	-	-	2	50.00	2	50.00	-	-	-	-
Dhal smash	-	-	2	22.22	3	33.34	1	11.11	3	33.33	-	-	-	-
Vegetable smash	-	-	-	-	4	100.00	-	-	-	-	-	-	-	-
Greens soup	-	-	-	-	-	-	2	66.67	1	33.33	-	-	-	-
Boiled egg	-	-	-	-	-	-	3	42.86	2	28.57	2	28.57	-	-

This also reveals that due weightage is given to locally available and age old customs prevalent in the community for preparing the special food.

Table 6.5 represents the members influencing the food habits of the preschool children.

Table 6.5. Members influencing the food habits of preschool children.

Members	Number	Per cent
Mother	76	50.67
Father	28	18.67
Older members	12	8.00
Neighbours	7	4.67
Friends	3	2.00
Relatives	8	5.33
Doctor/Nurse	16	10.66
Total	150	100.00

Table 6.5 reveals that mothers are mainly involved in influencing the food habits of children.

Table 6.6 represents the members involved in feeding the preschool children.

Table 6.6. Details of family members involved in feeding the preschool children.

Members	Number	Per cent
Mother	67	44.67
Children by themselves	42	28.00
Grand parents	10	6.66
Father	4	2.67
Other elder members	27	18.00
Total	150	100.00

Table 6.6 also shows that mothers are mainly responsible for feeding the preschool children.

From the survey conducted, the foods preferred by the preschool children were found out and the data is presented in table 6.7.

Table 6.7. Foods preferred by the preschool children.

Food preparations	Children pre- ferring the food		Children not pre- ferring the food	
	Number	Per cent	Number	Per cent
Rice preparations	136	79.07	36	20.93
Rice with fish	128	74.42	44	25.58
Confectionaries	113	65.70	59	34.30
Tapioca with fish	113	65.70	59	34.30
Ground nut	90	52.33	82	47.67
Milk and curd	58	33.72	114	66.28
Wheat preparations	48	27.91	124	72.09
Fruits	46	26.74	126	73.26
Pulses	45	26.16	127	73.84
Meat and egg	23	13.37	149	86.63
Vegetables	17	9.88	155	90.12

As revealed in table rice based preparations are mostly preferred by the preschool children. Tapioca with fish and confectionaries are other foods which are consumed without reluctance.

Menu pattern of preschool children was studied in detail by recall method for three consequent days and the average for each food combinations was taken and details are presented in table 6.8.

Table 6.8. Menu pattern of the preschool children.

Food combinations	Average for 3 days							
	Breakfast		Lunch		Tea		Dinner	
	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
Cereals with sugar/ jaggery	45.33	30.22	-	-	10.00	6.67	-	-
Cereals with chillies	15.67	10.47	-	-	0.67	0.45	0.67	0.45
Cereals with fish	26.00	17.33	46.33	30.89	8.00	5.33	74.33	49.55
Cereals with pulses	3.00	2.00	51.67	34.45	0.34	0.22	1.00	0.67
Cereals with vegetables	4.33	2.88	10.00	6.67	1.00	0.67	7.33	4.88
Cereals with fruits	18.00	12.00	-	-	7.33	4.89	-	-
Cereals with tubers	3.00	2.00	7.33	4.89	3.33	2.22	2.00	1.33
Cereals with pappads	5.00	3.33	-	-	1.33	0.89	-	-
Cereals, tubers & fish	4.00	2.67	22.67	15.11	0.67	0.45	58.00	38.67
Cereals, pulses and vegetables	2.33	1.55	3.33	2.22	-	-	0.33	0.23
Cereals, fish and vegetables	2.00	1.33	5.33	3.55	-	-	4.33	2.88
Cereals with egg	2.00	1.33	1.67	1.11	-	-	-	-
Cereals with pappad & butter milk	-	-	1.33	0.89	-	-	0.34	0.23
Cereals alone	1.33	0.89	-	-	76.33	50.88	-	-
Tubers alone	7.33	4.89	-	-	17.00	11.33	-	-
Tubers with fish	10.67	7.11	0.34	0.22	24.00	16.00	1.67	1.11
Total	150.00	100	150	100	150	100	150	100



Table 6.8 reveals that for break fast cereals with sugar/jaggery, fish, chillies and tubers with fish are mostly preferred. For lunch, cereals with fish, chillies, pappads and vegetables are preferred respectively. For tea, cereals alone, tubers with fish, tubers alone and cereals with sugar/jaggery is preferred. For dinner, cereals with fish is used by 50 per cent of the families and cereals, tubers and fish is preferred by 39 per cent of the families surveyed.

Table 6.9 represents details of family members who are responsible for child care activities.

Table 6.9. Family members responsible for child care activities.

Family members responsible.	Number of families	Per cent
Mother	49	32.67
Mother and father	23	15.33
Any family members free of activity	19	12.67
Mother and grand parents	18	12.00
Children by themselves	14	9.33
Grand parents	12	8.00
Elder children	7	4.67
Relatives	6	4.00
Father	2	1.33
Total	150	100.00

Table 6.9 depicts that both the parents mainly mothers are responsible for child care activities. The data also revealed that in 14 per cent of families children are allowed to take care by themselves or they are assisted by elder children. In 12 per cent of families no person is found to be specifically responsible for the activity.

Table 6.10 presents the reasons for the particular members to be involved in child care activities.

Table 6.10. Reasons for members engaged in child care activities.

Reasons	Number	Per cent
<u>Mother</u>		
It is the duty of mothers	48	32.00
Child will obey only the mother	5	3.33
Father/others have no time	19	12.67
Others do not know to manage children	36	24.00
Elder children are preoccupied because of their studies or play	7	4.67
<u>Other members</u>		
If mother is not well/gone away	3	2.00
Grand parents/other dependents have time to take care of children	19	12.66
Children look after by themselves	13	8.67
Total	150	100.00

As revealed in table 6.10 the reason for mother taking the main burden of child care, duty of mother, non availability of time and lack of knowledge regarding child care among other members of the family are the main reasons cited for the above. Non availability of mother at home, generally make other family members to take up these activities.

Details regarding the behavioural problem of preschool children are monitored and details are presented in table 6.11.

Table 6.11. Behavioural problems of preschool children.

Behavioural problem	Number	Per cent
Fighting with friends (F.F)	47	25.54
Nail biting (N.B)	41	22.28
Bed wetting (B.W)	40	21.74
Thumb sucking (T.S)	25	13.59
Eating clay, chalk etc. (E.C)	21	11.41
Chewing clothes, handkerchief (C.C)	6	3.26
Day dreaming (D.D)	4	2.18

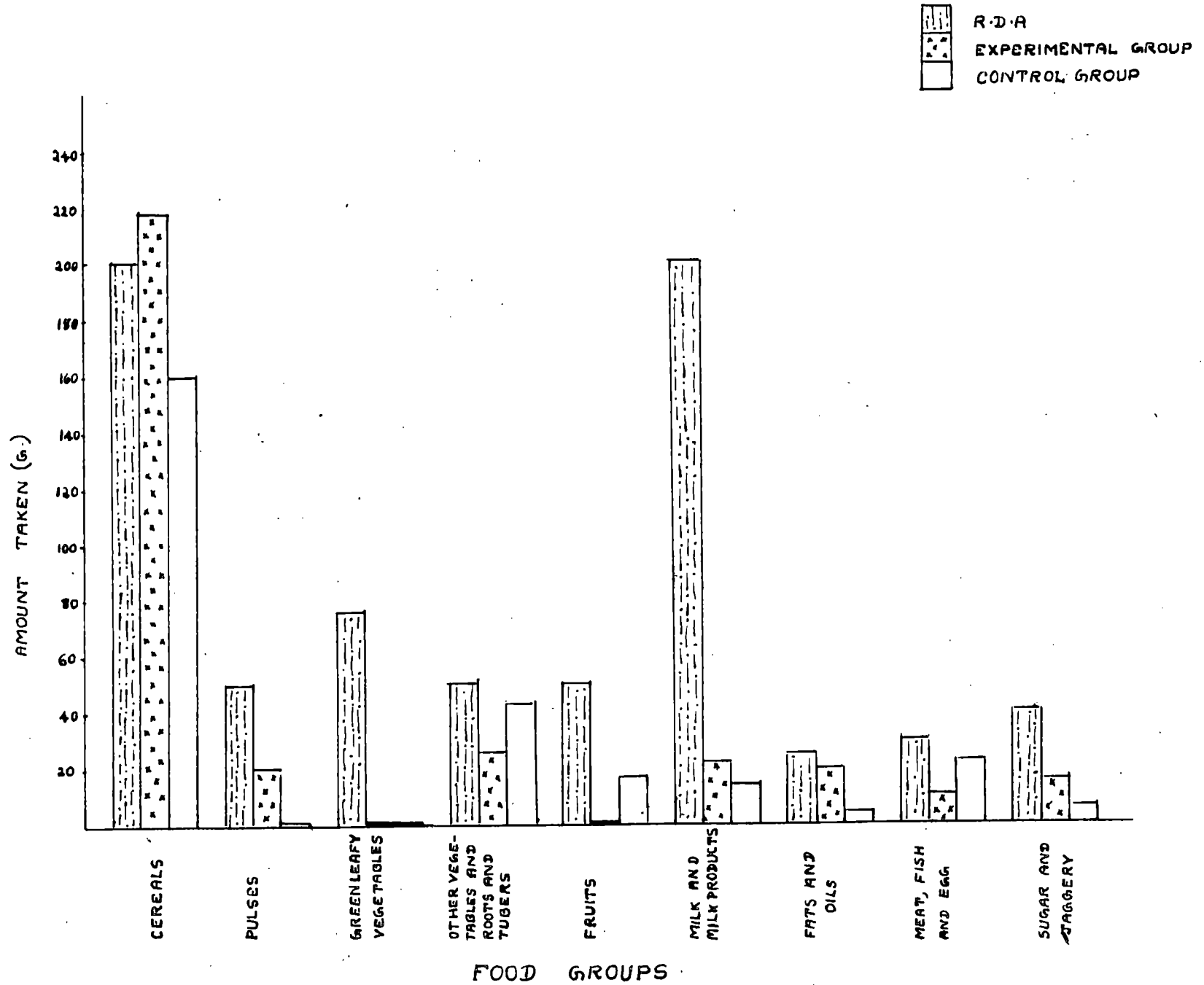
As revealed in table N.B, B.W and F.F are found to be the common behavioural problem prevalent among the children.

Table 6.12 represents the steps taken to solve the problem.

Table 6.12. Steps taken to solve the problem.

Steps taken	F.F.		N.B		B.W.		T.S.		E.C.		C.C.		D.D.	
	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent	Num	Per cent
Advice/ counselling	37	66.07	17	32.69	16	38.10	7	30.44	10	47.62	6	100.00	3	50.00
Punishment	16	28.57	2	3.85	5	11.9	4	17.39	4	19.05	-	-	-	-
Treatment	-	-	-	-	-	-	-	-	7	33.33	-	-	-	-
Distracting attention by giving some other work	3	5.36	-	-	-	-	12	52.17	-	-	-	-	3	50.00
Active step to correct the defect	-	-	33	63.46	21	50.00	-	-	-	-	-	-	-	-
Total	-	100.00	-	100.00	-	100.00	-	100.00	-	100.00	-	100.00	-	100.00

FIG. 5 AVERAGE FOOD CONSUMPTION OF CHILDREN



Good advice seems to be the best and mostly used method for correction of the problem. Punishments are also given and treatment is given to children for eating clay, chalk etc. because it is felt that such behaviour is due to food inadequacy.

### 7. Dietary intake of preschool children.

Dietary intake of ten children, five from the control and five from the experimental group were assessed by one day weighment survey. Comparisons of the diets are made with the recommended daily allowances of ICMR (1982).

The average quantity of foods consumed daily by the children (Fig.5) is given in table 7.1.

Table 7.1. Average food consumption of children.

Food groups	R.D.A.	Experimental group		Control group	
		Amount taken	Percentage of RDA met	Amount taken	Percentage of RDA met
Cereals	200	219.00	109.50	159.00	79.50
Pulses	50	19.70	39.40	1.00	2.00
Green leafy vegetables	75	--	--	--	--
Other vegetables and roots and tubers	50	26.00	52.00	42.80	85.60
Fruits	50	--	--	17.00	34.00
Milk & milk products	200	21.75	10.88	14.00	7.00
Fats and oils	25	19.10	76.40	4.40	17.60
Meat, fish and egg	30	10.40	34.67	22.40	74.67
Sugar and jaggery	40	15.35	38.38	6.20	15.50

FIG. 6

AVERAGE NUTRIENT CONSUMPTION OF CHILDREN

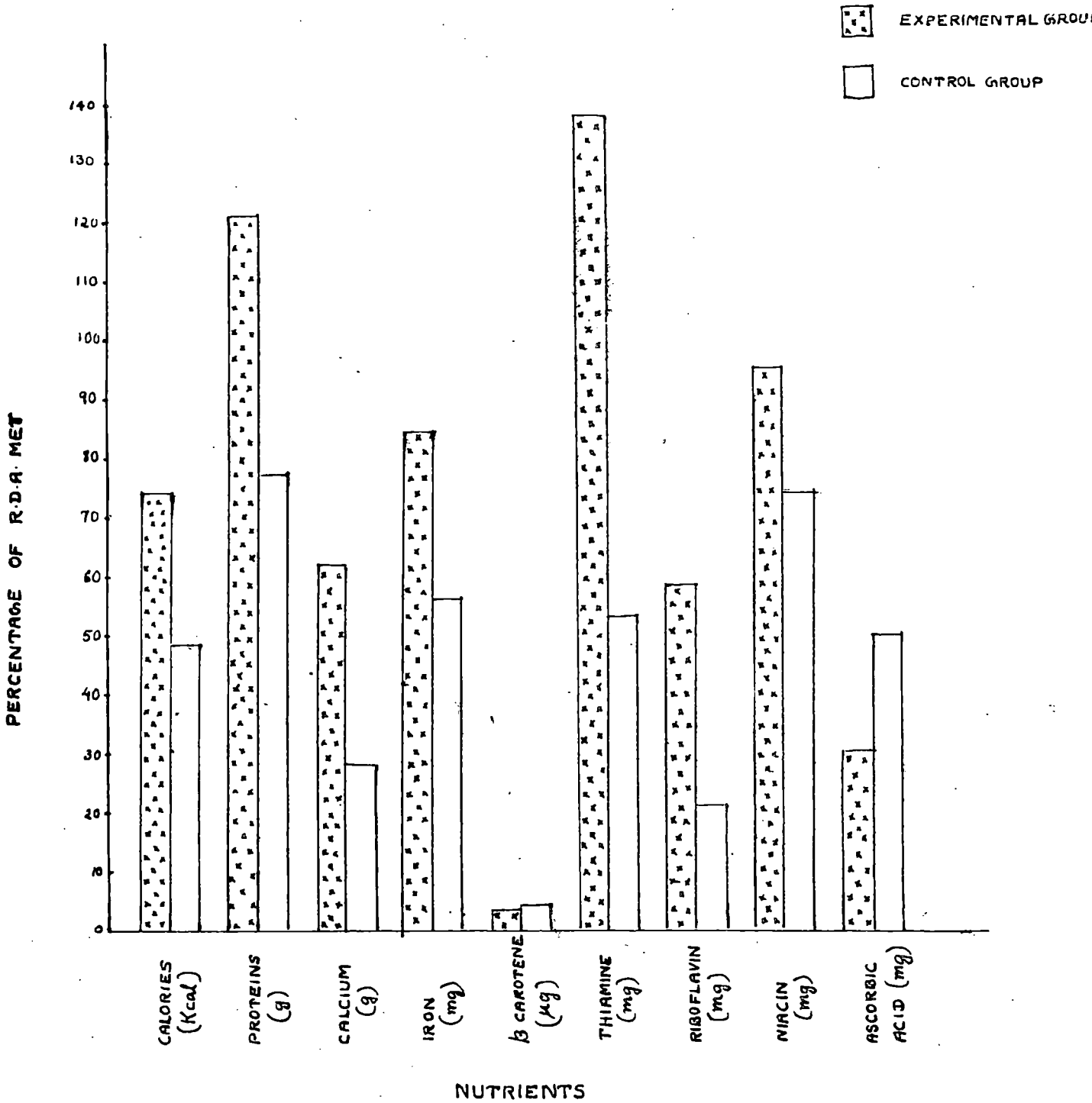


Table 7.1 reveals that the recommended allowances is met for cereals completely and more than 75 per cent is met for fats and oils in the case of experimental group. In case of the control group, cereals, other vegetables and roots and tubers and meat, fish and egg are included above 70 per cent. 39.4 per cent and only two per cent of recommended allowances of pulses are met by the experimental and control groups respectively. In both the cases consumption of milk and milk products are found to be highly negligible.

Average nutrient consumption of children is calculated from the above data (Fig.6) and the results are presented in table 7.2.

Table 7.2. Average nutrient consumption of children.

Nutrients	R.D.A.	Experimental group		Control group	
		Amount taken	Percentage of RDA met	Amount taken	Percentage of RDA met
Calories (K.cal)	1500	1106	73.73	713.00	47.53
Proteins (g)	22	26.70	121.36	16.90	76.82
Calcium (g)	0.4 to 0.5	0.25	61.75	0.11	27.75
Iron (mg)	15-20	12.60	84.00	8.40	56.00
B.cartone ( $\mu\text{g}$ )	1200	30.00	2.50	52.00	4.33
Thiamine (mg)	0.8	1.10	137.50	0.42	52.50
Riboflavin (mg)	0.8	0.46	57.50	0.17	21.25
Niacin (mg)	10	9.50	95.00	7.40	74.00
Ascorbic acid (mg)	30-50	9.00	30.00	15.00	50.00



Table 7.2 reveals that all nutrients except proteins and thiamine are not met adequately by the experimental group, and more than 70 per cent of requirements for calories, iron and niacin are met. In the case of the control group more than 70 per cent of the recommended allowances is met only for two nutrients namely proteins and niacin. More than 50 per cent of the recommended allowances is met for calcium and riboflavin in the case of experimental group and iron and thiamine in the case of control group.

#### B. ACCEPTANCE OF A SUPPLEMENTARY FOOD PREPARED WITH RAGI.

The acceptance of a supplementary food prepared with ragi was determined by developing suitable recipes for preschool children and the results are presented under the following headings.

1. Formulation and standardisation of recipes in the laboratory using ragi flour as a base.
2. Acceptability of ragi biscuits.

1. Formulation and standardisation of recipes in the laboratory using ragi flour as a base.

Developing suitable recipes for the preschool children based on the supplementary food prepared with ragi is the second objective of the study. A basic mix with ingredients ragi, green gram or sesame or groundnut, skim milk powder, butter and sugar was standardised and six combinations formulated are presented in table 1.1.

Table 1.1. Percentage composition of six combinations of ragi biscuits.

Ragi	30	30	30	30	30	30
Green gram	10	--	--	10	10	--
Sesame	--	10	--	10	--	10
Ground nut	--	--	10	--	10	10
Skim milk powder	25	25	25	15	15	5
Butter	10	10	10	10	10	10
Sugar	25	25	25	25	25	25
Total	100	100	100	100	100	100

Ragi was added in the proportion of 30 per cent in the different combinations of weaning formulae standardised while greengram, sesame, groundnut and butter were added in the proportion of 10 per cent. Skim milk powder was added in the proportion of 15 or 25 per cent and sugar is added in the proportion of 25 per cent for all the six combinations.

Table 1.2 represents the percentage preparation loss assessed for the six types of ragi biscuits.

Table 1.2. Percentage preparation loss for different types of ragi biscuits.

Types	AP weight (g)	EP weight (g)	Percentage preparation loss
1	120	100	0.17
2	125	95	0.24
3	132	104	0.21
4	125	90	0.28
5	128	99	0.23
6	132	88	0.33

As indicated in the table the percentage preparation loss is highest for group 6 which ranks least and this type score lowest marks for acceptability trials. The percentage preparation loss in general is mainly due to the removal of skin from ground nut after purchase and foreign materials and impurities from other food articles like ragi and sesame. Percentage preparation loss is lowest in type 1 ragi biscuits.

Cost per serving of the different types of ragi biscuits were worked out and are given in table 1.3.

Table 1.3. Cost per serving.

Type	Cost per serving (PS)
1	52
2	55
3	54
4	46
5	46
6	49

As revealed in table 1.3 the cost per serving is lowest for group 4 and 5 and it is highest for group 2 and 3.

Percentage yield is worked out for different types of ragi biscuits and the results are given in table 1.4.

Table 1.4. Percentage yield for the different types of ragi biscuits.

Types	Weight before cooking (g)	Weight after cooking (g)	Percentage yield
1	100	84	84
2	90	78	82
3	104	85	82
4	102	83	81
5	94	78	83
6	117	95	81

As evidenced from the table there is no significant variation in the percentage yield of the biscuits tried. Since among the various tests conducted no significant variation is observed. Type 1 ragi biscuits which gave the highest value for acceptability, amino acid profile, protein content, cost of biscuits prepared is selected for feeding the preschool children.

## 2. Acceptability of ragi biscuits.

Acceptability test of the six types of ragi biscuits was conducted at the laboratory level with the help of ten panel members.

Preference of the panel members for the six types of biscuits were tested and the results are presented in table 2.1.

Table 2.1. Preference of panel members for the six types of ragi biscuits.

Types	Highly accep- table	Accep- table	Slightly accep- table	Neither accept- able nor unaccep- table	Slightly unaccep- table	Un- accep- table	Highly unacce- ptable
1	10	60	30	--	--	--	--
2	10	60	10	20	--	--	--
3	10	50	20	20	--	--	--
4	--	50	40	10	--	--	--
5	--	40	40	20	--	--	--
6	--	30	40	20	10	--	--

As revealed in table 2.1, the preference of panel members was found to be higher in the case of the first three groups than the remaining.

The average scores obtained for the overall acceptability according to ranking for the six types of ragi biscuits are presented in table 2.2.

Table 2.2. Average scores for overall acceptability for ragi biscuits according to ranking.

Types of ragi biscuits	Average score according to ranking
1	22
2	24
3	25
4	26
5	28
6	31

The table reveals that there is no significant difference between the six groups of the biscuits prepared as evidenced by the analysis of variance. However, more preference is given for type 1 ragi biscuit.

Fig. 7a. Ragi biscuits

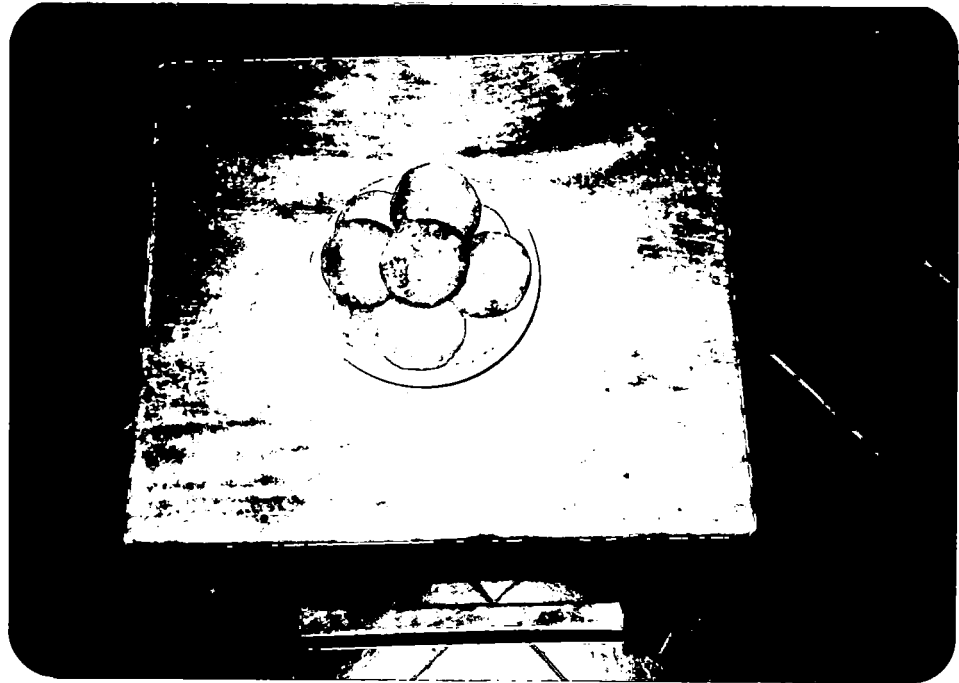
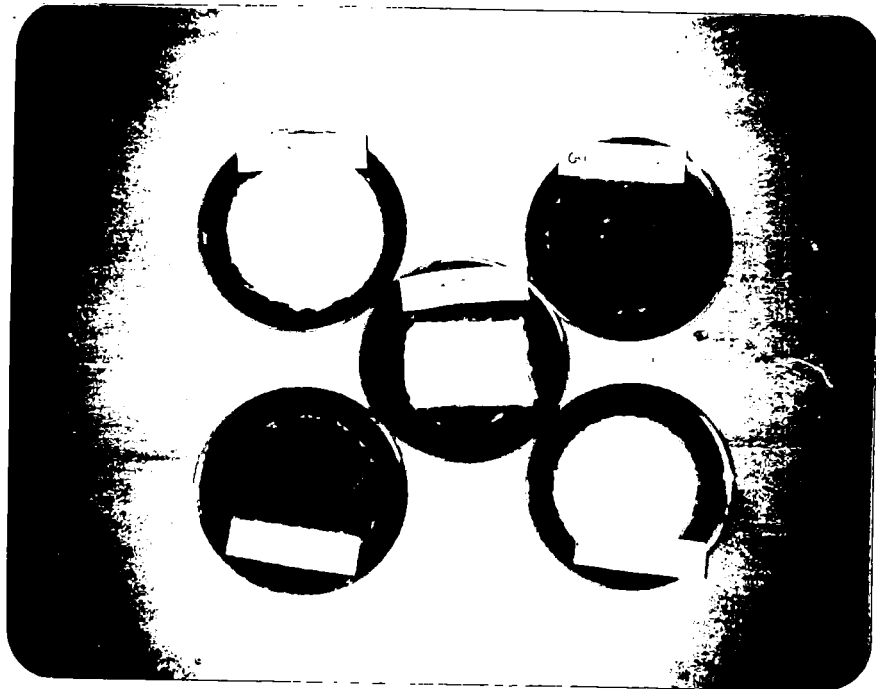


Fig. 7b. Ingredients used in the preparation of ragi biscuit





The average score obtained for the acceptability on a five point hedonic scale is presented in table 2.3.

Table 2.3. Average score for acceptability on a five point hedonic scale.

Type	Average score according to marks
1	16.2
2	15.7
3	15.3
4	14.6
5	14.1
6	13.6

As revealed in table 2.3 highest score is obtained for type 1 ragi biscuit, followed by 2, 3, 4, 5 and 6 respectively. The average scores obtained was not significantly different among types 1, 2, 3, 4, 5 and 6 as evidenced by the analysis of variance.

Since among the various tests conducted no significant variation is observed. Type 1 ragi biscuits (Fig.7) which gave the highest value for acceptability, amino acid profile, protein content, cost of biscuits prepared is selected for feeding the preschool children.

The nutritional quality for 100 g of type 1 biscuits calculated and is presented in table 2.4.

Table 2.4. Nutritional quality of 100 g of type 1 ragi biscuits.

Nutrients	Nutrient content (100 g)
Calories (K.cal)	394.00
Protein (g)	14.10
Calcium (mg)	461.00
Iron (mg)	3.00
B. carotene ( $\mu$ g)	342.00
Thiamine (mg)	0.28
Riboflavin (mg)	0.49
Niacin (mg)	0.80
Vitamin C (mg)	1.00

Table 2.4 reveals that 100 g of ragi biscuits supply 14.1 g of protein.

Actually it was decided to supply three biscuits daily. The weight of three ragi biscuits are 27 g and the nutrient content of the three biscuits are presented in table 2.5.

Table 2.5. Nutrient content of three ragi biscuits.

Nutrients	Nutrient content for three biscuits
Calories (K. cal)	106.00
Protein (g)	3.80
Calcium (mg)	124.00
Iron (g)	0.80
B. carotene (µg)	92.00
Thiamina (mg)	0.08
Riboflavin (mg)	0.13
Niacin (mg)	0.20
Vitamin C (mg)	--

Table 2.5 reveals that three ragi biscuits supplies 3.8 g of protein and 106 K. cal of calories.

#### C. THE EFFECT OF RAGI BASED SUPPLEMENTARY FOOD ON THE NUTRITIONAL STATUS OF SELECTED PRESCHOOL CHILDREN.

The results are presented under the following headings:

1. Conduct of the experiment
2. Assessing nutritional status of the preschool children

1. Conduct of the experiment.

40 preschool children selected as experimental group were given three ragi biscuits along with their regular anganwadi feed and this experiment was conducted for six months.

Table 1.1 represented the availability of different food articles from home diet, anganwadi diet and ragi biscuits daily for the experimental group.

Table 1.1. Availability of foods for the experimental group.

Food groups	RDA	Home diet		Anganwadi diet		Ragi biscuits		Total Availability	
		Quantity	Per cent of RDA	Quantity	Per cent of RDA	Quantity	Per cent of RDA	Quantity	Per cent of RDA met
Cereals	200	96	48.00	115	57.50	8.1	4.05	219	109.55
Pulses	50	2	4.00	15	30.00	2.7	5.40	19.7	39.70
Green leafy vegetables	75	-	-	-	-	-	-	-	-
Other vegetables & roots & tubers	50	26	52.00	-	-	-	-	26	52.00
Fruits	50	-	-	-	-	-	-	-	-
Milk & milk products	200	15	7.50	-	-	6.75	3.40	21.75	10.88
Fats & oils	25	8.4	33.60	8	32.00	2.7	10.80	19.1	76.40
Meat, fish and egg	30	104	34.67	-	-	-	-	10.4	34.67
Sugar & jaggery	40	8.6	21.50	-	-	6.75	16.87	15.35	38.38

Table 1.1 reveals that anganwadi diet supplies 57.5 per cent of the recommended allowances of cereals, 30 per cent of pulses and 32 per cent of fats and oils while through ragi biscuits 3.4 per cent of requirement for milk and milk products and 16.87 per cent of requirements for sugar and jaggery is supplied. However the recommended allowances for cereals is met fully through home diet and anganwadi diet while 75 per cent is met for fats and oils.

Table 1.2 presents the availability of nutrients for the experimental group from home diet, anganwadi diet and ragi biscuits daily for the experimental group in the anganwadi.

Table 1.2. Availability of nutrients for the experimental group.

Nutrients	RDA	Home diet		Anganwadi diet		Ragi biscuits		Total availability	
		Quantity	% of RDA met	Quantity	% of RDA met	Quantity	% of RDA met	Quantity	% of RDA met
Calories (K. cals)	1500	474	31.60	526	35.07	106	7.07	1106	73.73
Protein (g)	22	10.80	49.09	12.10	55.00	3.80	17.27	26.70	121.36
Calcium (g)	0.4 to 0.5	0.08	18.75	0.05	12.00	0.12	31.00	0.25	61.75
Iron (mg)	15 to 20	5.60	37.33	6.30	42.00	0.72	4.80	12.60	84.00
B.Carotene ( )	1200	16.00	1.33	14.00	1.17	-	-	30.00	2.50
Thiamine (mg)	0.80	0.27	33.75	0.70	87.50	0.13	16.25	1.10	137.50
Riboflavin (mg)	0.80	0.13	16.25	0.13	16.25	0.20	25.00	0.46	57.50
Niacin (mg)	10.00	4.20	42.00	5.30	53.00	-	-	9.50	95.00
Ascorbic acid (mg)	30 to 50	8.00	26.67	-	-	1.00	3.30	9.00	30.00

Table 1.2 reveals that 35.07 per cent and 7.07 per cent of recommended allowances of calories is met by the anganwadi diet and ragi biscuits respectively. 55 per cent of protein is supplied by the anganwadi diet and 17.27 per cent of protein is supplied by the ragi biscuits. Recommended allowances for protein and thiamine are met fully and above 70 per cent for calories, iron and niacin.

The details related to the attendance of the experimental group, reaction of the preschool children towards the ragi biscuits etc. are presented below.

Table 1.3 represents the details related to the attendance of the experimental group for the six months.

Table 1.3. Details related to the attendance.

Months	Average number of days	Percentage of attendance
After first	22	90.8
After second	24	92.5
After third	23	84.9
After fourth	21	88.7
After fifth	24	95.2
After sixth	22	98.6

As revealed in table 1.3 after the fourth month percentage of the attendance increased above 95 whereas during the last month 98.6 percentage of attendance is noted.

When the reaction towards the ragi biscuits by the experimental group is concluded, there was no plate waste at all during the experimental period of six months and all the children had taken the three biscuits given daily. Mothers of the children were eager to know about the preparation method and they concludes that the children like the ragi biscuits very well.

## 2. The nutritional status of the preschool children.

Nutritional status of the selected preschool children is assessed by collecting base line information on anthropometric measurements, clinical tests and haemoglobin estimation. The anthropometric measurements of preschool children both experimental and control before and after the experiment are compared with standards suggested by Rao et al. (1976).

The weight for age profile of the preschool children (Experimental) before experiment is presented in table 2.1.



Table 2.1. Weight for age profile before the experiment.

Age in ranges (months)	Sex	Number of children	Observed value(kg)	Standard Value(kg)	t value
37 - 42	M	6	11.78	13.40	13.50**
	F	5	11.14	12.00	5.06**
43 - 48	M	6	12.67	14.25	7.90**
	F	6	11.45	13.50	25.62**
49 - 54	M	5	13.72	15.50	29.67**
	F	6	12.85	14.25	15.25**
55 - 65	M	-	-	-	-
	F	6	15.03	15.25	0.24

\*\* Significant at 1 per cent level

Table 2.1 depicts that there is significant difference in weight between the preschool children selected for the study and the standards, except for the age group above 55 months.

The weight for age profile of the same preschool children after the experiment is presented in table 2.2.

Table 2.2. Weight for age profile after the experiment.

Age in ranges (months)	Sex	Number of children	Observed value (kg)	Standard value (kg)	t value
43 - 48	M	6	14.03	14.25	2.75*
	F	5	13.40	13.50	2.00
49 - 54	M	6	14.90	15.50	15.00**
	F	6	14.08	14.25	4.25**
55 - 60	M	5	15.88	16.40	14.86**
	F	6	14.82	15.25	6.14**
61 - 72	M	-	-	-	-
	F	6	16.88	16.74	0.31

\* Significant at 5 per cent level  
 \*\* Significant at 1 per cent level

Table 2.2 depicts that even after the experiment, the weight of preschool children is not significantly comparable with the standard values. However the trend shown by female children in the age group of 43 - 48 months is found to be different.

The children are classified by Gomez system (NIN 1975) which termed young children who are between 90 per cent and 76 per cent of the Harward standard for body weight as first degree malnutrition; between 75 to 61 per cent as second degree malnutrition and 60 per cent and below as third degree malnutrition and the results obtained by Gomez grading are presented in table 2.3.

Table 2.3. Percentage distribution of the children according to their weights in each age group before and after the experiment.

Age in ranges (months)	Before experiment				After experiment					
	Total children	Normal		1st degree mal-nutrition		Total children	Normal		1st degree mal-nutrition	
		Num	Per cent	Num	Per cent		Num	Per cent	Num	Per cent
		ber		ber			ber		ber	
37 - 42	11	7	63.64	4	36.36	-	-	-	-	
43 - 48	12	3	25.00	9	75.00	11	11	100	-	
49 - 54	11	5	45.45	6	54.55	12	12	100	-	
55 - 60	3	1	33.33	2	66.67	11	11	100	-	
61 - 72	3	3	100	-	-	6	6	100	-	

Table 2.3 reveals that before experiment 36 to 75 per cent of the preschool children of different age group were in the State of first degree malnutrition. On completion of the experiment all the children became normal.

Height for age profile of the experimental group before and after feeding is presented in table 2.4 and table 2.5 respectively.

Table 2.4. Height for age profile before the experiment.

Age in ranges (months)	Sex	Number of children	Observed value (cms)	Standard value (cms)	t value
37 - 42	M	6	91.30	92.9	0.16
	F	5	89.76	92.9	0.53
43 - 48	M	6	93.05	99.2	3.96*
	F	6	89.87	99.2	1.49
49 - 54	M	5	96.34	99.2	0.97
	F	6	92.58	99.2	1.20
55 - 66	M	-	-	-	-
	F	6	99.62	99.2	0.06

\* Significant at 5 per cent level

As revealed in table 2.4 there was no significant difference between the experimental group and standard before the experiment except in case of male children who belonged to the age group of 43 - 48 months.

Table 2.5. Height for age profile after the experiment.

Age in ranges (months)	Sex	Number of children	Observed value (cms)	Standard value (cms)	t value
43 - 48	M	6	96.80	99.2	0.20
	F	5	95.74	99.2	0.63
49 - 54	M	6	98.50	99.2	1.35
	F	6	96.07	99.2	0.28
55 - 60	M	5	102.06	99.2	1.36
	F	6	98.30	99.2	0.18
61 - 72	M	-	-	-	-
	F	6	104.70	106.4	29.00**

\*\* Significant at 1 per cent level

As revealed in table 2.5, even after the experiment there was no significant difference between the experimental group and standard except in case of male children who belonged to the age group of 61 - 72 months.

Profile for arm circumference for the preschool children before and after the experiment are presented in table 2.6 and table 2.7 respectively.

Table 2.6. Profile of arm circumference for different age groups before the experiment.

Age in ranges (months)	Sex	Number of children	Observed value (cms)	Standard value (cms)	t value
37 - 42	M	6	13.62	16.0	34.00**
	F	5	13.44	15.9	24.60**
43 - 48	M	6	14.22	16.3	4.24**
	F	6	13.77	16.4	29.90**
49 - 54	M	5	14.84	16.3	2.56
	F	6	14.20	16.4	12.94**
55 - 66	M	-	-	-	-
	F	6	15.18	16.5	11.00**

\*\* Significant at 1 per cent level

Table 2.6 depicts that there was significant difference when the experimental group was compared to standard except in the case of male children in the age group of 49 - 54 months.

Table 2.7. Profile of arm circumference for preschool children after the experiment.

Age in ranges (months)	Sex	Number of children	Observed value (cms)	Standard value (cms)	t value
43 - 48	M	6	14.85	16.3	11.15**
	F	5	14.84	16.4	7.45**
49 - 54	M	6	15.53	16.3	1.28
	F	6	15.07	16.4	3.80*
55 - 60	M	5	15.74	16.3	1.70
	F	6	15.28	16.5	4.50**
61 - 72	M	-	-	-	-
	F	6	16.35	16.5	0.45

\*\* Significant at 1 per cent level

\* Significant at 5 per cent level

Table 2.7 represents that except in the case of male children in the age group of 49 - 54 months and 55 - 60 months and children above 61 months, all other children are significantly different than the standard.

Chest/head ratio of the preschool children are also assessed to have an idea about the body build of the children and presented in table 2.8.

Table 2.8. Chest/Head ratio of the experimental group before and after the experiment.

Age in ranges (months)	Sex	Before the experiment				After the experiment					
		Total no. of children	Ratio less than one		Ratio one or more than one		Total no. of children	Ratio less than one		Ratio one or more than one	
			Num	Per cent	Num	Per cent		Num	Per cent	Num	Per cent
37 - 42	M	6	2	33.33	4	66.67	-	-	-	-	
	F	5	-	-	5	100.00	-	-	-	-	
43 - 48	M	6	-	-	6	100.00	6	-	-	6	100
	F	6	1	16.67	5	83.33	5	-	-	5	100
49 - 54	M	5	-	-	6	100.00	6	-	-	6	100
	F	6	1	16.67	5	83.33	6	-	-	6	100
55 - 60	M	-	-	-	-	-	5	-	-	5	100
	F	3	-	-	3	100.00	6	-	-	6	100
61 - 72	M	-	-	-	-	-	-	-	-	-	-
	F	3	-	-	3	100.00	6	-	-	6	100

As revealed in table 2.8, 10 per cent of the preschool children has reported to have chest/head ratio less than one and after the experiment all of them had their chest/head ratio more than one.

The mean anthropometric measurements of both the experimental and control group is assessed and the test of significance between the two groups are calculated.

The mean weight status of the preschool children is presented in table 2.9.

Table 2.9. Mean weight status of preschool children.

Month	Experimental group	Control group	t value
Initial	12.68 kg	12.57 kg	0.28
After first	13.01 kg	12.80 kg	0.55
After second	13.42 kg	13.02 kg	1.06
After third	13.74 kg	13.18 kg	1.54
After fourth	14.06 kg	13.40 kg	1.88@
After fifth	14.44 kg	13.75 kg	2.00@
After sixth	14.85 kg	14.10 kg	2.20*
Average	13.74 kg	13.26 kg	1.35

\* Significant at 5 per cent level

@ Significant at 10 per cent level



Table 2.9 represents that mean weight of the experimental group is significantly better than the control group after six months feeding.

Table 2.10 presented the mean height status of the experimental and control group.

Table 2.10. Mean height status of preschool children.

Month	Experimental group(cms)	Control group(cms)	t value
Initial	93.23	93.11	0.08
After first	94.31	93.55	0.50
After second	94.98	94.04	0.61
After third	95.87	94.48	0.91
After fourth	96.79	95.08	1.16
After fifth	97.81	95.51	1.53
After sixth	98.88	95.94	1.96@
Average	95.98	94.52	1.72

@ Significant at 10 per cent level

As revealed in table 2.10, similar trend is shown in the mean height status also. There is significant difference in mean height between control and experimental group after feeding.

Table 2.11 presents the average arm circumference status of control and experimental group each month of study.

Table 2.11. Mean arm circumference status of the preschool children.

Month	Experimental group (cms)	Control group (cms)	t value
Initial	14.18	14.20	0.076
After first	14.35	14.30	0.195
After second	14.72	14.52	0.787
After third	14.77	14.60	0.68
After fourth	14.93	14.57	1.35
After fifth	15.09	14.74	1.33
After sixth	15.39	14.88	1.99@
Average	14.78	14.54	1.32

@ Significant at 10 per cent level

10 per cent level of significant difference between control and experimental group is observed in the case of mean arm circumference status after six months feeding period.

Average chest circumference status of the experimental group and control group is tested and presented in table 2.12.

Table 2.12. Average chest circumference status of the preschool children.

Month	Experimental group (cms)	Control group (cms)	t value
Initial	49.72	49.64	0.14
After first	50.16	49.76	0.73
After second	50.52	49.97	1.037
After third	50.58	50.17	0.77
After fourth	50.78	50.29	0.94
After fifth	50.92	50.53	0.74
After sixth	51.32	50.89	0.81
Average	50.57	50.18	1.51

Table 2.12 reveals that there is no significant difference between the control and experimental group as far as chest circumference status is concerned.

Table 2.13 represents the average head circumference status of preschool children before and after feeding where the control and experimental group were compared.

Table 2.13. Mean head circumference status of preschool children.

Month	Experimental group (cms)	Control group (cms)	t value
Initial	47.15	47.56	1.07
After first	47.27	47.64	0.97
After second	47.36	47.70	0.89
After third	47.44	47.81	0.81
After fourth	47.55	47.91	0.94
After fifth	47.60	48.21	1.65
After sixth	47.70	48.31	1.65
Average	47.44	47.88	2.14

Table 2.13 reveals, that as such in case of chest circumference there is no significant difference in the case of head circumference between the two groups even after the feeding trial.

Table 2.14 represents the weight/height<sup>2</sup> ratio before and after the experiment.

Table 2.14. Weight/Height<sup>2</sup> ratio before and after the experiment.

Weight/Height <sup>2</sup>	Before the experiment				After the experiment			
	Experimental group		Control group		Experimental group		Control group	
	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
Below 0.0013	4	10.0	3	15	1	2.5	2	10
0.0013 to 0.0015	21	52.5	8	40	10	25.0	8	40
above 0.0015	15	37.5	9	45	29	72.5	10	50
	40	100.0	20	100	40	100.0	20	100

The table 2.14 reveals that there is a positive trend among the children. The health status of the children has improved from undernourished to moderately malnourished and moderately malnourished to normal children.

Table 2.15 presents the health status of the children on the basis of clinical examination concluded before and after the experiment.

Table 2.15. Prevalence of clinical signs of malnutrition among preschool children before and after the experiment.

Clinical signs	Male (N=17)				Female (N=23)			
	Initial		Final		Initial		Final	
	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
Anaemia	1	5.88	1	5.88	-	-	-	-
1st degree malnourished	2	11.76	-	-	2	8.7	-	-
Dental caries	3	17.65	2	11.76	6	26.09	2	8.7
Mottled enamel	1	5.88	1	5.88	-	-	-	-
Discoloured hair	4	23.53	2	11.76	3	13.04	2	8.7
Pigeon chest	1	5.88	1	5.88	-	-	-	-

N denotes sample size

Table 2.15 represents that there is no change in case of pigeon chest, anaemia or mottled enamel after feeding but there is a change in the malnourished children and discolouration of hair is also reduced.

Table 2.16 represents the haemoglobin levels of the preschool children before and after the study.

Table 2.16. Grouping of the children based on haemoglobin content before and after the study.

Haemoglobin levels g/100 ml	Initial readings				Final readings			
	Experimental		control		Experimental		control	
	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent	Num ber	Per cent
9.5 - 10	-	-	1	5	-	-	-	-
10.1 - 10.5	8	20	6	30	-	-	3	15
10.6 - 11	16	40	5	25	5	12.5	4	20
11.1 - 11.5	11	27.5	7	35	19	47.5	6	30
11.6 - 12	5	12.5	1	5	12	30.0	6	30
12.1 - 12.5	-	-	-	-	4	10.0	1	5
	40	100	20	100	40	100	20	100

Table 2.16 reveals that after feeding there is an increase in haemoglobin value of the children. Only 12.5 per cent of children had haemoglobin value between 10.6 to 11. 87.5 per cent of the children had haemoglobin value above 11 after the experiment.

## **DISCUSSION**



## DISCUSSION

The study on the impact of ragi based food supplement on the nutritional status of selected preschool children is based on certain observations on dietary pattern with special reference to the influence of supplementary feeding and ecological and socio-economic back ground. For this purpose a survey on the ecological and socio-economic characters and dietary habits was conducted among the rural families of preschool children.

Most of the families surveyed are either Hindus (74.67 per cent) or Christians (25.33 per cent). Here 75.33 per cent belonged to backward caste and 24 per cent belonged to scheduled caste/scheduled tribe. Earlier studies have indicated that this section of population is generally considered as an under priveleged one economically as well as nutritionally. Nuclear type of families are found to be more common (74 per cent) among the families surveyed. These findings are in line with the cultural set up of rural areas in the neighbourhood state like Tamil Nadu also, where more than 80 per cent of the house hold are found to be of nuclear type (Devadas et al., 1981). Compared to joint families, in nuclear type of families, children was expected to get better attention.

The families surveyed are found to be either medium sized with 5 to 6 members (47 per cent) or small sized with 2 to 4 members (37 per cent). Large size families are not common in these areas and similar results are observed in the survey conducted among rural household of Tamil Nadu by Devadas et al. (1975). The average family size observed from the survey is 5.15 and according to the 1981 census of India, in rural, Trivandrum the average size of household is 5.23 (Vijayanunni, 1982). As indicated by earlier studies, family size is a major factor influencing the nutritional status of the family members. In the present study this factor plays a positive role in determining nutritional status.

The living condition of the family reflects the economic and health condition of the family members. Thatched houses with clean surroundings and facilities for disposal of waste away from the houses are common. For 34 per cent of the families, drinking water facilities are available in the premises itself and only 16 per cent of the families have to travel more than  $\frac{1}{2}$  km to get potable water. In all the families mother is responsible for providing drinking water and average time spent by women for this purpose in a day is two hours. Similar results are observed in the survey conducted by George (1987).

Facilities for the disposal of human excreta seems to be another major problem faced by these rural families. Many of the houses do not have latrines (68.67 per cent) and 'open place' is used for this purpose. Even in families where such facilities are available many of the family members (57.45 per cent) are not in the habit of using this probably because of difficulties in collecting water. However this unhygienic habit is inculcated in children. Added to this is the congested living conditions which are mainly responsible for the prevalence of infectious diseases.

An analysis of the family population surveyed indicates that more than 50 per cent are adults. These findings match with the observations of Sadasivam et al. (1980), who found that adult and adolescent age group is more in number than other groups in rural population in Tamil Nadu. The vulnerable section of the population in the families surveyed is composed of 26 per cent with preschool children (22.28 per cent), pregnant mothers (1.68 per cent) and nursing mothers (3.37 per cent). The declined number of pregnant and nursing mothers among the surveyed population may be mainly due to the popularity of family planning operation after the second child. However the higher per cent of vulnerable section (27.33 per cent) indicates the need for special attention for their welfare in all respects.

The literacy level of male and female in all the age groups indicate that literacy level of male (71.54 per cent) as well as female (72.94 per cent) is more or less the same whereas the findings of 1981 census reveals that male literacy (74.13 per cent) is higher than the female literacy (64.25 per cent) in this state (Vijayanunni, 1982). About 14.17 per cent of males and 13.58 per cent of females are found to be illeterate when the population of 508 as a whole excluding small children not attending school. Only 0.39 per cent of male and 1.38 per cent of female are educated upto college level and this observation agrees with the findings of Sadasivam et al. (1980), who indicates that only a negligible percentage of rural population had came upto the College level in a survey conducted in Tamil Nadu. It can be assumed that majority of the adult members in the families surveyed have moderate education to realise the significance of various factors which is needed to improve the quality of life.

48 per cent of the families surveyed have their income below Rs.400/- and they are to be categorised under poverty line as per the norms suggested by Adiskshiah (1987). Major characteristics of this type of families viz. unemployment and underemployment are also prevelant among these families.

Analysis of the occupational status of the families surveyed indicates that majority of the adult members of the families are mainly agricultural labourers or coolies.

Media plays a very important role in improving the quality of life of individual especially if he is moderately or well educated. However in the present study different media such as newspaper, magazines, T.V etc. are found to be not very popular among the families surveyed probably because they have not realised the practical significance of such media in improving quality of life. Data related to the frequency of exposure to different media indicate that radio is found as the most popular media probably because of its entertainment value. However in earlier studies conducted in similar areas in Trivandrum district have indicated that printed media and radio are found to be used frequently by the rural families (Prema and Menon, 1978).

A glimpse on home production of food may indirectly enlighten the food consumption pattern. Among the families surveyed home production is popular among 44 per cent of families. Of these families, 28 families are interested in producing vegetable foods, 19 families animal foods and another 19 families both animal and plant foods.

34 families are in the habit of using the home produced foods by themselves whereas 57 families use or sell the products. Among the various types of food products sold, milk ranks first and average income obtained for 10 families from this sale is nearly Rs.548/- per month. Next to milk, poultry keeping is found to be popular among these families. This is probably because of lack of space available around the houses. Further observation indicates that costly foods like milk and egg are sold to purchase cheaper foods like tapioca.

An analysis of the expenditure pattern indicates that all the families spend more than 100 rupees per month for food. The expenditure incurred for various other items as well as savings are comparatively little. Average food expenditure of families surveyed is Rs.100 to Rs.400/- per month. This expenditure is found to be influenced by family size and occupational status of the families.

The economic status of the families as well as the knowledge and attitude of family members towards foods may influence the food consumption pattern of the families. Among the families surveyed rice is the only cereal which is consumed daily by all. Next to rice, tapioca is popular as a staple food (37 per cent) of the families and is used more than three days per week by 62 per cent of the families.

Lina and Reddy (1984) stated that among cereals rice, among roots and tubers tapioca and among flesh foods fish forms the staple food for the poor rural keralites. Expensive food items such as mutton, chicken, pork, egg etc. are rare items consumed by these families. Most of the food preparations are made once in a day eventhough three meal pattern is the most accepted form among these families. Further observations indicates that this system is adopted mainly to save fuel and the women are generally unaware of the disadvantage of storing cooked food for a long time. Food consumption pattern is found to be not affected by variation in season.

Among the family members, special attention is given mainly for school going children because these children are considered by the mothers as less fortunate when compared to preschool children who are getting two meals daily from anganwadi. 46.51 per cent of the mothers surveyed opinioned that the preschool children after returning from the anganwadi are not in the habit of eating any food and will go to sleep very early at six or seven. A probable reason for this negligence may be mainly the unnecessary importance given to the supplementary diets in the anganwadi.

Culinary practices is an important factor which may influence the availability of nutrients from the foods prepared. As per the conventional practises dry food articles such as cereals, pulses etc. are washed prior to cooking by 50 per cent of the families while in 36.67 per cent of families cleaning, followed by washing is practised. Washing several times may affect water soluble nutrients present in these food articles. Reasons suggested for not washing food articles by a few families is the scarcity of water. In case of fresh food articles like fruits, vegetables etc. washing is generally done before use. However few families ( 3 per cent) are not in this habit. This indicates the lack of awarness about the significance of hygenic handling of food before and during cooking.

Different cooking methods adopted during food preparations are a major factor which may influence the nutrient availability. Among various methods, common method followed by these families are steaming and frying. Earlier studies had indicated that constant use of boiling method for preparation of food may result in loss of water soluble vitamins and may lead to nutrient deficiency symptoms (Devadas et al,1975). Constant use of one method of cooking will result in lack of variety in the daily diet. This is also a common defect in the dietary pattern of the families.



Earlier studies have shown that conventional method of storage popular in rural areas can cause nutritional leaching. An assessment on these lines have indicated that different methods are adopted for storing different types of foods. Dry foods such as cereals and pulses are stored as such or as flour or after roasting the flour for one month. Sun drying is practiced by a small number of families to prevent insect attack. In 14.67 per cent of families roots and tubers are also stored after sundrying. However many of the families are not aware of the significance of proper storage of food articles. Among perishable food articles green leafy vegetables and other vegetables especially banana are immersed in water and stored upto one week. 43.33 per cent of the families are aware of processing banana into powder form and using it for infant mixes. Milk is stored only for few hours (as such or after boiling) or converted into curd or butter milk. Flesh foods especially fish is stored and used in the following day by 12 per cent of the families. Containers made of aluminium, mud, glass, tin and steel are found to be commonly used. This containers are kept in open place by majority of the families (70.67 per cent) while only very few families have safe cupboard for this purpose. The rural families are unaware of the advantages of proper storage method.

A major post harvest problem faced by the rural families are surplus production or availability of perishable foods at lower costs during seasons. In the present study mango and lime are the only two fruits most commonly used and preserved upto one month. Reasons suggested for using these two fruits is that they have better shelf life, availability, low cost and quality at seasons. Other fruits such as jack are not commonly preserved and kept probably because they are unaware of cheap processing method for these fruits. Glass container is commonly used for preserving pickles by 66 per cent of the families followed by mud pot (57 per cent) and steel (34 per cent).

An assessment of the health condition of the family members indicate that nearly three fourth of the adults had no ailments and health problems. Among the various treatments, allopathy is found to be the popular treatment followed by ayurvedic treatment. Very few families are found to neglect such ailments for old persons due to economic reasons. Common reason felt by these families for the occurrence of such ailments are genetic, digestive disturbance, climate, faulty food habits and small vices like drinking or smoking.

Very few children are found to be normal and healthy one. Others are found to be affected by fever (21.41 per cent), respiratory diseases (15.14 per cent), diarrhoea and dysentery (13.05 per cent) and scabies (3.66 per cent) etc. Skin infections, respiratory diseases, diarrhoeal diseases, fever, eye infection and ear discharge are generally reported as ailments among infants and preschool children (Gupta and Walia, 1980). For children first allopathy and next homoeopathy treatments are preferred. Mothers are generally unaware of the reason for the occurrence of illness among children (29.5 per cent). Unhealthy surroundings and change in climate are generally suggested as reasons for illness.

Nearly 75 per cent of the families are in the habits of attending primary health care facilities. 19.33 per cent of the families are utilising the primary health care facilities along with other local facilities also. Transport problem, lack of service facilities in primary health care centre, preference for private doctors and allergic to injection are the common reasons suggested for not preferring the primary health care facilities. Observations on health condition of preschool children as assumed by mothers indicate that 62 per cent of children are having satisfactory growth and development while 21.33 per cent of children are not having satisfactory growth and the rest of the children a good growth. The immunisation

status of 86 per cent of children are found to be satisfactory whereas 14 per cent are not immunised. The reasons suggested are attack of fever and other allergic reactions if immunized. The situation of child health care practises in Kerala is entirely different from other parts of the country where only 39 per cent of children below five years were vaccinated (Sahu et al., 1985). The reasons generally attributed to such situations are ignorance and indifference of parents, nonavailability of facilities, fear of complications and ill-health of the child.

Mothers are found to be well conscious about the need for supplementary feeding. Foods like cow's/goat's milk, ragi or rice porridge, fruits, tea, bun, vegetables and fish are found to be included during infancy. Similarly spicy foods, hot foods and flesh foods are avoided. Even though food taboos are not present in infant feeding practises it is prevalent during pregnancy and lactation. As in other parts of the country papaya is avoided during pregnancy. Similarly certain types of fish and gas producing foods are avoided for 41 days after delivery.

Only 53.33 per cent of the mothers are reported to give special foods. Porridge made of ragi and banana with or without milk, boiled banana, avaloose podi (mixture of rice and coconut with sugar), rice and wheat balls, uppuma, rava kanji, smashed dhal

and vegetable, green soup and boiled egg are included as special foods by these mothers. Coconut, jaggery or sugar are included in the preparations. Among the various foods, banana is found to be the most popular supplementary food.

Food habits of children are generally influenced by parents and elder members at the household level and by doctor or nurse outside the house. At home mother is responsible for feeding the preschool children (44.67 per cent). In certain cases children manage by themselves (28 per cent) and instead of mothers they are helped by elder members (18 per cent).

Rice based preparations are mostly preferred by the preschool children followed by confectionaries, tapioca with fish, groundnut and milk and curd. Even though the children have preference for these foods it was explained that they cannot offer these foods because of economic problem. An observation on three days meal pattern indicates that cereals form the staple food for breakfast, lunch, tea, and dinner by most of the families. During breakfast tea, rice with sugar or jaggery is preferred and fish is preferred with cereal during breakfast, lunch and dinner.

Mother is responsible for child care activities (32.67 per cent) and assisted by father (15.33 per cent) or by any other member of the family (12.67 per cent) in certain cases, or by grand parents (12 per cent) etc. Child care is considered as supreme responsibility of mothers by these families. However absence of women for a long time from houses and poor health condition are responsible for entrusting this work with others.

Fighting with others, nail biting, bed wetting etc. are the common behavioural problems found among the preschool children and correction for the same are oral advice and punishment of the teacher/parent. Mothers are reported to take adequate care to correct bed wetting habits. In certain cases children are prevented to drink water in the evening. Application of paste made of bitter leaves on hands to prevent nail biting is practised. Treatments are given in some families for eating clay, chalk etc. According to Singhal et al. (1988) thumb sucking may be associated with hunger and teething.

One day food weighment survey is carried out in ten families selected from five each from experimental and control groups reveals that the home diets of the children are quantitatively inadequate in all the food groups for control group.

The percentage of recommended daily allowances (ICMR, 1982) of cereals met by the control groups is nearly 80 per cent partly because rice is the staple item in the daily meal. Pulses, milk and milk products are the major sources of protein and are far below the recommended allowances. Inadequate intake of pulses is observed in both the groups where 39.4 per cent and 2 per cent of the allowances are met by the experimental and control group respectively. Fruits are not at all consumed by the experimental group whereas 34 per cent of allowances for fruits is met by the control group. Devadas et al., (1980) reported that the consumption of fruits is low even among the preschool children of highly educated mothers. Only 10.88 per cent and 7 per cent of recommended daily allowances for milk and milk products is met in the case of experimental and control group respectively. The findings are in agreement with earlier studies conducted in different states. Sadasivam et al. (1980) stated that the average quantity of milk consumption is not even half of the recommended allowances where milk is taken only in the form of tea or coffee. Thimmayamma et al. (1982) conducted a survey in Hyderabad and concluded that the preschool children could get only one fifth of the recommended quantity of milk.

No consumption of green leafy vegetables is noted in the control and experimental groups. Lina and Reddy (1984) in rural people of Trichur found that greens are found to be a rare item and similar results are shown by Puri et al. (1983). 38.38 per cent and 15.5 per cent of recommended allowances are met for sugar and jaggery by the experimental and control group respectively. These findings are in agreement with the findings of Devadas et al. and Puri et al. (1983) who had stated that the consumption of green leafy vegetables, fats and oils and sugar and jaggery is less than half the requirements. The food consumption pattern of experimental group is comparatively better in many respects.

An assessment of average nutrient consumption of the children indicate that nearly 50 and 75 per cent of the recommended allowances for calories and 75 and 121 per cent of recommended allowance for proteins are met by both control and experimental group respectively. With regards to nutrients like calcium, iron, thiamine, riboflavin niacin and ascorbic acid, the position of children belonging to experimental group is better than children of control group. The better intake of children may be mainly due to the food supplements included in their diets. Puri et al. (1984) has reported that the diets of preschool children are generally found to be highly



deficient in all the nutrients especially calories.

Thimmayamma et al. (1982) stated that in a survey in Hyderabad all the members of all the age groups are grossly deficient in the intake of iron.

Acceptability of a food supplement prepared with ragi as a base:

Ragi biscuits selected as a supplementary food is a mixture of ragi, green gram and/or sesame and/or ground nut, skim milk powder, butter and sugar. Six types of ragi biscuits with different combinations of these ingredients are formulated and standardised.

The percentage preparation loss is highest for type 6 followed by type 4, type 2 and type 5. Type 1 had the least percentage preparation loss may be due to the germination of greengram where the loss due to skim removal is reduced.

The cost per serving are worked out and it is highest for type 2 and type 3 biscuits followed by type 1 biscuits. The higher cost may be due to skim milk powder whereas in the other three types, 10 per cent of skim milk powder is replaced by other cheaper ingredients.

The percentage yield is calculated for all the six types and it is found that there is no significant variation in the percentage yield. Eventhen the highest percentage preparation yield is observed in type 1 biscuits.

The first three types of ragi biscuits where skim milk powder occupies 25 per cent of the mix is preferred mostly by the panel members. The type of biscuit where sesame and groundnut are added together is preferred least.

Eventhough no significant difference is obtained among the six types, according to ranking type 1 ragi biscuits occupies the first place of preference for the overall acceptability.

When the average scores obtained for the acceptability on a five point hedonic scale, highest marks are scored by type 1 eventhough there is no significant difference among the six type of ragi biscuits.

Assessing from all the above characters type 1 biscuits having ragi, green gram, skim milk powder, butter and sugar in the proportion of 3:1:2.5:1:2.5 is selected for the supplementary feeding for preschool children.

The protein content of 100 g of biscuits is found to be 14.1 g and 11 biscuits can be made from 100 g of mix. Hence it is decided to supply three biscuits daily. The protein content of the three biscuits are 3.8 and it supplies 106 K.cals of calories.

Effect of ragi based food supplement on the nutritional status of selected preschool children:

Under ICDS, there are two types of feeding at the anganwadi level. Rice (50 g) and greengram (15 g) are given as a noon feeding while a preparation with bulgar wheat (65 g) and oil (8 g) are given as a snack. Food articles like green leafy vegetables, other vegetables and roots and tubers, milk and milk products, fruits, meat fish and egg, sugar and jaggery are not included in the anganwadi diet.

An attempt was made to replenish the deficiency of anganwadi diet by including ragi biscuits which is made from a mixture of ragi, greengram, skim milk powder, butter and sugar.

Forty preschool children selected as experimental group were regular beneficiaries of ICDS Programme and they were given three ragi biscuits along with their regular anganwadi feed. These biscuits are prepared on alternative days where 120 biscuits are needed daily.

During the first two months of study the percentage of attendance was 90.8 and 92.5 respectively. This is decreased to about 84.5 per cent during the third month of study may be due to the prevalence of diarrhoea, mumps and fever in the village during this month. The percentage of attendance improve to about 88.7 per cent during the fourth month, 95.2 per cent in the fifth month and about 98.6 per cent during the last month of study. Ragi biscuits are popular among children during the six months feeding trial.

Anthropometric measurements are taken before and after feeding both for the experimental and control groups. Weight for age profile of the experimental group before and after the experiment reveals that even after the experiment the weight of preschool children is not significantly comparable with the standard values. However there is an increase in the weight status as the level of significance decrease from one per cent level to five per cent level except in the case of male children of 43 to 48 months of age. This children are classified on the basis of Gomez system of classification. A notable context is that on completion of the experiment children who were in the first degree of malnutrition became normal. In earlier studies a decreasing trend in the third degree malnutrition is reported in similar supplementary studies (Chandha, 1980).

Height for age profile before and after the experiment reveals that there is no significant difference between the experimental group and standard except one group of children in both cases.

Profile of arm circumference for preschool children before and after the experiment, reveals that there is a positive trend towards the standard value after the experiment. Chest/head ratio of the preschool children before and after the experiment was analysed and it was found that all the children became normal after the experiment whereas 12 per cent of preschool children has reported to have chest/head ratio less than one before the experiment. Similar results are reported by Devadas et al. (1983).

The mean anthropometric measurements of both the experimental and control group is assessed and the level of significance between the two groups are calculated. The mean weight of the experimental group is significantly better than the control group after six months feeding at five per cent level. The mean height status of the experiment preschool children after six months feeding is significantly different at 10 per cent level when compared with the control.

Similar results are found in the case of mean arm circumference status. However there is no significant difference between the control and experimental group before and after the experiment as far as the chest and head circumference status are concerned.

When the weight/Height<sup>2</sup> ratio before and after the experiment is found out, there is a positive trend among the children of both the group. The improvement is more in the case of experimental group, when the level of normal children increase from 45 per cent to 50 per cent.

Clinical examination conducted before and after the experiment reveals that anemia, first degree malnutrition, dental caries, mottled enamel, discoloured hair are the common deficiency symptoms prevalent among these preschool children.

Haemoglobin level of the children showed that before the study 20 per cent of children in the experimental group are below 10.5 and 30 per cent in the case of control group. After the experiment all the children in the experimental group have haemoglobin value above 10.5.

# SUMMARY

## SUMMARY

A study on the impact of ragi based food supplement on the nutritional status of selected preschool children is an assessment of their dietary habits and acceptability of an in-familier food. Most of the families surveyed are hindu backward, nuclear type and of small size. Eventhough majority of the families are below poverty line housing, potable water and latrine facilities are available in these areas. However congested living conditions are found in general creating a number of health problems.

Nearly 70 per cent of population surveyed are literates and they realise the significance of various factors responsible for improving the quality of life eventhough they are not in the habit of fully exploiting available facilities.

Majority of the adult family members are agricultural labourers or coolies. However unemployment and underemployment are major social problems prevalent among these families. Food articles like coconut, tapioca, milk and egg are food products produced at the household level by 50 per cent of the families and more than 38 per cent of the families are selling the food articles thus produced to purchase less costly staple food items.



Nearly 50 per cent of the families are located under poverty line. Rice and fish are the common food consumed by all the families and tapioca is used to supplement rice by 37 per cent of the families. One time preparation in a day is a common practice eventhough three meal a day is the pattern observed.

Among the family members of different age groups special attention is found to be given to school going children over preschool children who are getting supplementary foods from the anganwadi. Culinary practises observed by these families are not satisfactory due to scarcity of water. No variety in cooking is found, since only steaming and frying are commonly applied. Post harvest storage and preservation practises observed for various food articles are only conventional methods and modern scientific practises are unknown to these families.

Health condition of the family members in general are satisfactory and medical facilities avilable locally are well utilised by these families.

Fifty per cent of the mothers are conscious about the need for supplementary feeding. Food habits of children are influenced by parents, elder members, doctors and nurses.

However mother is responsible for feeding and other child care activities. Economic constraints prevent the introduction of foods according to the preference of children.

One day weighment survey data reveals that the home diets of control children are quantitatively inadequate in all the foods. Food articles such as pulses, green leafy vegetables, fruits and milk and milk products are found to be rare items in their daily diet. Analysis of average nutrient consumption of the children reveals that nearly 75 and 50 per cent of the recommended daily allowances are met for calories by the experimental group and control group respectively. Further analysis of the anganwadi diet indicated that nutrients such as calories (35.07 per cent), proteins (55 per cent) iron (42 per cent), thiamine (87.5 per cent) and Niacin (53 per cent) are supplied.

Since ragi is found to be a well accepted cereal for a toddlers diet, an attempt was made to prepare ragi biscuits of six combinations with a mixture of ragi, greengram or sesame or groundnut, skim milk powder, butter and sugar.

The amino acid composition of the different combinations are worked out and comparisons were made among these combinations. Type 1 ragi biscuits are found to be richer in Lysine, Tryptophan, Tyrosine, Leucine, Isoleucine and valine.

The percentage preparation loss, cost per serving, percentage yield and overall amino acid composition and overall acceptability are assessed and type 1 ragi biscuits having ragi (30 g) greengram (10 g) skim milk powder (25 g) butter (10 g) and sugar (25 g) is selected for the supplementary feeding. The protein content of the 100 g of type 1 ragi biscuit is 14.1 g and three biscuits supplied daily to a child is found to supply 3.8 g of protein.

The experiment is conducted for six months among forty preschool children who are regular beneficiaries of ICDS. Major nutrients supplied by the ragi biscuits are fats and oils (10.8 per cent) and sugar and jaggery (16.7 per cent). 35 per cent of calories and 55 per cent of protein are met by the anganwadi feed and 7 per cent and 17.21 per cent of calories and proteins are met by ragi biscuits. Ragi biscuits are well accepted by all the preschool children.

The influence of ragi biscuits are evaluated on the basis of changes in anthropometric measurements, clinical examination and biochemical investigations. Weight for age profile reveals that there is an increase in the weight status except children of a particular age group. According to Gomez classification all the children became normal after six months of supplementary feeding. Profile of arm circumference reveals a positive trend. From the chest/head ratio it is found that all the children became normal after the experiment.

The test of significance of the mean weight of both experimental and control is conducted and the mean weight was significantly higher for the experimental group. The mean height status of the experimental group after the feeding is significantly different at 10 per cent level and similar results are found in the case of mean arm circumference.

The weight/Height<sup>2</sup> ratio before and after the experiment shows that there is a positive trend among the children of both the groups. However the improvement is more in the case of experimental group.

Clinical examination conducted before and after the study reveals that in male and female children all the 4 children who were graded as first degree malnourished recovered completely and become normal. One male and 4 female children recovered from dental caries and 2 male and 1 female children recovered from discoloured hair.

Haemoglobin level is below 10.5 for 20 per cent of children prior to the experiment and it increased from this value for all the children after the experiment.

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\* Original not seen.

# APPENDICES

APPENDIX I

Initial determination related to the anthropometric measurement  
of preschool children

S.No.	Height in cm	Weight in kg
1	2	3

Experimental group

1.	96.6	14.6
2.	104.7	16.7
3.	94.0	12.0
4.	95.0	11.3
5.	96.0	13.5
6.	96.0	12.5
7.	99.8	13.7
8.	86.6	11.0
9.	96.3	11.8
10.	90.4	12.8
11.	93.0	13.1
12.	94.2	12.8
13.	94.0	14.3
14.	94.5	13.3
15.	94.2	13.4
16.	92.7	11.4
17.	97.6	13.7
18.	90.9	12.2
19.	90.0	13.7
20.	96.1	13.5
21.	94.4	13.3
22.	87.6	11.4
23.	88.6	12.0
24.	87.3	12.0
25.	98.9	15.0

APPENDIX I (Contd.)

1	2	3
26.	104.5	16.8
27.	90.0	11.3
28.	93.5	10.9
29.	86.8	11.2
30.	88.0	12.0
31.	92.4	11.8
32.	96.4	13.5
33.	89.0	10.5
34.	97.0	13.6
35.	88.2	12.5
36.	100.6	12.5
37.	89.5	11.2
38.	94.0	12.0
39.	85.0	10.9
40.	90.9	11.3
<u>Control group</u>		
1.	84.4	10.4
2.	102.4	13.0
3.	101.0	13.6
4.	97.9	12.5
5.	97.4	13.5
6.	106.0	13.7
7.	91.2	11.3
8.	95.7	13.0
9.	98.0	14.8
10.	98.8	12.7
11.	80.0	11.8
12.	85.0	11.0
13.	84.9	11.6
14.	83.3	10.2
15.	93.0	14.3
16.	98.2	15.0
17.	88.3	13.0
18.	96.0	11.4







APPENDIX III

Different types of ragi biscuits formulated

Diet	Ingredients	% of the various ingredients
1	Ragi	30
	Green gram	10
	Skim milk powder	25
	Butter	10
	Sugar	25
2	Ragi	30
	Sesame	10
	Skim milk powder	25
	Butter	10
	Sugar	25
3	Ragi	30
	Ground nut	10
	Skim milk powder	25
	Butter	10
	Sugar	25
4	Ragi	30
	Green gram	10
	Sesame	10
	Skim milk powder	15
	Butter	10
	Sugar	25
5	Ragi	30
	Green gram	10
	Ground nut	10
	Skim milk powder	15
	Butter	10
	Sugar	25
6	Ragi	30
	Ground nut	10
	Sesame	10
	Skim milk powder	15
	Butter	10
	Sugar	25

## APPENDIX IV

### Procedure for standardisation of ragi biscuits

Butter and sugar were creamed. To that the sieved powder of ragi, skim milk and baking powder with green gram/ground nut/sesame were added according to the combination and these were kneaded thoroughly and a dough was prepared. It was made into rounds of desired weight. These were kept in greased aluminium trays and baked in the preheated oven at 50°C for two hours. Two batches of biscuits of each combination were baked, cooled and stored in tin containers. The biscuits were subjected to sensory evaluation within four days of preparation.

## APPENDIX V

### Procedure for the triangle test

In the triangle test three sets of sugar solutions of different concentrations were used. Of the three sets two solutions were of identical concentrations and the women were asked to identify the third sample which is of different concentration.

### Evaluation card for the triangle test

Name of the product : Sugar solution

Note : Two of the three samples are identical

Identify the odd sample

---

S.No.	Code No. of samples	Code No. of the identical samples	Code No. of the odd sample
-------	---------------------	-----------------------------------	----------------------------

---

1 X, Y, Z

2 A, B, C

---

APPENDIX VI

Score Card

	A	B	C	D	E	F
<b>1. <u>Appearance</u></b>						
Very good						(5)
Good						(4)
Fair						(3)
Poor						(2)
Very poor						(1)
<b>2. <u>Flavour</u></b>						
Very pleasant						(5)
Pleasant						(4)
Neither pleasant nor unpleasant						(3)
Un pleasant						(2)
Not at all pleasant						(1)
<b>3. <u>Texture</u></b>						
Very crisp						(5)
Crisp						(4)
Slightly soggy						(3)
Soggy						(2)
Very soggy						(1)
<b>4. <u>Taste</u></b>						
Very tasty						(5)
Moderately tasty						(4)
Slightly tasty						(3)
Not taste						(2)
Not at all taste						(1)
<b>5. <u>Overall acceptance</u></b>						
Highly un- acceptable						(7)
Unacceptable						(6)
Slightly un- acceptable						(5)
Neither acceptable nor un- acceptable						(4)
Slightly acce- ptable						(3)
Acceptable						(2)
Highly acceptable						(1)

## APPENDIX VII

Schedule to collect Soci-economic and food consumption survey

Impact of Ragi based food supplement on the nutritional status of selected pre-school children

An ecological and Socie-economic data of the families selected for the study

1. Name of the head of the family:
2. Address:
3. Religion and Caste:
4. Type of family:
  - (a) Nuclear/Joint  
Reason
  - (b) Small/medium/large
5. Details of house:
  - (a) Rented/Own:
  - (b) Pukka/Kucha/tiled/thatched/terrace/others
6. Water availability for use at home:
  - (a) Source of water  
Private well/Public well/Private tap/Public tap  
Public tank/river/canal/ponds/others:
  - (b) Distance from the house:
  - (c) Person responsible for collecting water:
  - (d) Time spent for this work/day:
7. (a) Latrine facility at home Open place/  
Flush latrine:
  - (b) Localities of the latrine if available:
    - i. in the premises:
    - ii. distance of the latrine from the house:
    - iii. Did the facilities used by all the  
family members? Yes/No

APPENDIX VII (Contd.)

1. If no, details of members who are not using the facilities:
2. Reasons for not using the facility:

8. Details of the premises of the house:

- i. Well kept and clean :
- ii. Very dirty:

9. Disposal of gabage from house:

Adequate facilities available:

Adeq-uate facilities are not available:

10. Family income (in Rs.)

---

Income from sources such as	Daily	Weekly	Monthly	Annually	Total
-----------------------------	-------	--------	---------	----------	-------

---

Land

Animals

Farm

Trade

Others

Total

---



APPENDIX VII (Contd.)

11. Family pattern

Sl. No.	Relation-ship with head	Age	Sex	Occupational status	Phy-sical condition	Veg. or non veg.	Educational status				
							Illi-tera-te	Can-read Mala-yalam	Can-write Mala-yalam	Pri-mary level	Middle school

APPENDIX VII (Contd.)

12. Expenditure pattern.

Item	Expenditure (in Rs.)
Food	
Clothing	
Shelter	
1. Rent	
ii. Maintenance	
iii. Repaying loan	
Health	
Education	
Travel	
Recreation	
Gifts	
Ceremonies	
Others	

13. Home production:

Source	Quan- tity avai- lable	Quan- tity used	Quan- tity sold	Preser- vation method	Income by selling these products		
					Daily	weekly	Monthly
Coconut							
Vegetables							
Tapioca							
Pepper							
Cattle							
Poultry							

APPENDIX VII (Contd.)

14.A. Morbidity data of the family

Members	Type of disease	Symptoms	Treatments taken	Reasons for getting the disease

B. Morbidity data of the child

Disease	Age at which the disease occurred	Symptoms of the child recovered	Treatments taken	Reasons for getting the disease

15. Do you go to the adjacent PHC for treatment? :  
if not, why?

16. Has the child been immuned? If yes, give details:

17. Frequency of exposure to different media

Media	Daily	Twice a week	Weekly	Twice a month	Monthly	Occasionally
Newspaper						
Magazines						
Cinema						
T.V.						
Training programme						
Radio						

APPENDIX VII (Contd.)

18. Distance between Anganwadi and home:

Time	Distance of home from school	Mode of moving	Time taken
Morning	Within $\frac{1}{2}$ km		Less than 15 mts
Afternoon	Within 1 km		Less than $\frac{1}{2}$ hour
	Within 2 km		Less than 1 hour
Evening	More than 2 km		More than 1 hour

19. Frequency of use of different food materials by the family

Food groups commonly used	Quantity used	Frequency of use of different food stuffs				
		Daily	Less than 3 days a week	More than 3 days a week	Once in a week	Once in a month or occasionally
a) Cereals						
b) Pulses						
c) Oil seeds & Nuts						
d) Roots and tubers						
e) Other veg.						
f) Green leafy veg.						
g) Fruits						
h) Milk & milk products						
i) Meat & Fish						
j) Egg						
k) Fats & Oils						
l) Sugar/Jaggery						

APPENDIX VII (Contd.)

20. Food consumption according to season

Season	Foods taken	Foods avoided	Reasons
Summer			
Winter			
Spring			
Autumn			

21. Meal pattern of the family

Members	One meal a day	Two meals a day	Three meals a day	Four meals a day	Five or more meals a day

22. Any special foods cooked for the child:  
If yes, details:

S1. No.	Preparation	Food used	Once/ day	Once/ Twice/ day	Once in two days	Less than thrice per week	Once in a week	Occa- sion- ally

23. Who influences the food habits of your child, yourself/your husband/older members/neighbours/friends/relatives/his friends/doctor/nurse.

APPENDIX VII (Contd.)

24.(a) Meal pattern of the preschool children: I day

Feeding	Time	Preparations	Ingredients
Early morning			
Breakfast			
Midmorning			
Lunch			
Tea			
Dinner			
Bed time			

24(b). Meal pattern of the preschool children: II day

Feeding	Time	Preparations	Ingredients
Early morning			
Breakfast			
Midmorning			
Lunch			
Tea			
Dinner			
Bed time			

24(c). Meal pattern of the preschool children : III day

Feeding	Time	Preparations	Ingredients
Early morning			
Breakfast			
Midmorning			
Lunch			
Tea			
Dinner			
Bed time			

APPENDIX VII (Contd.)

25. Meal serving pattern Reasons
- a) 1. Meals taken together by all family members
2. Meals taken by the head of the family first and then by others
3. Meals taken by the male members first and then by female members
4. Meals taken by the children first and then by the parents
5. Meals taken last by the housewife
6. No such rules
- b) 1. Meal for the preschool child is given by the mother herself/by the elder children/by the father/by grand parents
2. Meals taken together with the adult members & elder children of the family Yes/No  
Reason

26. Favourite foods of the family:

Members	Foods	Reasons

27. Foods preferred by the preschool children

Foods	Preparations if any	Reasons

28. Foods given and restricted during special condition for the young children:

Family members of growing stage	Condition	Foods given	Foods avoided	Reasons

APPENDIX VII (Contd.)

29. Who is responsible for the child care activities

Details of members	Time spent for child care activities	Reasons
--------------------	--------------------------------------	---------

30. In your opinion in what state of health is your child?  
 Poor/Fair/Good/Very Good.  
 Reason for this condition:

31. Methods of preparing various food articles prior to cooking.

- i) Dry food article (like cereals)
  - a) Cleaning/winnowing, washing and drying (soon after purchase)
  - b) Cleaning/winnowing and washing (just before cooking)
  - c) Any washing just before cooking
  - d) Washing raw rice before cooking
    - i) Once ii) Twice iii) Thrice iv) More
- ii) Fresh food items like fruits & Vegetables
  - a) Washing soon after purchasing
  - b) Washing just before eating or using
  - c) No washing at all

Items	Size of cutting	Materials used for cutting	Washing before cutting	Washing after cutting
Fruits				
Vegetables				
Meat				
Fish				



APPENDIX VII (Contd.)

32. Methods employed and frequency of cooking

Food items	Method of cooking				Frequency			
	Boiling & Straining	Absorbing	Steaming	Frying	Fresh	Once	Twice	Thrice
Cereals								
Pulses								
Green leafy vegetables								
Other veg.								
Roots and tubers								
Oilseeds and Nuts								
Flesh foods								

33. Method of storage of food:

Food item	Method of storage	Period of storage	Used at home	Sold	Containers used for storage	Place of Storage	Reason
Cereals							
Pulses							
Green leafy vegetables							
Other veg.							
Fruits							
Milk							
Flesh-food							
Others							

APPENDIX VII (Contd.)

34. Food preservation at home

Food items	Methods used	Period for which it is preserved	Methods of using these items	Containers used	Reason
Cereals					
Pulses					
Green leafy vegetables					
Other veg.					
Fruits					
Milk and milk products					
Flesh foods					
Egg					
Others					

II. Details to be collected from the nursery school teacher and mother.

Behavioural problems	Period from which the child is having that behaviour	Steps taken to solve the problem
Nail biting		
Bed wetting		
Thumb sucking		
Day dreaming		
Fighting with friends		
others if any		

APPENDIX VIII

Diet survey - One day weighment

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

Age and sex composition of those who have partaken the meal.

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

Food stuff	Weight in grams	Food stuff	Weight in grams
1	2	1	2

Cereals

1. Bajra
2. Jowar
3. Maize-dry
4. Ragi
5. Rice
6. Wheat flour
7. Broken wheat
8. Maida
9. Others

Pulses

10. Bengal gram
11. Black gram
12. Green gram
13. Lentil
14. Red gram
15. Soybean
16. Cowpea
17. Others

Leafy vegetables

18. Drumstic leaves
19. Amaranthus
20. Chekurmanis

Other vegetables

- 21.

Roots and tubers

22. Carrot
23. Onion, big
24. Potato
25. Tapioca
26. Others

Nuts and oilseeds

27. Cashewnut
28. Coconut, dry
29. Groundnut
30. Others

APPENDIX VIII (Contd.)

1	2	1	2
<u>Fruits</u>		<u>Fats and oils</u>	
31. Amla		49. Butter	
32. Apple		50. Ghee	
33. Banana, Ripe		51. Hydrogenated oil	
34. Lime and Orange		52. Cooking oil	
35. Mango, Ripe			
36. Melon, water		<u>Other food stuffs</u>	
37. Papaya, Ripe		53. Betel leaves	
38. Tomato, Ripe		54. Biscuits, salt	
39. Others		55. Biscuit, sweet	
<u>Fish</u>		56. Bread, white	
40. Fish fresh		57. Sugar	
41. Fish, dry		58. Jaggery	
42. Prawns		59. Papad	
<u>Other flesh foods</u>		60. Sago	
43. Meat		61. Alcoholic beverages	
44. Chicken		62. Horlicks	
45. Liver, Goat		63. Farex	
46. Egg, Hen		64. Amul /	
<u>Milk and milk products</u>		Amulspray	
47. Milk		65. Sweets	
curds		66. Others	
buttermilk			
48. skimmed milk, liquid			
cheese.			

APPENDIX VIII (Contd.)

Dietary information

Meal pattern	Type of preparation	Ingredients used	Raw amount used g/ml	Total cooked amount g/ml
Early morning				
Break fast				
Midmorning				
Lunch				
Evening Tea and snakes				
Dinner				
Others				

## APPENDIX IX

### Procedure for height measurement

The subject was made to stand erect on a level ground with heels together and arms hanging. He was made to lean on a smooth wall on which markings up to 0.1 cm accuracy were made. The occipit shoulders, buttocks and heels were made to be in the same plane and perpendicular to the ground. A rod was held on the back of the subject and it was held perfectly vertical and parallel to the mid - sagittal plane. The reading was taken by keeping a wooden head piece gently on the head (vortex region). The line coinciding with the wooden piece was read and the reading was recorded accurately upto 0.1 cm.

## APPENDIX X

### Procedure for weighing the child

A spring balance was used to take the weight of the children. It was hung and the child was made to sit on it with minimum clothing and the weight was recorded in kilograms with an accuracy of 0.1 kg.

## APPENDIX XI

### Procedure for measuring head circumference

For taking head measurements, the child's head was steadied and the greatest circumference was measured by placing the tape firmly round the frontal bones just superior to the supra orbital, ridges, passing it round to the head at the same level on each side and laying it over maximum occipital prominence at the back. Measurements were made to the nearest 0.1 cm.



APPENDIX XII

Nutritional assessment schedule  
National Institute of Nutrition

State: District: Date:  
Taluk: Village : Block:

Serial No. Family No.

Name of the subject :

Sex : Male/Female

Name of the Father/Guardian:

Occupation :

Income (Per year): Date of birth:

Age : Years Months

Source : Present/record

Bread fed/BF + Supplements/Not BF/Pregnant/  
locating mts.

Anthropometry

---

Heights (cms)	Fat fold at triceps (mms)
Weight (kgs)	Head circumference (cms)
Arm circumference (cms)	Chest circumference (cms)

---

Clinical Examination:

Hair sparse	Pellagra
Discoloured	Crazy pavement dermatosis
Easily plucked	Pigmentation at
Moon face	knuckles/fingers/toes
Parotid enlargement	Phrynoderma
(bilateral, painless)	Koilonychia
Oedema	Gums-spongy bleeding
Emaciation	Craniotabes
Marasmus	Epiphyseal enlargement

APPENDIX XII (Contd.)

Conjunctival xerosis	Beading of ribs
Bitots' spots	Knock-knees/bow legs
Corneal xerosis/Keratemalacia	
Corneal opacity	Frontal Parietal bossing
Night blindness	: Caries
Photophobia	Teeth : Mottled enamel
Anaemia	Enlargement of spleen
Nasolabial dyssebacea	Enlargement of liver
Angular stomatitis	Soft .
Cheilosis	firm .
red & raw	hard .
Tongue: Papillae - atrophic	Tyroid enlargement
Papillae - hypertrophic	
	Others

For children below five years only

## APPENDIX XIII

### Estimation of haemoglobin - cyanmethaemoglobin method

Principle: Haemoglobin is converted into cyanmethaemoglobin by the addition of potassium cyanide and ferricyanide. The colour of cyanmethaemoglobin is read in a photoelectric calorimeter at 540 n.m. against a standard solution. Since cyanide has the maximum affinity for haemoglobin, this method estimates the total haemoglobin.

Reagent: Drabkin's solution: Dissolve 0.05 g of potassium cyanide, 0.2 g of potassium ferricyanide and 1 g of sodium bicarbonate in 1 litre distilled water.

Procedure: 20  $\mu$ l of blood are measured accurately from a haemoglobin pipette and delivered on to a whatman No.1 filter paper disc. The filter paper is air dried, labelled and can be stored upto one week. The portion of filter paper containing the blood is cut and dipped on 5 ml Drabkins solution taken in a test tube, wait for 30 minutes and mix the content on a vortex mixture and take the readings.

Construction of standard curve: If the blood drawn from the subject contain haemoglobin 15 g/dl after estimation then prepare three reference standards as follows:

1. Reference Standard A:

4 ml of blood in 1000 ml Drabkins reagent contain haemoglobin 15 g/dl

2. Reference standard B:

300 ml of reference standard A + 200 ml Drabkins reagent contain haemoglobin concentration of 10 g/dl

APPENDIX XIII (Contd.)

3. Reference standard C:

200 ml of reference standard A and 300 ml Drabkins reagent contain a haemoglobin concentration of 7.5 g/dl.

Thus we have three reference standards at three levels of haemoglobin concentration. Use 5 ml from each standard whenever haemoglobin estimations are done.

**IMPACT OF RAGI BASED FOOD SUPPLEMENT  
ON THE NUTRITIONAL STATUS OF SELECTED  
PRESCHOOL CHILDREN**

By  
**K. NAGAMMAL**

**ABSTRACT OF THE THESIS**  
SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT  
FOR THE DEGREE OF  
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DEPARTMENT OF HOME SCIENCE  
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VELLAYANI, TRIVANDRUM

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## ABSTRACT

A study on the impact of ragi based food supplement on the nutritional status of selected preschool children was conducted in the rural areas of Trivandrum district. As a first step, a survey to assess the dietary pattern of the preschool children with special reference to the influence of supplementary feeding and their food preference was conducted among 150 households using interview method.

Besides the lack of physical facilities such as water, latrines, drainage etc. food consumption pattern of the majority of the families indicated general inadequacies in quantity as well as quality. This pattern was reflected in the daily meal pattern of the preschool children.

Outbreaks of infectious diseases such as respiratory diseases, fever, diarrhoea and dysentery and scabies are found common among the preschool children. Nearly 25 per cent of the families were found to neglect primary health care facilities due to various reasons.

Food taboos were not generally found in infant feeding practices and mother were mainly responsible for child care activities.

The preschool children selected for the supplementary study (40) were attending anganwadies run under Integrated Child Development Scheme. The supplements regularly received under Anganwadies were rice, greengram, bulgar wheat and oil. Ragi biscuits were selected as a supplementary food for the anganwadi diet with a mixture of ragi, greengram, sesame, groundnut, skim milk powder, butter and sugar in different combinations. Twelve types of ragi biscuits were prepared and six were selected on the basis of the protein content and amino acid profile. From these six types, type 1 ragi biscuit was selected for feeding, after calculating the percentage preparation loss, cost per serving, percentage yield and acceptability. Overall acceptability was assessed on a five point hedonic scale.

The selected type 1 ragi biscuits have ragi, greengram, skim milk powder, butter and sugar in the proportion of 3:1:2.5:1:2.5. The protein content of 100 g of the biscuits is 14.1 g. It was decided to supply three biscuits daily one biscuit weighing 9g.

40 preschool children were selected for the study and the feeding was conducted for six months. Biscuits were prepared on alternative days. Attendance of the children and plate waste during the feeding period were recorded.

Anthropometric measurements were taken each month of the study and clinical and biochemical tests were carried out before and after the study for both experimental and control group. Weight for age profile of the preschool children indicated that there was an increase in the weight status eventhough the same was not significantly different for the experimental group. According to Gomez system of classification after the experiment children in the experimental group became normal.

Height for age profile revealed that in general there was no significant difference between experimental and standard. Profile of arm circumference revealed that there was a positive trend towards the standard. Chest/head ratio was found to be normal for all the children after the experiment.



The mean weight status was significantly better for the experimental group than the control and was significant at five per cent level. The mean height status was better for the experimental group at ten per cent level. Similar results were seen in mean arm circumference. There was no significant difference for chest and head circumference between experimental and control groups. There was a positive trend in both the groups when weight/height<sup>2</sup> was calculated. The improvement is more in the case of experimental group.

Clinical examination conducted before and after the experiment revealed that anemia, first degree malnutrition, dental caries, mottled teeth and discoloured hair were common deficiency symptoms prevalent among these preschool children.

Haemoglobin level measured before and after the experiment showed that there was a positive trend in both the groups and more in the case of the experimental group.