FEEDING PRACTICES AND NUTRITIONAL STATUS OF CHILDREN BELONGING TO HIGH RISK FAMILIES

By

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DECLARATION

I hereby declare that this thesis entitled **"Feeding practices and nutritional status of children belonging to high risk families"** is a bonafide record of research work done by me during the course work of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

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CERTIFICATE

Certified that this thesis entitled **"Feeding practices and nutritional status of children belonging to high risk families"** is a record of research work done independently by **Miss. SREEJA. K.P.** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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INTRODUCTION

INTRODUCTION

India along with many other developing countries has a comparatively young population with 38 per cent under the age of 14 years and 13.6 per cent under the age of 5 years (Ghosh, 1992).

Even though children are considered as supremely important, adequate attention is not given to their feeding practices. Feeding practices are strongly associated with the culture of a society. Rapid cultural changes due to industrialization and urbanization have largely modified such practices. Poor feeding practices inturn result in malnourishment of children. Malnourished children have less resistance to infection than wellnourished ones. The nutritional deficiencies endured in early childhood can have debilitating mental and physical consequences that are carried out into adulthood. The existence of such conditions in any population clearly has a negative impact on growth.

Circumstances, lifestyles and events can predispose an individual to disease. Observations of such associations have given rise to the concept of 'at risk' (Ebrahim, 1991). Nutritional deficiencies and other illness rarely occur alone; they are commonly associated with poverty, bad family relationships, poor hygiene and living conditions, strong cultural resistance to accepting new ideas and other similar detrimental influences (Ebrahim, 1991).

Kerala is adulated as the most progressive state in India in the domain of health, though the morbidity pattern is becoming highly prominent. This can be considered as a natural consequence of overall development, as observed in the developed western countries. But the morbidity pattern seen in Kerala is quite different from that of developed countries. There are both the 'lifestyle diseases' (non communicable diseases) and diseases of poverty (communicable diseases) coexisting in considerable proportions. More over Soman (1994) has reported that few studies conducted in Kerala have demonstrated the peculiar situation of children of the state with low mortality and high morbidity syndrome prevalent among the children below the age of two. Further NFHS (1992-93) as well as NNMB (1996) reports have revealed 35.4 to 35.6 per cent of children between 12 to 35 months of age are malnourished and malnourishment among girls is marginally higher than that among boys. Despite the overall improvement in health scenario, there is also the prevalence of under nutrition and overnutrition in Kerala. This may sound odd, but is a fact; and researchers have termed it as 'dual malnutrition'.

However nutritional status of the under five in Kerala is comparable to or even better than that of affluent sections of the populations of other parts of India.

In rural areas where living conditions are poor, children experience frequent growth disturbances especially during critical periods of growth such as infancy and toddlerhood. Reddy (1997) has reported that this age is highly vulnerable and crucial in the life of an infant. If the nutritional status of the 'under five' in urban Kerala is better and the nutritional status among rural areas is inferior, the 'villins' must be some of factors operating inbetween such as poverty, poor socio economic status, inadequate food intake, ignorance, false food believes, tradition and faulty feeding practices as reported by WHO (1997).

Widespread poverty resulting in chronic and persistent hunger is the single biggest problem of the developing world today. The physical expression of this continuously re-enacted tragedy is the condition of undernutrition which manifest itself among large section of the poor. particularly the women and children.

Useful baseline information about maternal and infant feeding practices is paramount to planning health service intervention designated to improve maternal and child health. Improvement in the quality of life of the people is an indicator of the growth and development of the state or nation.

Several studies have been done in India and Kerala on families who are below the poverty line. But in these cases poverty has been identified employing the criteria of family income (below 11000/year) or calorie intake (below 2100 kcal/per caput) (Anon., 1997). In the present study the poor families were identified on the basis of a poverty and an attempt was made to assess the feeding practices and nutritional status of children belonging to high risk families and to identify the risk factors influencing their diet and nutritional status. These risk factors could be used to select beneficiaries and to target nutritional and social interventions to needy families or individual children, as we stand in the door step of Nineth Plan and are planning to achieve self sufficiency through grass root level action programmes organised through gram panchayat.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Nutrition is the focal point for health and well being. The problems of poverty, safe drinking water, environmental hygiene and poor literacy contribute to problems of nutrition and public health. Malnutrition is an ecological problem that does not occur alone (Bamji *et al.* 1996).

Ghosh (1992) explains that India has a comparatively young population as 38 per cent are below the age of 14 years and 13.7 per cent are below the age of five years.

'The progress of nation's report' released jointly by Government of India and UNICEF in 1996 estimates that 53 per cent of all under five children are underweight, which is an indication of malnutrition (Anon., 1990).

National Family Health Survey (NFHS) reports of 1992-93 reaffirms that 35.4 to 35.6 per cent of children between 12 to 35 months of age are malnourished; and malnourishment among girls is marginally higher than that among boys as per both NNMB and NFHS data.

Prevalence of malnutrition

Malnutrition continues to undermine the development of vulnerable groups in developing countries (Yadav and Singhal, 1995).

India has been reported to have the highest per cent of moderately and severely under weight children, when compared to selected Asian countries, as reported by Grant (1993).

Of the nearly 12 million children under 5 who die each year in developing countries mainly from preventable causes, the death of over 6 million, or 55 per cent are either directly or indirectly attributable to malnutrition (UNICEF, 1998).

Gai and Gupta (1995) are of the opinion that among the highly susceptable group are infants and toddlers, who consistute nearly 10 per cent of India's population.

UNICEF (1991) has further reported that from the nutritional stand point the most vulnerable segments of the population are infants and young children and protein calorie malnutrition in these group belonging to the poor socioeconomic classes is a major public health problem.

UNICEF (1990) has also opined that in terms of age group, the incidence of severe malnutrition appears to be higher among children of 0-3 years than groups in almost all states. UNICEF (1990) has also reported that among infants protein, energy malnutrition was found in the Eastern states, Uttarpradesh, Madhyapradesh and Kerala.

Charanjit *et al.* (1997) reported that major nutritional deficiencies found in India include PEM, vitamin A deficiency, anaemia, iodine deficiency disorders and B complex deficiency. Among them PEM is found to affect 45 per cent of preschool children.

Gopalan *et al.* (1996) observed that 44 per cent of preschool children in India are suffering from PEM.

India is a country of villages in which about 70 per cent of people reside, their income levels are low and about one third live below the poverty line (Devi and Nair, 1998).

While poverty is a limiting factor in buying enough food, rampant malnutrition is not entirely due to poverty. There is widespread ignorance about the essentials of child care including nutritional requirements and the common foods that supply the necessary nutrients (Gupta, 1995).

Gupta (1995) has further reported that most mothers have very little idea about how much food a child needs for adequate growth and nutrition, hence inadequate feeding practices leads to malnutrition. There is now a growing realization that malnutrition is not only a problem of food supply but also behavioural determinants affecting child feeding and rearing (Devi, 1998). This fact is endorsed by Rao (1996) who has opined that widespread malnutrition prevalent in the world is largely attributed to social, cultural and economic factors.

According to Ghosh (1992) malnutrition results from the interaction of several factors, such as poor socioeconomic condition, parental ignorance and illiteracy, repeated infections, large families, closely spaced families etc.

The main causes of malnutrition in India includes non-availability of foods, poverty, population growth, custom and traditions, socio economic variables like caste, religion, level of education and influence of industrialization, urbanization and modernization as explained by Soman and Rajasree (1994).

WHO (1997) has documented the determinants of malnutrition to be poverty, poor socio economic status, inadequate food intake, ignorance, false believes, traditions, caste, poor living condition and faulty food habits.

Bethesda (1993) has reported that PEM is the outcome of a complex interplay of several socio economic and cultural factors.

Devadas (1992) has pointed out a positive correlation between large number of siblings and severity of protein energy malnutrition among children.

Nair (1995) is of the opinion that malnutrition and infant death are much higher in closely spaced pregnancies when compared to those with an interval of 3 to 4 years.

Singh (1997) has reported that with an increase of sibling number there is an apparent increase in moderate and severe forms of PEM. As the incidence of PEM reduces the nutritional status is also negatively modifies the feeding practices followed by the mothers of sick children and poor feeding practices worsen the condition of the child. Thus a vicious cycle of illness, malnutrition and poor feeding practices exists.

Feeding practices

The human infant, unlike young ones of other species is wholly dependent for his food and care, on others (Reddy, 1997).

Suryakanthi (1991) has stated that practices such as feeding, weaning, health care, feeling of affection and security are called child rearing practices. She is of the opinion that a number of factors influence child rearing practices. These include the educational status of the mother and father, occupation of the parent, type of the family and traditional practices of the society.

Gupta (1995) stated that 'feeding' is of great importance as it is a 'must' to meet nutritional as well as emotional and physchological needs of the infant.

The basic food for infant feeding is milk. Breast feeding is the most natural method of feeding infants (ICMR, 1996).

The practice of breast feeding is almost universal in India. For most of the rural mothers, this is a natural method of feeding because they see others around them doing the same (Ghosh, 1997).

The unparalleled value of breast feeding to infant health is well known. Although physiologic inability to breast feed is a very rare event, a multitude of external factors influence breast feeding behaviour as stated by Neyzi (1991).

Feeding practices are strongly associated with the culture of a society (WHO, 1996).

Breast feeding patterns determine the nutritional status of children both in health and disease. Arora (1990) has reported that breast feeding practices bear a strong relation with social customs and beliefs.

Delayed breast feeding is one of the reasons that precipitates malnutrition among infants (Banerjee, 1995). The main reason for the delay in starting breast feeding in some of the reason, appears to be the belief that lactation gets established only around the third day (Prabhakara *et al.*, 1987).

Prabhakara *et al.* (1987) have stated that breast milk and honey were the commonest first feeds given to children soonafter birth.

Madise and Mpona (1997) conducted a survey to assess the association between feeding practices and nutritional status of children under 5 years in Malawi. The results obtained suggest that socio-economic factors, morbidity in appropriate feeding practices are some of the factors associated with malnutrition.

Rao (1989) has reported that in Karnataka, several mothers are of the opinion that colustrum should not be given to new born infants and have discarded it.

ICMR (1996) stated that a majority of mothers in Poona and Gandhigram area, the colestrum is discorded, while in Kerala a majority of mothers fed colestrum to their infants.

Devadas (1991) has reported that prolonged breast feeding practices coupled with delayed and inadequate supplementation may cause growth retardation.

Rogers *et al.* (1997) had conducted a study on the relationship between early infant feeding and the rate of grant of the offsprings. After 3-4 months, breast fed infants in the developed world are light than formula fed infants.

IMHFW (1991) has reported that in north India the sophisticated mothers are keen on starting artificial feeding right at the birth of the baby. The other extreme are those women who continue breast feeding till the child is 5 years of age of so. They also found that breast feeding was almost universal and it was carried on for about 21st months, but the introduction of complementary food too late.

According to Ebrahim (1991) the prolonged breast feeding may lead to delayed weaning. They also found that breast feeding was almost universal and that it was carried on for about 21 months, but the introduction of complementary foods started too late.

Negeal *et al.* (1990) opined that duration of breast feeding was longest among low socioeconomic groups.

According to Ischorwood (1988) prolonged breast feeding usually ceased only when the mother becomes pregnant again.

Omondi (1990) reported that the New Guinea breast feeding duration was one year where as in urban areas it is less than one year. This was due to the fact that waged employment of mother was associated with shorter breast feeding duration.

Suryakanthi (1991) reported that another undesirable practice found is that a large number of mothers follow demand feeding. They fed their babies whenever they cry. This kind of irregular feeding causes stomach upsets and children develop had habit of crying frequently.

Awaste (1990) observed that in rural areas of Bangalore breast feeding was done on demand as manifested by crying of the child and mothers did not follow any specific schedule for breast feeding.

When the baby attains about 6 months of age, milk alone is no longer sufficient to meet its calorie requirements. It needs some more calories and other nutrients as supplement to milk till it is ready to eat fully the adult food. This is the weaning stage, when the baby is weaned from a diet based on milk to a diet based on milk and other solid foods. The supplementary foods may be either liquid or semisolid or solid foods (IIPS, 1995).

Weaning begins from the momemt supplementary food is started and continues till the child is taken off the breast completely (Srilakshmi, 1996).

Weaning is a crucial event in the life of an infant. Weaning is the partial or total replacement for breast milk. According to Devadas (1991) suitable weaning foods should be introduced to complement breast milk during the first year of life.

In a report, published by Gupta (1995) infant food is defined as a complementary food, breast milk supplement or weaning food represented as a partial or total replacement for breast milk. The so called supplementary foods are initiated in the form of some liquids like fruit juices or soups and semisolid and solid like gruel, biscuit and mashed fruits and vegetables. The author further states that introduction of semisolids and solids should be made when the baby is about 4-6 months of age. This depends upon the quantity of mothers milk, baby's ability to suck, mothers health and mothers availability to breast feed the child.

According to Dipak (1995) supplementation should be initiated after the third month to prevent malnutrition and related complications due to infection and infestation.

Indian Academy of Pediatrics (IAP, 1984) recommends that in general, any food or drink other than breast milk need not be introduced before the child completes 4 months of age.

Rao (1989) reported that supplementary foods given to children included milk, cereals, pulses with negligible amount of vegetables and diary products while tea was the usual beverage given to the child.

Awaste (1990) is of the opinion that in many rural communities in India, weaning doesnot start until two years and in rare cases upto 4 years, while in urban areas weaning often starts much earlier and additional foods are some times given when the infant is only a few months.

Rao (1989) reported that in Karnataka state most of the women started weaning their children around one year of age and in few instances weaning was not initiated until 3 or 4 years of age.

Dorea and Furumoto (1992) studied the type of food, time of introduction, frequency, and nutrient intake among infants and toddlers. They reported that breast fed and mixed fed infants were likely to receive more milk feedings than breast fed infants and that sugar and liquids such as the tea, fruit juices and soft drinks were introduced at a very early age.

A survey conducted by Kaur *et al.* (1989) has revealed that most mothers in rural Ludhiana introduced milk supplements before six months.

Prabhakara *et al.* (1990) a study conducted in Hyderabad revealed that introduction of semisolid supplements begins about 6 months after birth.

Semioal *et al.* (1986) studied the feeding and weaning practices of infant in the urban slums of Delhi. The result obtained, revealed that for 43.3 per cent of children, supplements were introduced at the age of 4 months, and 23.3 per cent prolonged breast feeding and delayed weaning upto one year and delayed weaning caused malnutrition among them.

According to Rathnaprabha and Vimala (1990) in tribal areas of Anthra Pradesh, large number of mothers felt that supplementary foods other than milk could be given by one year. Few mothers were of the opinion that foods other than milk could be given between 4 and 5 months. Thirty eight per cent of the mothers felt that all types of foods can be given to child by one year.

Viswanath (1990) had reported that in rural Bangalore. majority of the informants started weaning during the period between 7-12 months and only five per cent of mothers had started supplementary feeding by the time the infant attained six months of age. Majority had (90.8%) started supplementation late and they were ignorant about significance of supplementary feeding. The supplementary foods introduced were cereals, fruit, milk and milk based preparations. Over dilution of milkand use of unclean utensils were also observed during the study.

Gopujkar (1990) in his study conducted in Bombay observed that weaning began about 4 to 6 months. Most of infants were fed on commercial milk preparations.

Kylbert *et al.* (1990) explained that the formula fed infants who were 4 month old had a higher intake of all nutrients. The nutrient density changed from 9 to 24 months old, indicating a transition during that period from infant to adult food habits.

David and David (1984) studied feeding practice by interviewing women and examining their infants. Of the infants being bottled-fed at the time of survey, 73 per cent received unmodified dried whole milk products, and only 24 per cent were fed humanized or modified dried infant formula. In infants under six months age, bottle feeding caused at least an eight fold increase in the risk of severe malnutrition compared with breast feeding.

Khan (1989) conducted a study among rural Bangladeshi children from birth upto 12 month of age. The infants were breast fed alone or given home made supplements of rice gruel, rice powder paste, cow's milk, semi solid feeds of flour. The average weight of the infants was equal to the standard upto 4 month; changes in height followed a similar pattern. During the first year, the incidence and duration of diarrhoea were higher in the exclusively breast fed children than those given supplements.

Hansain *et al.* (1996) studied in a cohort of 200 infants over a period of one year in the rural area of Aligarh. Weaning was laste in most of the infants under the study. The nutritional status of infants upto 6 months was significantly better than that of infants who were more than 6 months of age. Most of them used the foods from family pot for weaning.

Huffman and Martin (1994) had conducted a study on feeding of infants and toddlers. The result revealed that poor weaning diet characterised by inadequate calories, proteins and micronutrients, accounts for high levels of malnutrition, morbidity and mortality among 6-24 months of age.

WHO (1993) has revealed that 72 per cent of the children from lower socio economic groups were undernourished due to poor quality of food and early weaning. Breast milk can sustain growth and development only till 4 to 5 months of age beyond which in the absence of supplementation, growth slows down and malnutrition results.

Simodan and Simodan (1997) conducted a study on the introduction of complementary food and physical growth of children between 2 to 9 months in rural Senegal. The result obtained revealed that some mothers consider that all infants should be exclusively breast fed for at least 6 months, since earlier introduction of complementary food was associated with higher morbidity, mainly diarrhoea.

Study conducted in Nigeria revealed that PEM is still highly prevalent there due to faulty weaning practices. Improper feeding practices such as non hygienic preparation of over diluted formula or starch gruels give rise to severe PEM (Nnakwe. 1995).

Infection and nutritional status

Ghosh (1991) has opined that repeated infections are very common among under privileged children especially those under 3 years of age. These infections have adverse effect on nutritional status and once the child is malnourished, she falls ill more often, making the infections more severe, further worsening malnutrition.

The six vaccine preventable infections are known as six major killers. They are diphtheria, petrusis, tetanus, T.B., polio and measles. While Western countries have been able to conquer these six killers, by immunization (Ebrahim, 1991).

In our country even now about 1 million children die annually of these diseases (Philip, 1990). There are ever so many infections for which immunizations are not available; diarrhoeal diseases being an example. This disease is of great public health importance, since it is responsible for one third of infant deaths and it also leads to malnutrition (Banergee, 1995).

Badrudhin *et al.* (1991) had reported that the reason for infant death in the world each year was that the poor section of the families were not immunized against killer diseases. In children who came from comparatively low socio economic settings the incidence of diarrhoial disease is more common. Delayed initiation of breast feeding was more common in the diarrhoea groups. This indicated that feeding practices may be important risk factor for diarrhoea. Diarrhoea especially when prologed and frequent affects the nutritional status of the child.

Gai (1996) had reported that children who were of fifth or higher birth order had significantly higher risk of diarrhoea when compared to them who were of the birth order two or three.

Malaria and intestinal parasites are other risk factors (Tabone *et al.*, 1992; Marinho *et al.*, 1991).

Pelto (1991) explains that insufficient use of health care services, noncomplaince with treatment, unhygienic behaviours, poor feeding practices of infants and toddlers and inappropriate handling of foods facilitate repeated infections.

The effect of infection on nutritional status may be mainly brought about by decrease in food intake and or increased metabolic losses of nutrients (Swaminathan, 1998).

Mehar (1995) reported that the importance of proper nutrition to the growth and development of infants during their first year, covers developmental aspects of infant feeding, trends in infant feeding of later infancy, nutritional considerations of feeding whole cow's milk to infants, and the introduction of supplementary foods.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The study comprised of the following aspects

3.1 Selection of area

3.2 Selection of families and subjects

3.3 Conduct of the study

3.3.1 Collection of data on vital statistics of the area

3.3.2 Socio economic survey

3.3.3 Assessment of feeding practices

3.3.4 Assessment of nutritional status

3.3.5 Consolidation and analysis of the data to identify the risk factors influencing diet and nutritional status of children of the locality.

The materials and methods used to assess the above factors are detailed below.

3.1 Selection of area

The study was conducted in Malappuram district of Kerala. Since the study aims to assess the feeding practices of children belonging to high risk families, Kalikavu panchayat of the district was purposively selected for the study as this panchayat was found to have highest number of children below the age of five (1991 census).

3.2 Selection of families and subjects

3.2.1 Selection and identification of high risk families

As the objective of the study is to assess the feeding practices of children belonging to high risk families it was necessary to identify the high risk families and to further select subjects for the study from such families.

High risk families were identified using the criteria suggested by Srilatha and Gopinathan (1995) by conducting a preliminary survey. A specially designed score sheet indicating the risk factors was used for interviewing an adult member of every household. The above criteria was adopted since the designers of the above method have successfully identified the at risk families in Alappuzha district using the same. A family was considered as 'high risk' if any of the 4 or more of the risk factors identified by Srilatha and Gopinathan (1995) existed in it.

Thus 150 families with at least one child below the age of 23 months but above the age of 6 months were selected for the study. In this study the children between 6 to 23 months of age were selected because this age group is a critical period of growth in the life span of a human being (Reddy, 1997).

3.2.2 Selection of subjects

One hundred children from the above 150 families who had maximum number of risk factors (more than 4) were selected at random as the subjects for the study. Care was taken to see that half of the children were infants and the remaining half were toddlers, as shown in Table 1.

Table 1 Classification of subjects

	Infants	Toddlers	Total
Experimental group	50	50	100
Control group	15	15	30
Total	65	65	130

According to Reddy (1997) infancy is the period from 0-1 year and toddler hood is the period between the age of 1-3 years.

A sample of 30 children belonging to the same social strata from the area of the study having one or two out of nine risk factors identified were selected for comparison as control group (Table 2).

A subsample of 20 per cent from the experimental and control groups were further selected at random for detailed study on food consumption pattern as detailed below.

Table 2 Classification of subjects in the subsample

	Infants	Toddlers	Total
Experimental group	10	10	20
Control group	5	5	10
Total	15	15	30

3.3 Conduct of the study

As the study envisages to assess the feeding practices and the factors influencing diet and nutritional status of children from high risk families the following aspects were studied in detail.

3.3.1 Vital statistics of the area of study

3.3.2 Socio economic condition of the families

3.3.3 Infant and toddler feeding practices

3.3.4 Nutritional status of children

The methods and materials used to study the above aspects are detailed below.

3.3.1 Vital statistics

Vital statistics of the area was collected as an indirect method to assess the health and nutritional status of the children with reference to social, economic and environmental conditions of the community in which the subjects are living. The details were collected from records and reports available from panchayat, block and government offices.

3.2.2 Socio economic condition of the families

The socio economic condition of the families of the subjects were assessed through a survey.

The socio economic survey was conducted since the social and economic condition in which one lives is said to have a direct impact on food habits, feeding practices and nutritional status as suggested by Meer *et al.* (1995).

The survey was conducted using a specially designed structured and pretested interview schedule (Appendix V) so as to collect details regarding the caste, type, size and composition of the family, income, employment status, educational status, expenditure pattern, availability of potable water, sanitary facilities, availability and cost of fuel, family meal pattern and social problems. The information was collected by interviewing the head of the family.

3.3.3 Infant and toddler feeding practices

The feeding practices were studied in detail among infants and toddlers separately since this forms the backbone of the study. Two separate schedules to assess the feeding and dietary practices of infants and toddlers were structured pretested and suitably modified (Appendix VI and VII). The schedules were developed in such a way so that information on infant and toddler feeding practices, introduction of supplementary foods, age of weaning and restriction of certain foods, type and quality of food consumed, nature of care takers, rate of participation in supplementary feeding programmes, food fads and fallacies, nutrient content of average daily diet etc. could be ascertained by interviewing the mother.

According to Britten (1995) interviewing is a well established research technique.

3.3.4 Assessment of nutritional status

Assessment of nutritional status is one of the first steps in the formulation of any public strategy to combat malnutrition. Nutritional status is the condition of health as influenced by intake of food (Robinson, 1957). The principal aim of such an assessment is to determine the type, magnitude and distribution of malnutrition in different geographic areas, to identify the "at risk" groups and to determine the contributory factors, as explained by Rao and Vijayaraghavan (1996).

In the present study three methods were employed to assess the nutritional status of infants and toddlers, namely

3.3.4.1 Anthropometry

3.3.4.2 Clinical examination and

3.3.4.3 Diet survey

3.3.4.1 Anthropometry

Nutritional anthropometry is the measurement of human body at various ages and levels of nutritional status and it is based on the concept that an appropriate measurement should reflect any morphological variation occurring due to a significant functional physiological change (Rao, 1996).

Nutritional anthropometry was adopted in the present study because the pattern of growth and physical fitness of an individual though genetically determined, are profoundly influenced by diet, as explained by Gai (1996).

Of the different measurements used in anthropometry, the following nutritional indicators were selected in this study as they are found to be most appropriate to assess the nutritional status of infants and toddlers.

1. Height for age
2. Weight for age
3. Mid upper arm circumference
4. Head circumference and
5. Chest circumference

Weight for age

Weight is the measurement of body mass (Rao and Vijayaraghavan, 1996). Weight deficiency appears to be the best indicator of the prevalence of protein energy malnutrition among all age groups. Jelliffe (1966) is of the opinion that comparison of weight for age values with regional standards at corresponding ages will help to determine the degree of underweight in a community.

The weight was measured once in three months and was compared with NCHS/IAP standards.

A spring balance was used to take the weight of the infant. 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.

Height for age

Height is a linear measurement made up of the sum of four components, leg, pelvis, spine and skull. The extent of height deficit in relation to age as compared to regional standards is regarded as a measure of the duration of malnutrition as suggested by Gopaldas and Seshadri (1987). A deficit in height may represent a short period of growth failure at an early stage or a longer period of growth failure at a later stage. Hence the height of all subjects were measured and compared with NCHS standards.

The height was taken three times during the period of study.

The infant was laid on the wooden 'length board' kept on a flat surface. The head was kept in position firmly against the fixed part with legs kept vertically. The knees were extended by pressure with the help of an assistant. Measurements were made to the nearest 0.1 cm.

The height was measured once in 3 months.

Head and chest circumference

Sharma (1995) reported that at the time of birth, head circumference is greater than that of chest. By the age of six months usually the chest circumference overtakes the head circumference. In undernourished, this process of overtaking gets delayed to 1.5 to 2 years. Hence this measurement was used to assess the nutritional status as well as their physical development pattern.

For taking head measurements, the child's head was steadied and the greatest circumference was measured by placing a soft fibre glass tape firmly round the frontal bones just superior to the supra orbital ridges, passing it round 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 (Meyers, 1972).

Chest circumference of the subjects were also taken with a fibre glass tape and measurement made at the nipple line. during mid-inspiration, to the nearest 0.1 cm (Jelliffe, 1966).

The head and chest circumferences were measured, once in 3 months and compared with NCHS standards.

Mid upper arm circumference (MUAC)

The measurement of the circumference at the mid upper arm is a useful and practical means of assessing protein calorie deficiency during early childhood (Swaminathan, 1998). Hence the mid upper arm circumference was measured.

The arm circumference of the left arm at its mid point with a flexible fibre glass tape, which was placed gently, but firmly embracing the arm without exerting too much pressure on the soft tissue.

The MUAC was taken once in 3 months and then compared with NCHS standards and during the period of study the MUAC was taken 3 times.

3.3.4.2 Clinical assessment

According to Swaminathan (1998) clinical examination is the most important part of nutritional assessment as direct information of signs and symptoms of dietary deficiencies prevalent are obtained. Hence the clinical assessment was carried out.

In the present study the investigator with the help of a qualified physician assessed the clinical symptoms of malnutrition among the infants and toddlers using the proforma prepared by NIN. The proforma used for clinical assessment is presented in Appendix VI.

3.3.4.3 Diet survey

In the present study diet survey was carried out on a sub sample of 30 children comprising of 10 infants and 10 toddlers from the experimental group of 100 children and 5 infants and 5 toddlers from the control group using circular systematic sampling technique. Twenty four hour recall method was used to assess the food intake of infants, while weighment method (one day) was used for toddlers.

The nutrient intake was calculated from the average food consumption of individual children using the food composition table (ICMR, 1991) and the values were compared with RDA of the respective age groups. From the nutrient intake data, Nutrient Adequacy Ratio, Mean Adequacy Ratio (MAR), Index of Nutritional Quality and probability approach to evaluating nutrient intakes were worked out.

3.3.5 Consolidation and analysis of data

The data derived from socio economic and diet surveys and anthropometric studies were subjected to suitable statistical treatments such as percentage analysis, test of significance and chi-square analysis, so as to find out the relationship among risk factors, feeding practices, nutritional status of infants and toddlers and also to find out their influence on the quality of life of these children who belong to high risk families.

RESULTS

4. RESULTS

The results of the study are presented under the following headings:

4.1 Vital statistics

4.2 Poverty index

4.3 Prevalence of child risk factors

4.4 Socio economic status

4.5 Feeding practices

4.6 Anthropometry

4.7 Clinical status

4.8 Diet survey

4.9 Nutritional status

4.1 Vital statistics of the study area

The vital statistics of the area under focus of the study with reference to infants and toddlers are presented in Table 3.

The vital statistics of the study area as against that of Kerala State and Indian nation as a whole were collected from the records available at panchayat office, Kalikavu, Block Development Office, Nilambur and also from reports received from Government departments and international organizations. The data reveals that Malappuram district has a high infant mortality rate, birth rate and death rate when compared with the average values reported for the state and the nation as a whole. This indicates that the risk of mortality is high in the district, which hampers the survival of children in general.

Table 3 Vital statistics of the study area

Particulars	India	Kerala State	Malappuram district	Nilambur Block	Kalikavu Panchayat
Birth rate/1000	29.00	17.30	6.30	29.41	8.5
Death rate	6.30	6.00	8.2	9.10	15.70
IMR/1000	73.00	13.00	43.40	27.20	8.70
MMR	4.00	3.00	20.00	11.80	15.00

4.2 Poverty index of the families

Srilatha and Gopinathan (1995) in their study done at Alappuzha had identified nine risk factors that may affect the welfare of families in a community. Family welfare directly or indirectly affects the nutritional and health status of children in particular. In the present study an attempt was made to identify the at risk families using the method suggested by Srilatha and Gopinathan (1995). Here poverty is defined on the basis of a risk index called 'poverty index' and a family is considered as high risk, if any four or more of the nine risk factors listed in the index scale are present. The poverty index scores, families with infants and toddlers belonging to experimental and control groups are given in Appendix I and II.

The data revealed that all the families were found to have four or more risk factors and hence are victims of poverty.

4.2.1 Distribution of subjects according to the presence of family risk factors

The data pertaining to distribution of families with respect to the presence of different risk factors are given in Table 4.

It is seen that all families had children below 5 years of age, and that itself could increase the risk of the family to be poverty stricken. Among these 100 families who had infants, lack of latrine facility, absence of employed adults and presence of alcoholics were the risk factors found respectively among 90 per cent, 70 per cent and 60 per cent of families. Being a member of the scheduled caste family was found to be a risk factor among 56 per cent while 36 per cent had housing problem which has lead them to poverty.

In the case of families with toddlers the presence of children below 5 years of age itself seems to be a risk factor for all families. Lack of drinking water facilities, poor

Table 4 Distribution of infants and toddlers with respect to family risk factors

Risk factors	Distribution of families of	
	Infants (n=50)	Toddlers (n=50)
1. Family belonging to SC/ST	28 (56)	20 (40)
2. Family having children below 5 years of age	50 (100)	50 (100)
3. Family having even one illiterate and adult	12 (24)	15 (30)
4. Family without one or no adult employed	35 (70)	37 (74)
5. Living in katcha houses	18 (36)	28 (56)
6. Family without a household latrine	45 (90)	19 (38)
7. Family with no access to safe drinking water	22 (44)	46 (92)
8. Family consuming only two or less meals a day	1 (0)	0 (0)
9. Presence of an alcoholic or drug addict in the family	30 (60)	31 (62)

* Figures given in parenthesis indicates percentage

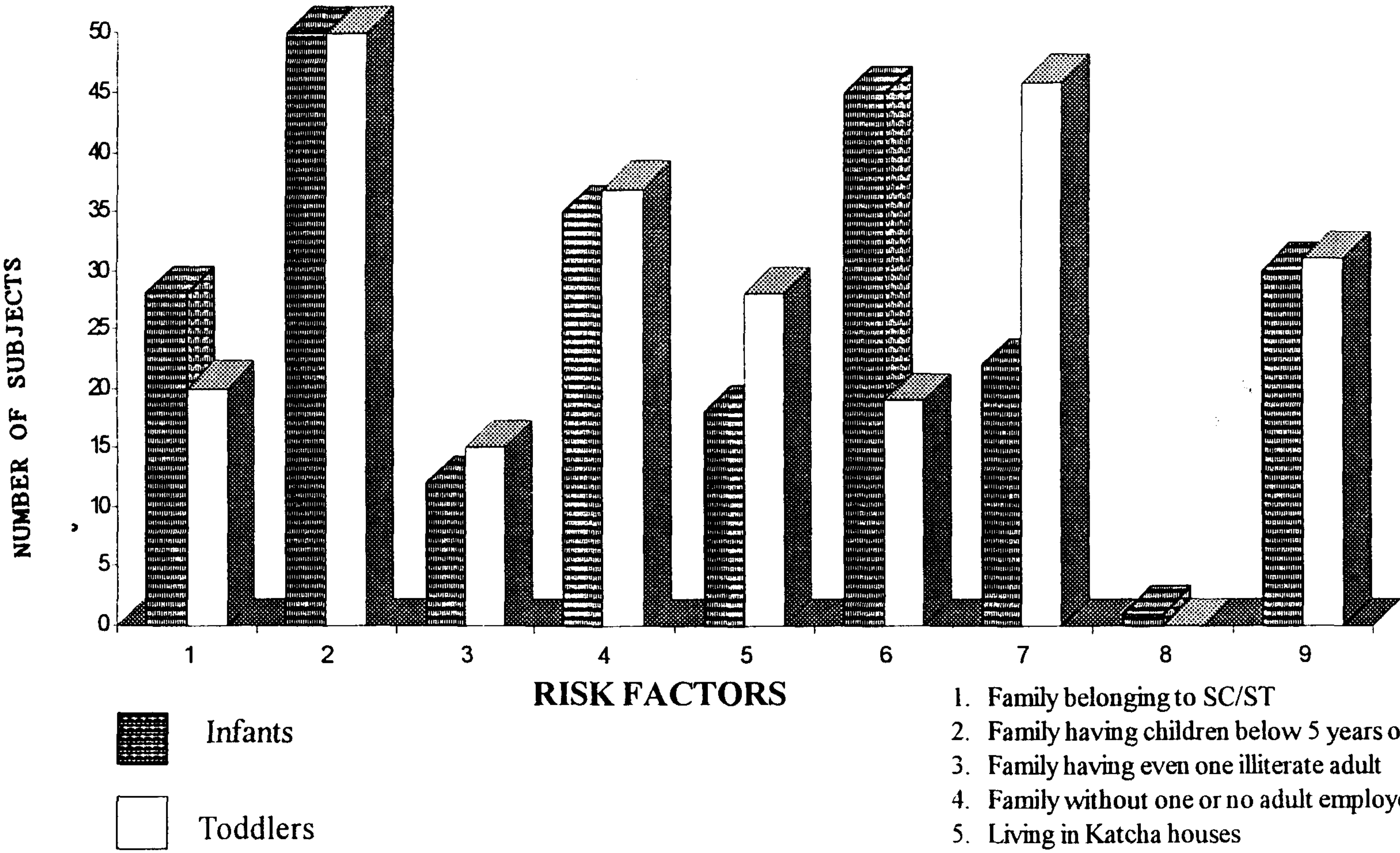
employment status and presence of an alcoholic are the major risk factors found respectively among 92 per cent, 74 per cent and 62 per cent of families. (Fig. 1)

The data on the prevalence of risk factors were further analysed to find out which were the most widely prevalent risk factors among the families of infants and toddlers selected for the study. The risk factors ranked according to their extent of prevalence are presented in Table 5.

Table 5 Rank order of risk factors

Risk factors	Ranking order	Number of families having the risk factors
1. Family having children below 5 years of age	I	100
2. Family without one or no adult employed	II	72
3. Family with no access to safe drinking water	III	68
4. Presence of an alcoholic or drug addict in the family	IV	63
5. Family belonging to SC/ST	V	48
6. Living in katcha houses	VI	46
7. Family having even one illiterate adult	VII	37
8. Family without a household latrine	VIII	31
9. Family consuming only 2 or less meals a day	IX	1

Fig. 1 DISTRIBUTION OF SUBJECTS WITH RESPECT TO FAMILY RISK FACTORS



1. Family belonging to SC/ST
2. Family having children below 5 years of age
3. Family having even one illiterate adult
4. Family without one or no adult employed
5. Living in Katcha houses
6. Family without a household latrine
7. Family with no access safe to drinking water.
8. Family consuming only two or less meals a day
9. Presence of an alcholic ot drug addict in the family

It is seen from the table that all families had children below 5 years of age and this factor was ranked as factor No. I. Lack of employment among adult members of the family and lack of access to safe drinking water were ranked as II and III which were observed respectively among 72 and 68 per cent of the families. The next important risk factors were absence of a household latrine and presence of an alcoholic which were observed among 31 and 68 per cent families. The other factors which were ranked as V, VI, VII and VIII were family belonging to SC/ST, living in katcha houses, family without household latrine and family having an illiterate adult and these risk factors were found among 31 to 48 per cent of the families surveyed. However it was surprising to note that there was only one family which had 'only two meals a day' a risk factor which was ranked at the lowest file of the ranking order.

In general the study indicated that the presence of children below 5 years of age, lack of safe drinking water and low employment status and alcoholism were the major risk factors observed among more than 60 per cent of the families surveyed at Kalikavu panchayat of Malappuram district in Kerala leading to poverty.

4.3 Prevalence of child risk factors

In order to identify children at risk the criteria suggested by Ghosh (1992) was used in the present study. She identified 10 risk factors which would make children nutritionally vulnerable. An initial survey was conducted using a scale consisting of 10 risk factors and the risk factors prevalent among the subjects were enumerated. In this each risk factor was given a score of 'one' and the total score indicates the number of risk factors. The maximum score that can be obtained through this scale would be '10' and minimum would be '0'. The risk index scores of infants and toddlers of the experimental and control groups are presented in Appendix II. . The distribution of subjects based on the number of risk factors are presented in Table 6.

Table 6 Distribution of subjects based on number of risk factors present

Score	Infants	Toddlers	Total
4	19 (38)	4 (8)	23 (23)
5	10 (20)	24 (48)	34 (34)
6	14 (28)	16 (32)	30 (30)
7	7 (14)	6 (12)	13 (13)
Total	50 (100)	50 (100)	100 (100)

Values in the parenthesis indicates percentage

Based on the child risk factors 62 per cent of infants had a total of scores 5 and above 5. Among the toddlers 92 per cent toddlers had score above 5 and 8 per cent had a total scores 5. In general 77 per cent of children had scores 5 and above 5 out of the total score of ten.

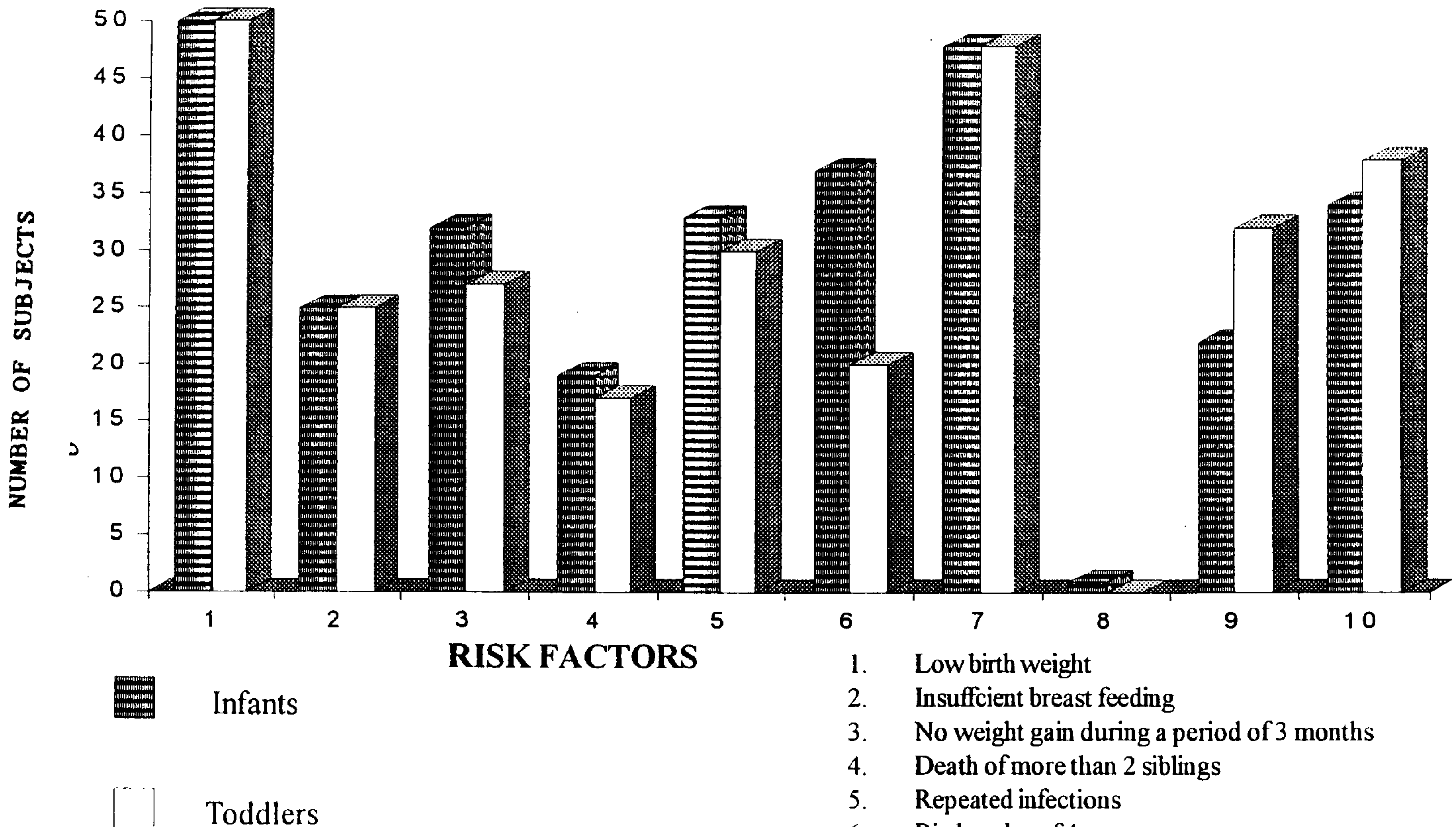
The data in general indicated that the control group had less than 3 risk factors while the experimental group had 4 to 7 risk factors out of 10.(Appendix II)

The prevalence of risk factors among infants and toddlers were further analysed and distribution of subjects with respect to the number of risk factors observed are presented in Table 7. The data revealed that among the 100 families surveyed 36 per cent, 63 per cent, 57 per cent and 96 per cent are affected by 4, 5, 6 and 7 risk factors respectively.

Data on the indicated risk factors prevalent among infants and toddlers are presented in Table 7. Among the risk factors low birth weight was (the most common problem) found in all the families. Spacing of less than two years, presence of a working mother and repeated infection were the risk factors found respectively among 96 per cent, 68 per cent and 66 per cent of infants. Low weight gain during a period of three months and insufficient breast feeding were the risk factors for 64 per cent and 52 per cent of infants respectively.

Among toddlers low birth weight was found in all families. Spacing of less than 2 years, working mother, family problems and birth order of four or more were the risk factors found in 96 per cent, 76 per cent, 64 per cent and 60 per cent respectively of families of toddlers. (Fig. 2).

figure 2 **DISTRIBUTION OF SUBJECTS WITH RESPECT TO CHILD RISK FACTORS**



1. Low birth weight
2. Insuffcient breast feeding
3. No weight gain during a period of 3 months
4. Death of more than 2 siblings
5. Repeated infections
6. Birth order of 4 or more
7. Spacing less than 2 years
8. Multiple births
9. Family problems
10. Working mother

44

Table 7 Distribution of subjects with respect to child risk factors

Risk factors	Infants n=50	Toddlers n=50
1. Low birth weight	50 (100)	50 (100)
2. Insufficient breast feeding	25 (50)	25 (50)
3. No weight gain during a period of 3 months	32 (64)	27 (34)
4. Death of more than 2 siblings	19 (38)	17 (34)
5. Repeated infections	33 (66)	30 (60)
6. Birth order of 4 or more	37 (74)	20 (40)
7. Spacing less than 2 years	48 (96)	48 (96)
8. Multiple birth	1 (2)	-
9. Family problem	22 (44)	32 (64)
10. Working mother	34 (68)	38 (76)

Figures in the parenthesis denotes percentage

Risk factors at aggregate level prevalent among infants and toddlers together are presented in Table 8. Among the risk factors low birth weight, birth interval of less than 2 years and the presence of a working mother were found to be the three most important risk factors that were observed among cent per cent, 96 per cent and 72 per cent of families surveyed. Risk factors such as birth order of four or more, repeated infection and family problem such as alcoholism and insufficient breast feeding were also found to be the risk factors with ranking order of ranging from 4 to 8 and these are found among more than half of the subjects surveyed.

Table 8 Prevalence of child risk factors according to their ranking order

Risk factors	Rank order	No.of children who had affected by the risk factor
1. Low birth weight	I	100
2. Spacing less than 2 years	II	96
3. Working mother	III	72
4. Birth order of 4 or more	IV	63
5. Repeated infections	IV	63
6. No weight gain during a period of 3 months	V	59
7. Family problem	VI	54
8. Death of more than 2 siblings	VII	51
9. Insufficient breast feeding	VIII	36
10. Multiple birth	IX	2

4.4 Socio economic status

The following details pertaining to the socio economic status of the subjects namely, religion, caste, family size and composition, employment status, income and expenditure pattern, type of house and physical amenities available in the house, meal pattern, social problems if any, that may be present in the households etc, were collected from 130 families selected for the study and the results obtained are presented below.

4.4.1 Religion

The religion and caste wise distribution of the respondents are presented in Table 9. The data collected revealed that 66.15 per cent of the subjects were Hindus while 33.85 per cent were Muslims. The predominance of Hindus were observed in the experimental as well as control groups. It was surprising to note that there were no christians in the population surveyed.

4.4.2 Caste

From the socio cultural point of view disparities between religions are further ramified through the caste system which further segregates individual religious groups. In order to find out the impact of cultural variation that may influence the feeding practices of infants and toddlers, the classification of subjects into different castes has been looked into. Caste wise distribution of the families of the subjects are also presented in the Table 9. The data indicated that all the subjects selected at random belonged to backward communities and none belonged to forward castes. The data depicted that 53.08 per cent of the subjects belonged to other back ward classes (OBC) such as Muslims, Ezhavas, etc. while

(46.92 per cent) of the subjects belonged to scheduled castes. There were no families coming under the schedule tribe group.

4.4.3 Type of family

The cultural milieu of India is studied with the composite family structure which has been proclaimed to be the characteristic phenomenon leading to the stability of its social structure. Hence the type of family was taken in to consideration so as to find out its influence on the feeding practices of children and the details are presented in the Table 9.

The results indicated that 94.00 per cent families belonging to the experimental group and 86.87 per cent families from the control group were found to be 'joint families' and the remaining were nuclear families and there were no extended families.

When the family size was analysed it was seen that only 7.70 per cent families had 1 to 4 members while the remaining 92.30 per cent families had more than four members Table 9. In the present study majority of the families were 'large families'.

4.4.4 Demographic profile of the families

The food needs of any population depends on its demographic characteristics like the total population, age and

Table 9 Religion, caste, type of family and size of family wise distribution

	Experimental group						Control group						Grand
	Infant		Toddler		Total		Infant		Toddler		Total		Total
Religion													
Hindu	33	(66)	35	(70)	68	(68)	8	(53.33)	10	(66.67)	18	(60)	86 (66.15)
Muslim	17	(34)	15	(30)	32	(32)	7	(46.67)	5	(33.33)	12	(40)	44 (33.85)
Total	50	(100)	50	(100)	0	(100)	15	(100)	15	(100)	30	(100)	130 (100)
Caste													
FC	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0 (0)
OBC	22	(44)	28	(56)	50	(100)	10	(66.67)	9	(60)	19	(63.33)	69 (53.08)
BC - SC	28	(56)	22	(44)	50	(100)	5	(33.37)	6	(40)	11	(36.67)	61 (46.92)
Total	50	(100)	50	(100)	100	(100)	15	(100)	15	(100)	30	(100)	130 (100)
Type of family													
Nuclear	2	(4)	4	(8)	6	(6)	2	(13.33)	2	(13.33)	4	(13.33)	10 (7.70)
Joint	48	(96)	46	(92)	94	(94)	13	(86.87)	13	(86.87)	26	(86.67)	120(92.30)
Total	50	(100)	50	(100)	100	(100)	15	(100)	15	(100)	30	(100)	130 (100)
Small family (1-4 number)	2	(4)	4	(8.00)	6	(6)	2	(13.33)	2	(13.33)	4	(13.33)	10 (7.7)
Large family (5-10 number)	48	(96)	46	(92.00)	94	(94)	13	(86.67)	13	(86.67)	26	(86.67)	120 (92.30)
Total	50	(100)	50	(100)	100	(100)	15	(100)	15	(100)	30	(100)	130 (100)

Table 10 Sex and age wise distribution of members of different families

	Experimental group						
	Male members of infant family	Male members of toddler family	Total	Female members of infant family	Female members of toddler family	Total	Tota
	1	2	3	4	5	6	7
18 years and above	58 (46.40)	89 (47.34)	147 (46.96)	64 (33.31)	100 (57.47)	164 (44.80)	311 (45.8
Adolescents (11-17 years)	8 (6.40)	4 (2.13)	12 (3.83)	8 (4.19)	7 (4.02)	15 (4.1)	27 (3.9
School going children (6-10 years)	26 (20.80)	37 (19.68)	63 (20.13)	20 (10.42)	22 (12.65)	42 (11.48)	105 (15.
Preschool children (0-5 years)	33 (26.40)	58 (30.85)	91 (29.08)	100 (52.08)	45 (25.86)	145 (39.62)	236 (34.
Total	125 (100)	188 (100)	313 (100)	192 (100)	174 (100)	366 (100)	679 (100

Control group						
Male members of infant family	Male members of toddler family	Total	Female members of infant family	Female members of toddler family	Total	Grand Total
8	9	10	11	12	13	14
23 (44.10)	13 (20.63)	36 (42.86)	24 (52.18)	14 (32.56)	38 (42.70)	74 (42.77)
3 (5.88)	30 (47.52)	3 (3.57)	5 (10.67)	8 (18.60)	13 (14.61)	16 (9.25)
15 (29.41)	5 (7.94)	20 (23.81)	4 (8.69)	2 (4.65)	2 (2.25)	22 (12.72)
10 (19.61)	15 (23.84)	25 (29.76)	17 (36.76)	19 (44.19)	36 (40.44)	61 (35.26)
51 (100)	63 (100)	84 (100)	46 (100)	43 (100)	89 (100)	173 (100)

sex wise distribution of its members. These details are necessary as food requirement availability and consumption pattern are known to be affected by these factors. Hence information on these parameters were collected and are presented in Table 10.

The total population, of 100 families surveyed under the experimental group, was 679. Out of this, 45.80 per cent were adults (above the age 18), 50.22 per cent were children. Among the adults 46.96 per cent were males and 44.80 per cent were females.

There were 236 children under 5 years of age, out of this 29.08 per cent were boys an 39.62 per cent were girls. The above results revealed the predominance of female population both among adults and children.

In the control group out of the 30 families selected, the total family size was 173 members. The table also revealed that 42.86 per cent of the adults were males and 42.70 per cent were females. This revealed the predominance of female population in the control group also.

4.4.5 **Educational status**

Assessment of educational status is an essential component of any developmental activity as it helps people to understand and practice, the ideals preached. The educational status of the parents of the subjects in general and the status

Table 11 Educational status of parents of infants and toddlers

	Experimental group			Control group			Grand Total
	Edn. st. of fathers of infants	End. st. of fathers of toddlers	Total	End. st. of fathers of infants	Edn. st. of fathers of toddlers	Total	
Illiterate	11 (22)	4 (8)	15 (15.62)	–	–	–	15 (11.90)
LPS	10 (20)	14 (28)	24 (25.00)	–	–	–	24 (19.05)
UPS	20 (40)	20 (40)	40 (41.67)	3 (20)	8 (53.33)	11 (36.67)	51 (40.48)
SSLC	9 (18)	8 (16)	17 (17.71)	12 (88)	7 (46.67)	19 (63.33)	36 (28.57)
Total	50 (100)	46* (92)	96 (100)	15 (100)	15 (100)	30 (100)	126 (100)
Educational status of mother							
Illiterate	5 (10)	4 (8)	9 (9)	–	–	–	9 (6.92)
LPS	8 (16)	12 (24)	20 (20)	–	–	–	20 (15.38)
UPS	28 (56)	24 (48)	52 (52)	5 (33.33)	7 (46.67)	12 (40.00)	64 (49.23)
SSLC	9 (18)	10 (20)	19 (19)	10 (66.67)	8 (53.33)	18 (60.00)	37 (28.46)
Total	50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	30 (100)	130 (100)

Figures in the parenthesis denotes percentage

* 4 died.

with special reference to the mothers were also taken into consideration. Educational status of the respondents showed wide variation which is evident from Table 11. Majority of the parents were literate.

In the experimental group 15.62 per cent of fathers of respondent children were found to be illiterates, while in the control group there were no illiterates. Fathers of 25 per cent of the respondents belonging to the experimental group had completed primary level of education, while 41.67 per cent had upper primary education. In brief the respondents from the control group had better educational status than the experimental group.

In the experimental group 9 per cent of mothers were illiterates while in control group there were no illiterates. Twenty per cent of the mothers had primary level of education while 40.23 per cent had upper primary level of education.

The data in general revealed better educational status of females when compared to the male counterparts in the area of study.

4.4.6 Employment status of the family

Level of employment is a crucial determinant of income. The employment pattern gives an idea about the nature of activities and the extend to which the parents of the

Table 12 Employment status of the family

No.of family members employed	Experimental group			Control group			Grand Total
	Infants	Toddlers	Total	Infants	Toddlers	Total	
Only member	6 (12)	16 (32)	22 (22)	11 (73.33)	10 (66.67)	21 (70)	43 (33.07)
2 Member	44 (88)	34 (68)	78 (78)	4 (26.67)	5 (33.33)	9 (30)	87 (66.93)
Total	50 (100)	50 (100)	15 (100)	15 (100)	15 (100)	30(100)	130 (100)

Nature of employment

Agriculture labourer	30 (60)	28 (56)	58 (58)	5 (33.33)	4 (26.67)	9 (30)	67 (51.53)
Labourer	20 (40)	22 (44)	42 (42)	8 (53.34)	7 (46.66)	15 (50)	57 (43.85)
Service	-	-	-	2 (13.33)	4 (26.67)	6 (20)	6 (4.62)
Total	50 (100)	50 (100)	100 (100)	15 (100)	30 (100)	130 (100)	130 (43.85)

Figures in the parenthesis denotes percentage subjects are unemployed or underemployed which indirectly gives an indication about their family income or economic status.

Details pertaining to the employment status of the family members are presented in Table 12. It could be seen from the table that 78 per cent of families in the experimental group had two employed adults, while in the control group only 30 per cent had two earning members. It was further observed that 22 per cent of the families in the experimental group and 70 per cent in the control group had one earning member each.

The nature of occupation of the respondents are also given in Table 12. The data revealed that 58 per cent of respondents were agricultural labourers in the experimental group and the remaining 42 per cent were labourers of a general category (Coolie). While in the control group 30 per cent of respondents were agricultural labourers and 50 per cent were coolies and 20 per cent were engaged in jobs of a service orientation. The data revealed that majority of the respondents of the study were agricultural labourers.

4.4.7 Monthly income

Examination of monthly income of families gives an indication of the standard of living and provides an indication of their purchasing capacity. Distribution of families based on their monthly income is presented in Table 13. Majority of the families had a monthly income ranging from 201 to 400 Rs.

Table 13 Monthly income of the family

Income range (Rs.)	Experimental group			Control group			Grand Total
	Families of Infants	Families of Toddlers	Total	Families of Infants	Families of Toddlers	Total	
< 200	4 (8)	8 (16)	12 (12)	-	-	-	12 (9.23)
201 - 400	37 (74)	36 (72)	73 (73)	-	-	-	73 (56.15)
401 - 600	5 (10)	6 (12)	11 (11)	-	-	-	11 (8.46)
601 - 800	4 (8))	-	4 (4)	7 (46.67)	8 (53.33)	15 (100)	19 (14.62)
> 800	-	-	-	8 (53.33)	7 (46.67)	15 (100)	15 (11.54)
Total	50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	30 (100)	130 (100)

The data revealed that 9.23 per cent of families (both experimental and control group) had a monthly income below Rs. 200, while in the income of 56.15 per cent of families (both experimental and control group) ranged between Rs. 200 to 400. Out of 130 families (of both experimental and control group) only less than 14.62 per cent of the families had an income ranging between 601 to 800 Rupees. It was observed that in the control group 11.54 per cent of families had an income greater than Rs.800 and the remaining 14.62 per cent had an income between 600 to 800 Rupees.

4.4.8 Monthly expenditure pattern

The economic status of families depends not only on the income, but also on the expenditure pattern. Expenditure on food is one of the most important and unavoidable items of family expenditure. Hence the details of expenditure was assessed in the study.

[illegible]. Assessment of the monthly expenditure on food items, revealed that the average expenditure of experimental group ranged between Rs.200-500.

The corresponding figures for the control group were Rs. 600 to 800 per month.

A comparison of the expenditure pattern of the experimental and control group revealed that families of control group were found to spend more on food and non food items.

4.4.9 Frequency of purchase of various food items

The distribution of families (both experimental and control groups and infants and toddlers) with respect to frequency of purchase of various foods presented Tables 15 and 16, indicated that 10 per cent families in the experimental group and 6.66 of families in the control group were purchasing cereals on a daily basis, while 95 per cent families in the experimental group and 96.66 per cent families in the control group were in the habit of purchasing cereals once in a week.

Green leafy vegetables were purchased on a weekly basis by 12 per cent of families in the experimental group and 60 per cent in the control group, while others purchased this once in a month. The remaining 71 per cent and 26.69 per cent of families respectively in experimental and control groups reported that they never purchased leafy vegetables. With respect to other vegetables only 98 per cent families were purchasing them on a weekly bais in the experimental group.

Over and above the food items like roots, milk and fish were purchased on a daily basis by families belonging to

Table 15 Distribution of families based on frequency of purchase of various food items - Experimental group

Food items	Daily			Weekly			Monthly			Once in 6 month			Never			Seasonably		
	Infant	Toddler	Total	Infant	Toddler	Total	Infant	Toddler	Total	Infant	Toddler	Total	Infant	Toddler	Total	Infant	Toddler	Total
Cereals																		
Rice	5 (10)	-	5 (10)	45 (90)	50 (100)	95 (95)	-	-	-	-	-	-	-	-	-	-	-	-
Wheat	-	-	-	10 (20)	10 (20)	20 (20)	-	40 (80)	40 (40)	-	-	-	-	10 (20)	10 (20)	-	-	-
Pulses	-	-	-	10 (20)	30 (60)	40 (40)	40 (80)	20 (40)	60 (60)	-	-	-	-	-	-	-	-	-
Green leafy vegetables	-	-	-	2 (4)	10 (20)	12 (12)	15 (30)	2 (4)	17 (17)	-	-	-	-	-	-	-	-	-
Other vegetables	2 (4)	-	2 (2)	48 (96)	50 (100)	98 (98)	-	-	-	-	-	-	-	-	-	-	-	-
Roots and tubers	36 (72)	45 (90)	81 (81)	4 (8)	4 (8)	8 (8)	10 (20)	5 (10)	15 (15)	-	-	-	-	-	-	-	-	-
Fruits	-	-	-	-	-	-	15 (30)	40 (80)	55 (55)	5 (10)	-	5 (5)	3 (6)	-	3 (3)	24 (48)	10 (10)	34 (34)
Nuts and oil seeds	-	-	-	50 (100)	40 (80)	90 (90)	-	10 (20)	10 (10)	-	-	-	-	-	-	-	-	-
Milk and milk products	30 (60)	34 (64)	64 (64)	20 (40)	16 (32)	36 (36)	-	-	-	-	-	-	-	-	-	-	-	-
Fats and oils	15 (30)	-	15 (15)	35 (70)	50 (100)	85 (85)	-	-	-	-	-	-	-	-	-	-	-	-
Sugar	6 (12)	-	6 (12)	10 (20)	25 (50)	35 (70)	34 (68)	25 (50)	59 (59)	-	-	-	-	-	-	-	-	-
Egg	-	-	-	-	-	-	10 (20)	10 (20)	20 (20)	-	-	-	40 (80)	40 (80)	80 (80)	-	-	-
Fish	48 (96)	45 (90)	93 (93)	2 (4)	5 (10)	7 (7)	-	-	-	-	-	-	-	-	-	-	-	-
Meat	-	-	-	12 (24)	5 (10)	17 (34)	-	-	-	-	-	-	28 (56)	17 (34)	45 (45)	-	-	-
Miscellaneous	-	-	-	30 (60)	-	30 (30)	50 (100)	-	50 (50)	-	-	-	20 (20)	-	20 (20)	-	-	-
Baby foods	-	-	-	-	-	-	14 (28)	3 (6)	17 (17)	-	-	-	36 (72)	47 (94)	83 (83)	-	-	-
Spices and condiments	-	-	-	50 (100)	50 (100)	100 (100)	-	-	-	-	-	-	-	-	-	-	-	-

Table 16 Distribution of families based on the frequency of purchase of various food items - Control group

Food items	Daily			Weekly			Monthly			Once in 6 month			Never		
	Infant	Toddler	Total	Infant	Toddler	Total	Infant	Toddler	Total	Infant	Toddler	Total	Infant	Toddler	Total
Cereals	1 (6.66)	-	1 (3.33)	14 (93.33)	15 (100)	29 (96.66)	-	-	-	-	-	-	-	-	-
Pulses	-	-	-	13 (86.66)	15 (100)	28 (93.33)	2 (13.33)	-	-	-	2 (13.33)	2 (50)	-	-	-
Green leafy vegetables	-	-	-	8 (53.33)	10 (66.66)	18 (60)	4 (26.66)	-	-	-	-	-	3 (3.33)	5 (33.33)	8 (26.60)
Other vegetables	-	-	-	12 (80.80)	15 (100)	27 (90.00)	3 (20.00)	-	-	-	- (13.33)	- (50)	-	-	-
Roots and tubers	-	-	-	15 (100)	15 (100)	30 (100)	-	-	-	-	-	-	-	-	-
Fruits	-	-	-	-	-	-	13 (86.66)	10 (66.66)	23 (76.66)	-	-	-	2 (13.33)	2 (26.66)	-
Nuts and oil seeds	-	-	-	13 (86.66)	5 (33.33)	18 (60.00)	-	-	-	-	-	-	2 (13.33)	10 (66.66)	-
Milk and milk products	14 (93.33)	10 (66.66)	24 (80.00)	1 (6.66)	5 (33.33)	6 (38.66)	-	-	-	-	-	-	-	-	-
Fats and oils	2 (13.33)	-	-	13 (86.66)	15 (100)	28 (93.33)	-	-	-	-	-	-	-	-	-
Sugar	-	-	-	-	-	-	7 (46.67)	8 (53.33)	15 (100)	-	-	-	-	-	-
Egg	-	-	-	5 (33.33)	5 (33.33)	10 (66.66)	-	-	-	10 (66.66)	10 (66.66)	20 (66.66)	-	-	-
Fish	15 (100)	15 (100)	30 (100)	-	-	-	-	-	-	-	-	-	-	-	-
Meat	-	-	-	8 (53.33)	7 (46.67)	15 (100)	-	-	-	-	-	-	8 (53.33)	7 (46.67)	15 (100)
Baby foods	-	-	-	-	-	-	4 (26.66)	4 (26.66)	8 (53.33)	-	-	-	11 (73.33)	11 (73.33)	15 (100)
Spices and condiments	-	-	-	15 (100)	15 (100)	30 (100)	-	-	-	-	-	-	-	-	-

experimental group and control groups. The table also revealed the fact that items such as fats and oils (85 per cent), sugar (70 per cent) and spices (100 per cent) were purchased on a weekly basis in the experimental group.

4.10 Frequency of use of various foods

The details pertaining to the frequency of use of various foods by the families (of experimental and control groups consisting of infants and toddlers) are presented in Tables 17 and 18. It can be seen from the table that food items like rice. other vegetables, coconut, fat and oils, sugars, spices and condiments were used daily by all the families (130 families) surveyed.

Only four per cent of the families among the experimental group used pulses daily as against 20 per cent in the control group. Thirty four per cent of families of the experimental group used pulses once in a month while in the control group 13.33 per cent used it weekly thrice.

Out of 100 families (experimental group) only 6 per cent families were found to use green leafy vegetables daily, while 16 per cent families were using it weekly twice. It is seen that 78 per cent families used green leafy vegetables only once in a month. This indicated the low level of consumption of green leafy vegetables.

Table 17 Distribution of families based on the frequency use of food items - Experimental group

Food items	Daily		Weekly thrice		Weekly twice		Weekly once		Once in month		Never		Total	
	Infant	Toddler	Infant	Toddler	Infant	Toddler	Infant	Toddler	Infant	Toddler	Infant	Toddler	Infant	Toddler
Cereals	50 (100)	50 (100)	-	-	-	-	-	-	-	-	-	-	50 (100)	50 (100)
Pulses	4 (8)	-	-	-		-	19 (38)	7 (14)	26 (52)	36 (72)	5 (10)	3 (6)	50 (100)	50 (100)
Green leafy vegetables	2 (4)	1 (2)	-	3 (6)	5 (10)	3 (6)	16 (32)	19 (38)	22 (44)	17 (34)	5 (10)	7 (14)	50 (100)	50 (100)
Other vegetables	29 (58)	18 (36)	15 (30)	14 (28)	6 (12)	5 (10)	-	4 (8)	-	9 (18)	- (10)	-	50 (100)	50 (100)
Roots and tubers	10 (20)	17 (34)	12 (24)	9 (18)	12 (24)	3 (6)	14 (28)	14 (28)	2 (4)	4 (8)	-	3 (6)	50 (100)	50 (100)
Fruits	-	-	-	-	3 (6)	7 (14)	6 (12)	2 (4)	24 (48)	28 (56)	17 (34)	20 (40)	50 (100)	50 (100)
Nuts and oilseeds	50 (100)	50 (100)	-	-	-	-	-	-	-	-	-	-	50 (100)	50 (100)
Fat and oil	50 (100)	50 (100)	-	-	-	-	-	-	-	-	-	-	50 (100)	50 (100)
Sugar	50 (100)	50 (100)	-	-	-	-	-	-	-	-	-	-	50 (100)	50 (100)
Egg	-	-	-	-	-	-	16 (32)	4 (8)	5 (10)	20 (40)	16 (32)	26 (52)	50 (100)	50 (100)
Meat	-	-	-	-	-	-	5 (10)	8 (16)	10 (20)	9 (18)	-	-	50 (100)	50 (100)
Fish	29 (58)	44 (88)	15 (30)	5 (10)	-	6 (12)	4 (8)	5 (10)	9 (18)	33 (66)	31 (62)	-	50 (100)	50 (100)
Milk	16 (32)	36 (72)	11 (22)	8 (16)	13 (26)	1 (2)	10 (20)	4 (8)	2 (4)	2 (4)	-	-	50 (100)	50 (100)
Beverages	50 (100)	50 (100)	-	-	-	-	-	-	-	-	-	-	50 (100)	50 (100)
Spices and condiments	50 (100)	50 (100)	-	-	-	-	-	-	-	-	-	-	50 (100)	50 (100)

Figures in parenthesis represent percentage

Table 18 Distribution of families based on the frequency of use of food items - Control group

Food items	Daily		Weekly thrice		Weekly twice		Weekly once		Once in month		Never		Total	
	Inf.	T	Inf.	T	Inf.	T	Inf.	T	Inf.	T	Inf.	T	Inf.	T
Cereals	15 (100)	15 (100)	-	-	-	-	-	-	-	-	-	-	15 (100)	15 (100)
Pulses	-	3 (20)	-	2 (13.33)	2 (15.32)	7 (46.67)	5 (33.33)	-	3 (20)	3 (20)	-	3 (20)	15 (100)	15 (100)
Green leafy vegetables	-	3 (20)	-	6 (40)	2 (13.33)	5 (33.33)	8 (53.33)	-	5 (33.33)	-	-	1 (6.67)	15 (100)	15 (100)
Other vegetables	6 (40)	2 (13.33)	8 (53.33)	1 (6.67)	1 (6.67)	6 (40.00)	-	1 (6.67)	-	5 (33.33)	-	-	15 (100)	15 (100)
Roots and tubers	1 (6.67)	2 (13.33)	4 (26.66)	4 (26.66)	5 (33.33)	8 (53.33)	5 (33.33)	1 (1.67)	-	-	-	-	15 (100)	15 (100)
Fruits	-	-	-	-	3 (20.00)	7 (46.66)	7 (46.66)	2 (13.33)	4 (26.67)	6 (40.00)	1 (1.67)	-	15 (100)	15 (100)
Fats and oils	15 (100)	15 (100)	-	-	-	-	-	-	-	-	-	-	15 (100)	15 (100)
Sugar	15 (100)	15 (100)	-	-	-	-	-	-	-	-	-	-	15 (100)	15 (100)
Egg	-	-	-	-	5 (33.33)	4 (26.67)	8 (53.33)	8 (53.33)	8 (53.33)	3 (20)	2 (13.33)	3 (20)	15 (100)	15 (100)
Meet	-	-	-	-	-	-	5 (33.33)	8 (53.33)	10 (66.66)	9 (66.63)	-	-	15 (100)	15 (100)
Fish	11 (73.33)	9 (66.63)	2 (13.33)	2 (13.33)	-	-	-	2 (13.33)	-	1 (1.67)	-	-	15 (100)	15 (100)
Milk and milk products	10 (66.66)	15 (100)	2 (13.33)	-	-	-	-	3 (20.00)	-	-	-	-	15 (100)	15 (100)
Beverages	15 (100)	15 (100)	-	-	-	-	-	-	-	-	-	-	15 (100)	15 (100)
Spices and condiments	15 (100)	15 (100)	-	-	-	-	-	-	-	-	-	-	15 (100)	15 (100)

Figures in the parenthesis indicates percentage

Other vegetables were found to be used moderately in the diet. Out of the 100 families 47 per cent were found to be taking other vegetables on a daily basis, while 29.33 families were consuming them on a weekly basis. The table also revealed that 8 per cent families were preparing other vegetables at least weekly once and five families were found to be using them weekly once. Rest of the families rarely included these vegetables in their diet.

Roots and tubers were found to be moderately used. Twenty seven per cent families were using roots and tubers daily, while 31 per cent families consumed them weekly thrice.

Details pertaining to inclusion of fruits in the daily diet are also presented in the Table 17 and 18. Fruits in general have found to be an item most neglected. Majority of the families (62 per cent) were taking fruits just once in a month while 22.23 per cent stated that they never consumed fruits.

As the general dietary survey had revealed that all the respondents were non vegetarians, enquiries were made with reference to frequency of use of different foods of animal origin such as egg, meat, milk and fish.

Consumption of egg was found to be very low. Most of the families reported that they never used egg. Only 10 per cent of the families had reported the use of egg once in a month.

Meat was used moderately among 30 families, 26 families were found to use meat weekly once.

However majority of the families were found to consume fish on a daily basis. Ninety three out of 130 families were found to eat fish daily.

Milk was purchased by 72.60 per cent of families and was given to children daily.

Frequency of use of various food items in the daily diet was measured on five point rating scale. Mean scores obtained for each food item on the basis of frequency of use are given in Table 19. As indicated in the Table only cereals, coconut, oil, sugar/jaggery, tea/coffee, spices and condiments were found to have a mean score of five.

Based on the score obtained for different food articles, the food items were classified in to 4 groups viz., most frequently used foods, moderately used foods, less frequently used foods, and least frequently used foods. The classification of food items based on the frequency scores are given in Table 20.

The data presented in Table 20 shows that among the families belonging to the experimental group, foods such as cereals, fish, coconut oil, sugar and beverages like tea/coffee were the most frequently used foods and were used daily. Moderately used foods were milk and milk products, other

Table 19 Classification of food items based on frequency scores

Food items	Mean score				Mean percentage		Mean score over total score	
	Infants		Toddlers					
	Experi-mental group	Control group	Experi-mental group	Control group	Experi-mental group	Control group	Experimental group	control group
Cereals	5.00	5.00	5.00	5.00	100.00	100.00	100.00	100.00
Pulses	1.42	2.27	1.45	3.13	28.44	45.33	29.38	62.66
Green leafy vegetables	1.75	1.80	1.88	3.85	35.11	36.00	37.61	77.00
Other vegetables	3.60	4.30	3.56	2.60	72.03	86.67	71.20	52.00
Roots and tubers	3.75	3.07	3.45	3.53	75.00	61.33	68.94	70.60
Fruits	1.36	1.66	1.06	2.04	27.27	33.33	21.33	41.33
Nuts and oil seeds coconut oil.	5.00	5.00	5.00	5.00	100.00	100.00	100.00	100.00
Fat and oils	5.00	5.00	5.00	5.00	100.00	100.00	100.00	100.00
Sugar and jaggary	5.00	5.00	5.00	5.00	100.00	100.00	100.00	100.00
Egg	1.17	1.38	1.17	1.20	23.52	27.69	23.33	29.44
Meat	1.70	2.00	1.48	2.00	34.17	40.00	29.58	40.00
Fish	4.46	4.85	4.80	4.67	89.20	96.92	96.00	93.33
Milk and milk products	3.62	4.26	4.64	5.00	73.28	85.33	93.33	100.00
Beverages	5.00	5.00	5.00	5.00	100.00	100.00	100.00	100.00
Spices and condiments	5.00	5.00	5.00	5.00	100.00	100.00	100.00	100.00

Table 20 Classification of food items based on food groups

Scores	Subjects		Food items
Most frequently used foods (76-100)	Experimental group	Infant	Cereals, nuts, oils, sugar, fish, beverages, spices
		Toddler	Cereals, roots and tubers, nuts, oil, sugar, fish, beverages, spices
	Control group	Infant	Cereals, other vegetables, nuts, oils, sugar, fish, milk, beverage, spices
		Toddler	Cereals, nuts, oils, sugar, fish, milk, beverages, spices
Moderately used foods (51-75)	Experimental group	Infant	Other vegetables, milk and milk products
		Toddler	Other vegetables
	Control group	Infant	Roots and tubers
		Toddler	Pulses, other vegetables
Less frequently used foods (20-50)	Experimental group	Infant	Pulses, green leafy vegetables, fruits
		Toddler	Pulses, green leafy vegetables, meat
	Control group	Infant	Green leafy vegetables, fruits
		Toddler	Fruits, egg
Least frequently used foods (below 25)	Experimental group	Infant	Egg
		Toddler	Egg

vegetables, roots and tubers. Meat, pulses and green leafy vegetables were found to be less frequently used.

In the case of control group most frequently used foods were cereals, other vegetables, coconut, oil, sugar, fish, milk and milk products and beverages. Moderately used foods were roots and tubers and less frequently used foods were pulses, green leafy vegetables, fruits and egg.

4.4.11 Possession of assets

Apart from food, housing condition as well as physical amenities in and around the household has a profound influence on health and nutritional status of infants and toddlers. The results obtained on such lines of enquiry are detailed below.

Possession of the house is one of the factors determining the economic status of a family. Enquiry on ownership of house and land by the respondents revealed that all the 130 families had their own houses as revealed in Table 21.

Majority of the families had land holdings less than 15 cents. Information related to the distribution of families with respect to the area of land available around the house is presented in Table 21.

Table 21 Housing conditions of families

	Experimental group			Control group			Grand Total
	Infants	Toddlers	Total	Infant	Toddler	Total	
Land area (cents)							
< 5	14 (28)	14 (28)	28 (28)	2 (13.33)	6 (40)	8 (26.67)	36 (27.69)
6 - 10	28 (56)	22 (50)	50 (50)	4 (26.67)	5 (33.37)	9 (30)	62 (47.67)
11 - 15	6 (12)	11 (22)	17 (17)	4 (26.67)	4 (26.67)	8 (26.67)	25 (19.25)
16 - 20	2 (4)	3 (6)	5 (5)	5 (33.33)	0 (0)	5 (16.66)	7 (5.39)
Total	50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	30 (100)	130 (100)
Ownership of the house							
Owned	50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	30 (100)	130 (100)
Rented	0 (0)	0 (0)	0	0	0	0	0
Total	50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	30 (100)	130 (100)

Figures in parenthesis denotes percentage

4.4.11.1 Housing condition

As housing was reported to be a major problem faced bv the high risk families (Mishra, 1995) more details were collected with respect to the housing condition of the respondents.

From the Table 21 it can be seen that 47.67 per cent families had around 6-10 cents of land while 27.69 per cent families reported having less than five cents of land. Nearly 19.25 per cent of the families were found to possess 11-15 cents of land and only 5.39 per cent families had 16-20 cents. None of them had more than 20 per cents of land. From this observation it is inferred that half of the families in the experimental group had 6 to 10 cents while in the control group majority (72.66 per cent) had of 10-20 cents of land.

4.4.12 Nature of the house

Nature and facilities available in the households were ascertained as it would help to find out the standard of living. Half of families in the experimental group had houses with mud wall and tiled roof. The details pertaining to the nature of house presented in the Table 22 revealed that 49 per cent families had houses with mud wall and tiled roof and another 49 per cent of families had mud wall and thatched roof

Table 22 Distribution of families based on type and nature of houses

	Experimental group			Control group			Grand total
	Infants	Toddlers	Total	Infants	Toddlers	Total	
Nature of house							
MW + TR	27 (54)	22 (44)	49 (49)	1 (6.67)	2 (13.33)	3 (10)	52 (40)
MW + TiR	22 (44)	27 (54)	49 (49)	12 (80)	6 (46.67)	18 (60)	67(57.53)
BW + TR	1 (2)	1 (2)	2 (2)	2 (13.33)	7 (40)	9 (30)	11 (8.47)
Total	50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	30 (100)	130(100)
Number of rooms							
1 to 2	37 (74)	34 (68)	71 (71)	5 (33.38)	5 (33.33)	10(33.33)	81 (62.31)
3 to 4	13 (26)	16 (32)	29 (29)	10 (66.67)	10 (66.67)	20(66.67)	49 (37.69)
Total	50 (100)	50(100)	100 (100)	15 (100)	15 (100)	30 (100)	130 (100)

Figures in parenthesis denotes percentage
MR - Mudwall, Tir - Tiled roof, TR - Thached roof, BW - Brick wall

and only 2 per cent families had brick wall and tiled roof for their houses.

While in the control group 10 per cent of families had houses with mud wall and thatched roof, 60 per cent had mud wall with tiled roof and 30 per cent of families had brick wall with tiled roof. In general, the control group had better shelter arrangements than the experimental group.

In this study 62.31 per cent of families had one to two rooms and 37.69 families had three to four rooms and none had more than 4 rooms. Details pertaining to these are presented in the Table 22.

4.4.13 Physical amenities available in the households

Information related to physical amenities are presented in Table 23.

In the study area water was available to all the families by way of either a well with in the premises of the household or a public well or a tap (from public water distribution system) nearby.

It may be seen that 71 per cent of families were depended on public wells for water, some had to walk half km to one and a half kilometer to collect water from open wells.

Table 23 Physical amenities available in the households

	Experimental group			Control group			Grand total
	Infant	Toddler	Total	Infant	Toddler	Total	
Sanitary condition							
Good	14 (28)	20 (40)	34 (34)	6 (40)	5 (33.33)	11 (36.67)	45 (34.62)
Fair	28 (56)	24 (48)	52 (52)	8 (53.33)	8 (53.33)	16 (53.33)	68 (34.31)
Poor	8 (16)	6 (12)	14 (14)	1 (6.67)	2 (13.33)	3 (10.00)	17 (13.07)
Total	50 (100)	50 (100)	100(100)	15 (100)	15 (100)	30(100)	130 (100)
Electricity							
Yes	3 (6)	3 (6)	6 (6)	-	1 (6.67)	1 (3.33)	7 (5.39)
No	47 (94)	47 (94)	94 (94)	15 (100)	14 (93.33)	29 (96.97)	123 (94.61)
Total	50 (100)	50 (100)	100(100)	15 (100)	15 (100)	30 (100)	130 (100)
Drinking water							
Well	8 (16)	7 (14)	15 (15)	15 (100)	13 (86.87)	28 (93.33)	43 (33.08)
Pipe	8 (18)	5 (10)	14 (14)	-	2 (13.33)	2 (6.67)	16 (12.31)
Public well	33 (66)	38 (76)	71 (71)	-	-	-	71 (34.61)
Total	50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	30 (100)	130 (100)
Lavatory							
Yes	13 (26)	17 (34)	30 (30)	14 (43.33)	14 (93.33)	28 (93.33)	58 (44.62)
No	37 (74)	33 (66)	70 (70)	1 (6.67)	1 (6.67)	2 (6.67)	72 (55.38)
Total	50 (100)	50 (100)	100(100)	15 (100)	15 (100)	30 (100)	130 (100)

Figures in parenthesis denotes percentage

The present study revealed that majority (94.61 per cent) of families did not have electricity in their house. It was further disturbing to realise that lavatory facility was not available to half of the families. Only 44.62 per cent of families had lavatories attached to the household and 55.38 per cent of families had no lavatory facilities.

Health risks in households of developing countries arise from poor sanitation, inadequate water supply, poor hygiene, inadequate garbage disposal and drainage (Philip, 1995). However the present study revealed that majority of the families had fair sanitary conditions.

The Table 23 revealed that 34 per cent of the families in the experimental group and 53.33 per cent of families in the control group lived under neat environmental conditions. 52.31 per cent of families of both experimental as well as control group were found to have fairly acceptable conditions while 13.07 per cent of families had poor sanitary environment.

When experimental and control groups were compared the control group had better sanitary facilities than the experimental group.

4.4.5 Feeding practices

In the study a survey was undertaken to evaluate the feeding practices followed by the mother of children belonging to high risk families. As opined by Devadas *et al.* (1999) as the feeding practices of a community will be influenced by the prevailing habits, tradition and custom of the area, the following details were collected and the results obtained are explained under the following headings.

4.4.5.1 General characteristics of children - Sex and ordinal position.

4.4.5.2 Feeding practices - with special reference to breast feeding.

4.4.5.3 Weaning and supplementary foods, morbidity associated with introduction of food and participation in nutrition intervention programme.

4.4.5.1 General characteristics of children

The subjects selected for the study were 130 children below the age of two years. Out of them 100 children constituted the experimental group and 30 belonged to the control group. The experimental group in turn consisted of 50 infants and 50 toddlers. The control group had 15 each of infants and toddlers.

Sex wise distribution of infants revealed that in the experimental group there were 18 (36.00 per cent) males and 32 (64.00 per cent) females, in which the control group consisted of 4 (26.67 per cent) boys and 11 (73.33) girls (Table 24).

Table 24 Sex wise distribution of infants

	M	F	Total
Experimental group	18 (36.00)	32 (64.00)	50 (100.00)
Control group	4 (26.67)	11 (73.33)	15 (100.00)

Ordinal position

Enquiry on the ordinal position of infants revealed that 20 (30.77 per cent) of infants were of third birth order while about 45 (69.23 per cent) belonged to birth order of 4.

Table 25 Ordinal position of the children

Ordinal position	Experimental group	Control group	Total
2	0	0	
3	14 (28)	6 (40)	20 (30.77)
4	36 (72)	9 (60)	45 (69.23)
Total	50 (100)	15 (100)	65 (100)

4.4.5.2.1 Feeding practices of infants

4.4.5.2.1.1 First feed

An enquiry on the first feed given to the new born revealed that 24.62 per cent of the mothers were in the habit of giving wayampu (*Acorus calamus* Lin) as the first feed. Sometimes a thin wire of gold is hammered into a piece of Wayampu. Wayampu is made into a paste with water by rubbing the two on a special stone. Others fed their children with honey (33.84 per cent), water alone (12.31 per cent). The above details are presented in Table 26.

Table 26 Items given as the first feed

Items	Experimental group Infant	Control group Infant	Total
Water alone	6 (12)	2 (13.33)	8 (12.31)
Wayampu	11 (22)	5 (33.33)	16 (24.62)
Honey	18 (36)	4 (26.67)	22 (33.84)
Breast milk	15 (30)	4 (26.67)	19 (29.23)
Total	50 (100)	15 (100)	65 (100)

Figures in parenthesis indicates percentage

It is noted that 29.23 per cent of respondents did not given anything to their infants before starting breast feeding.

An enquiry on who gives the first feed, 32 per cent reported that it was given by grand-mother, while 53 per cent reported that it was given by the child's aunt and the remaining (15 per cent) by the mother. This is reported to be a traditional practice.

An interrogation as to when was that first feed given revealed that the time of introduction of the first feed varied over a wide range (Table 27).

Table 27 Time of introduction of first feed

Time and after birth (hours)	Experimental group infant	Control group infant	Total
1/2	18 (36)	5 (33.33)	23 (35.38)
2	5 (20)	2 (13.33)	7 (10.77)
3	10 (20)	4 (26.67)	14 (21.54)
4	5 (10)	4 (26.67)	9 (13.85)
>4	12 (24)	-	12 (18.46)
Total	50 (100)	15 (100)	65 (100)

Figures in the parenthesis indicates percentage

Majority of the mothers had reported that they had given the first feed within half an hour to three hours after delivery.

4.4.5.2.1.2 Breast feeding pattern

Breast feeding pattern determines the nutritional status of children in health and disease to a great extent (Ghosh. 1997). The details pertaining to the breast feeding pattern collected from 50 respondents revealed that they had fed their children with breast milk after four hours. Only 6 per cent of mothers reported an interval of seven hours after delivery. All the mothers were in the habit of giving breast milk to infants on the first day itself hence they did not discard colustrum. The reason for initiation of breast feeding on the first day itself was done in accordance with the advice of the doctor as well as elders of the family. They also reported that colostrum which is present in milk is good for the child and hence they follow the habit of initiation of breast feeding from the first day onwards.

4.4.5.2.1.3 Details pertaining to breast feeding

Breast feeding practices varies from place to place and from mother to mother. The details pertaining to duration of breast feeding are given in Table 28.

Table 28 Distribution of infants according to duration of feeding

Month	Experimental group	Control group	Total
3	20 (40)	3 (20)	23 (35.39)
5	27 (54)	11 (73.33)	38 (58.46)
7	3 (6)	1 (6.67)	4 (6.15)
Total	50 (100)	15 (100)	65 (100)

Figures in parenthesis indicates percentage

The Table reveals that out of 65 infants 23 (35.39) received breast milk alone up to 3 months while 58.46 per cent of mothers solely breast fed their infants upto 5 months. About 6.15 per cent of mothers did not give any supplements to their children upto seven months. In the present study majority of the mothers had the habit of giving breast milk alone to the children up to 5 months.

4.4.5.2.1.4 Frequency of breast feeding

Frequency of breast feeding is reported have an influence on the nutritional status of children as well as on the milk production by the mother. Details on breast feeding practices collected revealed that all the mothers had the habit of giving breast milk during the day and night. Majority of mothers in experimental group and control group fed their children 4-6 times in a day as shown in Table 29.

Table 29 Frequency of breast feeding during day and night

No.of feeding	During day			During night			
	Experi-mental group	Control group	Total	Experi-mental group	Control group	Total	Grand total
2-3	2 (4)	0 (0)	2 (3.08)	18 (36)	3 (20)	21 (32.31)	23 (19.69)
4-6	34 (68)	12 (80)	46 (70.77)	32 (64)	12 (80)	44 (67.69)	90 (64.28)
7-9	14 (28)	3 (20)	17 (26.15)	-	-	-	17 (13.07)
Total	50 (100)	15 (100)	65 (100)	50 (100)	15 (100)	65 (100)	130 (100)

Figures in parenthesis indicates percentage

As shown in Table 29 70.77 per cent of the mothers from the experimental group had reported a frequency of 4 to 6 feeds during the day. During night 21 (32.31 per cent) of mothers had the habit of giving breast milk 2-3 times while 67.69 were in the habit of giving 4 to 6 feeds during the night also. While in the control group 80 per cent of the mothers reported a frequency of 4 to 6 times during the day as well as at night.

70.77 per cent of mothers were going to work and they fed their infant as per a stipulated time schedule.

The remaining fed their children on demand as and when they felt that the child is crying because of hunger.

Out of 50 respondents from the experimental group nine (18 per cent) mothers were in the habit of giving water in between the feeds. Seven mothers had given water 1-2 times during the day while in the control group only one mother had given water in between feeds. The data collected reveals that majority of the mothers did not have the habit of giving water in between breast feeding.

4.4.5.2.1.5 Interval between feeds

An enquiry on the time interval between two feeds revealed that 62 per cent from the experimental group had followed an interval of 2-3 hours and 32 per cent of mothers had an interval of 3-4 hours and only 6 per cent of mothers had followed an interval of more than 4 hours between the feeds. While in the control group all the mothers had followed by an interval of 2-3 hours (Table 30).

Table 30 Interval between feeds

Hours	Experimental group	Control group	Total
2-3	31 (62)	15 (100)	46 (70.77)
3-4	16 (32)	-	16 (24.62)
>4	3 (6)	-	3 (4.61)
Total	50 (100)	15 (100)	65 (100)

Figures in parenthesis indicates percentage

4.4.5.3 Weaning and supplementary feeding

Weaning is a transition from breast milk to a diet that includes breast milk and other foods, and finally to a family diet (Srilakshmi, 1996). Details pertaining to supplementary feeding were ascertained and the results pertaining to the introduction of supplementary food are presented in the Tables 31 and 32.

While 68 per cent of the mothers in the experimental group had started feeding supplementary foods in the fourth month, eight per cent had started it only by the seventh month. About 18.46 per cent reported that they had started supplementation as early as three months.

Table 31 Distribution of infants according to age of introduction of supplementary food

Age in months	Experimental group	Control group	Total
3	12 (24)	-	12 (18.46)
4	34 (68)	14 (93.33)	48 (73.85)
7	4 (8)	1 (6.67)	5 (7.69)
Total	50 (100)	15 (100)	65 (100)

Figures in parenthesis indicates percentage

In the control group 93.33 per cent of mothers had initiated supplementary feeding from fourth month onwards and only 6.67 per cent of mothers had started supplementation during the seventh month.

The reasons for supplementary feeding was also ascertained. Most of the mothers reported that when the child attains fourth month of age, they felt that breast milk alone was insufficient and so they had started supplementary feeding. Hindu women reported that they have a rice giving function or 'annaprasham' at the sixth month and only after this function they started giving rice based supplementary foods to their children. This was observed to be a traditional custom still prevalent in the area.

An enquiry on what was the first supplement given, it was found that majority of mothers (58.46 per cent) had given cow's milk as the first supplement (Table 32) from fourth month onwards.

Table 32 Distribution of infants according to type of first supplement given

Type of food	Experimental group	Control group	Total
Cow's milk	28 (56)	10 (66.66)	38 (58.46)
Goat's milk	8 (16)	1 (6.67)	9 (13.85)
Buffaloe's milk	4 (8)	-	4 (6.15)
Ragi	7 (14)	3 (20.00)	10 (15.38)
Banana flour	1 (2)	1 (6.67)	2 (3.08)
Cerelac	2 (4)	-	2 (3.08)
Total	50 (100)	15 (100)	65 (100)

Figures in parenthesis indicates percentage

As a first supplement 56 per cent of mothers from the experimental group had given cow's milk, while 16 per cent of mothers had given goat's milk and 8 per cent had used buffaloe's milk. It was seen that ragi was given as the first supplement by 14 per cent of mothers while 2 per cent had given banana flour and 4 per cent of mothers had given cerelac, which is a commercial weaning food.

In the control group 66.66 per cent of mothers had given cow's milk as a first supplement. While 20 per cent of mothers had given ragi, 6.67 per cent of mothers had given banana flour as the first supplement.

It was further observed that semi solid or solid supplements were given using a spoon (58 per cent) or by hand (52 per cent), while liquid foods are given using a steel tumbler or spoon. When supplementary foods were introduced the frequency of breast feeding was reported to be reduced.

The study revealed that the major reason for introducing supplementary food which resulted in the reduction of breast feeding and employment of mothers in the experimental group. In this group 26 (52 per cent) mothers went out to work and they had to introduce supplementary foods while another 24 per cent reported that there was a reduction in the secretion of breast milk and hence they had to resort to artificial feeding.

From the control group five (33.33 per cent) of the respondents reported reduction in the secretion of breast milk and the remaining ten mothers (66.67 per cent) revealed that they had to start supplementary feeding because they had to go out for work leaving their children.

Artificial feeding with other commercial milk formula were introduced by 20 per cent of mother at 4th month of age. The mothers were fully aware of the importance of care to be taken during artificial feeding with respect to cleanliness of bottle. They washed the bottle in boiling water. Nipples and bottles were kept in boiling water after washing them with soap. It is gratifying to note that majority of mothers were disinterested in bottle feeding. Due to their low income they felt that they cannot afford it and they believed that bottle feeding causes health problems. About 20 per cent of mothers said that bottle feeding would cause pot belly and infectious diseases among children.

The respondents reported that most of the infants had suffered from health problems like diarrhoea, vomiting, constipation and colic pain due to introduction of supplementary foods as shown in Table 33.

Table 33 Problem associated with introduction of supplementary foods

Problem	Experimental group	Control group	Total
Diarrhoea	28 (56)	5 (33.33)	33 (50.77)
Vomitting	18 (36)	2 (13.33)	20 (30.77)
Constipation	21 (42)	6 (40)	27 (41.54)
Colic pain	2 (4)	1 (6.67)	3 (4.62)

Figures in parenthesis indicates percentage

Out of 50 infants in the experimental group 33 (50.77) had suffered from diarrhoea, while 18 (36 per cent) had vomiting and 21 (42 per cent) had constipation and 2 (4 per cent) of them had suffered from colic pain. In the control group also of 4 to 50 per cent of infants had suffered from ailments such as constipation, diarrhoea, colic pain and vomiting.

The result revealed that problems related to weaning is a common phenomena as far as the infants from the control and experimental group are concerned.

Enquiry on number of episodes of such gastro-intestinal problem revealed that 50 per cent of infants suffered from diarrhoea three times and 30 per cent had constipation two times and 30 per cent had suffered from vomiting only twice during the introduction of supplements.

An enquiry on the time of withdrawal of breast feeding revealed that 83.08 per cent of mothers were still breast feeding their infants while 10.77 per cent of mothers had stopped when their children were above eleven months old. They reported that they had insufficient milk and they were giving cow's milk to their infants.

4.4.5.3.1 Feed management and health care activities

An enquiry on the enrolment of subjects under intervention programmes revealed that 95 per cent of infants from the experimental group were not beneficiaries of such programme while in the control group 10 per cent were beneficiaries of ICDS.

An enquiry on immunization coverage it was noted that 56 per cent of infants from the experimental group were immunized partially or had a irregular schedule of immunization, while in the control group 90 per cent were fully immunized.

The nature of caretakers may affect the health and well being of children. When the mother was going to work 56 per cent of infants from the experimental group were fed by older siblings and 44 per cent were fed by grand mothers. In the control group 20 per cent were fed by older siblings and the rest of them were fed by grand mothers.

4.4.5.2.2 Toddler feeding practices

Toddlerhood is the period from one year to two and a half years from birth. The respondents selected for the study were 65 toddlers who were below the age of two years. Out of 65 toddlers 50 constituted the experimental group and the control group had 15 subjects.

In the study a separate survey was undertaken to evaluate the feeding practices followed by mothers of selected toddlers. As the prevailing habits, traditional practices and customs in an area are expected to influence the feeding practices, the details pertaining to the toddlers as well as the feeding practices followed by their mothers were studied in details and the results are elaborated below:

4.4.5.2.2.1 Sex and ordinal position of the toddlers

Table 34 Sex and ordinal position of the toddlers

	Experimental group		Control group		Total
	Male	Female	Male	Female	
Toddlers	22 (44)	28 (56)	9 (60)	6 (40)	65 (100)

Ordinal position

	2	3	4	5	Total
Experimental group	4 (8)	7 (14)	25 (50)	14 (28)	50 (100)
Control group	2 (13.33)	13 (86.67)	-	-	15 (100)

The term ordinal position indicates the birth order of a child. Enquiry on the ordinal position of the toddlers revealed that 8.00 per cent of toddlers were 'second' in their birth order, while about 50 per cent belonged to the birth order of four and above and only 28.00 per cent were 5 in the birth order, while about 14.00 per cent belonged to the birth order of 'three'.

General personal information collected on the toddlers of the study revealed that in the experimental group there were 44 per cent boys and the remaining 56 per cent were girls. Among 15 toddlers who constituted the control group 60 per cent boys and the remaining 40 per cent were girls.

An enquiry on the first feed given to their children. at birth revealed that 36 per cent of mothers were in the habit of giving wayambu (*Acorus calamus* Lin.) as the first feed. It is given along with gold into paste with water by rubbing the two on a special stone. Others fed their children honey (20 per cent) and water with sugar (36 per cent).

An enquiry as to when breast feeding was started revealed that 53.84 per cent of mothers had breast fed their babies five to seven hours after delivery (Table 35).

Table 35 Initiation of breast feeding

Time in hours	Experimental group	Control group	Total
1 - 2	5 (10)		5 (7.70)
3 - 4	12 (24)	7 (46.67)	19 (29.23)
5 - 7	28 (56)	7 (46.67)	35 (53.84)
> 7 - 48	5 (10)	1 (6.66)	6 (9.23)
Total	50 (100)	15 (100)	65 (100)

Figures in parenthesis indicates percentage

The data presented in the Table further reveals that five (7.70 per cent) mothers from the experimental group had breast fed their babies one to two hours after delivery. However 12 (24 per cent) mothers reported that they had breast fed their babies 3-4 hours after delivery. It was surprising to learn that five (10 per cent) mothers had initiated breast feeding only after 7 to 48 hours after delivery. This indicates that these five (10 per cent) women had discarded the colustrum, which they reported as "not good for the child's health".

In the control group seven mothers had revealed that they had started breast feeding their babies three to four hours after delivery, while an equal number of mothers reported a gap of five to seven hours after delivery before starting the first feed. One mother in the control group also reported that breast feeding was started only ~~after~~ two days after delivery.

4.4.5.2.2.2 Duration of breast feeding

The duration of breast feeding varied from child to child. The details pertaining to duration of breast feeding are depicted in Table 36. Only 19 mothers were found to breast feed their children at the time of the survey and their children were 12 months to 14 months old.

Table 36 Duration of breast feeding

Age at complete withdrawal of breast feeding	Experimental group	Control group	Total
8 month	17 (34)	-	17 (26.15)
11 month	4 (8)	-	4 (6.15)
14 month	10 (20)	6 (40)	16 (24.61)
Continuing	19 (38)	9 (60)	28 (43.08)
Total	50 (100)	15 (100)	65 (100)

The data revealed that 17 (34 per cent) mothers in the experimental group had completely stopped feeding breast milk to their children at the age of six to eight months and four mothers (8 per cent) had withdrawn breast milk by eleventh month. Almost ten (20 per cent) mothers had reported that they had weaned the children by the age of 14 months.

In the control group six (40 per cent) mothers had withdrawn breast milk at the age of 14 months while nine (60 per cent) children were still being fed with breast milk who were in the age group of 12 months to 14 months.

The interval between the feeds varied from child to child. An enquiry on the interval between the feeds revealed that majority (36 23 per cent) of mothers from the experimental group and control group had chosen an interval of more than two hours (Table 37).

Table 37 Interval between the feeds

Interval (in hours)	Experimental group	Control group	Total
1 - 2	18 (36)	6 (40)	24 (36.93)
2 - 3	12 (24)	9 (60)	21 (32.30)
> 4	20 (40)	-	20 (30.77)
Total	50 (90)	15 (100)	65 (100)

Figures in the parenthesis indicates percentage

An enquiry on the habit of feeding at night revealed that 48 mothers out of 65 had given up feeding their children at night.

When they felt that breast milk was insufficient comercial infant food formula was used by 8 per cent of mothers in the experimental group and 20 per cent of mothers in the control group.

Majority (50 per cent) of the mothers had started supplementary foods from seventh month onwards. The data collected on these lines are presented in Table 38.

Table 38 Details of supplementary feeding

Age of introduction of S.F. *	Experimental group	Control group	Total
2nd to 3rd month	8 (16)	-	8 (12.30)
4th to 6th month	15 (30)	3 (20)	18 (27.69)
7th to 9th month	25 (50)	12 (80)	37 (56.93)
> 9 months	2 (4)	-	2 (3.08)
Total	50 (100)	15 (100)	65 (100)

*SF Supplementary food

It is revealed from the Table 38 that 16 per cent of mothers from experimental group had started supplementary feeding as early as 2-3 months and only 30 per cent from the experimental group and 20 per cent from the control group had started weaning at the right age viz. 4 to 6 months. Fifty per cent in the experimental group and 80 per cent in the control group of children had received supplementary foods from the seventh month onwards.

An enquiry on what was the first supplement given revealed that 38.46 per cent of families used cow's milk as the first supplement. Details presented in Table 39 also revealed that 18.46 per cent of mothers had used goat's milk as the first supplement. It was interesting to note that 26.16 per cent of mothers had introduced ragi while 15.35 per cent of mothers reported that they gave banana flour as the first supplement to their children.

Table 39 Item given as the first supplement

First supplement	Experimental group	Control group	Total
Cow's milk	17 (34)	8 (53.33)	25 (38.46)
Goat's milk	8 (16)	4 (26.67)	12 (18.46)
Buffalo's milk	1 (2)	-	1 (1.54)
Ragi	14 (28)	3 (20)	17 (26.16)
Banana flour	10 (20)	-	10 (15.38)
Total	50 (100)	15 (100)	65 (100)

Figures in the parenthesis indicates percentage

Weaning is a critical period and introduction of new foods sometimes triggers minor problems among children.

An enquiry on these lines revealed that 70 per cent of children in the experimental group and 86.67 per cent of children in the control group had some problems with the introduction of new foods other than breast milk.

The mothers from the experimental group reported that 13 (26 per cent) children suffered from diarrhoeal disorders while 9 (18 per cent) children had vomiting and few had constipation and colic pain.

In the control group seven children suffered from diarrhoeal disorders while 4 suffered from vomiting and one had constipation and colic pain (Table 40).

Table 40 Weaning problems

Problem	Experimental group	Control group	Total
Diarrhoea	13 (26)	7 (46.67)	20 (30.77)
Vomitting	9 (18)	4 (26.67)	13 (20)
Constipation	8 (16)	1 (6.67)	9 (13.85)
Colic pain	5 (10)	5 (33.33)	10 (15.38)

Figures in the parenthesis indicates percentage

Number of episodes of such ailments (both experimental and control group) were also noted and it revealed that 19 children had diarrhoea once or twice along with vomiting and 27 children had suffered from 3 to 4 episodes of diarrhoea while 13 children suffered from diarrhoeal diseases more than 4 times during the introduction of supplementary foods.

Further enquiry on the use of weaning foods revealed that in this rural area, majority (92 percentage) of mothers had prepared their own weaning foods as shown in Table 41. The weaning food were prepared either with ragi, banana or rice flour, 52 per cent of mothers in the experimental group and 66.67 per cent of mothers in the control group had prepared ragi based weaning foods. They washed, soaked and ground ragi to form a very loose pour batter. Banana based weaning food was prepared by 30 per cent mothers from experimental group and 26.67 per cent from control group. These powders are mixed with large amount of water (4 to 5 parts) and cooked into semi solid consistency and fed to the child with added sugar or jaggery. Rice based weaning food was prepared by 20 per cent and 2.23 per cent of mothers respectively from experimental group and control group.

Table 41 Use of home made weaning foods

Type of supplement used	Experimental group	Control group	Total
Ragi powder	26 (52)	10 (66.67)	36 (60.00)
Banana flour	14 (28)	4 (26.67)	18 (30.00)
Rice flour	10 (20)	1 (6.67)	6 (2.23)
Total	50 (100)	15 (100)	65 (100)

Figures in the parenthesis indicates percentage

Toddler hood is the period where likes and dislikes with reference of food are being formed. The data on likes and dislikes revealed that 50 per cent of toddlers liked biscuits; and 20 per cent had preference for banana. When 10 per cent liked spicy foods, others showed a preference for sweet items. The data also revealed that most of children disliked orange, chappathi, roots and spicy foods.

Enquiry pertaining to a general tendency to include or exclude some foods from the daily diet of toddlers revealed that the majority of the mothers were excluding foods like wheat, pulses, roots and fleshy foods like meat from the diets of toddlers. Verbal autopsy further revealed that mothers had several misconcepts pertaining to such foods. It was found that they believed that pulses would induce flatulence, while item such as meat and wheat are 'heat producing' and roots can not be digested easily by children hence might cause in digestion and gastro intestinal problems among children.

They also reported that they received such informations from their grand mothers or such information commonly prevails in the community.

When the respondents were asked to report as to who decides what foods are to be given to the toddlers it was found that it was decided by mother herself in case of 76 per cent of families. while it was imposed by grand mothers in 22 per cent of the families surveyed and by neighbours in 2 per cent of the cases.

4.4.5.2.2.3 Nature of caretakers

The nature of caretakers may affect the health and well being of the children. Hence the data on who feeds the child and manages the children at home, especially when the mother is employed or going to work outside were collected. It was observed that when the mother goes out to work 54 per cent toddlers from the experimental group were fed by older siblings and (42 per cent) toddlers were fed by their grand mothers and 4 per cent were fed by their fathers.

When the grand mother or older siblings were functioning as caretakers, bottle feeding was adopted. Cow's milk diluted with equal volume of water was used for bottle feeding. They washed their hands before preparing bottle feed. The bottle was washed with soap and water.

All the mothers were fully aware of the importance of the care to be taken during artificial feeding with respect to the cleanliness of bottle and rubber nipples, temperature of the milk, and importance of washing hand, bottle and washing toddlers mouth after feeding.

An enquiry on the participation in intervention programmes revealed that 90 per cent of toddlers were not participating in intervention programmes like ICDS. From the control group 5 per cent of the toddlers had registered as beneficiaries under ICDS though their attendance was very low.

An enquiry on the extent of immunization given it was found that 50 per cent of toddlers in the experimental group were partially immunized while in the control group 90 per cent were completely immunized. It was also noted that only 20 per cent from the experimental group and 40 per cent of the control group have received one dose of vitamin A massive oral dose through ICDS during the past six month.

It was the opinion of 32 per cent of the mothers that physical amenities, good environment and sanitation (24 per cent) and money for buying nutritious food (10 per cent) are required to faster good health among children.

An enquiry on which are the factors that are responsible for the poor health and low nutritional status of toddlers, the mothers reported that diseases, wrong beliefs, lack of water, lack of food, poor sanitation and draining away of family income by alcoholism or smoking by the men of the family are some of the important contributing factors.

When the mothers were asked about the measures to improve nutritional status of children, they were of the opinion that better food, good hygiene, care given to the child by the mother, healthy and cordial family atmosphere are essential to improve the health status of children.

The survey also revealed that (10 per cent) mothers were aware of foods that are necessary to improve nutritional status of the children. 15 per cent mothers reported that items such as egg, pulse, milk and milk along with pulses are helpful in improving the nutritional status of children. They reported that these foods are rich in protein and are good for the health of children.

Few (10 per cent) had expressed a view that goat's milk is good for their children because it has some medicinal properties as it is effective in preventing worm infestation, which is a major problem found in several toddlers. It was found that information on the nutritional benefits of egg and milk were passed on to them from the anganawadi workers or by the health workers of the area. While information that pulses are rich in protein was received from grand mothers. The medicinal significance of goat's milk is a traditional belief percolated from the ayurveda.

An enquiry on which are the foods that are harmful to children, revealed that food such as raw papaya, guava (especially the seeds in it), pulses, potato, meat and green leafy vegetables are harmful to children and these beliefs are found to be infiltered into the society from the ancestors. They have strong notion that papaya and guava seeds would lead to colic pain; while potatoes is are gas producing. Meat and leafy vegetables are reported to cause indigestion among

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children and therefore are not given to children of the area in general.

An enquiry on "self medication" it was seen that ayurveda system is the choice of treatment preferred by the mothers. It was noticed that for fever, cough, jaundice, diarrhoea and colic pain which are common ailments seen among children. Mothers would initially give well known indigenous medicines which are substances available inthe locality or their extracts. Only when the condition is beyond control they take their children to hospital. This is so because they feel that ayurvedic medicines have no side effects and that this treatment is less costly.

4.6 Nutritional anthropometry

Anthropometric measurements of the subjects were recorded to assess the nutritional status as well as the nutritional anthropometry is concerned with measurement of variation in the physical dimensions and gross composition of human body at different age and degrees of nutrition (Jelliffe, 1966; Rao and Vijayaraghavan, 1996).

In the present study all infants (50) and toddlers (50) of experimental (100) and control groups (30) were weighed and their crown heal length (Height), mid upper arm, head and chest circumferences were measured consecutively three times with an interval of three months in between and were recorded along with age (Appendix X). The birth weight of these children as reported by the mothers were also recorded since birth weight is an indicator of foetal growth and development, which reflects overall health and nutritional status of both mother and child (Gai, 1996). According to Bennet and Byrene (1990) low birth weight baby is a baby weighing less than 2.5 kg at birth regardless of the period of gestation. In the present study birth weight of the subjects ranged from 2.10 kg to 2.40 kg. Therefore all the subjects were found to be low birth weight babies. The mean birth weight of infants in the experimental group was found to be 2.03 kg for boys and 2.24 kg for girls, while in the control group it was 2.24 kg for boys and 2.40 kg for girls as given in Table 42.

For the toddlers the mean birth weight was found to be 2.21 kg for boys and 2.36 kg for girls. While in the control group it was 2.00 kg for boys and 2.4 kg for girls as given in Table 42.

Table 42 Mean birth weight for subjects

Subjects	Birth weight in kg.			
	Experimental group		Control group	
	Boys	Girls	Boys	Girls
Infants	2.03	2.24	2.24	2.40
Toddlers	2.21	2.36	2.00	2.40

The overall picture indicated that all infants and toddlers included in the study have the handicap of low birth weight at birth, which indeed becomes a 'risk factor' for further development. It is also seen that the boys in the all the groups have a lower birth weight than girls, indicating a higher rate of risk.

In the present study anthropometric data such as weight for age, height (length) for age, weight for height, head, chest and mid upperarm incumberences were used as one method to assess the nutritional status of both infants and toddlers. The data obtained with respect to anthropometric parameters, and the prevalence and extent of malnutrition among the subjects based on the anthropometric figures are detailed below.

4.6.1 Weight for age profile of infants and toddlers

The most recognised indicator of protein energy malnutrition is weight for age (Jelliffe, 1966) and comparison of weight for age value with standards (International/National/ Local) recommended for corresponding age group will help to determine the degree of under nutrition in a community, in the present study details of the body weight of the infants and toddlers belonging to the experimental and control groups were recorded and compared with suitable national and international standards. Anthropometric standards developed by Ghosh (1986) was used in the present study for comparison as 'national' standard. whereas anthropometric standards developed by 'National Centre for Health Statistics (NCHS)' (1976) was used as international reference standard which were also recommended by WHO expert group.

The weight for age data was further used to categorise the subjects into different grads of malnutrition based on Gomez et al (1956) classification to find out their current nutritional status.

The data on weight for age of all subjects (experimental and control groups) are given in Appendix X. . The actual weight of infants in the experimental group was found to range from 3.25 to 8.00 kg for boys and 3.3 kg to 8.5 kg for girls, while in the control group it was 3.3 kg to 7.6 kg for boys and 5 kg to 6.8 kg for boys.

Among the toddlers of the experimental group the actual weight of boys was found to range from 5 kg to 12.3 kg and for girls from 5 kg to 10.5 kg while in the control group it was 6 kg to 10.8 kg for boys and 6 kg to 11.5 kg for girls.

The age and sex wise distribution of infants of both experimental group (Eg) and control group (Cg) based on the mean values of their weight for age are given in Table 43.

The data given in Appendix X-I and summarised in Table 43 reveals that among infants there are 18 boys and 32 girls belonging to 3 different age groups viz., six, seven and eight months of age. The mean weight of infants varied from 4.20 kg to 6.43 kg and that of girls from 4.10 to 6.17 kg. The table reveals the fact that infants and toddlers in the control are better than those in the experimental group irrespective of their age and sex. The weight for age of male infants are found to be better than girls among all infants and among toddlers up to the age of 13 months. However the weight for age female toddlers were found to be better than that of male toddlers who were above 30 months of age especially in the experimental group.

The data presented in the table also reveals that weight for age of all the subjects belonging to different age and sex are found to be below reference standards.

The mean weight for age of infants and toddlers along with reference standards for comparison are also presented in Table 44. Contents of Table 44 reveals that the mean weight for age of infants of the experimental group was found to be 4.74 $\pm$ 1.38 kg for boys and 5.10 $\pm$ 1.04 kg for girls, and that of control group was 5.83 $\pm$ 0.84 kg for boys and that of girls 6.61 $\pm$ 1.00 kg. Data presented in the above table also reveals that the mean weight for age of infants of both experimental and control group are much lower than the national and international reference standards.

Table 43 Distribution of subjects based on their age, sex and mean body weight

Subject	Age in months	Sex	Number Eg	Number Cg	Mean values (kg) Eg	Mean values (kg) Cg	Standard* value
	6	M*	11 (22)	1 (6.67)	4.20	4.50	7.6
		F**	13 (26)	5 (13.33)	4.10	5.72	7.2
Infants	7	M	4 (8)	3 (20.00)	4.60	6.60	8.3
		F	9 (18)	3 (20.00)	4.89	7.49	7.7
	8	M	3 (6)	-	6.43	-	8.8
		F	10 (20)	3 (20.00)	6.17	7.50	8.2
	12	M	3 (6)	1 (6.67)	6.54	6.90	
		F	2 (4)	-	5.50	-	
Toddlers	13	M	2 (4)	1 (6.67)	7.80	6.80	11.5
		F	4 (8)	1 (6.67)	6.75	8.30	10.5
	14	M	3 (6)	2 (13.33)	8.33	9.85	
		F	4 (8)	1 (6.67)	8.75	8.80	
	15	M	11 (22)	4 (26.67)	8.75	10.80	
		F	13 (26)	3 (20.00)	9.32	8.87	
	16	M	3 (6)	1 (6.67)	8.57	10.80	
		F	5 (10)	1 (6.67)	9.20	10.30	

Figures in parenthesis represents percentage
*NCHS (1976) *M - Male **F - Female
Eg - Experimental group Cg - Control group

Table 44 Weight for age profile of infants and toddlers in comparison with national and international standards

	Age in month	Sex and number of subjects			Mean weight/age (kg) Eg	± SD Cg	*National standard (kg)	t value Eg	t value Cg	**International standard (kg)	Mean weight/ age ±SD	t value	
Infants	6-11	M	18	4	4.74±1.38	5.83±0.84	7.44	1.59*	4.10*	8.8	4.74±2.60	1.08*	3.55**
		F	32	11	5.10±1.04	6.61±1.00	6.86	3.56*	4.64*	8.2	5.10±1.76	2.16*	4.34**
Toddler	12-16	M	22	9	8.29±1.44	9.67±1.29	10.49	4.89*	6.69*	11.5	8.29±2.05	2.43*	5.83**
		F	28	6	8.58±1.27	8.90±0.89	9.84	3.24*	3.66*	10.5	8.58±0.89	2.93*	4.13**

Significant at 1% level
* Ghosh 1986
** NCHS 1976

Statistical analysis of the data pertaining to infants further has revealed the fact that the mean weight for age of boys was significantly lower than national and international standards. As far as the girls were concerned, the weight for age of infants in the experimental group was found to be significantly lower than the national and international standards. However the difference was not significant when the weight for age of girl subjects of the control group were compared with international reference standards.

Mean weight for age of toddlers of experimental group was found to be 8.29 $\pm$ 1.44 for boys and 8.58 $\pm$ 1.27 for girls. While those of control group was found to be 9.67 $\pm$1.28 for boys and 8.90 $\pm$ 0.89 for girls. The table also reveals that mean weight for age of toddlers of both experimental and control groups were significantly lower than that of standards.

4.6.2 Extent of malnutrition among the subjects

Gomez etc(1956) had classified children in to different grades based on their body weight. This classification would enable to identify most needy children in any field oriented programmes (NNMB, 1996). In this study using the data collected on weight for age of subjects they were classified into different grades, to find out their nutritional status, and such details are presented in Table 45.

Data presented in the Table 45 reveals that only six per cent of boys and 10 per cent of girls among the infants of the experimental group are normal. While in the control group 20 per cent of boys and 33.67 per cent of girls were found to be normal. The table also reveals that grade I type of malnutrition was seen among 12 per cent each of boys and girls in the experimental group and 6.67 per cent and 40 per cent of boys and girls respectively in the control group. It may be also observed that 56 per cent of infants (18 per cent of boys and 38 per cent of girls) in the experimental group were victims of grade II type of malnutrition. Only two per cent of boys and four per cent of girls were found to be victims of grade III malnutrition in the experimental group. However there were none with grade II and grade III type of malnutrition in the control group.

Among toddlers of experimental group 14 per cent of boys and 4 per cent of girls and 40 per cent each of boys and girls respectively from the control group were found to be normal. While 32 per cent of the subjects in the experimental group (14 per cent boys and 18 per cent girls) and 20 per cent of the subjects in the control group (13.33 per cent of boys and 6.67 per cent girls) were found to be affected by grade I type of malnutrition. About 24 per cent (14 per cent boys and 10 per cent girls) and 26 per cent (2 per cent boys and 24 per cent girls) respectively were victims of grade II and grade III type of malnutrition.

Table 45 Distribution of infants and toddlers based on Gomez classification of grades of malnutrition

Grades of malnutrition	Sex	Experimental group Infants	Toddlers	Total	Control group Infants	Toddlers	Total	Grand total
Normal (≥ 90)	M	3 (6.00)	7 (14.00)	10 (10)	3 (20.00)	6 (40.00)	9 (30.00)	19 (14.61)
	F	5 (10.00)	2 (4.00)	7 (7)	5 (33.67)	6 (40.00)	11 (36.67)	18 (13.85)
Grade I (75-90)	M	6 (12.00)	7 (14.00)	13 (13)	1 (6.67)	2 (13.33)	3 (10)	16 (12.31)
	F	6 (12.00)	9 (18.00)	15 (15)	6 (40.00)	1 (6.67)	7 (23.33)	22 (16.92)
Grade II (60-75)	M	9 (18.00)	7 (14.00)	16 (16)	-	-	-	16 (12.31)
	F	18 (36.00)	5 (10.00)	23 (23)	-	-	-	23 (17.69)
Grade III (≤ 60)	M	1 (2.00)	1 (6.00)	2 (2)	-	-	-	2 (1.54)
	F	2 (4.00)	12 (24.00)	14 (14)	-	-	-	14 (10.77)
Total		50 (100)	15 (100)	100 (100)	15 (100)	15 (100)	30 (100)	130 (100)

Figures in parenthesis indicates percentage

When experimental and control groups (both infants and toddlers) were compared control group was better than the experimental group.

4.6.3 Height for age profile of infants and toddlers

Height for age profile indicates the state of chronic malnutrition or stunting in children (Gopaldas and Seshadri, 1987). The extent of height deficit in relation to age, as compared to standards can be regarded as a measure of the past nutritional status of a subject. The length of the subjects were measured and recorded with their age in months at the beginning of the study and was repeated two times, and the actual height for age are given in Appendix X.

The actual height of infants from the experimental group ranged between 55 cm and 82 cm for boys and 52 cm to 79 cm for girls while in the control group the height of infants ranged from 72 cm to 74.6 cm for boys and 62 cm to 79.5 cm for girls.

The age and sex wise distribution of infants and toddlers of both experimental and control groups based on the mean values of their height for age are given Table 46.

The Table reveals that the height of boys (infants) in the experimental group ranged between 64.68 cm and 69.00 cm and that of the control group from 70.33 cm to 72.00 cm when catagorised into different batches based on their age and sex.

Table 46 Distribution of subjects based on their age, sex and height

Subject	Age in month	Sex	Number Eg	Number Cg	Mean value** (kg) Eg	Mean value** (kg) Cg	Standard* (cm)
Infants	6	M	11 (22)	1 (6.67)	64.48	72.00	67.80
		F	13 (26)	5 (33.33)	59.85	67.00	65.90
	7	M	4 (8)	3 (20)	64.75	70.33	69.50
		F	9 (18)	3 (20)	60.33	70.67	67.60
	8	M	3 (6)	-	69.00	-	71.00
		F	10 (20)	3 (20)	63.63	70.33	69.10
Toddlers	12	M	3 (6)	1 (6.67)	80.67	88.00	82.40
		F	2 (4)	- (6.67)	90.00	-	
	13	M	2 (4)	1 (6.67)	84.50	90.00	
		F	4 (8)	1 (6.67)	75.50	87.00	
	14	M	3 (6)	2 (13.33)	82.67	88.50	
		F	4 (8)	1 (6.67)	79.00	92.00	
	15	M	11 (22)	4 (8)	85.55	88.75	
		F	13 (26)	3 (20)	82.62	82.33	
	16	M	3 (6)	1 (6.67)	86.67	95.00	
		F	5 (10)	1 (6.67)	85.60	94.00	

Figures in parenthesis indicate percentage
Eg - Experimental group Cg - Control group
Source: NCHS (1976)

As far as the female children were concerned the mean height ranged from 59.85 cm to 63.63 cm in the experimental group and in the control group it was between 67 cm and 70.67 cm.

When the mean values of the experimental group were compared with standard values it was found that all the infants were below the standard; while those of control group, were found to have their height for age above the standard.

The mean height for age values of toddlers in the experimental group reveals that the height of varied from 80.67 to 86.67 cm for boys and from 75.50 cm to 90.00 cm for girls. While it was found to be 88.00 cm to 95.00 cm and 87.00 to 94 cm respectively for boys and girls who belonged to the [redacted] group. As far as the height for age is concerned, the boys were taller than the girls and the toddlers of control group were better than the experimental group.

Mean height of infants and toddlers as two different segments belonging to experimental and control groups were compared with national and international standards and the details are presented in Table 47.

As indicated in the Table (the mean height of male infants belonging to experimental group was found to be 65.29±1.64 cm. In the control group the mean height of the male infants as a single category was found to be higher than national and international standards.

Table 47 Height for age profile of infants and toddlers in comparison with national and international standards

Age in month	Sex	Number Eg	Number Cg	Mean Height ±SD Eg	Mean Height ±SD Cg	National standard	t value Eg	t value Cg (cm)	** International standard	Mean height (cm) ± SD Eg	Mean height (cm) ± SD Cg	t value Eg	t value Cg
6 - 11	M	18	4	65.29 ±1.64	69.77±2.87	66.90	2.083*	6.437*	67.8	65.29±2.51	69.77±1.97	4.019*	3.55*
	F	32	11	61.51 ±3.69	70.75±5.55	65.20	1.011*	1.890*	65.9	61.51±4.39	70.75±4.85	2.47*	1.74*
12 - 16	M	22	9	84.55 ±4.55	88.33±8.33	80.00	4.527*	2.120*	82.4	84.55±2.15	88.33±5.93	4.08*	1.33*
	F	28	6	85.52 ±7.20	86.67±8.37	78.30	6.83*	4.301*	80.9	85.52±4.62	86.67±5.77	2.42*	0.189*

Eg - Experimental group   Cg - Control group   Significant at 5% level

* - Source (Ghosh 1986)   ** - NCHS 1976

Among the female infants of the experimental group, the mean height was found to be 61.51 ± 3.69 cm and in the control group it was 70.75 ± 5.55 cm.

Comparison between the groups revealed that the infants of the control group were taller than those in the experimental group. Sex wise comparison revealed that the boys were taller than the girls in both the groups (experimental group and control group).

Table 47 also gives the mean height for age of children in the age group of 12 to 16 months (Toddlers).

When the mean height of the toddlers were calculated the male subjects of the experimental group had a value of 84.55 ± 4.55 while the females scored a mean value of 85.82 ± 7.20 cm. In the control group the mean height of toddlers was found to be 88.33± 8.33 cm for boys and 86.67±8.37 for girls.

The data given in Table 47 also reveals that the subjects of the control groups had better height than those in the experimental group. It was interesting to note that the girls were found to be taller than the boys in the experimental group as far as the toddlers were concerned, which may be an indication of prolonged malnutrition of the past seen among the male toddlers.

The height for age of the subjects were compared with reference standards to find out whether they are normal and healthy. The mean height for age, in comparison with the standards for infants and toddlers of experimental group and control group are presented in Table 47. The data reveals that the mean height for age both of the experimental and control groups were significantly lower than that of national and international reference standards.

When sex and age difference was taken into consideration girls were found to be better than boys among infants, while boys were found to be better than girls among the toddlers in both experimental group and control group. When the age difference was taken in to consideration toddlers were better than the infants.

When the subjects of experimental group and control group were compared the height/age of control group was better than that of experimental group.

4.6.4 Assessment of duration of malnutrition

The data on height for age deficit can be used as an indicator of the duration of malnutrition Jelliffe (1966). Therefore, for detailed nutritional evaluation, data on the height for age of subjects from the experimental and control groups were further analysed and they were classified in to different grades viz. normal, short and dwarf based on the classification suggested by McLaren (1987). The distribution of the subjects based on the above classification is presented in Table 40.

The data reveals that in the experimental group 20 per cent of boys and 36 per cent of girls who are infants and 40 per cent boys and 42 per cent girls who are toddlers were found to be 'normal'.

In the same group sixteen per cent of boys and 28 per cent of girls who were infants and four per cent of boys and 14 per cent of girls who were toddlers were found to be "short". In the control group only about six per cent of boys who are infants were found to be 'short'. None were found to be "dwarfs", neither among the infants or among the toddlers of both the experimental and control groups.

In general, the data on height for age reveals that 56 per cent of infants and 82 per cent of toddlers in the experimental group are normal. While in the control group 93.33 per cent of infants and cent per cent of toddlers were found to be normal based on height for age data.

4.6.5 Weight for height

Weight for height is believed to be age independent. It is reported to be a good prognostic indicator, particularly of severe malnutrition. It has often been considered as a good index for the evaluation of current nutritional status, as

Table 48 Distribution of subjects based on McLaren classification of height for age

Grade	Sex	Experimental group: Infants	Experimental group: Toddlers	Total	Control group: Infants	Control group: Toddlers	Total
Normal	M	10 (20.00)	20 (40.00)	30 (30.00)	3 (20.00)	9 (60.00)	42 (32.31)
	F	18 (36.00)	21 (42.00)	39 (39.00)	11 (73.33)	6 (40.00)	56 (43.00)
Short	M	8 (16.00)	2 (4.00)	10 (10.00)	1 (6.67)	-	11 (8.46)
	F	14 (28.00)	7 (14.00)	21 (21.00)	-	-	21 (16.15)
Dwarf	M	-	-	-	-	-	-
	F	-	-	-	-	-	-
Total		50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	130 (100)

Figures in parenthesis indicates percentage

Table 49 Distribution of subjects based on Waterlaw's classification of weight/height

Grade	Sex	Experimental group: Infants	Experimental group: Toddlers	Total	Control group: Infants	Control group: Toddlers	Total
Normal	M	6 (12.00)	4 (8.00)	10 (100)	3 (20.00)	4 (26.67)	7 (23.33)
	F	12 (24.00)	2 (4.00)	14 (14)	7 (46.66)	4 (26.67)	11 (36.67)
Wasting	M	4 (8)	6 (12.00)	10 (10)	1 (6.67)	5 (33.33)	6 (20.00)
	F	10 (20.00)	12 (24.00)	22 (22)	4 (26.67)	1 (6.67)	1 (3.33)
Stunting	M	4 (8.00)	10 (20.00)	14 (14)	-	1 (6.67)	1 (3.33)
	F	5 (10.00)	9 (18.00)	14 (14)	-	-	-
Stunting and wasting	M	4 (8.00)	2 (4.00)	16 (16)	-	-	-
	F	5 (10.00)	5 (10.00)	10 (10)	-	-	-
Total		50 (100)	50 (100)	100 (100)	15 (100)	15 (100)	30 (100)

Figures in the parenthesis indicates percentage

reported by Rao and Vijayaraghavan (1996). Hence weight for height of the subjects were calculated. The data on weight for height was further amplified to find out the effect of malnutrition on the overall nutritional status of the children, as per the categorisation suggested by Waterlow (1987). The distribution of subjects based on Waterlow's classification are presented in Table 49.

The data presented in Table 49 reveals that only 12 per cent of boys in the experimental group of infants and eight per cent of toddlers of the same age and sex were normal. Among girls 24 per cent (infants) and four per cent (toddlers) were normal. Wasting was observed in eight per cent and 12 per cent and 20 per cent and 24 per cent of boys and girls among infants and toddlers of the experimental group and control groups which indicates short duration malnutrition associated with low weight gain. Stunting was observed among eight per cent of boys among infants and 20 per cent of toddlers of experimental group and 10 per cent and 18 per cent of girls respectively among the infants and toddlers, which reveals that there was height deficit which is an indication of previous events of malnutrition. It may also be noted that eight per cent of male infants and four per cent of male toddlers and 10 per cent of girls among both infants and toddlers had stunting along with wasting which indicates acute chronic malnutrition.

The above table also reveals that wasting as well as stunting alone were more among toddlers when compared to infants, while stunting along with wasting was more prevalent among infants of the experimental group. The result of the study as inferred from the above table also reveals that only 36 per cent infants, and 12 per cent of toddlers from the experimental group were found to be 'normal' with respect to their weight/height ratio. When this index was used as an indicator for nutritional status assessment, in the control group more than 50 per cent of the subjects were (both infants and toddlers) found to be normal. There were neither stunted subjects nor nutritional dwarfs among control subjects. But there were a few 'wasted' subjects (36.67 per cent) in the control group which indicates effects of short duration malnutrition.

In a nutshell here the control subjects were better than experimental subjects and more of the toddlers were found to be malnourished than the infants. Sex wise analysis reveals that females were less malnourished than males.

4.6.6 Mid upper arm circumference

Mid upper arm circumference (MUAC) values are used as an indicator for screening the severity of malnourishment among children (Jellifee, 1966). Hence MUAC of all subjects were measured using standard technique and were recorded along with

Table 50 Age and sex wise distribution of subjects based on their mean MUAC values

Subject	Age in month	Sex	Subjects number Eg	Cg	MUAC Mean values Eg	Cg	MUAC Standard**
	6	*M	11 (22)	1 (6.67)	9.20	13.00	14.50
		*F	13 (26)	5 (33.33)	8.75	11.43	13.50
Infant	7	M	4 (8)	3 (20)	9.68	12.33	15.00
		F	9 (18)	3 (20)	9.68	12.33	15.00
	8	M	3 (6)	-	9.70	-	15.50
		F	10 (20)	3 (20)	11.45	12.33	15.00
	12	M	3 (6)	1 (6.67)	10.77	12.30	
		F	2 (4)	-	9.00	14.00	
Toddler	13	M	2 (4)	1 (6.67)	9.00	14.00	
		F	4 (8)	1 (6.67)	11.50	10.00	
	14	M	3 (6)	2 (13.33)	9.50	15.50	16.50
		F	4 (8)	1 (6.67)	10.75	11.00	16.00
	15	M	11 (22)	4 (26.67)	11.16	10.78	
		F	13 (26)	3 (20)	12.68	13.77	
	16	M	3 (6)	1 (6.67)	13.33	12.00	
		F	5 (10)	1 (6.67)	12.20	10.00	

* Male
* Female
** NCHS, 1976

their age and sex. The MUAC values are presented in Appendix X. The actual MUAC ranged between 8.50 and to 12.50 cm. Age and sex wise distribution of infants and toddlers of different age groups based on their mean MUAC values are presented in Table 50. The table reveals that the mean MUAC of male infants of three different age groups (6, 7, 8 months) in the experimental group varied from 9.20 cm to 9.70 cm and that of girls ranged between 8.75 cm and 11.45 cm.

In the male infants of the control group MUAC ranged from 12.33 cm to 13.00 cm and that of girls ranged between 11.43 cm and 12.33 cm. All were found to have MUAC values below the reference standard for their age and sex.

The above table also indicates that MUAC of girls were higher than that of boys and the subjects of control group were better than those of the experimental group as far as the MUAC measurements were concerned.

The mean MUAC of the subjects (infants and toddlers) of experimental group and control group in comparison with reference standards are presented in Table 51.

Table 51 revealed that the MUAC values of both boys and girls in the experimental group and control group were significantly lower than that of reference values suggested by NCHS (1976). The same trend was observed both among infants and toddlers which proves that there is wasting among infants

Table 51 Distribution of infants and toddlers based on mean MUAC values in comparison with standard

Age in month	Sex	Mean MUAC value Eg cm	Cg cm	NCHs standard value	't' value Eg	Cg
6-11	M	9.86	12.25	14.00	2.82*	2.56*
	F	9.21	14.76	13.50	2.86*	3.80*
12-16	M	10.75	12.48	16.10	3.48*	3.88*
	F	11.52	12.25	16.00	3.68*	3.86*

* Significant at 1% level

and toddlers who were examined, which indicates a negative aspect of their nutritional status.

4.6.6 Head circumference

The head circumference of all the subjects were measured and the individual values are presented in the Appendix X along with their age and sex. Age and sex wise distribution of infants and toddlers of different age grups based on their mean Head circumference are presented in Table 51. The above table reveals that the head circumference of the boys (infants) varied from 35.71 cm to 37.23 cm and that of girls (infants) from 36.67 cm to 38.66 cm, in the experimental group while in the control group it ranged between 40.33 cm and 40.80 cm for boys (infants) and from 39.80 cm to 40.77 cm for girls.

The mean head circumference of toddlers (boys and girls) from experimental group and control group, as presented in Table 52 reveals that it ranges between 38.15 cm and 40.00 cm for boys and 33.86 cm to 39.25 for girls in the experimental group and 39.90 to 42.00 cm for boys and 40.33 to 41.60 cm for girls in control group. The table also gives an indication to the fact that the toddlers of the control group had better head circumference than those in the experimental group.

The mean head circumference values of infants and toddlers of experimental group and control group in comparison with respective standard values are presented in Table 53.

Table 52 Distribution of infants and toddlers based on their age, sex and mean head circumference

Subject	Age in month	Sex	Number Eg	Number Cg	Mean value** (kg) Eg	Mean value** (kg) Cg	Standard value*
	6	M	11	1	35.71	40.80	37.50
		F	13	5	37.50	39.80	37.50
Infants	7	M	4	3	37.23	40.33	38.00
		F	9	3	36.67	40.77	38.00
	8	M	3	-	36.76	-	38.50
		F	10	3	38.66	39.90	38.50
	12	M	3	1	40.00	42.00	
		F	2	-	39.30	-	
Toddlers	13	M	2	1	39.85	40.00	
		F	4	1	39.25	40.33	
	14	M	3	2	38.33	39.90	41.50
		F	4	1	39.25	40.33	41.00
	15	M	11	4	38.15	39.90	
		F	13	3	37.86	41.33	
	16	M	3	1	38.53	40.20	
		F	5	1	38.56	41.60	

* NCHS (1976)
** Experimental group
** Control group

Table 53 Mean head circumference of subjects in comparison with standards

Age in month	Sex	Number		Mean head circumference Eg	Cg	Standard	t value Eg	Cg
6 - 11	M	18	4	36.33	38.33	40.00	3.80*	3.25*
	F	32	11	36.24	39.11	40.00	4.00*	4.32*
12-16	M	22	9	35.16	40.23	41.50	3.95*	3.80*
	F	28	6	36.91	41.18	41.00	3.80*	3.96*
Total		100	30					

Significant at 0.05% level
Eg - Experimental group Cg - Control group

The head circumference values of the subjects when statistically treated revealed that the mean values were significantly lower than that of reference standard, for both infants and toddlers belonging to both the sexes.

Chest circumference

Chest circumference of all the subjects were measured to estimate the growth pattern of children and the individual values are presented in Appendix X. The chest circumference ranged from 35.4 cm to 43.06 cm. Age and sex wise distribution of infants and toddlers of different age groups based on the chest circumference are presented in Table 54.

The data indicated that through the mean head circumference value for boys and girls of the experimental group ranged from 36.98 cm to 40.00 cm and 37.29 cm and 40.86 cm respectively and all infants were found to be below the recommended normal value of 44.00 cm suggested by NCHS (1976). It is observed that the girls were found to have a higher chest circumference value than boys of the same age group. Moreover the chest circumference values of control children were found to be better than those of experimental group.

Table 54 also depicts the age and sex wise distribution of toddlers of 12 to 16 months of age based on their chest circumference. When the different sex groups were compared, though the boys were better than the girls, all the

Table 54 Age and sex wise distribution of subjects based on chest circumference

Subjects	Age in month	Sex	Number		Mean Eg (cm)	Value Cg (cm)	Standard (cm)
	6	M	11	1	36.98	38.80	
		F	13	5	37.29	40.60	
Infants	7	M	4	3	39.13	39.70	44.00
		F	9	3	40.15	41.86	44.00
	8	M	3	-	40.00	-	
		F	10	3	40.86	40.60	
	12	M	3	1	39.90	45.00	
		F	2	-	40.55	-	
Toddlers	13	M	2	1	41.15	43.20	44.00
		F	4	1	40.73	43.00	44.00
	14	M	3	2	39.00	43.45	
		F	4	1	39.75	39.00	
	15	M	11	4	38.05	41.68	
		F	13	3	38.33	41.80	
	16	M	3	1	38.67	38.00	
		F	5	1	38.60	39.70	

Table 55 Mean chest circumference of infants and toddlers in comparison with reference standards

Age in month	Sex	Number Eg	Number Cg	Chest circumference mean values Eg (cm)	Chest circumference mean values Cg (cm)	Reference standard (cm)	t value Eg	t value Cg
6 -11	M	18	4	38.66	39.82	44.00	4.32*	3.84*
	F	32	11	37.25	40.48	44.00	3.84*	4.25*
12 - 16	M	22	9	39.48	42.35	45.00	3.98*	3.85*
	F	28	6	39.08	41.18	45.00	3.99*	4.38*

Significant at 5% level
Eg - Experimental group
Cg - Control group

boys and girls of both experimental group and control group had chest circumference values below the recommended standard values of NCHS (1976).

Statistical analysis of the data pertaining to the mean chest circumference of infants and toddlers in comparison with reference standards are presented in Table 55.

Mean chest circumference values when compared with standard values suggested by NCHS (1976) for the respective age groups revealed that the mean values of infants and toddlers belonging to experimental as well as control group were significantly lower than that of the standard.

Head/chest circumference ratio

Utilizing the measurements pertaining to head and chest circumference the "Head/Chest circumference ratio" was worked out as it would reveal irregularities in growth, which can be taken as an indicator of nutritional and health status of the subjects (Sundaram, 1994). The head/chest circumference ratio of all the subjects are presented in the Appendix X. Based on the head chest circumference ratio the malnourished subjects were identified. Waterlow (1987) has stated that a child would be considered as malnourished if the head/chest ratio is less than 'one'. Distribution of infants and toddlers of both sexes from the experimental and control groups based on head and chest ratio are presented in Table 56.

Table 56 Distribution of infants and toddlers based on head/ chest circumference ratio

Grades	Sex	Eexperimental group Infants	Toddlers	Total	Control group Infants	Toddlers	Total	Grand Total
≤1 normal	M	11 (22)	12 (24)	23 (23)	4 (26.67)	5 (33.33)	9 (30)	32 (24.62)
	F	20 (40)	17 (34)	37 (37)	8 (53.33)	4 (26.67)	12 (40)	49 (37.69)
≥1 normal	M	7 (14)	11 (22)	18 (18)	-	4 (26.67)	4(13.33)	22(16.92)
	F	12 (24)	10 (20)	22 (22)	3 (20)	2 (13.33)	5 (16.67)	27(20.76)
Total		50 (100)	50 (100)	100 (100)	15(100)	15 (100)	30 (100)	130 (100)

As revealed in Table 56 among infants 22 per cent of boys and 40 per cent of girls from the experimental group and 26.67 per cent and 53.33 per cent of boys and girls respectively from the control group were found to be normal as per the classification suggested by Waterlow (1987). It was also noted that 14 per cent of boys and 24 per cent of girls in the experimental group and 20 per cent of the girls in the control group were malnourished.

Among toddlers 24 per cent of boys and 34 per cent of girls from the experimental group and 33.33 per cent and 26.67 per cent of boys and girls respectively from the control group were normal. Twenty two per cent of boys and 20 per cent of girls in the experimental group and 26.67 per cent and 13.33 per cent of boys and girls respectively from the control group of toddlers were found to be malnourished.

When experimental and control group (infants and toddlers) were compared the control group had less number of malnourished children.

The boys in the control group of infants were better than girls and among toddlers the girls were better than boys.

As stated in the chapter on methodology of the study the anthropometric measurements were recorded at the start of the study and were repeated once after three months and six months to find out the growth trend.

Table 57 Mean increments in anthropometric characters over a period of 3 months and 6 months (Infants)

Parameters	Mean increase		t value	
	Experimental group	control group	Experimental group	control group
1a. Weight after 3 months	0.56	2.19	0.49	0.66
b. Weight after 6 months	2.74	2.01	0.65	0.90
2a. Height after 3 months	1.23	2.97	1.13	0.68
b. Height after 6 months	0.98	1.34	1.99	0.74
3a. MUAC after 3 months	1.83	2.00	0.35	1.33
b. MUAC after 6 months	0.31	1.94	0.64	1.26
4a. Chest circumferences after 3 months	1.27	2.35	0.60	1.38
b. Chest circumferences after 6 months	0.43	1.31	0.58	0.23
5a. Head circumferences after 3 months	0.63	1.42	0.47	0.78
b. Head circumferences after 6 months	0.89	1.46	0.68	0.49

Table 58 Mean increments in anthropometric measurements of toddlers

Parameters	Mean increase		t value	
	Experimental group	control group	Experimental group	control group
Weight (kg) after 3 months	0.32	0.23	1.15	0.74
Weight after 6 months	0.50	0.43	1.55	1.97
Height first 3 months	1.45	1.47	1.48	1.48
Height after 6 months	2.39	2.74	1.27	1.86
MUAC first 3 months	0.55	0.63	1.58	1.86
MUAC after 6 months	1.01	1.13	1.16	1.30
Chest circumferences after 3 months	0.16	0.48	1.12	1.28
Chest circumferences after 6 months	0.62	0.86	0.41	1.90
Head circumferences after 3 months	0.46	0.32	1.50	1.90
Head circumferences after 6 months	0.78	0.61	0.75	1.15

The data pertaining to mean increments in the anthropometric characters of infants over a period of 3 months and 6 months revealed that there was no significant increase in various measurements as shown in Table 57. This indicate that the rate of growth over a period of 3 months measured at two intervals of three months each revealed that there was no significant increase in each of the parameters such as weight, height, MUAC, head and chest circumferences even after 6 months which indicates that rate and direction of growth is not progressing in the desired level and this could be taken as a risk factor which hampers the overall development of these infants.

The mean increments in anthropometric measurements pertaining to toddlers are presented in Table 58.

As shown in the Table there is no significant increase in anthropometric parameters over a period six months. The rate and direction of growth of these toddlers were also not progressing in a satisfactory manner. So it is necessary to enhance the quality and quantity of foods consumed by the toddlers.

As a part of subsample study body weight of mothers and siblings were measured and details are given below.

4.6.9 Body weight of mothers

The body weight and height of mothers are reported to be significantly associated with the nutritional status of infants and toddlers (Deshpande et al, 1994). Hence the body weight and height of mothers were recorded.

To find out whether the family risk factors mentioned in the poverty index developed by Srilatha and Gopinathan (1995) has affected the nutritional status of the mothers and other siblings of the family, the height and weight of the mothers as well as that of the siblings of selected subjects from the subsample are measured. The body mass index of selected mothers are presented in Table 59.

Figures presented in Table 59 reveals a very poor status when the weights of mothers of the subjects were compared with a reference well nourished, Indian women in the age group of 20 to 39 years as per the recommendations of ICMR (1989). All the 30 women (mothers of infants and toddlers from experimental group and control group) were found to be much below the standard weight. It may also be noted that there is no much difference between their age and their respective body weight.

When the height was taken in to consideration all were found to be below the standard height suggested by ICMR (1991). This indicates that the mothers themselves are stunted and they have not received the advantage of their own genetic potential.

Table 59 Classification of mothers based on their BMI

Classes	Grades	Experimental group: Mother of infant	Experimental group: Mother of toddler	Experimental group: Total	Control group: Mother of infant	Control group: Mother of toddler	Control group: Total	Grand Total
20-25	Normal	-	-	-	-	-	-	-
18.50 to 20.00	Low weight Normal	1 (10)	-	1 (5)	-	1 (20)	1 (10)	2 (6.67)
17.00 to 18.50	Chronic Energy Deficiency Gr.I	-	2 (20)	2 (10)	1 (20)	2 (40)	3 (30)	5 (16.67)
16.00 to 17.00	Chronic Energy Deficiency Gr.II	-	-	-	2 (40)	-	2 (20)	2 (6.67)
>16.00	Chronic Energy Deficiency Gr.III	9 (90)	8 (80)	17 (85.00)	2 (40)	2 (40)	4 (40)	21 (70.00)
Total		10 (100)	10 (100)	20 (100)	5 (100)	6 (100)	11 (100)	30 (100)

When their nutritional status of these mothers were further evaluated using BMI as an indicator, taking into account the height as well as weight (the data being independent of the age factor) it is seen that all the subjects had poor BMI. The classification of the subjects (Table 59) based on BMI as suggested by Bamji *et al.* (1996) reveals that 70.00 per cent of mothers were less than 16.00. The remaining 6.67 per cent and 16.67 per cent each were 16.00 to 17.00 and 17.00 to 18.50 and 6.67 per cent 18.50 to 20.00.

The data from the table 59 indicates that the poverty factors are affected the children directly as independent risk factors, as well as indirectly through the mothers.

As the mothers were found to have low body weight, the details pertaining to their ordinal portion was looked. It was seen that all the mothers except five had ordinal position of 2. This indicates that the poor health status of the mothers as indicated by their height/weight/or BMI could also be due to their own higher birth order, (four or more) larger family size and consequent low percapita availability of different social economic and cultural resources of the family.

In the present study maternal weight and height was found to be significantly associated with nutritional status of both infants and toddlers ($x^2 = 4.043^*, 4.033^*$).

The body weight of siblings also found to be below their standard weight. In the present study body weight of siblings were associated with nutritional status of infants and toddlers ($x^* = 6.30^*$, 6.09^*).

4.7 Clinical status of the infants and toddlers

Clinical examination has always been, and remains an important practical method for assessing nutritional status.

In the present study the investigator with the help of a qualified physician had assessed the clinical symptoms of malnutrition seen among the subjects using the proforma prepared by NIN. Details of clinical manifestations of malnutrition found among the subjects are presented in Table 60.

As shown in the Table clinical signs prevalent among the infants in the experimental group were were anaemia (80 per cent) sparse hair (40 per cent) discolouration of hair (30 per cent) and cheilosis (10 per cent). In the control group 20 per cent of infants were found to have sparse hair while 13.13 per cent of had oedema and anaemia and 6.67 per cent of the subjects exhibited discolouration of hair.

The data on the whole revealed that anaemia is the major clinical deficiency sign observed among the subjects followed by sparseness and discolouration of hair which could

Table 60 Distribution of subjects based on the presence of deficiency signs

Clinical signs of deficiency	Experimental group			Control group		
	Infants	Toddlers	Total	Infants	Toddlers	Total
Anaemia	40 (80)	42 (84)	82 (82)	2 (13.33)	1 (6.67)	85 (65.38)
Sparse hair	20 (40)	10 (20)	30 (30)	3 (20.00)	2 (13.33)	35 (26.92)
Discolouration of hair	15 (30)	20 (40)	30 (30)	1 (6.67)	2 (13.33)	38 (29.23)
Oedema	10 (20)	25 (50)	35 (35)	2 (13.33)	1 (6.67)	38 (29.23)
Cheilosis	5 (10)	5 (10)	10 (10)	-	-	10 (7.69)
Angular stomatitis	-	4 (8)	4 (4)	-	-	5 (3.85)
Thyroid enlargement	-	5 (10)	5 (5)	-	-	5 (3.85)

Figures in parenthesis represent percentage be attributed to protein and micronutrient (mineral and vitamin) deficiency. Eighty four per cent of toddlers were also found to be victims of anaemia while about 20-40 per cent were suffering from oedema and discolouration of hair. Out of 50 toddlers (experimental group) examined two (4 per cent) were found to be affected by cheilosis which could be attributed to B complex deficiency. It was surprising to find that to 4 per cent of the toddlers had enlargement of the thyroid gland which is reported to be associated with iodine deficiency. In the control group two children had sparse hair and discolouration of hair and only one child was seen with oedema and anaemia.

In general clinical examination revealed that majority (60 per cent) of the subjects had one or more deficiency signs in the experimental group of infants and toddlers. The most commonly observed symptoms were that related to protein and micronutrient deficiencies. It was also observed that toddlers exhibited symptoms of deficiency disorders more than infants which can be attributed to defective feeding and insufficiency with reference to supplementary feeding.

The clinical profile of the individual infants and toddlers were also evaluated by scoring for each deficiency symptom. A score of 'one' was given to the presence of a deficiency sign and the total score of each child was worked out by adding the scores. These score would range from a minimum of 'zero' to a maximum of 38.

Analysis of the total scores obtained by each subject revealed that the maximum mean score obtained by the children in the experimental group was three and that of the control group was two. Among the toddlers only two children had a score four and the remaining had scores ranging from 1 to 3. From the above data it was clear that 50 per cent of the infants and toddlers had a score of 3 out of 38. The toddlers were found to exhibit more symptoms than infants.

The overall clinical picture of the subjects revealed the absence of severe forms of deficiency disorders among the infants and toddlers. This indicates the extent of malnutrition found in these children through anthropometry is subclinical as well as mild.

4.8 Diet survey

Diet surveys are carried out to assess what people eat qualitatively and quantitatively and to find out the inadequacies or imbalance if any in the existing dietary pattern. Measurement of dietary intake had been widely used to assess the nutritional status of population groups (Gopaldas and Seshadri (1987). Since diet has far reaching influence on health, it was essential to have an idea of the dietary pattern of the area through a diet survey.

In the present study diet survey by weighment method was carried out on a subsample of 30 children comprising of 10 infants and 10 toddlers from the experimental group and five (5) infants and five (5) toddlers from the control group. In the study an one day weighment of cooked food was carried out to find out the actual food intake.

The nutrient intake was calculated from the average food consumption of individual infants and toddlers using Food Composition Tables (ICMR, 1989). From the nutrient intake data the adequacy of the diets were evaluated. The methods used to evaluate nutrient adequacy of individuals included computation of Nutrient Adequacy Ratio (NAR) and Index of Nutritional Quality (INQ) as well as comparison of individual intakes with corresponding recommended nutrient intakes (RDA). The pobability approach was employed further to assess more reliably the risk of nutrient inadequacy of an individual. The results pertaining to the adequacy of the diets using the above methods are detailed below.

Gibson (1990) has stated that such an approach is preferable for identifying and targeting nutrition and food intervention programme at the more vulnerable groups and for the estimation of risk of individuals and/or population groups to excessive intakes of nutrients.

4.8.1 Individual food and nutrient intake of infants

To find out the adequacy of diets consumed by the subjects, diet survey was conducted on a subsample of 20 per cent and the details are presented below.

The dietary intake of the infants were found by one day recall method. The percapita daily dietary and nutrient intake of selected 10 infants from experimental group and 5 from control group were calculated.

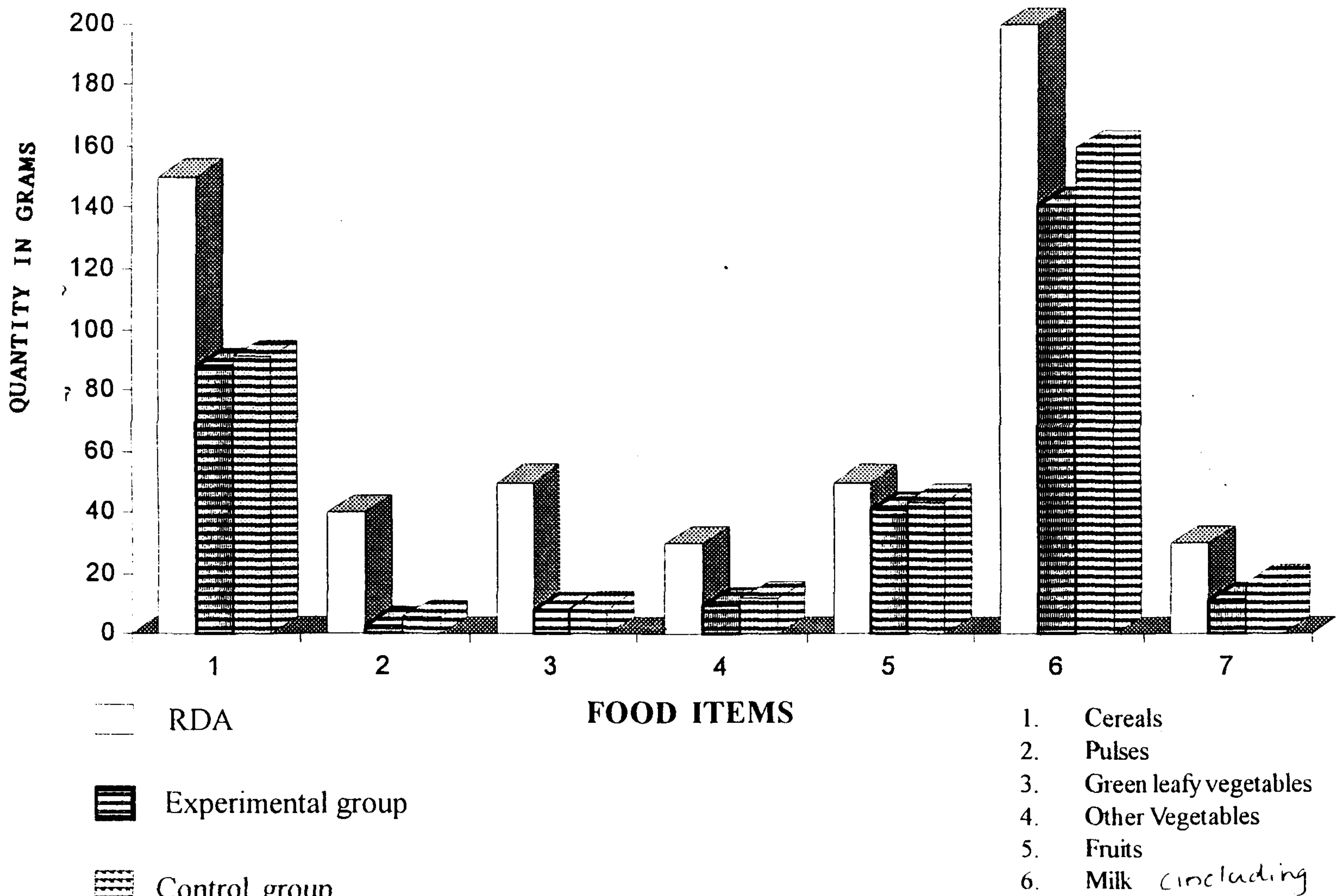
The actual food intake of the individual infants are presented in Table 61. The data revealed that the diets of individual infants are ill balanced and the diets of most of the infants were highly deficient in cereals, other vegetables and sugar. It is also seen that the diets of infants from the control group are better than that of experimental group.

As far as milk group is concerned, those infants who were being breastfed, received more amount of milk while those who received animal milk as a supplement received only half the quantity of milk. It was also noted that the milk that was given as a supplement was seen diluted with water, and the milk intake was round to be only half of RDA. For those children who received breast milk, the quantity of milk consumed was not assessed but was taken as 200 ml arbitarly. The quantity of breast milk was taken as 200 ml on the arbitrary manner

Table 61 Actual food intake of infants

Food items (g)	Experimental group										Control group					RDA
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	
Cereals	100	85	75	100	90	100	100	80	75	75	80	90	100	90	95	150
Pulses	–	–	–	5	–	–	5	–	10	–	4	5	6	8	–	40
Green leafy vegetables	–	–	–	10	–	–	–	10	5	–	10	5	10	–	–	5
Other vegetables	10	8	15	–	10	10	–	4	10	–	10	12	15	10	–	30
Fruits	–	50	–	50	25	–	30	50	–	–	50	50	50	25	–	50
Milk	100	200	200	200	150	100	200	200	150	200	200	200	100	200	200	200
Sugar	10	15	20	6	8	10	15	10	5	10	14	18	20	18	15	30

Fig.3 **AVERAGE DAILY FOOD INTAKE OF INFANTS**



1. Cereals
2. Pulses
3. Green leafy vegetables
4. Other Vegetables
5. Fruits
6. Milk (including breast milk)
7. Sugar

Table 62 Average daily food intake of infants

Food items (g)	RDA*	Qty. of food consumed by infants of Eg.	% RDA met	Qty. of food consumed by by infants of Cg.	% RDA met
Cereals	150	88.00	58.88	91.00	60.67
Pulses	40	3.00	7.50	5.75	14.38
Green leafy vegetables	50	8.33	6.66	8.50	17.00
Other vegetables	30	9.57	31.90	11.75	39.17
Fruits	50	41.00	82.00	43.75	87.75
Milk	200	141.00	70.50	160.00	80.00
Sugar	30	11.00	36.67	17.20	57.33

Source: Srilakshmi, 1996

because Ghosh (1992) had stated that at this age (after one year) mother probably has only 200-300 ml of breast milk produced during this time.

From the individual food intake data, the average daily food intake of the subjects were worked out and are given in Table 62 in comparison with RDA. The data with respect to the percentage of RDA met by the diet revealed that the diets of the infants were highly ill balanced and that such a diet would lead to undernutrition, resulting in low gain in body weight, and retardation of growth. It was seen that the average diets were highly deficient in pulses and vegetables and contained lesser amounts of energy giving foods such as cereals, fats and oils, sugar and jaggery (Fig. 3). Though the diets of control group are better than that of experimental group, the composition as well as inadequacies are common and their diets are also ill balanced.

The nutrient intake of the infants were calculated from the daily per capita food intake and the details are presented in Table 63. The data revealed that the diets of infants are found to be deficient in almost all the nutrients, (micro and macro nutrients) when compared to RDA.

The average daily nutrient intake of infants was computed and the details are presented in Table 64.

Table 63 Daily per capita nutrient intake of infants

Nutrients	Experimental group						
	1	2	3	4	5	6	7
Protein (g)	10.10	12.72	7.48	11.49	11.36	9.88	9.09
Energy (Kcal)	498.60	618.60	495.70	687.35	611.40	476.30	719.25
Calcium (mg)	131.00	259.25	64.64	123.00	194.47	129.62	81.10
Irong (mg)	4.52	8.06	3.20	7.72	4.45	4.44	4.87
Vitamin (ug)	174.00	387.00	271.50	256.90	280.50	174.00	228.10
Thiamine (mg)	0.27	0.32	0.17	0.30	0.30	0.37	0.22
Riboflavin (mg)	0.25	0.47	0.10	0.29	0.37	0.25	0.29
Nicotinic acid (mg)	4.00	3.74	2.97	4.39	3.98	4.14	3.33
Vitamin C (mg)	2.80	8.11	6.35	13.55	5.60	2.75	23.12

Nutrients			Control group					RDA
	8	9	10	1	2	3	4	5	
Protein (g)	8.46	9.66	9.86	14.65	10.40	8.75	11.49	9.20	15.00
Energy (Kcal)	594.92	514.60	594.40	679.08	637.07	605.10	687.35	690.08	842.00
Calcium (mg)	73.62	188.95	79.27	266.65	80.39	164.64	130.99	173.88	500.00
Irong (mg)	4.54	3.62	4.09	6.06	4.76	8.20	7.72	8.34	15.00
Vitamin (ug)	73.68	261.00	30.20	388.52	47.80	271.50	202.86	264.75	350.00
Thiamine (mg)	0.25	0.33	0.21	0.23	0.40	0.17	0.19	0.08	0.50
Riboflavin (mg)	0.13	0.65	0.11	0.49	0.13	0.20	0.24	0.22	0.60
Nicotinic acid (mg)	3.37	3.90	3.13	4.13	3.90	3.99	3.99	3.79	6.50
Vitamin C (mg)	10.84	3.80	6.10	5.10	9.14	7.35	8.85	24.10	25.00

Table 64 Average daily nutrient intake of infants

Nutrient	RDA	Average nutrient intake of subjects in Eg	% of RDA (Eg)	Average nutrient intake of subjects Cg	% RDA met (Cg)
Protein (g)	15.00	10.01	66.67	10.89	72.50
Calories (Kcal)	842.00	637.71	75.77	659.73	78.35
Calcium (mg)	500.00	132.49	26.50	163.31	32.66
Iron (mg)	15.00	4.95	33.00	7.01	46.73
Vitamin A (ug)	350.00	213.68	61.05	235.00	67.33
Thiamine (mg)	0.50	0.21	42.00	0.27	54.00
Nicotinic acid (mg)	6.50	3.70	56.92	4.00	61.63
Vitamin C (mg)	25.00	9.29	37.16	11.50	46.00

* ICMR: 1989

The data on average nutrient intake of the subsample of infants in comparison with RDA reveals that none of the nutrients are supplied adequately by the diet and consumed by these infants. The requirement of nutrients such as calcium, iron and vitamin C were met only up to less than 40 per cent of the actual requirements, while requirements of B vitamins, protein and vitamin A are satisfied only upto 65 per cent and only calorie requirements were met atleast upto a lord of 75 per cent and above. The same dietary trend was observed among the infants belonging to the 2 different groups, though on an average the infants of control group were better than that of experimental group. The result of diet survey explained above in general reveals that there was general undernutrition. The children need more food which itself would improve the nutritional status.

4.8.2 Individual food and nutrient intake of toddlers

The food intake of toddlers (10 from experimental group and 5 control group) were collected through an one day weighment survey. The per capita daily food intake of a subsample of toddlers from experimental group and control group are presented in Table 65 and the average daily food intake of toddlers are presented in 65 (Fig. 4). The data revealed that their diets of toddlers from experimental group are grossly inadequate with respect to green leafy vegetables, pulses, fruits, milk, fleshy foods and even sugar, when compared to the

Table 65 Actual daily food intake of toddlers

Food items	Experimental group										Control group					RDA
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	
Cereals	100	140	150	160	90	100	125	80	100	100	100	125	100	100	150	150
Pulses	25	-	-	10	-	-	20	20	10	-	-	10	25	20	-	40
Green leafy vegetables	-	-	-	-	10	-	-	-	10	5	-	-	10	5	10	50
Other vegetables/ Roots and tubers	25	50	25	-	25	20	-	10	15	-	20	15	20	20	15	30
Fruits	-	50	-	50	25	-	30	50	-	-	50	25	50	25	-	50
Nuts and oil seeds	10	5	10	10	15	5	10	-	10	5	5	10	5	10	-	30
Milk and milk products	15	100	50	15	75	50	100	50	75	50	100	125	50	100	50	200
Fat	10	5	10	5	10	-	10	5	10	10	5	6	10	10	10	20
Fish	20	25	20	-	-	-	-	-	-	-	-	20	25	-	-	30
Egg	-	-	-	-	20	-	-	20	-	-	-	30	-	-	20	30
Sugar	10	15	5	10	10	10	5	10	5	8	5	10	15	10	15	30

Table 66 Average daily food of toddlers

Food items	RDA*	Experi-mental group	% of RDA met	Control group	% of RDA met
Cereals	150.00	114.50	76.33	123.00	82.00
Pulses	40.00	17.00	43.00	18.33	45.83
Green leafy vegetables	50.00	8.33	16.66	8.30	16.66
Other vegetables/ root and tubers	30.00	20.71	69.03	20.00	66.67
Fruits	50.00	41.00	82.00	37.50	75.00
Milk and milk products	200.00	58.00	29.00	131.25	65.62
Fleshy foods	30.00	23.00	76.67	23.33	77.77
Sugar/Jaggery	30.00	8.80	29.33	11.00	36.66

* Source: ICMR, 1989

Table 68 Average daily nutrient intake of toddlers

Nutrient	RDA*	Experi-mental group	% of RDA met	Control group	% of RDA met
Protein (g)	22.00	19.60	89.09	21.42	97.36
Energy (Kcal)	1140.00	934.59	81.98	997.12	87.47
Calcium (mg)	400.00	243.00	60.75	351.04	87.86
Irong (mg)	12.08	11.08	65.40	14.04	75.20
Vitamin A (ug)	400.00	195.50	48.83	230.99	57.54
Thiamine (mg)	0.70	0.54	77.10	0.56	80.00
Riboflaving (mg)	0.80	0.62	77.50	0.87	108.00
Niacin (mg)	8.00	6.80	85.00	7.84	102.00
Vitamin C (mg)	40.00	12.50	31.25	12.47	31.18

* Source: ICMR, 1989

Fig.4 AVERAGE DAILY FOOD INTAKE OF TODDLERS

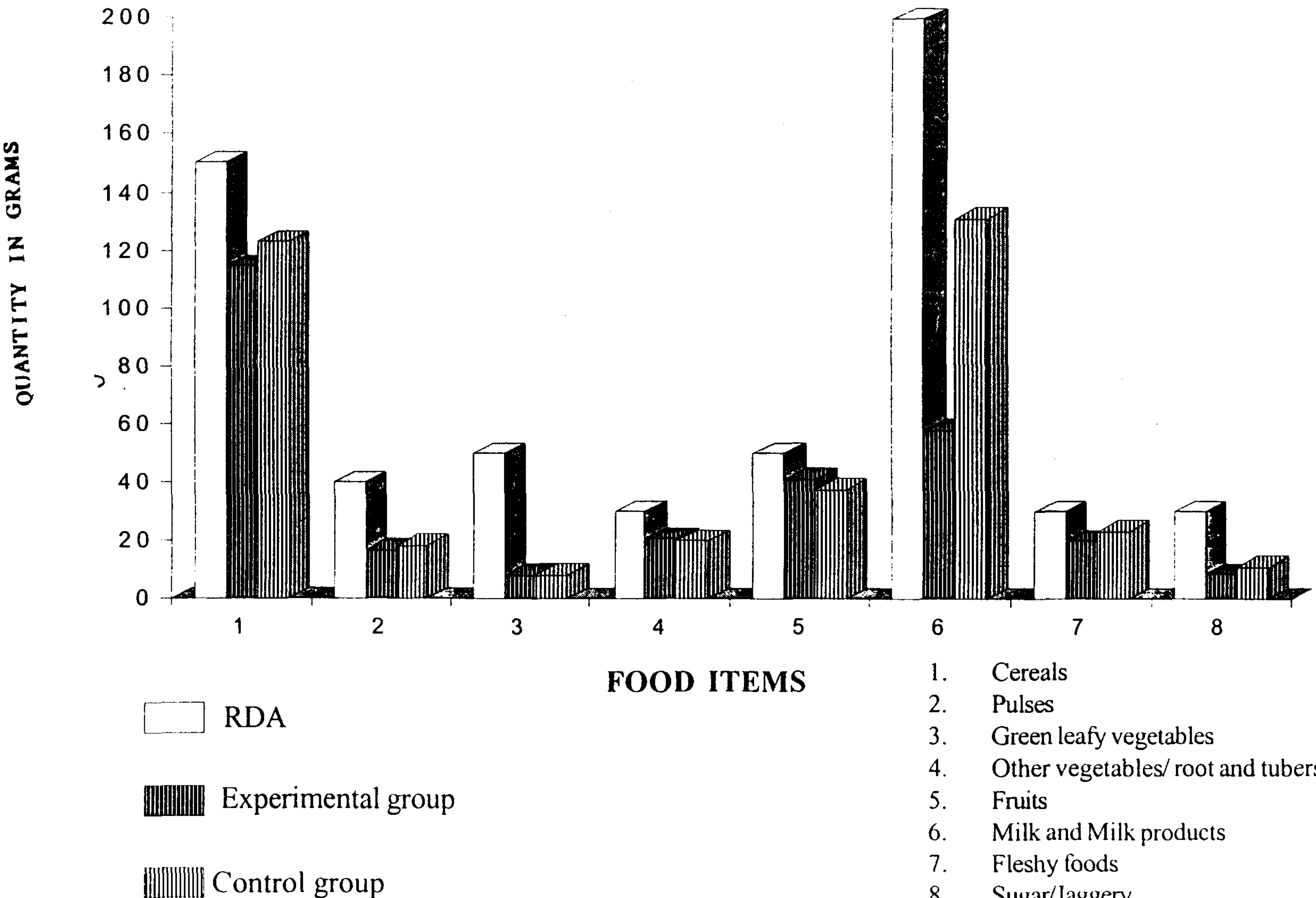


Table 63 Actual nutrient intake of toddlers

Nutrients	Experimental group										Control group					RDA
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	
Protien (gm)	16.40	12.00	20.17	18.91	19.74	21.00	18.75	19.84	11.20	12.00	14.11	20.20	22.40	12.40	20.00	22.00
Energy (kcal)	711.40	1020.20	990.20	990.20	970.10	922.30	943.10	903.20	904.30	986.30	1006.30	989.40	989.40	1000.30	1000.20	1145.00
Calcium (mg)	261.12	229.02	282.72	203.07	245.72	269.82	238.32	352.30	130.00	216.72	303.07	352.00	386.72	261.12	352.30	400.00
Iron (mg)	9.21	8.56	11.05	9.85	12.79	13.09	10.26	10.31	10.00	4.08	13.68	19.85	8.56	10.31	12.79	12.00
Vitamin A (ug)	21.60	99.17	51.70	115.21	266.50	68.00	269.00	99.90	99.98	266.50	266.50	151.70	131.60	299.90	115.21	400.00
Thiamine (mg)	0.15	0.56	0.34	0.52	0.74	0.63	0.28	0.12	0.58	0.74	0.74	0.54	0.16	0.23	0.51	0.60
Riboflavin (mg)	0.45	0.28	0.17	0.58	0.24	0.13	0.94	0.24	0.28	0.24	0.24	0.17	0.95	0.24	0.58	0.70
Nicotinic acid (mg)	8.46	4.56	7.89	7.36	4.43	6.72	8.00	4.08	4.56	5.50	4.43	7.89	8.42	11.08	7.38	8.00
Vitamin C (mg)	10.60	9.60	4.25	18.10	14.25	14.46	17.05	9.00	9.60	18.30	14.25	14.28	10.60	9.00	14.00	40.00

recommended dietary allowances suggested by ICMR (1989) for the toddlers belonging to the age group of 1-3 year. Though the diets of toddlers selected from control group is also highly inadequate, on a comparative basis, it may be stated that the diets consumed by toddlers of control group are better than that of experimental group. The inadequacies in the diets are highlighted, when the per capita nutrient intake of toddlers were computed. The per capita daily nutrient intake as presented in Table 67 and the average daily nutrient intake are presented in Table 68 reveals that 89 per cent energy and protein requirements were met by the diets consumed by the toddlers. Table 68 reveals that 89 per cent energy and protein requirements were met by the diets consumed by the toddlers. Table 68 reveals that the diets of individual children from the experimental group are highly deficient in vitamin A, vitamin C and iron. The diet seems to be moderately deficient in calcium, protein and energy in the dietaries of the toddlers. The diets of children from the control group was found to be deficient in vitamin A, iron, vitamin C and thiamine.

In general the nutrient intake of control group was found to be better than experimental group, though it was found to be deficient in vitamin C, vitamin A and only moderately adequate with respect to iron, calcium and energy. It was found the diets of toddlers of control group was almost adequate with respect to protein, riboflavin and niacin.

However the average daily intake of toddlers from control group is better than that of experimental group inspite of the fact that the diets in general were inadequate.

4.8.3 Evaluation of nutrient intake of individual subjects

From the individual food and nutrient intake data generated through the weighment survey, the adequacy of nutrient intake was further evaluated through the computation of (1) Nutrient Adequacy Ratio (NAR) (2) Mean Adequacy Ratio (MAR) and (3) Index of Nutritional Quality (INQ) are detailed below. The nutrient adequacy of toddlers alone were assessed, since the nutrient intake of diets of infants were estimated by assuming the quantity of milk consumed as 200 ml per day, which involves an element of generalization.

4.8.3.1 Nutrient adequacy ratio (NAR)

The nutrient adequacy ratio (NAR) represents an Index of adequacy for a nutrient based on the corresponding Recommended Daily Allowances (RDA) suggested by ICMR (1989) for that nutrient.

The NAR is expressed as follows

$$NAR = \frac{\text{Subjects daily intake of a nutrient}}{\text{RDA of that nutrient}}$$

The NAR values are always trancated at 1.0 to prevent intakes in excess of RDA for any nutrient from increasing the index as explained by Smith *et al.* (1987) and Guthrie and Crocetti (1981).

The nutrient adequacy ratio of a subsample of 20 per cent of toddlers (10 toddlers from experimental group and 5 from control group) were calculated from the per capita nutrient intake data and applying the formula for computing NAR (given above). The NAR values for different nutrients obtained by individual toddlers are presented in Table 69.

Diet can be considered as adequate if the NAR values for individual nutrients are '1' or nearer to '1'. It may be seen that the energy supply was found tobe almost adequate except for one subject from the experimental group, who had NAR as 0.72 while five others had it above 0.91 and four had NAR as '1'. All the subjects from the control group had energy value above '1'.

The data in general indicates that the diets of more than 95 per cent of the subjects from the experimental group were deficient in all the micronutrients, especially iron, vitamin A, vitamin C and B group of vitamins. The diet seems to be moderately adequate with reference to protein and energy. The diets consumed by the subjects of the control group were found to be better than those from the experimental group.

As there are wide variations in the adequacy or inadequacy with respect to different nutrients and between the

Table 69 Nutrient Adequacy Ratio (NAR) of subjects (Sub sample)

Nutrients	Experimental group (Serial number of individul subjects)										Mean	Control group (Serial number of individul subjects)					Mean
	1	2	3	4	5	6	7	8	9	10		1	2	3	4	5	
Protein (g)	0.75	0.91	0.92	0.86	0.90	0.95	0.85	0.90	0.96	0.91	0.89	1.05	0.92	1.02	0.98	0.91	0.98
Energy (Kcal)	0.75	1.03	1.00	1.00	1.00	0.98	0.93	0.95	0.91	0.91	1.00	0.84	1.02	1.00	1.11	1.11	1.05
Calcium (mg)	0.65	0.57	0.71	0.51	0.62	0.67	0.60	0.88	0.33	0.54	6.60	0.78	0.88	0.97	0.90	0.88	0.88
Iron (mg)	0.46	0.43	0.70	0.99	0.64	0.65	0.68	0.52	0.75	0.70	0.65	0.68	0.99	0.93	0.52	0.64	0.75
Vitamin A (ug)	0.05	0.25	0.13	0.29	0.67	0.17	0.67	1.75	0.25	0.67	0.49	0.47	0.18	0.80	0.75	0.29	0.54
Thiamine (mg)	0.19	0.70	0.43	0.65	0.93	0.79	1.00	0.15	0.73	0.93	0.65	0.93	0.68	0.20	1.54	0.64	0.79
Riboflavin(mg)	0.56	0.35	0.21	0.73	0.30	0.16	1.18	0.30	0.35	0.30	0.44	0.30	0.21	1.192	0.30	0.73	0.55
Nicotinic acid (mg)	1.06	0.57	0.99	0.92	0.55	0.84	1.00	1.34	0.57	0.69	0.85	0.55	0.99	1.05	1.39	0.92	0.98
Vitamin C	0.35	0.16	0.14	0.60	0.48	0.48	0.57	0.30	0.16	0.61	0.36	0.48	0.48	0.35	0.30	0.48	0.42
MAR	0.53	0.55	0.58	0.73	0.67	0.64	0.83	0.78	0.56	0.71	0.58	0.70	0.70	0.83	0.86	0.71	1.38

MAR - Mean Adequacy Ratio

subjects the overall quality of the diet consumed by individual subjects were assessed by averaging the NAR values of each of the selected nutrients to yield a Mean Adequacy Ratio (MAR) for each subject using the formula

$$\text{MAR} = \frac{\text{Sum of the NAR's of '9' nutrients}}{9}$$

The MAR for each of the subjects are given in the bottom line of Table 69. The MAR indicated that in the experimental group and control group none have adequate diets. The subjects in the control group had higher MAR indicating that they have better diets than the subjects in the experimental group.

The MAR does not indicate the adequacy of individual nutrients, as all the nutrients are given equal weightage in developing the ratio hence the INQ was calculated.

4.8.3.2 Index of Nutritional Quality (INQ)

This method, developed at Utah State University (Hansen, 1973) has been designed to evaluate the adequacy of meals and diets of individuals and therefore was used to estimate the adequacy of diets consumed by individual toddlers.

The index of nutritional quality (INQ) for each nutrient represents the quantity of a nutrient in a food, meal or diet relative to the recommended nutrient intake. It is expressed as

$$INQ = \frac{\text{Amount of nutrient in 1000 Kcal of food}}{\text{Allowances of the nutrients per 1000 Kcal}}$$

An INQ value greater than 1.0 for any nutrient indicates that an amount of a particular food or a combination of foods that would satisfy the total energy requirement would also provide a sufficient amount of the nutrient. An INQ less than 1.0 indicates that for that nutrient an excess of a particular food or groups of foods must be consumed to meet the recommended allowance. Thus computation of INQ values helps to evaluate the capacity of an individuals' diet to provide both energy and nutrient needs. The reference values for the nutrient allowance per 1000 kcal (with the exception of fat and carbohydrate) based on the nutrient requirements and Recommended dietary allowances for Indians (ICMR, 1989) are presented in Table 70.

As stated by Gibson (1990) these single value nutrient allowances are designed to meet and in some cases exceed the needs of all age groups and physiological states in the population when the energy needs of each group are met. To meet the nutritional needs, composite diets must have INQ values 1.0 or more for all vitamins and minerals and protein.

Table 70 Single value nutrient allowances per 1000 kcal

Nutrients	Allowances for 1000 kcals (ICMR, 1989)	RDA
Protein (g)	19.30	22
Calcium (mg)	350.88	400
Iron (mg)	10.52	12
Vitamin A (ug)	350.88	400
Thiamine (mg)	0.53	0.60
Riboflavin (mg)	0.61	0.80
Nicotinic acid (mg)	7.02	7.00
Vitamin C (mg)	35.09	4.00

Based on the above concept, the dietary data collected through weighment conducted on a subsample of 20 per cent of the subjects (10 toddlers from the experimental group and 5 toddlers from control group) were utilized for the calculation of INQ.

The dietary data of only toddlers were utilized for this calculation, because the infants diet depends more on the quantity of breast milk, and it is difficult to assess the exact quantity of this major food consumed by the infants.

The INQ, values for major nutrients (except calories) computed based on the food intake by each of the 10 toddlers from the experimental group and 5 from the control group are presented in Table 71.

Table 71 Index of nutritional quality values of individual subjects

Nutrients	Experimental group										Mean	Control group					Mean
	1	2	3	4	5	6	7	8	9	10		1	2	3	4	5	
Protein (g)	0.85	0.62	1.04	0.97	1.02	1.08	0.97	0.97	0.58	0.62	0.91	0.71	1.03	1.14	0.63	1.03	0.90
Calcium (mg)	0.74	0.65	0.80	0.57	0.70	0.77	0.68	1.00	0.37	0.61	0.75	0.86	1.00	1.10	0.74	0.99	0.93
Iron (mg)	0.87	0.81	0.12	0.93	1.21	1.23	0.97	0.98	0.95	0.38	0.84	1.14	1.65	1.54	0.85	0.32	0.54
Vitamin A (ug)	0.06	0.28	0.15	0.33	0.78	0.21	0.76	0.28	0.28	0.76	0.38	0.75	0.43	0.38	0.85	0.32	0.54
Thiamine (mg)	0.28	1.05	0.64	0.98	1.39	1.18	0.52	0.22	1.09	1.39	0.87	1.39	1.01	0.30	0.43	0.96	0.81
Riboflavin(mg)	0.73	0.45	0.28	0.95	0.39	0.21	1.54	0.39	0.46	0.39	0.59	0.39	0.27	1.55	0.39	0.95	0.71
Nicotinic acid (mg)	1.20	0.64	1.12	1.04	0.63	0.95	1.13	0.58	0.65	0.78	0.87	0.63	1.12	1.19	1.57	1.05	1.11
Vitamin C	0.30	0.27	0.12	0.51	0.40	0.41	0.48	0.26	0.27	0.52	0.35	0.40	0.40	0.30	0.26	0.41	0.35

The Table reveals that the protein supply was almost adequate for 3 subjects each of experimental as well as control group. The other nutrients were found to be almost inadequate.

In general, diets of more than 90 per cent of the subjects from the experimental group were found to be deficient in all the micronutrients like iron, Vitamin A, Vitamin C and B complex vitamins.

The diet consumed by the subjects of the control group were found to be better than those from the experimental group.

4.8.3.3 Evaluation of nutrient intake by probability of approach

Dietary data alone is generally used to estimate the risk for nutrient inadequacies. The reliability of this risk estimate depends on the method used for the evaluation. Gibson (1990) is the opinion that none of the methods such as diet survey, MAR, NAR, INQ can accurately define an individuals' degree of nutrient inadequacy at the present time, and states that a probability approach first used by Beaton in 1972 is a better method to evaluate more reliabily the risk of nutrient inadequacy both for an individual and a population. Moreover ICMR (1995) in their report on nutrient requirements and recommended dietary allowances for Indians has stated that RDA's are not meant to be used as standards to determine whether or not a given individuals requirements has been met and the ICMR expert group has suggested that the probability approach may be used to find out the inadequacy of nutrients in a diet consumed by individuals in a population (Gibson, 1990). Hence probability approach was used to assess the risk of nutrient adequacy of both the individual toddlers comprising of experiment group. Due to limitations in sample size this analysis could not be carried out on control subjects.

More over this approach was applied only for the interpretation of few nutrients such as protein, calcium, iron and vitamin A and not used for estimating energy and vitamin C as advocated by Anderson *et al.* (1986) and NRC (1986).

The adequacy of the diets of individual toddlers (sub sample) with respect to protein, calcium. Vitamin A and iron are presented in Table 72.

The data presented in Table revealed that 40.70 per cent of toddlers surveyed have inadequate intake of proteins. To overcome this risk, these subjects should receive additional protein supplements.

Data pertaining to calcium vitamin A and iron indicated that 50 per cent each and 30 per cent of the toddlers are at risk with reference to their intake of calcium, vitamin A and iron respectively.

Table 72 Probability approach - Toddlers

	Individual intake in terms of distribution of requirement	Individual intake in terms of per cent of RNI	Probability that individual intake does not meet requirement	Number of individuals	No. of individuals expected to have below requirements
Protein					
Class I	< -2 SD	< 36.27	1	1	1
Class II	-2 SD to -1 SD	76.27 to 83	0.93	0	0
Class III	-1 SD to Mean	83 to 89.09	0.69	2	1.38
Class IV	Mean to 1 SD	89.09 to 91.31	0.31	5	1.55
Class V	+1 SD to +2 SD	91.31 to 100	0.07	2	0.14
Class VI	> 2 SD	-	0	0	0
Calcium					
Class I	< -2 SD	< 31.95	1	0	0
Class II	-2 SD to -1 SD	31.95 to 46.35	0.93	1	0.93
Class III	-1 SD to Mean	46.35 to 60.75	0.69	4	2.76
Class IV	Mean to 1 SD	60.75 to 75.19	0.31	3	0.93
Class V	+1 SD to +2 SD	75.19 to 89.54	0.05	2	0.10
Class VI	> 2 SD	> 89.54	0	0	0

Table 72 Continued

	Individual intake in terms of distribution of requirement	Individual intake in terms of per cent of RNI	Probability that individual intake does not meet requirement	Number of individuals	No. of individual expected to have below requirement
Vitamin A					
Class I	< -2 SD	< 51.33	1	0	0
Class II	-2 SD to -1 SD	-51.33 to -1.95	0.93	0	0
Class III	-1 SD to Mean	1.95 to 100	0.69	6	4.14
Class IV	Mean to 1 SD	100.00 to 149	0.31	3	0.93
Class V	+1 SD to +2 SD	149.00 to 152	0.01	0	0
Class VI	> 2 SD	> 162	0	1	0
Iron					
Class I	< -2 SD	> 59.67	1	0	0
Class II	-2 SD to -1 SD	31.59.67 to 76.75	0.93	1	0.93
Class III	-1 SD to Mean	76.75 to 93.83	0.69	2	1.38
Class IV	Mean to 1 SD	93.83 to 110.92	0.31	5	1.55
Class V	1 SD to 2 SD	110.92 to 128	0.01	1	0.01
Class VI	> 2 SD	> 128	0	1	0

RNI - Required nutrient intake

The data in general indicated that more than 40 per cent of the subjects are consuming diets deficient in major nutrients such as protein, vitamin A, calcium and iron.

4.8.3.4 Adequacy of current dietary pattern of infants

The foods given to infants and young children varies from one place to another, depending on availability, cost, culture, food preference etc. A meal is made usually from several foods, each food supplies some energy and different nutrients all of which combines together to form a meal. It is important that the foods are in the right proportion so that there is an adequate balance between the nutrients and between energy and the nutrients.

Several scientists have suggested that the receipe used for weaning should have at least two ingredients and other foods are added gradually to make a complete meal. In formulating weaning mixes Mitzner *et al.* (1984) has suggested that four ingredients suggested as a 'Food square' with breast milk when used together in a suitable proportions forms a complete meal. Based on this principle the concept of food square has been used to check the adequacy of the daily dietary pattern of infants included in the study. The 'food square' is shown in Fig. 5.

The composition of the current meal pattern of infants belonging to experimental and control groups were

Figure 5

Food square

A	B
Staple Rice, wheat, maize potatoes, sweet potatoes yam, plantain	Protein supplements Beans and peas (all kinds) ground nut milk, yogurt, soft curd, cheese Fish - Fresh, dried, canned Meat - Fresh, canned chicken Eggs

Breast milk

C	D
Vitamin and Mineral Food supplements Dark green leaves, pumpkin, tomatoes, carrots, sweet peppers and other vegetables Oranges, limes, mangoes, papaya and other fruits	Energy supplements: Red palm oil, Groundnut oil, Butter, ghee, margarine Lard, cooking fat Sesame seeds Coconut, sugar, cream

Source: Mitzner *et al.*, 1984

compared with the components of food square to check their adequacy.

This comparison was applied only with respect to the meal pattern of infants. While comparing the above, it is assumed that, if the meal consumed by the infant, contains all the four components along with breast milk, the diet is adequate, and the adequacy diminishes with consequent reduction in different components as represented in Figure 6.

Figure 6 depicts the distribution of infants of the study based on the composition of their current meal pattern in comparison with the components of food square. The above data reveals that the meal pattern of 79.99 per cent of the infants from the control group can be considered as adequate while only 32 per cent of infants from the experimental group had adequate meals. It is further observed that 44 per cent of infants from the experimental group had one major component, viz. protein supplement missing from their current meal pattern. It is also visible that eight per cent had the "mineral and vitamin supplement" missing from their daily diet. The current meal pattern of 16 per cent was found to be quite poor since two essential and major components namely 'protein supplement' and "mineral and vitamin supplement" were missing from the daily diet.

Figure 6

Distribution of infants based on the composition of current meal pattern in comparison with the components of food square

Food square	Distribution of subjects		Total
	Experimental group	Control group	
Staple; Protein food supplements; BM; Vitamins and mineral supplements; Energy supplements	16 (32)	12 (79.99)	28 (43.08)
Staple; —; BM; Vitamins and mineral supplements; Energy supplements	22 (44)	1 (6.67)	23 (35.38)
Staple; Protein food supplements; BM; —; Energy supplements	4 (8)	1 (6.67)	5 (7.69)
Staple; —; BM; Vitamins and mineral supplements; Energy supplements	8 (16)	1 (6.67)	9 (13.85)
Total	50 (100)	15 (100)	65 (100)

4.8.3.5 Adequacy of current dietary pattern of toddlers

From time immemorial a meal is considered to be adequate if it supplies a variety of foods chosen from different food groups. Several systems were in vague with respect to classification of foods in to different groups - such as 'Basic four', 'Basic five', 'Basic seven' and 'Basic Eleven'. While the first three systems make use of a combination of foods based on their nutrient content (eg. protein, Vitamin A), the "Basic Eleven" takes in to account only the different categories of foods/commonly consumed. Moreover this system gives a wider variety of choice of foods. Hence the adequacy of current meal pattern of toddlers of this study was assessed in the light of 'Basic Eleven' food grouping system. Analysis of the composition of meal pattern of individual toddlers in the experimental group, revealed that there is a wide variation in the type of food included and therefore to accommodate this variation, 'Basic Eleven' grouping was found to be more viable. Therefore Basic Eleven food grouping system was used to check whether the diet consumed by toddlers were balanced or not. To make the comparison easy, a numerical scoring system was designed. As the "Basic Eleven" grouping comprises of 11 food groups, one score each, was awarded to the inclusion of an item from each of the eleven groups. Therefore the maximum score that can be obtained by an individual using this scoring pattern would be 11 while the minimum score would be 'one'. It is assumed that if the score value is high, the adequacy of the diet is better, or that the diet is balanced to a greater extent than the one wish a low. Using this system the meal pattern of the toddlers were scored individually.

The data obtained revealed that the maximum score obtained by an individual subject was eight and minimum score was four as against the total score of 11 that could be obtained if all the foods in Basic Eleven were included in the daily diet at least once a day.

The distribution of toddlers based on the scores obtained are presented in Table 73.

Table 73 Distribution of toddlers based on total score

Scores obtained	Subjects		Total
	Experimental group	Control group	
4	2 (4.00)	-	2 (3.08)
5	20 (40.00)	-	20 (30.74)
6	15 (30.00)	2 (13.33)	17 (26.15)
7	10 (20.00)	6 (40.00)	16 (24.62)
8	3 (6.00)	7 (46.67)	10 (15.38)
Total	50 (100)	15 (100)	65 (100)

Figures in the parenthesis indicates percentage

The data revealed that the diets of the control group was better than that of the experimental group, since all the children in the control group had scores between 6 and 8, while 70 per cent of the subjects in experimental group had scores six and below six but above four.

The distribution of toddlers in the experimental group also revealed that all had scores above four but none had it above eight.

The data indicated that the diet of the toddlers in general are not fully balanced; at the same time it is not totally ill balanced; and therefore it is moderately balanced.

Further search made in to the data revealed that the food items missing from the 'Basic Eleven' from the meals of majority of toddlers in the experimental group are egg (86 per cent), fish (66 per cent), pulses (56 per cent) and fruits (34 per cent).

The data pertaining to the control group revealed that their diets were deficient in egg (60 per cent), fish (46 per cent) and pulses (20 per cent).

The above details revealed that the diets of toddlers in general are deficient in protein supplements such as pulses and fleshy foods (meat fish, and egg). Though all the subjects were reported to be non-vegetarians as revealed by the preliminary diet survey, it was seen that fleshy foods were not included in the diets of majority of toddlers (60 per cent) upto the age of two years.

Observations on the family dietary pattern followed by weighment survey conducted had revealed that though a few mothers (25 per cent) stated that they give pulses to their toddlers it was seen that only the liquid portion of the dhal boiled in water (soup) was given to the toddlers. It is seen that children who received dosai or iddli for breakfast had a share of pulses through these preparations.

Critical evaluation of individual dietary pattern also revealed that vegetables were given to more than 75 per cent of the toddlers. It is seen that only thouse vegetables which are categorised as "other vegetables" alone are included in the regular diet while leafy vegetables are totally lacking. It is noted that leafy vegetables are given only to a minority of 28 per cent of toddlers.

With respect to the food group 'fruits', it was observed that plantain was the single fruit given to most of the children who had it as a component of their daily diet. The diets of the population as a whole seemed to be devoid of citrus fruits.

The results given on the basis of the current dietary pattern indicates only an arbitrary estimate of the adequacy of the diets consumed by toddlers included in the study. Since it was necessary to collect qualitative and quantitative data to ascertain the quality of the diets consumed by the subjects based on the quality and quantity of foods consumed and the nutrients derived from them which ultimately decides the nutritive adequacy of the diet, as well as the health and nutritional status of the subjects a detailed diet survey using weighment method was conducted.

4.9 Nutritional status index

In order to find out the overall status of the individual subjects as influenced by diet, as well as by their cultural and social back ground nutritional status index of individual subjects were worked out and their index was used to make comparison between individual subjects and also to identify risk factors that have influence on the nutritional status of subjects of the locality.

Nutritional Status Index (NSI) is an index of social well being of a community (Krishna, 1988). Hence nutritional status index was worked out using the formula

Suppose x_{ij} be the observation corresponding to the j^{th} variable for the i^{th} sample $w_i = 1/s_i^2$, the nutritional status of i^{th} individual is calculated as follows:

$N_i = \sum^{k} w_i x_{ij}$,

$i = 1, 2, \ldots\ldots\ldots\ldots N$

N = No. of respondents

k = No. of variables

$W_i = 1/S_i^2$, S_i^2 being the variance of the i^{th} variable based on a sample of N size.

The NSI of all the individuals subjects were worked out using the anthropometric measurements such as birth weight, weight, height, mid upper arm, head and chest circumferences.

These parameters were taken for working out NSI mainly because variation in anthropometric measurements indicates variation in growth pattern; infancy and childhood are marked with changes in growth which determines the overall physical development of children.

The NSI of individual children (infants and toddlers) belonging to experimental group and control group are presented in Appendix XI and it is summarised and presented in Table 74.

Table 74 Nutritional status index of the subjects

Subjects	Sex		Nutritional Status Index			
	Eg	Cg	Experimental group	Mean value	Control group	Mean value
Infants	M = 18	4	43.40 to 48.50	45.50	46.80-49.80	47.40
	F = 32	11	44.50 to 48.90	46.40	46.50-49.30	46.40
Toddlers	M = 22	9	22.60 to 26.90	24.90	24.80-26.80	25.80
	F = 28	6	23.54 to 26.80	25.00	25.80-26.90	26.80

M = Male
F = Female

Nutritional status index computed for infants who are boys and girls from the experimental group ranged between 43.40 to 48.50 and 44.50 to 48.90 for the boys and girls respectively

As far as the toddlers are concerned the NSI ranged between 22.60 and 26.90 and 23.54 to 26.80 for boys and girls respectively. For the control group it ranged from 24.80 to 26.80 for boys and 25.80 to 26.90 for girls.

The result indicates that the NSI of infants are found to be better than that of toddlers. When the children of the experimental group and control group were compared to children of control group had better NSI than those in the experimental group.

4.9.1 Association between family risk factors and nutritional status index of infants and toddlers

As reported earlier the NSI is an indicator of social well being, the NSI could be influenced by several social and cultural factors prevalent in the society in which these children are living.

Hence the association between family risk factors and nutritional status index of infants and toddlers were also analysed.

Srilatha and Gopinathan (1995) in their study done at Alleppy had identified nine risk factors, that may affect the family in its allround well being. The health status of infants and toddlers of these families may be affected by these risk factors. Hence the effect of family risk factors on NSI of infants and toddlers were analysed statistically and the results are presented in Table 75.

Table 75 Association between family risk factors and nutritional status of infants and toddlers

Family risk factors	x^2 values	
	Infants	Toddlers
1. Children below 5 years	8.96*	8.88*
2. Family belonging to SC/ST	0.10	1.59
3. Family having an illiterate adult	8.96*	6.27*
4. Without or no adult employed	6.49*	3.90*
5. Living in Katcha houses	0.64	4.70*
6. Family without a household latrine	4.32*	3.96*
7. No safe access to drinking water	7.21*	24.53*
8. Presence of an alcoholic	0.18	1.60
9. Consuming 2 or less meals a day	0	0

Significant at 5% level

Out of the nine risk factors studied, the factors such as the presence of children below 5 years of age (x^2 = 8.96*), family having illiterate adult, (x^2 = 8.96*), lack of employment (x^2 = 6.49*), lack of latrine facilities (x^2 = 4.32*), and lack of drinking water facilities (x^2 = 7.21*) were found to have significant impact on nutritional status index of infants.

It was found that caste (x^2 = 1.02), housing condition (x^2 = 0.64) and family problems (x^2 = 0.18) had no impact on NSI of the infants.

However in the case of toddlers there was significant association between nutritional status index, and family having children below 5 years of age (x^2 = 8.88^X), family having even one illiterate adult (x^2 = 6.27^X), poor employment status of family members (x^2 = 3.96^X), poor housing condition (x^2 = 4.70, lack of sanitary latrine (x^2 = 3.90) and lack of drinking water facilities (x^2 = 24.53*). It can be deduced from the above facts that the above mentioned factors would negatively influence the health and nutritional status of toddlers. The type of house (x^2 = 4.70*) was one of the factors which had significant impact on nutritional status.

Analysis of the data also revealed that presence of family problems (x^2 = 1.60) and the caste to which the family being a scheduled caste (x^2 = 1.59) had no significant influence on the NSI of the infants and toddlers.

4.9.2 Association between child risk factors and nutritional status of infants and toddlers

The health status of infants may be affected by the family risk factors and child risk factors. The effect of child risk factors on the nutritional status of infants and toddlers were studied using chisquare test and the results are presented in Table 76.

Low birth weight (x^2 = 4.568*) repeated infection (x^2 = 4.410^X), birth order above 4 (x^2 = 6.148*), spacing between

Table 76 Association between child risk factors on nutritional status index of infants and toddlers

Risk factors	x^2 value	
	infants	toddlers
1. Low birth weight	4.560*	5.68*
2. Insufficient breast feeding	1.238	0.14
3. No wt. gain during a period of 3 months	5.864*	2.23
4. Repeated infection	4.410*	6.05*
5. Birth order of 4 or more	6.148*	5.24*
6. Multiple birth	0.047	0.23
7. Spacing less than 2 years	7.190*	3.96*
8. Working mother	5.158	4.46*
9. Death of more than 2 siblings	2.130	5.63*
10. Family problems	0.356	1.34

* - Significant at 1% level

the children (x^2 = 7.190*) working mother (x^2 = 5.168*). and inadequate weight gain during a period 3 months (x^2 5.864*) are found to be the factors which significantly influence the nutritional status index of the infants, as far as the condition prevailing in this study are concerned.

This analysis also revealed that multiple birth (x^2 = 0.047), family problems (x^2 = 0.356), and death of more than 2 siblings (x^2 = 2.130) had no influence on nutritional status index.

When toddlers were considered (Table 76) low birth weight (x^2 = 5.68*), death of more than two siblings (x^2 = 5.63*), repeated infection (x^2 = 6.05*) birth order 4 or more (x^2 = 5.24*); spacing less than two years (x^2 = 3.96*), and the presence of working mother (x^2 = 4.46*) were the factors which had direct or indirect influence on the nutritional status.

Inability to gain weight within a period of 3 months, insufficient breast feeding, multiple birth and family problems were found to have no effect on nutritional status of the toddlers.

As revealed from several studies it is assumed that socioeconomic variables like type of family, family composition, occupation, income, educational status of family members, drainage facility and sanitary conditions of the household determine the quality of life which have an important

Table 77 Socio economic variables influencing nutritional status of infants and toddlers

Socio economic variables (Related to family/household)	x^2 value for Infants Eg	Infants Cg	Toddlers Eg	Toddlers Cg
Type	0.45	0.84	2.80	0.62
Composition	4.66*	6.86	5.26*	3.89*
Occupational status of members	3.95*	4.80*	3.92*	3.90*
Income	6.38*	5.80*	6.30*	4.88*
Educational status of members	7.06*	4.88*	5.34*	3.80*
Drainage facility	5.592*	4.32*	7.89*	6.32**
Sanitary condition	4.40*	3.89*	14.503**	3.84*

** - Significant at 0.1% level
 * - Significant at 1% level

role in deciding the health status of family members especially children. To identify the socioeconomic factors that might influence the nutritional status of the subjects the available data on socio economic and nutritional status were subjected to suitable statistical treatment (Chisquare test) and the results are presented in Table 77.

In the case of children (both infants and toddlers) belonging to the experimental group, factors such as composition of the family, occupation, income, education of the family members especially the parents were found to have a significant impact on nutritional status.

Apart from the income, amount spent on food (ie. expenditure on food) was also found to have a significant relationship with the nutritional status of both the infants and toddlers of both experimental group and control group.

4.9.3 Relationship between feeding practices and nutritional status

It is generally understood that feeding practices influence health and well being of infants. Faulty feeding habits could lead to malnutrition and infection. So chisquare test was applied to identify the relationship between feeding practices and nutritional status. The results are presented in Table 78 and 79

Table 78 Relationship between feeding practices and nutritional status

Feeding practices	x^2 value for infants	
	Experimental group	Control group
Initiation of breast feeding	12.848*	6.280*
Frequency of breast feeding	4.48*	4.380*
Pattern of breast feeding	0.470	0.490
Water given between feeds	2.27	3.250
Breast milk alone	1.911	1.290
Age of introduction of supplementary food	3.88*	3.940*
Weaning problem	7.451*	6.800*
Breast feeding withdrawn	1.54	1.300
Nature of care takers	3.926*	4.260

T.79. Relationship between feeding practices of toddlers and nutritional status

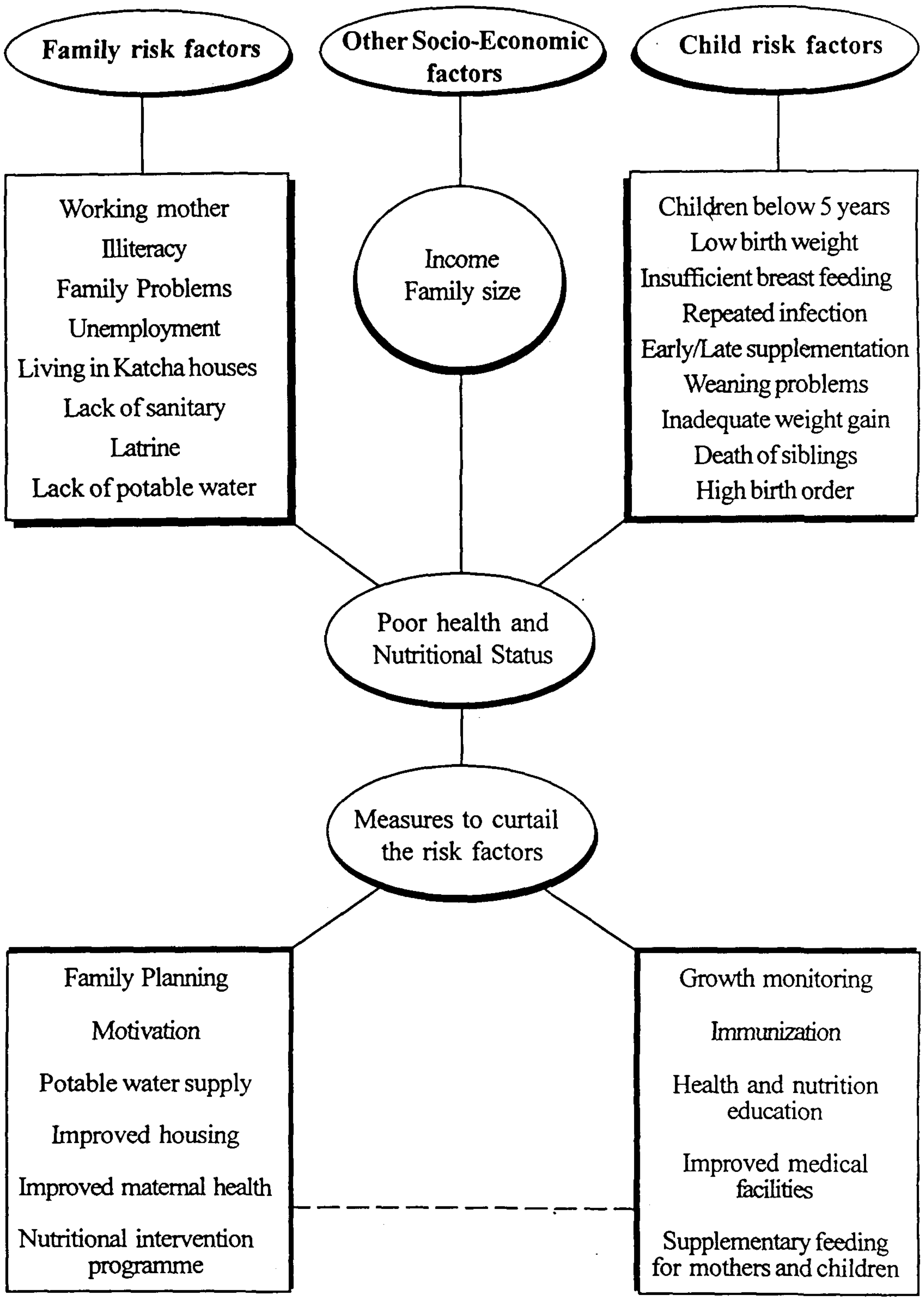
Feeding practices	x^2 value for toddlers	
	Experimental group	Control group
Initiation of breast feeding	9.171	8.35*
Breast milk alone	1.1090	1.22
Type of introduction of supplementary food	16.015	6.38*
Pattern of breast feeding	0.79861	6.38*
Weaning problem	6.496*	4.84*
Commercial milk formula	0.131	0.18
Nature of care takers	0.131	0.184

Among infants late introduction of supplementary food and weaning problem and nature of caretakers (x^2 = 3.88, x^2 = 7.45, x^2 = 9.171) like elder siblings and grand mothers were negatively influenced the NSI.

When toddlers were considered delayed of breast feeding (x^2 = 9.17), late introduction of supplementary foods (x^2 = 16.023*), and weaning problem (x^2 = 6.60*) were negatively influenced the NSI of toddlers.

In general delayed breast feeding late introduction of supplementary foods, weaning problems and nature of caretakers were negatively influenced the NSI of children.

Fig. 7. Risk factors ~~that~~ affecting the nutritional status of a child



DISCUSSION

DISCUSSION

The principal objective of the present study is to assess the existing feeding practices of children in the age group of 6-23 months belonging to high risk families. It also aims to assess the nutritional status of the above subjects as influenced by their feeding pattern. It is hypothesised that risk factors that are present in the families in which the subjects are born may directly or indirectly influence their nutritional status negatively. The synergestic influence exerted by the risk factors that may be present in the matrix of the families in a community is expected to bring down the nutritional status of the members of that society.

Studies undertaken in Kerala have revealed that the nutritional status of children comprising of infants and toddlers within the age range of 6-23 months, is a matter of concern because 70 per cent of the children below 2 years, in the state are victims of mild to moderate forms of malnutrition (Soman, 1994).

Quantitatively though Kerala has achieved remarkable progress in the reduction of infant mortality which has been identified as an indicator of positive health status, the incidence of mild to moderate levels of malnutrition among two thirds of infants population cannot be treated as trivial, but is to be viewed with caution and is to be treated with utmost care and insight. Otherwise the quality of life of future citizens may be at stake. This condition if allowed to prevail would negatively influence the physical, mental, intellectual and cognitive development of the child population currently, and would affect the well being and socio economic as well as cultural milieu of a major section of the future generation. Such a weak foundation is sure to rattle the national health structure in the near future.

The state has been able to lower the infants mortality rate and quality of life of infants through different strategic measures; by a multifaceted approach that could strengthen weak linkages, and trim off negative forces. As the state has been able to achieve low mortality rate during infancy, the next step in the road to progress for a healthier nation is to find out ameliorative measures to curtail the incidence of malnutrition rampant among children. In order to find solutions to this sub clinical problem which has long lasting effects on the health status it is essential to identify the factors that might contribute to the high prevalence of malnutrition among this particular segment of population. The present study is an attempt on these lines.

In the third world countries, poverty has been identified as one of the factors contributing to poor nutritional status among the vulnerable groups, including children. But in Kerala reduction in mortality rate and improvement in health status has been achieved without a concurrent improvement in the economic scenario and this has been achieved by harnessing the collateral benefits of positive demographic and social features of the state such as high female literacy, better communication net work, improved transportation availability of health care facilities; and better sex ratio favouring the weaker sexes. The influence of the economic factor, namely the income, has been relegated to the background while the strong social fibres have been brought together to improve the quality of the health fabric of the state. Levinson (1990) has postulated that economic status is found to influence the health status of family members and that the income directly influences the socioeconomic status of the family, its standard of living, and the quality of life enjoyed by the members of the family which directly affects the purchasing power and indirectly influence the feeding practices. Choudhary (1992) has also reported that income is considered to be one of the important factors determining the level of nutrition. Therefore in order to find out whether the social factors have an influence on the poor nutritional status of infants and toddlers. This study was undertaken among a group of children belonging to poor families from Kalikavu Panchayat of Malappuram district.

Here the "poor" have been identified through an indigenous method suggested by Srilatha and Gopinathan in 1995.

They have identified the poor families on the basis of a risk index called the poverty index which was found to be suitable for Alappuzha district where the excise of developing of their 'yardstick' was undertaken to identify the poor, and to find out the needs of the family and what specific package of interventions are needed for their uplift.

In this index it is not the income alone, but several family as well as community based social factors were taken into consideration for the identification of a poverty stricken family. Hence using this yardstick an attempt was made in this study to include only those children from poor families and find out whether the factors mentioned in the poverty index has any influence on the nutritional status of the children belonging to such families, in comparison with a control group selected from the same community but who are not categorised as "poverty stricken".

It is believed that the enlisted social risk factors could influence the dietary pattern as reported by several workers. Dietary factors along with social factors could influence the nutritional status as emphasised by Harrel *et al.* (1989). Agarwal (1990) reported that the social and cultural factors would influence food choice and ultimately the health status of the children.

Pandey *et al.* (1986) reported that poverty and lack of education were both responsible for malnutrition. Hence the present study is an attempt to identify the dietary practices followed by selected families which could influence their nutritional status. The study also attempts to magnify and thrush out those social risk factors which may influence the dietary habits and consequently the nutritional status of the population directly or indirectly. Such an identification is expected to help in chalking out programmes to improve the nutritional status and health profile of these vulnerable sections of children and the development model suggested could be tested in similar situations elsewhere. These risk factors could be used to target nutritional and social interventions to needy families and individual children as we stand in the door step of ninth plan and are planning to achieve self sufficiency through grass root level action programmes organised through grama panchayats.

Soman (1995) has reported that stunting and under weight are prevalent among children of 11 months and the most crucial period in the child's growth is between 6-23 months. As there is adequate data to prove that Kerala is showing an increasing trend in the morbidity pattern among children especially the ones between 6-23 months of age an attempt is made to identify social risk factors pre disposing a child to mal or undernourishment.

Ghosh (1992) reported that several studies in India have shown that the weight curve of many children are excellent for the first 4 to 5 months of life, with the birth weight doubling by this age. Thereafter, however, the curves tend to flatten, because by this time the breastmilk diminishes and insufficient or no food is given to supplement it.

In the present study the poor families were identified on the basis of an index and not by taking into consideration a single factor such as income/or calorie consumption, but a group of factors which have local implications. The poverty index measuring yardstick suggested by Srilatha and Gopinathan (1995) has '9' identified risk factors and a family is considered as "high risk" if any four or more of the nine risk factors are present.

This yardstick was used mainly because of its local origin being developed from the parameters identified by neighbourhood groups (NIG) under the community development society and also because it does not depend solely or one single factor but a group of social and cultural factors, rather than economic factors. Economic factors ascertained through surveys are found to be distorted being influenced by several items of bias, and hence was thought to be less reliable.

Therefore using the above poverty index a survey was conducted in Kalikavu Panchayat and 100 families having more than four out of nine risk factors identified by Srilatha and

Gopinathan were present. Care was taken to see that at least one child was in the age group of 6-23 months in each of these families.

This survey revealed that out of the nine factors 58 families had five different risk factors (Table 4). While four and six risk factors existed in 52 and 48 percentage of families respectively. There were just 10 per cent families which had seven out of nine risk factors. This indicates that all the families had several risk factors and as the number of risk factors increased the hardship suffered by the family becomes more leading to higher risk and unstability.

Coming to the individual risk factors the presence of a child below five years of age itself is an identified risk factor found in all of the families introduced by the design of the study, since the study was conducted only among families which had children between the age 6 to 23 months. When the risk factors were ranked according to the incidence among the population surveyed it was seen that in the descending order lack of an employed adult or having only one employed adult; lack of access to safe drinking water and lack of sanitary latrines were found as risk factors among 72 per cent, 68 per cent and 64 per cent of families respectively (Table 7).

Lack of access to safe drinking water and absence of sanitary latrine are two identified factors among 68 and 64 per cent of families surveyed which could indirectly affect the nutritional status. Several studies have revealed the interaction between lack of sanitation, infection and nutritional status. Lack of sanitation and hygiene due to unhygienic disposal of excreta or due to shortage of water would lead to increased morbidity leading to malnutrition. Malnutrition inturn has been reported to produce immuno suppression leading to increased susceptibility to infection and increased morbidity (NIN, 1996).

NIN (1996) has reported that information available from epidemiological, clinical and experimental studies supports this association and forms the basis for the modern concepts of the vicious cycle of malnutrition and infection. They have further stated that poverty through deprivation is the root cause of malnutrition while infectious diseases act as aggravating factors. This assumes greater significance in developing countries where both malnutrition and infection are widely prevalent and often co-exist. Infectious diseases precipitate malnutrition particularly in an already mal nourished child.

Severe PEM induces immunosuppression thereby increasing the susceptibility of the child to infections. It also contributes to the severity of illness in a malnourished child (NIN, 1996).

Ghosh (1991) has stated that repeated infections are very common among under privileged children especially those under three year of age. These infections have adverse effect on nutritional status and once the child is malnourished, she falls ill more often, making the infections more severe, further worsening malnutrition. While Banerjee (1995) reports that infectious diseases leads to malnutrition and that the effect of infection on nutritional status is mainly brought about by decrease in food intake and increased metabolic losses of nutrients.

A family having at least one illiterate adult and family consuming only two or less meals a day were two risk factors identified as risk factors from Alappuzha experiment are found to be less relevant with respect to Kalikavu. Presence of an illiterate adult is ranked as the 7th factor of risk by only 27 families. It was noted that the factors denoting the consumption of less than 2 meals a day is not a risk factor for the entire sample population except one family. Hence this need not be considered as a risk factor for the families of Kalikavu though this factor is directly related to dietary pattern and hence to the nutritional status.

The above findings indicate that any family with children below 5 years are to be treated as special groups for targeting developmental programmes which aims specially to improve health and nutritional status of the people. Lack of employment has been found as another major risk factor that needs rectification since it would affect the per capita as well as the family income. Lack of income or low level of income and reduced per capita income due to under or unemployment in turn is expected to negatively influence the purchasing power; and lack of purchasing power primarily affects the quality and quantity of food purchased and consumed by a family.

The economic status has been found to be influencing the health status of the family members and the allocation of income for various household expenditure.

Mehar (1995) reported that the income is considered to be one of the important factor determining the level of nutrition. He has also stated that the economic situation is a potent factor in determining how much and what kind of foods will be available in the family pot and it is therefore expected that with the enhancement of household income, absolute expenditure on food is likely to go up, rising the nutrient intake of household and better nutritional status of children.

Harrel *et al.* (1989) has opined that nutritional problems were associated with insufficient income, inadequate diets, low level of schooling, poor housing quality and unsanitory conditions.

Hence measures to improve income generation through better employment opportunities through government, local bodies or by self help must be a part of any programme that is intended to improve the health nutritional status of a community/family or individuals.

In short as reported by Pelto (1991) and Mlpack *et al.* (1994) insanitary practices, inappropriate handling of food and lack of safe drinking water facilities are the factors that lead to infectious diseases.

Caldwell (1988) has pointed out that educational status and literacy rate have been proved to be powerful determinants of nutritional status and this may affect the feeding practices. Chakraborty *et al.* (1985) has opined that the educational status can influence child health, their mortality and feeding practices and that, the illiterate adults having no idea about nutritious food, may follow the faulty habit of feeding which could affect the nutritional status of their children.

More over it may be noted that one reason for low IMR in Kerala in par with other developed nations was attributed to the prevalence of high female literacy in the state. Therefore it is imperative that lack of education (illiteracy) among adult could precipitate malnutrition in two ways specifically one through reducing the opportunities for better paid jobs and through its negative influence on awareness about better infant feeding practices, better sanitary measures, better child rearing practices by opening ones awareness about these facts from the external world through mass media or greater interpersonal communication.

Child risk factors

A child born in to a particular community or a family would survive in to an healthy adult if family risk factors are absent or if he/she is able to overcome these risk factors with assistance from the parents or other members of the family, support from community, state or national activists or programmes. Apart from the known social risk factors Ghosh (1992) has reported that the child may have to face several risk factors which would threaten or endanger the life of a child or might lead to malnutrition of varying degrees. Such factors would make a 'normal' child in to a 'CHILD AT RISK'. Keeping this in mind, in the present study the status of the selected children were reviewed to find out whether any of the risk factors ascribed by Ghosh (1992) are responsible for precipitation of malnutrition.

The prevalence of the different 10 risk factors identified by Ghosh (1992) among the 100 subjects of the experimental group of children consisting of 50 infants and 50 toddlers belonging to poverty stricken families are presented in Table 8. The above data have indicated that among the 50 infants more than 20 were found to have eight out of the 10 risk factors which would curb their development and health status. It is seen that the most important risk factors identified among infants were low birth weight (100 per cent), and birth interval of less than 2 years between the siblings (96 per cent) followed by a high birth order (birth order of 4 and above) (74 per cent), and the presence of a working mother (70 per cent). Repeated infections and inability to gain weight (growth faltering) were observed among 66 per cent and 62 per cent of infants and toddlers surveyed. All the above factors have been reported to be associated with poor nutritional status among children as reported by several workers. Low birth weight causes stunting and wasting. Low birth weight babies who survive infancy have been shown to have permanent disabilities (Singh (1991); Sen (1995).

Infancy by itself is an important transitional, as well as critical phase of life in humans, and it assumes greater significance in the case of low birth weight infants. Chandrasekhar (1999) is of the opinion that the fact that the proportion of low birth weight babies are quite high especially in developing countries and that the risk of their impaired development being high, these subjects become an important point to ponder over and research upon for future generation to be healthier.

According to Helsing and King (1984) Health workers have recognised for a long time that low birth weight babies have special nutritional needs.

Reggers *et al.* (1991) had reported that in low birth weight babies mortality and morbidity rate was very high. Low birth weight babies are prone to repeated infections and that it adversely affects their nutritional status as reported by Senigal (1985).

Nair (1995) has reported that low birth weight is an important risk factor for under 3 malnutrition. Long term studies conducted by Child Development Centre, Trivandrum now suggests that the low birth weight baby continues to grow and develop both physically and mentally at a lower level as compared to his or her normal weight counterpart.

The number of children born with low birth weight is reported to be generally high in Kerala. While the developed countries children have a low birth weight rate of about seven per cent. India has an overall rate of 30 per cent where as data from Malappuram district depicts a low birth weight rate of 38.4 per cent (Nair, 1995).

In a study conducted at New Delhi, the research workers have identified the important determinants of low birth weight are antenatal care, haemoglobin, height and weight of the mother. Through improvement in antenatal care, and enhancing the Haemoglobin level and height and weight and educational status of mothers and giving better education one reduce the number of low birth weight babies.

Nair (1995) has stated that low birth weight has a lasting impact on the subsequent growth performance of the infant. WHO (1992) is of the opinion that programmes for combating the problem of low birth weight should be directed to improving the maternal health and nutritional status rather than to repairing the handicap of low birth weight through better infant feeding. However in the present study, as the children are born with low birth weight, the current alternative will be improved feeding.

Adequate breast feeding is the single most vital factor that facilitates child growth (Mahadevan, 1992). Insufficiently breast fed child is found to be more prone to infectious diseases which adversely effect the nutritional status (Swaminathan, 1994).

Studies in India have shown that infant mortality rates among babies born with in one year of previous birth are 2 to 4 times more when compared to babies born after an interval of two years or more (Ahammad *et al.*, 1988; UNICEF, 1990; WHO, 1997). WHO (1997) has also reported that short spacing is associated with poor nutritional status and higher morbidity and mortality. Morely (1988) showed that children born at a longer birth interval were heavier and taller than those with a shorter birth interval.

The incidence of severe and mild forms of PEM and other nutritional deficiency signs were significantly higher among children of higher birth order than those of lower birth order (Ahammad *et al.*, 1988, Rao and Gopalan, 1992).

According to Gai (1996) and NNMB (1996) the PEM and iron deficiency anaemia are common causes of inadequate weight gain. In gross nutritional deficit, the weight gain is slow and the muscles are wasted. Martorell (1995) reported that growth retardation in developing countries is assumed to start between 3-6 months after birth when low quality and often contaminated foods are introduced in children's diet.

Lianage and Wikramanayake (1986), Babu (1989) and Mart and Belsy (1990) have also reported that working mothers do not have enough time to look after their children and lack of motherly care adversely affects the development of children.

The condition of the toddlers when analysed revealed that more than 95 per cent were in the grip of risk factors such as low birth weight (100 per cent) while repeated infection has affected 60 per cent of the toddlers. Compared to infants two more additional factors were identified as risk elements among toddlers. One is the presence of working mother identified as a risk factor among 76 per cent of families and another is the presence of a family crisis observed among 64 per cent of families.

Though Ghosh (1992) has identified multiple births as a problem that could precipitate malnutrition, this factor could not be identified as a risk factor in this area of study (Kalikavu Panchayat) and therefore can be deleted from the list or risk factors.

When the subjects (both infants and toddlers) were grouped together more than half of subjects had eight out of 10 risk factors identified by Ghosh. Out of these, low birth weight, reduced birth space and presence of working mother could be ranked as three important risk factors in the descending order as it was found among more than 70 per cent of the subjects covered under this study. It may again be seen that the risk factor of sibling deaths of more than two is a risk factor of a lower order seen only among less than 40 per cent of the subjects and multiple births are observed only among 2 per cent.

The data also revealed that factors such as multiple birth family problems and inability to gain weight over a period of three months do not have significant influence in lowering the nutritional status of toddlers.

Mishra *et al.* (1995) reported that low birth weight, repeated infection, spacing less than two years and mothers employment were significantly associated with nutritional status. This similar finding has been reported by other workers (Lal, 1981, Choudhary *et al.*, 1987, Kapil *et al.*, 1988).

In the present study 63 per cent of children were found to be at risk. A study conducted in Gadaipur village of Delhi by Bhasim *et al.* (1994) had revealed that 67.2 per cent of children are 'at risk' in that area. While Kapil *et al.* (1988) and Sen *et al.* (1995) in their study in Japalpur district found that 68.65 per cent of their subjects were 'at risk' children.

The above reports indicate that risk factors are in operation in under developed states but as well as in Kerala which has lowest IMR. On comparison it is seen that the prevalence of at risk children is a major problem in India, and special efforts needs to be taken to improve the status of these children.

Socio economic factors

Studies done in different parts of India have revealed that the nutritional status of infants and toddlers are influenced to a great extent by several socio, cultural and economic factors. NNMB (1996) had reported that the socio cultural factors like family size, land holdings, income and occupation are significantly associated with nutritional status of a community. Harrel *et al.* (1989) also reported that the nutritional problems are associated with insufficient income, inadequate diets, low levels of schooling, poor housing quality, inadequate water supply and unsanitary conditions. Though some of these socio cultural factors have found a place among the factors included under the 'poverty index' and for the identification of 'at risk' children, in this study an analysis of all the existing socio cultural features of the population of Kalikavu panchayat was carried out and the data was critically examined to find whether these factors would contribute in diminishing the nutritional status of infants and toddlers selected as subjects.

Unitwise analysis of the socio-cultural matrix of the community reveals that religion is a parameter which reflects the socio cultural behaviour of a population. According to Smith *et al.* (1993) the religious practices are significantly related to the nutritional status of children. Religious practices and religious leaders are found to influence the food habits of communities, families or individuals. Hence the details pertaining to the religion of the subjects and their families were assessed in the study and it was found that the subjects belonged to Hindu and Muslim communities with a predominane of Hindus. The absence of christians in the selected population is a matter which merits discussion. The predominance of Muslims followed by Hindus could be attributed to the demographic profile of the district itself. A review of the demographic distribution of the population according to their religious distribution indicated that 32.13 per cent population are Hindus, 65.50 per cent are muslims and only 2.37 per cent are christians.

Though christians are found in the population profile of the district, they are not depicted in the study sample which could be due to the criterion applied for the selection of subjects; only those categorised as poverty striken based on the scale developed by Srilatha and Gopinathan (1995) have been included in the study. And the results indicate that the poverty striken are more among Hindus followed by Muslims.

The data further indicates that the scheduled castes and other backward groups are the most affected by poverty, though India has celebrated its 50th year of independence recently. The absence of forward communities among the subjects under focus selected by a poverty index reaffirms the blight of the backward communities.

In the present study caste had no influence on nutritional status. Similar findings have been reported by Susan (1992); Sen *et al.* (1995).

The result presented in Table reveals that majority of the subjects belong to joint families which again indicates that joint family system still is a cause of poverty especially among the downtrodden. The joint family system though is advantageous in caring for the young and vulnerable, from the social point of view, it seems to be a negative sign from the economic point of view as it reduces the per capita availability of income, land, space, etc. This in turn creates a vicious cycle which at some point tries to nullify the beneficial effects of the system (Devadas, 1991).

The joint family system might adversely affect the nutritional status of every member of the household. This may affect the child rearing and feeding also as reported by Gonzalo (1986). He has reported that the allocation of food per member is likely to decrease with increase in the number of household members, which inturn may have a negative effect on nutrient intake.

However, the studies from Bangladesh indicates that joint family may by itself lead to higher economic status. It is not the family size but the number of adults in relation to children there is a crucial factor that influences the food intake of members of a house hold as explained by Choudhary (1992). In the present study joint family system prevalent in the area of focus seem to be a helpful factor, since it provides more caretakers. The family size is of great social significance since it has a direct influence on the food and feeding practices.

The economic status is reported to be a factor influencing the health status of family members and allocation of income for various household expenditure. The occupation or employment status is one factor which directly influences the family income. In this study major occupation of the parents of the children were agricultural labour. The agricultural labourers though they have comparatively good income as daily wages, their employment is seasonal and the days in a month they are employed may be very few. This leads to under nutrition or to indebtedness. This condition adversely affects the nutritional status where a vicious cycle of unemployment leading to poor nutritional status persists. This reveals that employment or under employment keeps them poor and lead to food insecurity. Such findings have been supported by Musud (1992) and Welch *et al.* (1990).

In a community a visible expression of poverty is the living condition. Poor people are characterised with their poor living conditions such as katcha habitats, small houses with poor amenities such as lack of potable water, electricity and poor facilities for waste disposal and poor sanitation.

Studies have brought into lime light the association between poor living condition and nutritional and health status which are linked directly or indirectly. Poor living conditions and nutritional status have been linked together by low immunity, repeated infections and high morbidity and the vicious cycle of poverty, disease and malnutrition have been explained by several research workers. NIN (1996) has reported that poverty through deprivation is the root cause of malnutrition while infectious diseases act as aggravating factors. Banergee (1995) and Pelto (1991) have also reported that infectious disease are associated with poor nutritional status.

Pelto (1991) had also reported that the prevalence of infectious diseases can be facilitated by unhygienic behaviour, poor feeding practices and inappropriate handling of foods.

In the present study queries were made to find out whether the nutritional status of infants and toddlers who are subjects of the study was influenced by their living conditions. Data collected on the living conditions revealed that the subjects lived in small houses with 6 to 15 cents of land around. At the exterior, the surroundings looked neat and tidy but amenities that are related to sanitation potable water, sanitary latrines were not available in the area to the desired level of satisfaction. Though the families made use of potable water it had to be fetched from a distance which itself could limit the use of water for cleaning and to that extent could reduce the personal sanitary practices observed and adopted by the members of the community. Lack of sanitary latrines among 64 per cent of families and drainage facilities (36 per cent) could accentuate poor personal and environmental sanitation which could pave the way to infection and infestation and resultant low health and nutritional status and high morbidity and mortality. The influence of poor sanitation has come in to focus already in the analysis of risk factors. Presence of repeated infection has been identified as a risk factor among families of 66 per cent of infants and 60 per cent of toddlers. Infections of varying nature and frequency have been reported to reduce the nutritional status by improving the household measures. WHO (1996) has reported that one half of all people in the developing world are suffering from one or more of the six main diseases associated with water supply and sanitation.

Therefore in the present study analysis of the data revealed that there was a significant association between lack of drainage facility and poor sanitary conditions with the poor nutritional status of both infants and children.

From the above discussion it may be inferred that the low nutritional status observed among infants and toddlers could be attributed to lack of variables like potable water, sanitary practices, employment and income along with other dietary practices.

Feeding practices

One of the major objectives of the present study is to assess the feeding practices followed by the parents of children belonging to high risk families as reflected also in the title. Therefore different approaches were made to assess the feeding practices along with the current feeding pattern. Yaing and Shalee (1999) had opined that infant feeding can have long lasting effect on development and behaviour of an individual. Similar remarks have been made by Chikkara and Gupta (1990). Arora (1990) and Madise and Mpoma (1997). An attempt was also made in this study to find out the adequacy of the diets based on the feeding pattern through various ways. The reflection of efficacy of feeding practices and adequacy of current meal patterns were measured through calculation of nutritive value and comparison with nutrient and dietary requirements (RDI) suggested by ICMR (1989) and using various indices of nutritional adequacy suggested by Gibson (1990).

The feeding practices followed by the caretakers of infants and toddlers were initially assessed through personal interview with mothers of these children, using pretested specially designed schedule. An inquiry on the first feed given to the new born revealed that 87 per cent mothers had given items such as *Acrorus calmus* Lin, honey or water is the first feed given within a period of half hour to 4 hours after delivery. This information indicates that introduction of prelacteal feeds within a time slot of 4 hours and feeding the new born with items other than breast milk seems to a traditional and culture based practice.

This could be because of the fact that Malappuram district still is one of the most under developed districts of Kerala and the backwardness of this area is well known. The low literacy level and lack of accessibility of mothers to new information or due to the restriction imposed by the society which inhibits the women especially those from the deprived section might have led to their following the traditional practices which they have learned from their ancestors. They were made to believe that water, and honey, are introduced to prevent dehydration and hunger in the new born child, while *Acor us calmus* Lin is given to clear or purify the intestinal tract as well as to enhance brain development or intellectual development.

Wayampu (*Acorus calamus* Lin) is enhances the brain development (Chadda and Grewal, 1993). A study conducted in Vellayani area of Trivandrum district conducted by Susan (1992) had also revealed that the habit of given *Acorus calamus* Lin to the new born, as a prelacteal is a common practice which is followed even today.

Kerala, with special reference to Malabar is a acclaimed seat of Ayurvedic system of medicine and it is believed that the practice of giving Wayampu or honey might have its root from the early ayurveda based paediatric practices which might have been cascaded from the previous generations to the present generation. Enquiry into this habit revealed that these young mothers followed this habit because they were adviced so by the elders of the family, Wayampu as well as honey are believed to have some medicinal properties which enhances the well being of the child.

It is further noticed that Wayampu (*Acorus calamus* Lin) with or without the addition of items such as gold. butter, sandal are given to children in very minute quantities from the day of birth till one year on a daily basis. This is found to be general practice.

Srivastava *et al.* (1994) had conducted a study in Patna to assess the breast feeding pattern in neonates along with beliefs and practices followed by the mother. They found to that 87.9 per cent mothers used prelacteals of one sort or other (Water, honey etc.). In Coimbatore study done by Devadas *et al.* (1999) reported that a good proportion of mother gave sugar, water, honey mixed with water as the first fed. They reported that these prelacteal feeds were not given as a food but as cleansing agent. Similar findings have been reported by Kaur *et al.* (1989) and Devadas *et al.* (1999). Gupta (1992) has stated that prelacteal feedings are the source of infection to the new borns.

Results of the survey conducted to find out the breast feeding pattern revealed that about 94 per cent of the subjects received breast milk within 5 hours after birth while health experts are of the opinion that breast feeding should be initiated within 24 hours (Belawady, 1999). However WHO (1990) advocates that breast feeding should be initiated within 30 minutes. Gupta (1995) reported that breast feeding should be initiated as early as possible, preferably with in a few hours after birth. Rao (1989) had opined that breast feeding should be initiated within 12 hours after delivery.

Laxity with reference to early introduction of breast feeding at the right time is not found to be a critical factor that would affect the health and nutritional status of new borns of this area of the study. The mothers, interviewed in the current study seemed to be fully aware of the beneficial aspects of colostrum and were proud of the fact that they had initiated breast feeding right from day one and they reported that the advices given by the doctors as well as the elders of the families had gone along way in inculcating this positive practice.

A study conducted in rural areas of Trivandrum by Susan (1992) has also shown that the mothers were in the habit of giving breast milk on the first day itself. UNICEF (1998) advocates that early breast feeding would prevent incidence of infectious diseases and malnutrition. Colostrum has less fat and more protein, especially more of the immunoglobulin they help to protect against a number of infections and it help to prevent the development of allergies (Helsing and King, 1991). The similar observations were made by several workers (Sundaram, 1994, Srilakshmi, 1996).

Information on duration of breast feeding revealed that only about 59 per cent of infants received breast milk upto 5 months as the sole source of nutrition. Though the medical practioners in general are advocating breast feeding alone upto 6 months, Ghosh (1997) had reported that about 51 per cent women in India exclusively breast fed their babies up to three months. Following the general feeding practices of the area, about 30 per cent of mothers introduced supplements from third month itself while a minority of six per cent had introduced supplements only after seven months. ICMR (1996) in their study conducted in the rural areas of Gandhigram and Coimbatore followed a practice of supplementary food after 8 months. Saowakache *et al.* (1995) had reported that in Thailand rice porridge was supplemented at the age 6-8 months. Similar findings have been reported by Susan (1992); Gopalan (1999) is observed that it is the children of employed mothers who received breast milk substitutes prior to 3 months of age. The above fact indicates that the employed women who have dual roles are forced to introduce breast milk substitutes or other food supplements at an early age against their will and due to the sheer need induced by their occupation outside the household. A study conducted among rural areas of Hyderabad and the areas of Avinashilingam College revealed that mothers started early supplementation.

In the present study it is encouraging to note that the children are fed with breast milk on demand, which indicates that there is no thumbrule in the feeding schedule with respect to the time interval. As a general practice 'demand feeding' is followed in India. Reason for this practice is that the mother thought that because of hunger (Gupta, 1993) similar findings have been reported by Huschke *et al.* 1986, Williams and Sabota, (1993) WHO (1994). Moreover breast milk was given both during night and day. Enquiry on the frequency of the feeds revealed that during the day frequency ranged from 4-6 times.

The interval between the feeds was found to 2-3 hours between feeds by 70 per cent of the mothers. The same finding was reported by Susan (1992) the rural areas of Trivandrum city, the infants were found to be given feeding with long intervals. A study conducted by Vimala and Ratnaprabha (1987) among tribals of Andhrapradesh observed that the mothers followed a long interval between feeds.

A constant reduction in number of feeds with increasing age has been observed by Gupta (1993) and the author is of the opinion that after 8 months, the infant is usually reduced with just 3 to 5 feeds.

Observations and enquiry on feeding practices also revealed that sips of water were introduced in between feeds by a minority. This practice is rooted from their notion that the child may be thirsty due to loss of water, through frequent urination. Few mothers are of the opinion that water is an essential item for maintenance of good health among children and that the absence of water might lead to dehydration.

As far as supplementary feeding was concerned it was seen that the first supplement given was a breast milk substitute comprising of either cow's, goat's or buffaloes milk. Majority had resorted to feeding cow's milk diluted with an equal quantity of water with added sugar and mostly such breast milk substitutes/supplements were introduced as early as third or fourth month and cow's milk seems to be the choice by preference or availability as done by mothers elsewhere. The milk substitute was given in a diluted form. A study conducted by Vimala and Ratnaprabha (1987) in the tribal communities of Andhra Pradesh revealed that cow's milk was the supplement given to infants and that it was given in the diluted form. Similar observations have been made by Awaste (1990) from Bangalore city, rural areas of Trivandrum city by Susan 1992 and Suja. 1989, Ukkuru, 1993 in Malappuram. This practice may have to be considered as a risk factor that might precipitate malnutrition because dilution of milk reduces the nutrient content (Rao, 1989).

In addition to liquid supplements such as milk, semisolid supplements made from ragi, banana was also found being used as supplement by a minority (less than 20 per cent) of women surveyed. It is gratifying to note that commercial weaning foods like cerelac, was given only to 4 per cent of the subjects in the study area, though there were several pharmacies and grocery shops selling such foods in the area. Introduction of ragi or banana flour seems to be a traditional practice which is slowly waning from even the remote areas of Malappuram district.

Reintroduction of indigenous healthy supplements and practices and utilization of positive conventional norms could be taken as a measure to overcome malnutrition or under nutrition. The habit of preparing malted weaning supplements from ragi and feeding it alone with milk as a semisolid supplement as well as processing of banana (Nendran, Kunna, Kannan) varieties. Formulation of instant weaning foods utilising traditional home based technology needs encouragement and wide publicity. Rejuvenation of such traditional technology, processes and practices with necessary upgradation with respect to nutrient make-up choice of complimentary ingredients and efforts to save time, energy and other family resources needs to be taken up as one measure to over come early child hood malnutrition. Encouraging production as well as use of such 'ready to use' supplements should be brought to the attention of health as well as the extension workers of the society both as a measure of enhancing the nutritional status of infants without undue strain to the young mother as well as a means for income generation for unemployed mothers/women/ youth. The production and use of such weaning foods can be identified as a vital component of the peoples programme which is a innovative decentralised developmental scheme initiated by Government of Kerala recently which encourageous initiation and sustinance of need and resource based developmental programmes.

Anthropometry

One of the objectives of the study entitled "feeding practices and nutritional status of children belonging to high risk families is to assess the nutritional status of the subjects as influenced by the diet and family risk factors. There are several methods to assess the nutritional status of children such as population sampling, anthropometry, diet survey, clinical studies, biochemical methods, radiological and biophysical methods (Swaminathan, 1998). As reported by Swaminathan (1998) to get an overall picture of the nutritional status of individuals or population groups it is better to use a combination of methods. Accordingly in the present study methods such as diet survey, anthropometry and clinical examination were used as methods to assess nutritional status. In a small way the vital statistics of the study area was also taken in to account to indirectly assess the nutritional status of the subjects.

Anthropometry is a method which involves measurement of human body, was taken as a primary method to assess the nutritional status of the subjects and to categories them in to different groups based on their physical development pattern into normal or malnourished children. Anthropometry is also utilized to picturise the rate and direction of growth and to identify deviation if any from the pattern of growth and to identify deviation if any from the pattern of growth of well nourished infants and toddlers. A nutritional status index was also worked out using the anthropometric measurements which was used as a yard stick to find out the variation in the nutritional status of individual children and of children belonging to different age and sex groups. The above mentioned data was further used to identify risk factors which has negatively affected the anthropometric measurement as well as the nutritional status of infants and toddlers of the experimental group in comparison with a control group of children who are devoid of most of the identified social and cultural risk factors.

As part of the anthropometric measurement a supplementary data namely the birth weight of infants was taken in to consideration. The data revealed that all the children (130) who wee incidentally included in the study where low weight babies at the time of birth. This points to the fact that these children are born with a handicap which could be carried over to infancy, toddler-hood as well as to the later phases of life if not corrected through adequate diet coupled with immunization and better physical quality of life provided by the environment in which the child lives.

It is further noticed that among the subjects the boys had lower birth weight in comparison with girls, which indicates that the boys face a higher risk of survival. In Kerala 20 per cent of children born were low birth weight babies whereas it is reported to be 30 per cent (UNICEF, 1998) when all India figures are taken into consideration. In the present study the birth weight of control group of children who had lesser number of risk factors were found to be better than those in the experimental group though all were born as low birth weight babies. The study indicates that birth weight of less than 2.5 kg is to be taken as a risk factor and appropriate measures to improve the birth weight of children are to be initiated in the area, on a massive scale.

Primary data on physical status of the subjects through anthropometric measurements such as height for age, weight for age, arm, head and chest circumferences were also collected as part of the assessment of health and nutritional status. The data revealed that weight for age of all the subjects were found to be below normal when compared to NCHS standards. Analysis of the data further revealed that the weight for age of infants were better than that of toddlers. Poor diet may be one of the factors which has reduced the weight of toddlers. The sex wise analysis revealed that weight for age of boys were better than girls (infants), and among toddlers the weight for age of female toddlers were better than male toddlers. According to Mitzner *et al.* (1984) during the early months of childhood the children are going through a dangerous period of weaning. As age advances and or as the child progresses from infancy to childhood the frequency of breast feeding is found to decrease and the type and frequency of supplements given may not be sufficient to improve growth or maintain their body weights.

Joshi *et al.* (1998) had further ascertained that in rural areas where living conditions are poor and children experience frequent growth disturbances especially during critical periods of growth such as infancy or early child hood. Moreover it is up to one year that the child receives the immunization package in an intensive manner which protects the child from most of the infectious diseases of early child hood. Further as a routine practice the infants are not exposed much to the outside world to come in contact with the natural elements of the external world. These two protective measures prevent repeated infections. Increased exposure to the world out side the home during toddlerhood and along with lessera attention from the elders including the mother, increases the chance of infection. Incidence of repeated infections along with poor quality of diet might together retard the growth of toddlers which could reflect in their lower weight for age when compared to infants as seen in the present study also. It has been hypothesised that the better weight seen among infants are due to their being able to satisfy the nutritional needs through breast milk and some complementary foods. Whitehead (1979) and Christian *et al.* (1988) have stated that after the first year of life, when the breast feeding no longer meets their nutritional needs, and complementary food is inadequate, there is likely to be an increase in the prevalence of low weight for age.

Therefore it is a natural phenomenon, that the infant of the study had a better nutritional status than the toddler when their weight was taken as parameter.

When height for age was taken as a parameter to assess the growth, health and nutritional status, it was found that the values of children in the experimental group was found to be below the standard while that of control group were above the standard. When the height of toddlers were examined their height for age was significantly higher than the standard value. Sex wise analysis of infants revealed that girls were better than boys and among toddlers boys were better than girls. Similar findings have been reported by Ukkru (1993) in her study conducted at Ponnani Taluk of Malappuram district. Assessment of nutritional status of children of rural areas of Trivandrum (Sreekaryam) conducted by Asha (1990) revealed that the boys were better than girls although they were all found to be below the standard height. However similar studies conducted in urban areas of Trivandrum by Beegum during 1990 revealed that the height of 12-17 months old children were found to be above standards. NNMB (1996) had reported that height for age of children belonging to rural areas of Trivandrum are lower than the standard.

Mid Upper Arm Circumference (MUAC) value was used as an indicator for screening the severity of malnourishment among children. MUAC values of all the subjects (both infants and toddlers) when compared with standards revealed that MUAC of children from both experimental group and control group were significantly lower than that of standards. Similar results have been reported by Susan (1992). Multilocational study conducted by NNMB during 1993-94 among rural population including Trivandrum showed that the MUAC values of children were below standard.

When head and chest circumferences of the (130) subjects were measured and the mean values were compared with standards, it was found that all the subjects had values below standard. Based on the head and chest circumference value, head/chest circumference ratios were worked out. Based on the ratio, in the present study 62.31 per cent of the subjects were found to be normal and 37.69 per cent were found to be malnourished. Another study conducted in Malappuram during 1992-93 had revealed that only 30 per cent children out of 110 were found to be normal. The present study conducted in Malappuram district reveals that the nutritional status of children of the area has improved over the years. A survey conducted in urban areas of Trivandrum during 1989-90 by Beegum (1992) has also revealed that head/chest circumference ratio of only 4.4 per cent children were found to be less than normal.

Head/chest circumference ratio is a measure of physical growth. The new borns have a large head and small body and as they grow the chest measurement gradually exceeds the head measurements which indicates a normal trend of physical growth. Normal infants are expected to have a value of 'one'. Children who have poor diet, which is specially deficient in protein, energy and calcium may have values indicating growth retardation and poor nutritional status.

The nutritional status of the subjects when further evaluated by the classical procedure suggested by Gomez in 1956 it was found that only 17 per cent of the 130 subjects included in the study were 'normal'. While the remaining had different grades of malnutrition. A very similar result has been reported during 1996 from Trivandrum by NNMB, which revealed that only 22.1 per cent of children were normal; they found mild to moderate forms of malnutrition respectively among 51.5 per cent and 25.3 per cent of the subjects. But in the present study only 17 per cent were found to be normal. This lower percentage could be due to their poor economic status, poor diet and poor feeding practices. Nair (1995) had reported that, in the coastal areas of Trivandrum district there were 36.1 per cent who suffered from first grade of malnutrition. UNICEF (1998) reported that 17.7 per cent were normal, 47.4 per cent grade I, 32.9 per cent, grade II and only 2 per cent were grade III type of malnutrition.

Weight for height has been considered as a good index for the evaluation of current nutritional status. In the present study 24 per cent of subjects were found to be normal based on "weight for height" norms. Twenty two per cent of subjects were found to be "wasted" which indicates short duration malnutrition associated with low weight gain.

Stunting was observed among 28 per cent of subjects which reveals that there was height deficit which is an indication of previous events of malnutrition. It was further noticed that 16 per cent had stunting along with wasting which indicates acute chronic malnutrition. NNMB surveys of 1993-94 revealed that in Kerala only 63 per cent of children are normal while 25.3 per cent and 34.7 per cent were found to suffer from mild to moderate malnutrition and 32.3 per cent were found to be victims of severe forms of malnutrition. Similarly Asha (1990) had reported that (in Trivandrum) an evaluation of weight for height calculation showed that 40 per cent were normal and rest were malnourished.

Through this data it can concluded that the anthropometric status of the subjects are very poor. Through intervention programme or supplementary feeding programmes, the growth pattern of subjects could be improved.

The measurements taken at one point of time may give only an indication of current status. Therefore an attempt to find out the growth pattern including the rate and direction of growth. The weight and height of these children were recorded three times consecutively with a gap of three months in between revealed that there was no significant increase in the anthropometric characters. Normally the infants of 6-9 months of age are expected to gain 100 g/week. Therefore over a period of six months healthy infants are expected to gain 1.2 kg (Eswaran, 1981: Ghosh, 1992). In the present study no one has gained this target over a period of six month. Thirty six per cent of infants are found to be middle value. This may be effect of short duration malnutrition.

As far as the height is concerned infants of the above age group are to gain five cm over a period of six months if they are growing in a healthy way. That indicates only 18 per cent have attained the above growth.

This gives a clear indication to the fact that the children are not receiving adequate nutrition or there are other deterrents such as repeated infection or poor quality of life which negatively influences the desirable upward trend and onward direction in the growth pattern of these infants and toddlers.

Ramalingaswami (1999) had reported that recurrent infection and unhygienic practices adversely affects the nutritional status of children.

This indicates the prevalence of poor nutritional status among the subjects in the present as well as the immediate past. The data on anthropometry reveals the inability to gain weight over a period of three months which could be due to lack of participation in the intervention programmes, beginning of life with a lower body weight and stature are to be found to risk factors which affects the growth and development of children.

In order to improve the nutritional status as reflected by anthropometric measurements it is essential to improve the quality and quantity of food consumed as well as physical quality of environment, as well as the care that is bestowed on these infants and toddlers. Compulsory enrollment and enhanced motivation of mothers in ensuring the participation of these children as beneficiaries of nutrition intervention programmes is highly essential to improve the condition.

Clinical status of children

Jelliffe (1966) has stated that clinical examination has always been and remains as an important practical method for assessing the nutritional status of a community. The clinical assessment done on infants and toddlers revealed that the most prevalent deficiency sings was anaemia (87 per cent) followed by symptoms of protein deficiency such as sparse hair

(30 per cent), discolouration (38 per cent) and oedema (50 per cent). Discolouration and sparse hair would also reflect poor living conditions and the effects of poor physical environment on physique. Consistent exposure to dusty and dry environment along with inability to purchase and apply oil on the hair, lack of parental attention, lack of access to water for bathing could all lead to the presence of such non-specific symptoms like discolouration and sparseness of hair.

NNMB (1996) had reported that manifestation of pure clinical deficiency signs of mal nutrition are lesser in Kerala when compared to other state of India. Asha (1990) reported that in rural areas of Trivandrum clinically detectable nutritional deficiency signs were much less, only 19 per cent had some or other clinical signs of deficiency disorders 36 per cent showed marasmic kwashiorkor and 3.6 per cent showed anaemia among children. Anaemia is the most widespread nutritional deficiency disorder in the country with high prevalence particularly among children. It is primarily due to inadequate intake of iron and its poor absorption from predominantly cereal based habitual diets (Prakash, 1999). Prakash (1999) had also reported that in India 56.3 per cent and 10.9 per cent moderate and severe forms of anaemia among boys (57.5 per cent) and girls (7.6 per cent) of 1-6 years of age.

Several systematic dietary and nutrition surveys conducted among Indian population in different parts of the country over the years have shown that the major nutrition deficiencies in our country (both in rural areas and urban slums) are protein energy malnutrition, Vitamin A deficiency, nutritional anaemia in children and iodine deficiency disorders and all deficiency diseases lead to considerable morbidity among population and contribute directly or indirectly to much of ill health in the population as stated by Rao (1988). The survey done on dietary intake among the subjects has also indicated that the diets are poor in protein foods such as pulses, animal foods (such as egg, meat and milk) and protective foods (green leafy vegetables and other vegetables) which could supply vitamins and minerals which if supplied adequately could ameliorate the most common symptoms of anaemia and protein deficiency observed among infants and toddlers. Therefore poor sanitary conditions, lack of access to sanitary latrines and potable water and poor housing conditions, which are identified as risk factors could also precipitate clinical deficiency through infection and infestation which are most common among infants and toddlers. Thus the clinical picture reveals that the nutritional status of the subjects are not satisfactory and family and child risk factors such as low birth weight, repeated infection, insufficient breast feeding, lack of access to safe drinking water and lack of time for the mother to take care of the child due to increased work load within and out side the house could all be responsible for the presence of protein and mineral deficiency signs found among these children and overall improvement in the dietary pattern and quality of life including income, education and living conditions of the families are to be taken in to consideration, the clinical picture of these infants and toddlers could be made into a better one.

Dietary survey

Nutritional status in general is the condition of health as influenced by food intake (Robsinson, 1970). As part of the study the nutritional status as well as the food intake of selected groups of children (Infants and toddlers) were assessed. The food intake data collected through 24 hour recall revealed that breast milk is the major food received by the infants and the quality and quantity of supplements that they received were inadequate. Their diets were deficient in all the nutrients when compared to their actual dietary requirement suggested by ICMR (1989). Their diet seems to be highly deficient in protein foods and protective foods specially vegetables. The average diet seems to be inadequate with reference to calories, protein, iron and calcium. Gopalan (1992) had also reported that the dietaries of poor Indian children are deficient in calories, vitamin A, calcium and vitamin C. Similarly Dorea and Furumoto (1992) who studied nutrient intake of infants by 24 hour dietary recall found that the diets of infants were deficient in iron and vitamin A. These deficiencies could be made up if the child receives sufficient amount of breast milk. It may be recalled that in this study the quantity of breast milk consumed by the individual children were not measured directly. However the study revealed that more than the quality it is the quantity of the supplements that needs to be increased, so as to enable the child to progress through the road to health. The inadequacy in terms of quantity of food is further reflected in their body weight and other anthropometric measurements which were found to be much below the NCHS standards. The inadequacy was further ramified when body weight of these infants were measured three times during the study with an interval of 3 months each.

It was seen that there was no significant increase in the body weight of these children over a period of 3 months. It was further noted that more than 80 per cent of the subjects were victims of anaemia when clinical examination was carried out by a qualified physician. This could be attributed to deficient food intake with special reference to green leafy vegetables, cereals, milk and other animal foods. Similar results have been reported from other parts of India and the world. Lindjorn *et al.* (1993) after assessing the dietary habits of Ethiopean children observed that these children received only milk and cereals and they received only limited quantities of animal foods and legumes as supplements. A study conducted in rural Hariyana also found that the diets of children are cereal based and are deficient in animal foods and pulses (Gujral and Gopaldas, 1999). Therefore, it is essential to improve the quantity as well as the quality of food received by these children.

Enquiry on common misconceptions, fads and fallacies pertaining to dietary habits prevlent in the community had revealed that mothers were hesitant to give items such as egg, pulse and green leafy vegetables to young infants. It was noticed that the mothers were of the opinion that the above food items cannot be tolerated by young infants who have a delicate gastro intestinal system. They believed that pulses are hard to digest and would cause flatulance. They strongly believed that items such as egg and meat can be digested only by children who are more than one and a half years old. Therefore, in the present context it is clearly evident that the infants received lesser amount of supplementary foods which had affected their nutritional status. Situational evidence leads one to believe that it is ignorance and false notions which have lead to poor infant feeding practices prevailing in the area. Therefore a multidimentional approach for enhancing the quality and quantity of food that are given to infants had to be undertaken to improve the status of these infants. This can be achieved by through nutrition and health education programmes given to mothers and conduct of demonstrations on simple way of incorporating items such as egg, pulses and leafy vegetables in the dietary pattern of infants and motivating mothers to feed their infants with items selected from their own family pot along with breast feeding which can be continued up to two years.

Though inadequate, the dietary pattern of toddlers were found to be slightly better than that of infants. This inferene is based on the fact that the diets of toddlers was found to be some what adequate with respect to two major nutrients namely protein and energy ie, the need for the above two nutrients were met to a level of 89 and 51 per cent of the requirements. However their diets seemed to be deficient in vitamin C followed by vitamin A and moderately deficient in calcium and iron. This is mainly due to insufficient intake of green leafy vegetables, other vegetables and milk as shown in Table. A study conducted by Devadas and Jaya (1990) among children in Coimbatore had also revealed that the meal pattern of 95 per cent of children were deficient in green leafy vegetables, milk and protein rich foods. A study conducted by Beegum (1990) in the urban areas of Trivandrum city revealed that the diets of 1-3 year old children were composed of cereals, roots and tubers and fleshy foods (mainly fish) which were consumed in quantities above the RDI. Intake of food items like milk and milk products, and other vegetables were below 50 per cent of their requirements. They also reported that green leafy vegetables and fruits were included only in negligible amounts. Similar findings have been reported from vegetables in the dietary pattern of infants and motivating mothers to feed their infants with items selected from their own family pot along with breast feeding which can be continued up to two years.

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A study conducted in rural areas of Trivandrum by Asha (1990) showed that the diets of children (1 to 3 years) were deficient in calories, but adequate in protein and with respect to other nutrients their diets were found to be inadequate. Similar observations have been presented by Beegum (1990). Susan (1992) and NNMB (1996).

In the present study the data collected through weighment survey was used to calculate nutrient adequacy indices such as nutrient adequacy ratio (NAR), Mean nutrient Adequacy Ratio (MAR) and Indix of Nutrient Quality (INQ). INQ values for different nutrients were calculated. There was very few subjects who had values around or above '1' for the different nutrients. The adequacy of nutrient intake of toddlers were assessed by the "probability approach". It was seen that 40 per cent of the toddlers had inadequate intake of protein, while 40-50 per cent of the toddlers had inadequate intake of calcium, iron and vitamin.

Clinical examination done on these toddlers had revealed high incidence of anaemia, and prevalence of signs of protein malnutrition such as sparse hair, oedema and discolouration which reaffirms the dietary inadequacy. Biggelaar and Broeck (1995) conducted a study among Zairian preschool children and they reported that the clinical signs like sparse hair, dispigmentation were related to poor weaning diet especially during 6 to 18 months of age. The above findings again point to the fact that the diets of infants as well as toddlers are only partially balanced/adequate. These subjects who are in a poor socio economic strata and who are living in a poor environment (with poor sanitary conditions and lack of water) are liable to be poorly nourished and are prone to succumb to several episodes of infections. These infections and recurrent morbidity would further lead to the poor physical, mental and social development affecting the overall development of these children who are the future citizens of the nation. Abdulwahab *et al.* (1991) had reported that improper feeding practices and poor environment were the causes PEM in children. While of Hussain and Koale (1996) have opined that environmental factors (water and sanitation) and health behaviour (breast feeding practices and vaccination) are significantly associated with the nutritional status of children.

Therefore while trying to minimise the effect of social and personal risk factors which are found existing within the family or are embedded in the physical environment in which the child survives. Efforts to improve the quantity and quality of the diet along with appropriate measures for prevention of morbidity is necessary to improve the health and nutritional status of these children.

A healthy mothers can only look after a child to become healthy. In the present scenario it is surprisingly transparent that all the mothers of a sub sample of children surveyed at random were found to be wasted and stunted. This means that they have not gained the full potential of their genetic make up and hence have poor stature. A mother having such a visible but subclinical symptom of under nourishment will not be efficient to deliver or take care of a healthy child. This is further obvious from the fact that other siblings of the index children belonging to a subsample of detailed study were all found to be either "wasted/stunted" or "wasted and stunted".

This fact indicates that these mothers are not physiologically empowered to give birth to healthy children which is reflected initially from the fact that all the children (130) surveyed were born as low birth weight (LBW) babies. Secondly all the children born to these mothers had low weight for age in comparison with reference standards. The subjects of the study born in the families having mothers with low BMI indicating chronic energy deficiency (Grade II and III) and have elder siblings numbering three and above cannot be expected to be born with normal body weight nor can they be expected to flourish in to a healthy child in such situation. This is because the genetic as well as the environmental factors play a competitive role in deciding the health of these children.

The above fact has been confirmed through this study which revealed that among the infants only 16 per cent were normal while among toddlers only 18 per cent were normal based on Gomez classification. This could be so because, from the genetic point of view these children are born to mothers with very low body weight and are brought up in an environment which is impregnated with multiple risk factors which are embedded in the family matrix. Or the child himself is born with several personal risk factors such as low birth weight, repeated infections, high birth order, and inadequate weight gain which have been established as negative forces that retard growth and alround development of children. Hence it is primarily essential to improve the living conditions of these children. Secondary efforts to minimise the influence of existing risk factors are to be attempted. Appropriate and timely action need to be under taken to improve the quality of life of these unlucky children.

As part of the detailed investigation conducted on a subsample of subjects, inorder to find out individual children were worked out. This index was developed from the anthropometric parameters. The nutritional status index gives a yard stick to measure the nutritional status of individual children with a unit value. The results obtained, revealed that the nutritional status indices of infants were better than that of toddlers, which reaffirms the earlier observation on weight for age. Similar observations have been reported by

Gopaldas *et al.* (1988) who conducted a study among infants and toddlers, in the city of Baroda and rural villages of Gujarat. This could be because of the fact that the infants had the nutritional as well as immunological support derived from breast milk which they received 7-9 times during a 24 hour period of a day. Being highly dependent on the mother as well as on the caretakers the infants are liable to receive better care and attention than the toddlers. The toddlers on the other hand because of their newly acquired physiological skills are more mobile and to that extent less dependent on their care takers and therefore would receive lesser attention especially with respect to feeding. The infants who are breast fed have direct access to the food ie. breast milk which is highly nutritious and good enough to meet the requirements of children. As they grow into toddlerhood their activity and mobility increase which inturn enhance their nutritional requirements on one hand but on the other hand they would receive lesser amount of breast milk. Belawady (1999) has observed that breast milk production by an average Indian mother from 600 ml would be reduced to 300 to 400 ml by one year after delivery, while ICMR recommends more energy, proteins and other nutrients for the toddlers than that of infants. For example an infant of 6-12 months requires around 15 gms of protein (8.6 kg body weight x 1.65 g of protein/kg), while a toddler requires between 15-22 g and which itself indicates the increased demand for nutrients by the toddler.

Similar variation could be observed in the requirements for iron, vitamin A and vitamin C.

Observations made during the study has further elaborated the fact that the incidence of infections ie, morbidity is found to be more among toddlers than infants. Such a state of affairs further increases the nutritional requirements of toddlers because Rao (1999) has opined that infection brings about deterioration of nutritional status. Moreover dietary deficiencies and infective morbidity act synergestically (Prakash, 1999). Similar studies were reported by Latham (1999) and Ramalingaswami, 1999). Infection precipitates malnutrition either by reduced intake or by decreased utilization of food or through increased nutrient loss.

Higher incidence of morbidity among toddlers would also be attributed to a decrease in the protective influence induced by reduction of termination of breast feeding. Moreover while an infant remains most of the time with in the four walls of the household, the toddler because of his morbidity and briskness exposes himself to the action of infective agents through his contact with external air, water, objects that he handles of a variety of new foods to which he gets direct access. The infant has the added advantage of immunization that he routinely receives upto the age of one year on a regular basis. These immunization procedures are carried out under strict medical/paramedical supervision. With all the benefits the general health status of infants are liable to be better than that of toddlers, as also brought to lime light through the study.

These observations demand that the toddler requires better attention by way of personal care that he receives from the parents as well as careful monitoring with respect to the quantity and quality of foods that he receives. Special emphasis with reference to the personal hygiene of care takers as well as the sanitation pertaining to environment is essential for maintenance of the health status of toddlers. Murthy (1997) and UNICEF (1990) have reiterated the point that lack of sanitation, poor personal hygiene, introduction of diluted formula and reduced food intake are responsible for poor nutritional and health status which is so rampant among children below the age of three.

Moreover it is further observed from the present study that although these children require more food and more nutrients than the infants. Their participation in the intervention programmes is found to be highly negligible. It is seen that 80 per cent of the subjects were not participating in nutrition intervention services extended to the needy under the ICDS programme. It may also be realised that ICDS was first started to Malappuram district of Kerala, as early as 1976, mainly because of the deplorable state of the vulnerable sections of the area. Inspite of this, it is still noticed that the subjects of the study, who belong to high risk families are not utilizing the services. It is also depressing to note that majority of these children have also not received the massive doses of Vitamin A under the vitamin A prophylaxis programme, which is in operation in this area under focus.

It is also recorded that more than 50 per cent of the subjects have not received the full dose of immunization as per the norms suggested by health services department. All these together would have negatively affected the nutritional status of the subjects included in the study.

Though an attempt was made to analyse the extent of influence which each of the factors included under poverty index, child risk factors, feeding habits, exerted on the overall nutritional status and to prioritise the factors according to their influence, neither a single factor could be identified as most important nor the factors could be ranked based on their extent of influence, using available data and statistical tools. This indicates in a way that no one factor by itself is responsible for low nutritional status observed among these subjects. This points to the fact that all these factors in different permutations and combinations have influenced the nutritional status of these children. This finding seem to be a true explanation, since the factors like socio economic condition as well as environmental and dietary factors are found to influence the nutritional status as reported by several workers. Devi and Geervani (1994) had conducted a study in rural areas of Andhra Pradesh and they had reported that socio economic factors, dietary practices and environmental conditions adversely affect the nutritional status of children. Harrel *et al.* (1989) are of the opinion that nutritional problems were associated with insufficient income, inadequate diets, low levels of schooling, poor housing quality, inadequate access to safe drinking water and unsanitary conditions.

In a nutshell, the above findings are based on small sample study conducted in a micro area which is only a portion of the under developed area of Malappuram district. Therefore this study can be treated only as a pilot study, all the findings of which cannot be extrapolated even to the realities existing in the entire Malappuram district or that existing in other districts of Kerala or elsewhere. Therefore a multidimensional approach to minimise or nullifying the effects of various risk factors identified through the study is necessary to improve the nutritional status of these under previleged children. Such an attempt would not only increase the nutritional status of children but would go a long way in providing a better quality of life for the families involved, ultimately benefiting the immediate community or society involved. Therefore area specific studies to identify at risk children and the risk factors that influence the health and nutritional status of children below two years are to be undertaken in every district or in specified problem/agro climatic/socio economic settings to find out actual factors or indicators which retards growth and development of children who are to determine the future of a nation. Such bench mark studies could be taken at without difficulty in the current set up of decentralised governments through their three tier panchayat raj system and through the activities of the peoples level planning which has received much appreciation and which is being done in right earnest throughout the breadth and length of the small state of Kerala. After identifying the risk factors, measures to improve the quality of life through the expulsion of deterrent risk indicators by taking up suitable area specific action programmes. This can be done by peoples groups including activities similar to that done by neighbourhood groups (NIG) under the community development society.

Multiple channel action programmes that can be undertake to reduce the identified risk factors categorised into groups in order to elevate nutritional status, thereby improving the overall quality of life that may be attempted is shown in figure 7. Based on the above model the following activities suggested to improve the health and nutritional status of at risk children of Kalikavu panchayat of Malappuram district.

Based on the observation of the study the nutritional status of these selected infants and toddlers were found to be poor to enhance the nutritional status it is essential to improve the dietary practices as well as the socio economic condition of the families.

* Motivate and if necessary educate the parents (both fathers and mothers and caretakers of the children) to improve the feeding practices.

* Motivate the parents to enroll their children positively as beneficiaries of national/state/local intervention programmes with special reference to health and nutrition.

- Enhanced participation in feeding programmes
- Referral services
- Immunization, health and nutrition education programmes under ICDS or others that organised by other governmental or nongovernmental agencies.
- Vitamin A prophylaxis programme
- Special Nutrition Programme

* To sensitice the parents, caretakers, local leaders/planners, grassroot level workers, NGO's about the prevalence, incidence and magnitude and hazards of different indicators which are area specific.

SUMMARY

SUMMARY AND CONCLUSION

A study was conducted to assess the feeding practices and nutritional status of children belonging to high risk families.

The study was conducted at Kalikavu Panchayat of Malappuram district. It was carried out on a macrosample of 130 children consisting of 100 children (50 infants and 50 toddlers) in the experimental group and 30 children in the control group (15 infants and 15 toddlers). Out of these children a subsample of 30 children (15 infants and 15 toddlers) were selected as microsample for detailed study.

Feeding practices are said to be influenced by the socioeconomic and cultural background of a community and hence the socioeconomic background and dietary habits of the families of selected children from the area were ascertained.

An attempt was made to identify the at risk families using the method suggested by Srilatha and Gopinathan (1995). The study indicated that children below 5 years of age, lack of access to safe drinking water and low employment status are the major risk factors observed among more than 60 per cent of the families surveyed. The presence of 'child risk' factors which were listed by Ghosh (1992), among the subjects of the study when assessed revealed that low birth weight, lesser spacing between the siblings, repeated infection and the presence of a working mother were the major child risk factors prevalent among more than 65 per cent of the subjects.

The data gathered on socioeconomic background of the families of the subjects revealed that, all belonged to backward communities and about half of them were from scheduled caste communities. They followed a joint family system which had a predominance of female children. Though literacy level of adults were comparatively high, the occupational status revealed that majority (51.33 per cent) were agricultural labourers with a monthly income below Rs.1000. They were found to be living in their own small katcha houses with out electricity. They had no potable water supply and there were no sanitary latrines. The above facts implies that all factors except caste and religion could negatively influence the nutritional status of children belonging to high risk families.

An assessment of infant feeding practices revealed that 80 per cent of mothers were giving prelacteal feeds such as water, wayampu (*Acorus calamus Lin*) and honey to the new borns. All the mothers were in the habit of breast feeding their children from the first day itself and they had fed their children 4-6 times a day with long intervals between the feeds.

As a general practice supplementary feeding seems to be initiated around 4-7 months after birth and foods such as cows milk, goat's milk, buffaloe's milk, ragi, banana and rice flour were the first supplements introduced. Problems related to weaning were common among the infants and majority (more than 60 per cent) of the mothers were disinterested in bottle feeding and giving artificial formula for feeding, mainly due to their low income.

Participation in nutrition intervention programme by the subjects (infants and toddlers) was found to be most unsatisfactory.

An enquiry on the extend of immunization given it, was found that majority (60 per cent) of infants and toddlers were only partially immunized.

When the growth status of subjects were assessed by anthropometric measurements, it was observed that 29.23 per cent of the infants and 35.38 per cent toddlers were grouped as "wasted/stunted" or "wasted and stunted". To be more precise, weight for age classification of the subjects indicated that only 17 per cent of subjects were found to be normal and rest of them were found to be malnourished. The height for age of subjects revealed that 50 per cent of the subjects were normal and rest of them were malnourished. When the weight for height was worked out, it revealed that 24 per cent of subjects were normal and the remaining were malnourished. The study also revealed that children from the control group who had less than four family risk factors had better nutritional status than the experimental group. Sex wise analysis revealed that boys were better among infants and girls were better among toddlers comparison revealed that infants had better than toddlers.

Clinical examination of the subjects indicated that clinical symptoms such as sparse hair, discolouration, oedema and anaemia were present among more than 50 per cent toddlers of the subjects.

The adequacy of diets consumed by the subjects were assessed by diet survey conducted on a sub sample of 20 per cent, and the food intake of infants were found out by 24 hour recall method. The data obtained revealed that the diets of individual infants were ill balanced and contained inadequate amounts of pulses and green leafy vegetables and moderately low even in cereals, other vegetables and sugar. The average food intake when compared with RDA revealed that the average consumption of different foods were below the RDA. The data also revealed that the diets of infants were deficient in all the nutrients, when compared to RDA.

Food intake of toddlers revealed that their diets were grossly inadequate with respect to green leafy vegetables, pulses, milk, fleshy foods and even sugar. When compared to RDA with respect to the nutrients their diet were highly deficient in vitamin A and vitamin C. The diet seems to be moderately deficient in energy, protein and calcium. The diets of even the control group of toddlers were deficient in vitamin A, iron and vitamin C.

The data collected through weighment survey when used to calculate nutrient adequacy indices such as Nutritional Adequacy Ratio (NAR) Mean Nutrient Adequacy Ratio (MAR) and Index of Nutrient Quality (INQ), further classified the extent of inadequacy. When the adequacy of food consumed by a subsample of toddlers when assessed by the "probability approach" it was seen that 40 to 50 per cent of the subjects had inadequate intake of protein, calcium, vitamin A and iron. The diets of both infants and toddlers were found to be ill balanced.

Based on the anthropometric parameters a Nutritional Status Index (NSI) was developed. The NSI of infants were found to be better than that of toddlers. When experimental group and control group were compared control group had better nutritional status than that of experimental group.

In a nutshell the study reveals that more than 60 per cent of the children belonging to selected high risk families were malnourished. They were born with the primary handicap of low birth weight, and they did not receive adequate supplements in upgrade their growth, since their meal pattern as well as the feeding practices followed by their caretakers were not adequate to make up their weight deficit. Moreover as evident from the results obtained all the subjects in the experimental group were living in with several risk factors which could deteriorate or negatively influence their nutritional and health status.

Statistical analysis of the data pertaining to NSI and the risk factors revealed that illiteracy, unemployment, lack of access to safe drinking water, absence of sanitary latrine, working mother, low income, low birth weight, as well as inadequate weight gain during a period of three months, repeated infections, short birth interval between two children birth order of 4 or above, late initiation of breast feeding, late introduction of supplementary food and weaning problems and the nature of caretakers were all found to have significant impact on nutritional status of the subjects under focus.

Based on the general observation of the study the nutritional status of these selected infants and toddlers were found to be poor. To enhance the nutritional status it is essential to improve the dietary practices as well as the socio economic condition of the families to which these subjects belong. Educating the community about better dietary

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management, and control of nonnutritional diseases by providing appropriate and acceptable therapeutic regimen is also advocated.

Children are the most important assets of a country because they will be the primary citizens of tomorrow who will be called upon to provide the human potential required for the countries' development. It is therefore necessary that todays child should be healthy both physically and mentally so that tomorrow he/she may prove to be an energetic and dynamic young adult with an alert mind and is able to contribute his maximum to the development of this nation.

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APPENDICES

APPENDIX I

Risk index score of families with infants

Experimental group Sl.No.	Score	Experimental group Sl.No.	Score	control group Sl.No.	Score
1	7	26.	4	1	3
2	6	27	5	2	2
3	5	28	6	3	3
4	4	29	5	5	2
5	6	30	5	5	2
6	6	31	4	6	2
7	7	32	6	7	2
8	7	33	5	8	3
9	6	34	5	9	3
10	5	35	4	10	2
11	5	36	6	11	1
12	5	37	4	12	2
13	5	38	7	13	2
14	5	39	5	14	2
15	4	40	5	15	2
16	4	41	5		
17	4	42	5		
18	5	43	5		
19	5	44	5		
20	6	45	4		
21	4	46	4		
22	4	46	4		
23	6	48	5		
24	4	49	5		
25	4	50	5		

Appendix I contd.

Risk index score of families with toddlers

Experimental group Sl.No.	Score	Experimental group Sl.No.	Score	control group Sl.No.	Score
1	5	26.	5	1	2
2	5	27	5	2	3
3	5	28	4	3	3
4	5	29	7	4	1
5	5	30	6	5	3
6	4	31	4	6	2
7	5	32	5	7	1
8	6	33	5	8	1
9	5	34	6	9	2
10	6	35	5	10	2
11	5	36	6	11	2
12	6	37	6	12	2
13	5	38	4	13	1
14	4	39	5	14	2
15	5	40	4	15	3
16	4	41	5		
17	5	42	5		
18	5	43	6		
19	4	44	4		
20	4	45	6		
21	6	46	6		
22	6	46	6		
23	5	48	4		
24	4	49	6		
25	6	50	5		

APPENDIX II

Child risk index scores of infants

Experimental group Sl.No.	Score	Experimental group Sl.No.	Score	control group Sl.No.	Score
1	6	26	7	1	3
2	6	27	5	2	3
3	6	28	4	3	2
4	6	29	5	5	3
5	5	30	4	5	3
6	7	31	5	6	3
7	4	32	5	7	2
8	5	33	4	8	2
9	7	34	5	9	3
10	6	35	4	10	3
11	6	36	4	11	3
12	6	37	4	12	3
13	6	38	4	13	3
14	6	39	4	14	3
15	7	40	4	15	3
16	6	41	4		
17	7	42	5		
18	5	43	4		
19	5	44	6		
20	7	45	4		
21	6	46	4		
22	6	46	4		
23	6	48	4		
24	7	49	4		
25	4	50	4		

Appendix 2 contd.

Child risk index scores of toddlers

Experimental group Sl.No.	Score	Experimental group Sl.No.	Score	control group Sl.No.	Score
1	5	26	5	1	3
2	7	27	5	2	3
3	6	28	5	3	3
4	7	29	4	5	3
5	6	30	5	5	3
6	6	31	6	6	2
7	6	32	5	7	3
8	6	33	5	8	2
9	6	34	6	9	2
10	5	35	6	10	2
11	5	36	5	11	2
12	7	37	5	12	3
13	7	38	6	13	3
14	7	39	5	14	2
15	5	40	6	15	2
16	5	41	4		
17	7	42	5		
18	5	43	5		
19	6	44	5		
20	6	45	6		
21	5	46	5		
22	4	46	6		
23	6	48	5		
24	4	49	5		
25	4	50	5		

APPENDIX - III

KERALA AGRICULTURAL UNIVERSITY

SCHEDULE FOR IDENTIFYING THE HIGH RISK FAMILIES

1 a)	Name of respondent	:	Male
b)	Name of child	:	
c)	Age	:	
2.	Address	:	
3.	Religion	:	
4.	Caste	:	
5.	Monthly income	:	

No.	Risk index		Yes	No
1.	Family belonging to SC/ST	:		
2.	Families with children below 5 years of age	:		
3.	Families having even one illiterate adult	:		
4.	Family without one or no adult employed	:		
5.	Family living in Katcha houses	:		
6.	Family without a household latrine	:		
7.	Family with no access to safe drinking water	:		
8.	Family consuming only 2 or less meals a day	:		
9.	Presence of an alcoholic or drug addict or other major crisis in the family	:		

APPENDIX - IV

KERALA AGRICULTURAL UNIVERSITY

SCHEDULE FOR IDENTIFYING HIGH RISK CHILD

1. Anganwadi No. 2. Place: 3. Name of the child:

4. Address: 5. Age: 6. Religion 7. Caste:

No.	Risk factors	Toddler Yes/No	Infant Yes/No
1.	Low birth weight (Less than 2.5 kg)		
2.	Inadequate or no weight gain during a period of three months		
3.	Having twins/triplets as siblings		
4.	Where breast feeding is not established or is insufficient		
5.	Working mother		
6.	History of death of more than 2 siblings (during the first 2 years of life)		
7.	Repeated infections		
8.	Birth order of 4 or more		
9.	Spacing of less than 2 years		
10.	Illness of parent, alcoholism etc. (family problem)		

APPENDIX - V

QUESTIONNAIRE TO ELICIT INFORMATION ON THE SOCIOECONOMIC STATUS

A. Socio-economic status of families of the respondent (the following details will be collected from the mother of the infant/toddler)

1. Schedule No. :

2. Sl.No. of Household :

3. Name of Panchayat :

4. Name of the investigator :

    1. Name of the respondent :

    2. Full address :

    1. Religion :

    2. Caste :

    3. Type of family :

    4a) Family size and composition

Members	Number
(a) Adults	
Males	
Females	
(b) Children	
Males	
Females	

4b) Household members and their demographic particulars

Sl. No.	Name	Relation to the head	Sex	Age	Literacy status	Marital status

Physiological status	Type of activity	Usual occupation	No.of days of work in a year	Income/ annum

5. No. of earning members in the family :

6. Major occupation of the Head of the family :

7. Total monthly income (Actual) Rs. :

8. Sources of income :

9. Family possessions

   (a) Ownership of House/Land :

   (b) Land owned in Acres :

   1. Dry 2. Wet

Crops raised

Type	Type	Code	Area in acres	Total yield	Total value in Rs.
11-12	Cereals	1			
13-15	Pulses	2			
16-17	Cash crops	3			
18-20	Others	4			

21 Live stock

No. of cows

Yield of cows milk (Ltrs.)

No. of baffaloes

Yield of buffaloes/milk

No. of goats

Yield of goats

No. of poultry

Yield from poultry (No. of eggs)

Others

22 Monthly expenditure pattern of the family

Sl.No.	Item	Actual amount spent/month
1.	Food	
2.	Clothing	
3.	Housing	
4.	Education	
5.	Transport	
6.	Medicine	
7.	Electricity	
8.	Gifts	
9.	Entertainment	
10.	Fuel	
11.	Savings	
12.	Miscellaneous	

23 (a) Type of house

(b) Nature of house:

House is electrified or not:

(c) No. of rooms

(d) Availability of latrine:

23 Availability of drainage facility

24 Sanitary conditions of the house

25 Source of drinking water

26 Distance covered for collection of water

27 Who does the collection of water

28 Fuel availability

(a) Fuel(s) used

(List in ranking order)

Fuels used	Source	Qty/Month	Cost
1. Kerosine			
2. Firewood			
3. Saw dust			
4. Rice husk			
5. Cowdung			
6. Electricity			
7. Gobar gas			

PART - I (B)

1. Name of Panchayat
2. Name of respondent
3. Address

4. Food expenditure pattern in the family

Sl. No.	Items	Frequency of purchase: Daily	Weekly	Monthly	Never	Qty. purchased	Amount spent on each item per purchase
1.	Cereals						
	Rice						
	Wheat						
2.	Pulses and Legumes						
3.	Green leafy vegetables						
4.	Other vegetables						
5.	Roots and tubers						
6.	Fruits						
7.	Nuts and oil seeds						
8.	Milk and milk products						
9.	Fish (Fleshy food)						
10.	Meat (Fleshy food)						
11.	Egg (Fleshy food)						
12.	Commercially available baby foods						
13.	Fats and oils						
14.	Sugar/jaggery						
15.	Miscellaneous						

5. Frequency of use of various foods:

Sl. No.	Item	Frequency of use					
		Daily	Weekly	Monthly	Sea-son-ally	Rar-ely	Ne-ver
		Once/Twice/Thrice/For	Once/2-3/4-6	Once/Twice			
1.	Cereals						
2.	Pulses						
3.	Green leafy vegetables						
4.	Other vegetables						
5.	Roots and tubers						
6.	Fruits						
7.	Nuts and oilseeds						
8.	Fats and oils						
9.	Sugar and jaggery						
10.	Egg						
11.	Meet						
12.	Fish						
13.	Milk and milk products						
14.	Beverages						

6. How many times the meals are cooked

7. Do you have specific time for taking foods

8. If yes specify meal timing

APPENDIX - VI

QUESTIONNAIRE TO ELICIT INFORMATION ON INFANT FEEDING AND WEANING PRACTICES (THE FOLLOWING DETAILS WILL BE COLLECTED FROM MOTHERS OF INFANTS)

Serial No. :

Name of interviewer :

General information :

1. Name of village :
2. Informants' name :
3. Address :
4. Name of the child :
5. Sex :
6. Age :
7. Ordinal position of the child :

   1. What was the first feed given to the infant (soon after delivery) :

   2. When was that given (Actual) (time after delivery) :

   3. When did you start breast feeding the child (after delivery) :

   4. Did you discard colostrum :
      1. Yes 2. No.

   5. Details pertaining to breast feeding :

   6. How long the child was fed on breast milk :

7. During this period what was the frequency of breast feeding :

8. What was the pattern of breast feeding :

   a) Fed on demand : Yes/No

   b) Specific time schedule : Yes/No

9. If yes what was the time schedule followed :

10. Did you feed the child with breast milk at night : Yes/No

11. If yes, what was the schedule of feeding at night :

12. Was water given to the child in between breast feeding?

During day	During night
Yes/No	Yes/No

13. If yes how many times :

14. How much water is given :

15. Interval between the feeds :

16. Did you use bottles for feeding your infant :

    Yes/No

17. During the period of breast feeding did your child get any specific disease :

    Age Disease Infection

    No. of episodes

18. At what period the breast feeding was withdrawan :

    Weaning/Supplementary feeding

19. From which month onwards foods other than breast milk was introduced to the infant (Actual)

20. What was the first supplement given? :

21. Due to the introduction of the supplementary foods did you reduce the frequency of breast feeding : Yes/No

22. If yes what was the reason? :

23. Due to ntroduction of the supplementary foods did your child get any problem : Yes/No

24. If yes what were the problem :

25. Do you perform any religious ceremoney at the time of giving solid food to the infant for the first time : Yes/No

26. If yes what foods do you prepare on that day (Details) :

27. Details of giving supplementary foods:

	Age of starting					
Name of food	When	What	How	Frequency Qty	Reason	How prepared
Liquid food						
Semi solid						
Solid						

28. Explain is the current dietary pattern? :

29. Nature of care takers :

APPENDIX - VII

Questionnaire to elicit information on toddler feeding practices

I. 1. Sl. No. :

2. Name of the child :

3. Informants' name and relation to the head :

4. Sex of the child :

5. Age :

6. Ordinal position of the child :

II. Previous feeding habits/ practices :

a) Breast feeding

1. Was the child breast fed :

2. If no give reason :

3. When was breast feeding started :

4. At what age breast feeding was completely with drawn (months) :

5. Is the child given feeds at regular interval : 1. Yes 2. No.

6. If yes what is the interval between feeds :

7. Is the child fed at night :

8. If yes give details of feeding at night

Time	Food/Feed given	Ingredients

b) Supplementary/weaning practices

a) What was the first food introduced to the child along with breast milk

b) When was it introduced

2. On an average how many feeds were given to the child during the following periods (current month/specify)

1st month

3rd month

6th month

9th month

3. During the introduction of supplementary foods did your child suffer from any specific problem

1. Yes 2. No.

If yes

Age in months	Problem	No. of episodes (Upto current age)

5. Did you use any commercial milk formula to feed the child

1. Yes 2. No.

If yes

What	Method of preparation	Qty. required for a month	Cost/month

6. Did you feed the child with commercial weaning/baby foods

7. Did you prepare any weaning food at home to feed your child?

If yes,

Food	Method of preparation	Cost/ month

10. Current feeding habits/practices

1. Is the child fed at night

1. Yes 2. No

2. If yes give the details of feeding

Time	Food/feed given	Ingredients

3. If no why?

4. Do you avoid/exclude any food in the daily diet of your child.

1. Yes 2. No

5. If yes list those foods or preparations that you specifically exclude from the child's diet and give reasons for the same

Item avoided	Food preparation	Reason	Source of such information

6. List those foods or items that you had specially included in the child's diet and give reasons for the same.

Item	Food specially included	Reason	Source of such information

7. Which are the "adult foods" that are given to the child as such

Foods	Breakfast	Lunch	Tea	Dinner

8. Which are the foods most liked by your child and how often do you include these foods in the daily diet of the child in a week

Foods liked	Frequency						
	Daily				Weekly		
	1	2	3	4	1	2	3

9. Which are the foods most disliked by your child and how often do you exclude there foods in the childs diet is a week

Foods disliked	Frequency						
	Daily				Weekly		
	1	2	3	4	1	2	3

10. Give details of the current feeding pattern of the child on 3 consecutive days of this week

Day I	Time	Menu	Preparation	Ingredients	Qty
Early morning					
Breakfast					
Midmorning					
Lunch					
Mid afternoon					
Tea time					
Dinner					
Any other food					

II Day	Time	Menu	Preparation	Ingredients	Qty
Early morning					
Breakfast					
Midmorning					
Lunch					
Mid afternoon					
Tea time					
Dinner					
Any other food					

IIIrd Day	Time	Menu	Preparation	Ingredients	Qty
Early morning					
Breakfast					
Midmorning					
Lunch					
Mid afternoon					
Tea time					
Dinner					
Any other food					

IV. Feed management

1. Who feeds the child?

2. If the mother is going to work, who feeds the child?

3. Did you bottle feed your child: Yes/No

4. If yes do you boil the bottle : Yes/No

5. If yes do you always use a freshly boiled bottle? :

6. Before preparing the bottle feed do you wash your hand? : Yes/No

7. If weaned

8. a) Who decided as to when the child should be weaned

   b) Who decides as to what foods are to be given to the child during weaning.

9. Who decides what feeds are to be given to the child after washing

Health status of child

V. 1. Apart from the food, what are essential requisites that would help to improve the health of children

2. Do you think that any other problem in the family has affected the health of your child

Problems related to	Yes	No
Family		
Social		
Health		
Cultural		

3. What do you think that you can do to improve the health of the child?

4. According to you what are the foods which are helpful to improve the health of your child?

Foods	Reason	Source of such information

5. According to you which are the foods that are harmful to children?

Foods	Reason	Source of such information

VI. Participation in health intervention programmes

1. Is the child a participant in any of the feeding programmes : Yes/No

If yes

Which programme	Since when	Where	What food	How many times	Attendance of a month

2. Has the child been fully immunized

3. Has the child recovered vit. A. dose under the vit. A. phophylaxid programme : Yes/No

If yes

How many	Dose	When

APPENDIX VIII

KERALA AGRICULTURAL UNIVERSITY
College of Agriculture, Vellayani, Trivandrum
Nutritional assessment schedule
Department of Home Science

Date:

State: District: Taluk: Village:
Serial No. Family No. Block:
Name of the subjects: Sex: Male/Female
Name of the Father/Guardian: Occupation:

Income (per annum): Date of birth:
Age: ... Yrs ... Mths.

Source: Parents/record
Breast fed/DF + Supplements/Hot BF Pregnant/Lactating ... mths (DF)

CLINICAL EXAMINATION:

Hair	Sparse	01.	Pellagra	22.
	Discoloured	02.	Craz pavement dermatosis	23.
	Easily plucked	03.	Pigmentation at kunckies/fingers/toes	24.
	Moon face	04.	Phrynoderma	25.
	Parotid enlargement (billateral, painless)	05.	Koilonychia	26.
	Oedema	06.	Gums-spongy bleeding	27.
	Emaciation	07.	Craniotabes	28.
	Marasmis	08.	Epiphyseal enlargement	29.
	Conjunctival		Breading of ribe	30.
	xerosis	09.	Knock-knees/how legs	31.
	Bitat's spots	10.	Frontal parietal hoosing	32.
	Corneal xerosis/		:- caries	33.
	Keratomalacia	11.	Teech : Mottled enamel	34.
	Corneal opacity	12.	Enlargement of liver	35.
	Night blindness	13.	Enlargement of liver	36.
	Photophobia	14.	Soft	
	Anaemia	15.	Firm	
	Nasolabial		Hard	
	dyssebacea	16.	Thyroid enlargement	37.
	Angular stomatitis	17.	Others	38.
	Cheilosis	18.		
	: red & raw	19.		
Tongue:	Papillae-atrophic	20.		
	Papillae-hypertrophic	21.		

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* For children below 5 years only

APPENDIX XI

Schedule for ascertain the actual food intake of the child (food weighed method)

INDIVIDUAL DIETARY SURVEY

Sl.No.	Name of meal	Menu	Wt. of total raw ingredients used (g)	Wt. of total cooked food (g)	Amount of cooked food consumed by the child	Wastage	Raw equivalent used by the individual (g)
1.	Early morning						
2.	Breakfast						
3.	Lunch						
4.	Tea						
5.	Dinner						
6.	Others						

$\bar{X}$

Anthropometric measurements - Infants

			B.Wt.	Wt. (kg)			Ht. (cm)			MUAC (cm)			Head (cm)			Chest (cm)		
1	F	6	2.3	3.25	3.3	3.4	75.0	76.0	77.0	8.0	8.5	8.8	36.0	36.3	36.7	34.0	34.5	34.8
2	M	6	2.4	3.30	3.5	3.5	68.0	69.0	71.0	6.7	7.0	7.2	38.0	38.3	38.8	37.0	38.0	39.0
3	F	6	2.2	4.00	4.5	4.5	70.0	71.0	72.0	7.2	7.5	7.8	39.0	39.5	39.5	42.0	42.3	42.5
4	M	6	2.4	4.50	4.7	4.8	65.0	66.2	67.0	8.4	8.5	8.7	36.0	36.3	36.4	38.0	38.3	38.4
5	F	6	2.3	3.80	3.8	4.0	58.0	60.0	62.0	10.0	11.0	13.0	38.0	38.3	38.8	39.3	39.3	39.9
6	F	6	2.2	3.50	3.6	3.8	52.0	54.0	56.0	9.0	10.0	10.3	40.0	40.3	40.8	36.0	36.3	36.5
7	F	6	2.1	3.50	3.4	3.6	51.0	52.0	53.0	6.0	6.5	6.9	33.0	34.3	34.3	36.0	36.8	36.8
8	F	6	2.3	4.00	4.2	4.5	55.0	56.0	58.0	8.0	8.5	9.2	38.0	38.3	38.4	38.2	38.5	38.5
9	M	6	2.2	4.00	4.5	4.5	58.0	59.0	61.0	9.0	9.5	9.7	38.0	39.0	40.0	37.0	38.0	38.0
10	F	6	2.3	4.00	4.3	4.5	58.0	59.2	61.0	8.5	8.5	8.7	39.0	39.1	39.4	37.0	38.0	38.8
11	F	6	2.2	5.00	5.3	5.4	59.0	59.0	61.0	9.0	9.2	9.5	35.2	35.5	36.0	38.0	38.2	39.0
12	M	6	2.2	4.00	4.3	4.5	62.0	62.3	63.2	9.0	9.2	9.8	34.4	35.0	35.6	39.9	39.9	40.1
13	F	6	2.2	4.00	4.2	4.5	55.0	55.7	56.8	8.2	8.5	8.7	38.9	38.9	40.0	37.0	38.0	38.2
14	M	6	2.3	4.02	4.0	4.2	58.0	59.2	59.0	10.0	11.0	12.0	30.2	30.3	30.5	32.0	33.0	33.5
15	M	6	2.2	4.02	4.4	4.2	72.0	73.0	74.0	11.0	11.3	11.5	38.0	38.5	38.8	34.0	34.5	34.6
16	F	6	2.2	4.00	4.8	5.0	65.0	65.6	66.4	9.0	9.2	9.3	38.0	38.3	38.5	39.0	39.3	40.2
17	M	6	2.3	4.50	4.6	4.8	68.0	69.5	69.5	8.2	9.0	9.2	40.0	41.0	41.3	40.0	41.0	42.0
18	F	6	2.3	4.40	3.8	4.3	69.0	72.1	72.3	8.6	8.9	9.0	38.0	38.2	38.3	37.3	37.3	37.8
19	F	6	2.3	4.00	4.2	4.2	60.0	61.0	63.0	6.8	6.8	7.2	35.0	36.0	37.0	37.0	37.0	37.0

			B.Wt.	Wt. (kg)			Ht. (cm)			MUAC (cm)			Head (cm)			Chest (cm)		
20	M	6	2.3	5.00	4.3	4.5	62.0	63.0	64.2	8.6	8.8	8.8	35.0	35.5	35.8	34.0	34.5	35.0
21	F	6	2.3	4.50	4.5	4.7	60.0	64.0	65.0	7.0	7.3	7.3	36.0	36.8	37.0	38.0	38.2	38.2
22	M	6	2.1	5.00	4.8	5.2	65.0	66.1	66.8	10.0	11.3	11.4	33.0	36.3	36.5	38.9	39.0	39.9
23	M	6	2.1	5.00	4.8	5.0	65.0	65.6	65.8	10.0	11.3	11.5	33.0	33.5	34.0	38.0	38.3	39.0
24	M	6	2.1	4.00	4.1	4.2	66.2	66.4	67.4	10.3	10.4	11.0	36.3	36.8	36.8	38.0	39.0	40.0
25	F	7	2.4	5.00	5.2	5.5	65.0	66.0	67.0	9.3	9.5	9.7	37.0	37.3	37.5	38.3	38.5	38.5
26	F	6	2.2	6.00	6.3	6.5	68.3	69.3	69.5	8.8	9.0	9.2	38.0	38.2	39.2	39.2	39.3	39.5
27	M	7	2.3	4.00	4.2	4.5	64.0	65.0	66.2	10.6	10.9	10.9	40.0	40.2	40.2	38.3	38.3	38.5
28	F	7	2.1	6.00	6.3	6.6	65.0	66.0	68.0	7.0	7.2	7.5	37.0	37.5	37.8	42.0	42.1	42.1
29	M	7	2.2	6.00	6.2	6.5	65.0	68.0	68.2	11.8	11.8	11.9	39.3	39.5	39.9	39.9	39.9	40.0
30	F	7	2.2	4.00	4.3	4.5	55.0	56.0	58.0	9.0	9.3	9.5	36.0	37.0	39.3	40.0	40.5	41.0
31	F	7	2.3	5.00	5.2	5.3	55.0	57.0	59.0	10.0	10.2	10.3	38.0	39.3	39.3	38.3	39.3	39.5
32	F	7	2.2	4.50	4.6	4.7	54.0	55.0	56.8	10.0	10.3	11.0	35.0	37.0	39.0	39.2	39.3	39.4
33	M	7	2.3	4.40	4.6	4.6	58.0	58.5	59.0	9.0	9.3	9.3	30.3	30.5	30.8	38.3	38.4	39.0
34	M	7	2.3	4.00	4.3	4.5	72.0	75.0	77.0	7.1	7.3	7.3	39.3	39.5	39.9	40.0	41.0	42.0
35	F	7	2.3	4.00	5.2	5.3	64.0	64.4	65.2	8.6	8.8	8.9	38.7	38.7	38.8	40.0	42.0	43.0
36	F	7	2.3	5.50	5.3	6.5	55.0	56.8	58.0	9.8	9.8	9.9	34.5	34.6	34.8	43.8	44.0	48.0
37	F	7	2.3	5.40	5.3	5.5	62.0	62.8	63.4	11.1	11.3	11.4	36.0	36.8	36.9	40.0	42.0	43.0

			B.Wt.	Wt. (kg)			Ht. (cm)			MUAC (cm)			Head (cm)			Chest (cm)		
38	F	8	2.3	5.20	5.5	5.5	64.0	65.2	65.8	9.3	9.8	10.0	38.0	39.0	40.0	40.2	40.5	40.5
39	F	8	2.2	5.40	6.3	6.5	66.0	67.2	67.9	9.9	10.0	11.0	37.0	38.0	39.0	40.2	40.5	41.0
40	F	8	2.1	6.00	6.3	6.5	65.0	66.0	67.0	9.8	9.9	10.0	40.0	40.0	40.0	38.4	38.5	38.8
41	M	8	2.4	6.00	6.9	6.9	64.0	65.0	66.2	9.5	9.3	9.5	38.3	38.3	38.5	40.0	40.5	40.6
42	M	8	2.2	6.50	6.7	6.9	73.0	74.6	75.6	9.0	9.3	9.9	34.0	38.0	38.3	40.0	40.5	40.5
43	F	8	2.2	5.50	5.7	5.7	62.0	63.0	65.0	10.9	10.9	10.9	39.0	39.2	39.8	38.0	39.0	39.2
44	F	8	2.3	6.30	6.4	6.5	60.0	60.0	62.0	9.0	9.3	9.3	39.0	39.8	40.2	39.0	39.3	39.4
45	F	8	2.3	7.80	7.9	8.1	62.0	62.8	63.0	9.9	10.1	10.3	39.5	39.5	39.5	40.0	40.3	40.5
46	F	8	2.3	5.00	5.2	5.3	65.0	66.2	67.2	9.2	9.7	9.8	38.5	38.5	38.5	40.0	41.0	41.0
47	F	8	2.4	7.60	7.7	7.8	62.3	63.4	64.5	12.2	12.2	12.2	38.0	39.3	39.5	38.0	38.0	39.0
48	M	8	2.2	6.80	6.9	7.0	70.0	71.2	72.3	10.6	10.7	10.9	38.0	39.3	39.5	40.0	41.0	42.0
49	F	8	2.2	6.40	6.7	6.8	68.0	68.2	68.8	8.6	8.8	8.9	38.0	38.7	39.0	40.0	41.0	42.0
50	M	7	2.3	4.40	4.6	4.6	58.0	58.5	59.0	9.0	9.3	9.3	30.3	30.5	30.8	38.3	38.4	39.0

Anthropometric measurements - Control

			B.Wt.	Wt. (kg)			Ht. (cm)			MUAC (cm)			Head (cm)			Chest (cm)		
1	6	F	2.4	5.5	5.8	6.0	62	62.4	62.9	13.0	13.3	14.3	38.0	38.5	38.5	39.0	40.0	41.0
2	6	M	2.4	4.5	4.8	5.0	72	72.8	73.1	13.0	14.3	15.0	38.0	38.8	39.2	40.8	41.0	42.0
3	6	F	2.4	6.4	6.8	6.9	70	72.0	74.0	11.4	11.5	12.5	40.0	41.0	42.0	37.0	38.0	39.0
4	6	F	2.4	7.0	7.2	7.3	73	75.0	77.7	11.9	12.0	12.8	41.3	41.5	41.8	41.5	42.9	42.9
5	6	F	2.3	4.9	4.9	5.0	64	65.0	65.9	11.9	12.0	12.8	43.5	43.8	43.8	40.5	40.5	41.0
6	6	F	2.2	4.8	4.7	4.8	66	67.2	67.9	9.0	9.5	10.0	40.2	40.4	40.4	41.5	42.0	42.0
7	7	M	2.1	7.0	7.0	7.4	72	73.4	75.0	13.8	14.0	14.9	40.0	40.2	40.3	40.4	40.7	41.0
8	7	M	2.2	6.0	6.4	6.9	74	74.6	74.9	11.4	11.7	12.3	41.0	41.0	42.0	39.5	40.0	41.0
9	7	M	2.4	6.4	6.8	6.8	72	73.0	75.0	13.8	14.0	14.9	40.0	40.1	40.2	40.4	40.7	41.0
10	7	F	2.3	5.9	6.1	6.10	73	75.0	78.0	12.3	12.5	12.8	40.0	41.1	42.3	37.6	38.0	39.0
11	7	F	2.4	8.0	8.2	8.3	70	72.4	74.3	13.8	14.0	14.8	41.3	41.5	41.8	40.0	45.0	42.0
12	7	F	2.2	8.0	8.4	8.5	69	69.9	72.1	12.0	12.3	13.9	41.0	42.2	41.5	41.5	42.0	42.0
13	8	F	2.4	7.5	7.5	8.0	69	69.9	71.0	12.3	13.0	13.0	40.0	41.0	42.0	39.8	40.0	41.0
14	8	F	2.4	6.8	6.5	6.8	79.5	81.0	83.0	11.8	12.4	13.0	37.0	37.2	37.5	40.4	40.7	41.0
15	8	F	2.3	8.2	8.5	8.8	72	73.0	75.0	12.9	13.8	14.0	43.0	43.3	43.5	39.5	40.0	41.0

Anthropometric measurements - Toddlers

			B.Wt.	Wt. (kg)			Ht. (cm)			MUAC (cm)			Head (cm)			Chest (cm)		
1	M	12	2.3	7.7	7.8	7.9	74.0	75.0	75.6	12.0	12.5	13.0	40.2	40.3	40.4	39.7	39.8	39.8
2	M	12	2.2	5.0	5.2	5.3	88.0	89.2	89.5	10.0	11.0	12.0	40.0	43.0	44.0	38.0	40.0	41.0
3	M	12	2.4	7.0	7.3	7.5	80.0	82.3	83.5	10.3	10.4	10.5	39.8	39.8	40.0	42.0	43.0	43.0
4	F	12	2.3	6.0	6.5	6.7	90.0	90.9	91.2	10.5	10.8	11.0	38.4	40.0	41.0	40.0	41.3	42.5
5	F	12	2.3	6.0	6.2	6.5	90.0	91.3	91.9	10.2	10.3	10.4	40.2	40.3	40.4	41.1	41.2	42.3
6	M	13	2.3	8.6	8.4	8.6	80.0	82.0	84.0	8.0	8.5	9.5	39.9	40.0	41.0	42.3	43.0	43.4
7	M	13	2.3	7.0	7.5	7.8	89.0	90.0	92.0	11.0	11.5	12.0	39.8	40.0	42.0	40.0	42.0	43.0
8	F	13	2.2	8.0	8.3	8.4	68.0	70.0	73.0	12.0	12.5	12.7	38.8	38.9	38.9	39.5	39.8	39.9
9	F	13	2.2	6.0	6.2	6.4	76.0	78.0	78.6	12.0	12.2	12.5	40.0	42.0	42.0	43.4	43.5	43.5
10	F	13	2.1	6.0	6.2	6.3	74.0	78.0	78.0	14.0	14.2	14.5	40.2	40.9	40.9	40.0	40.0	41.0
11	F	13	2.2	7.0	7.3	7.5	84.0	88.3	88.8	8.0	8.5	8.8	38.0	39.0	39.8	40.0	41.0	42.0
12	M	14	2.2	9.0	9.5	9.7	80.0	81.3	81.9	10.0	10.3	10.5	38.0	38.2	39.0	40.0	41.0	42.0
13	M	14	2.3	8.0	8.2	8.5	88.0	88.9	90.4	10.0	10.2	10.3	37.0	38.0	39.0	37.0	38.0	38.3
14	M	14	2.2	8.0	8.7	8.8	80.0	82.0	82.9	8.5	8.8	9.0	40.0	42.0	42.0	40.0	41.0	42.0
15	F	14	2.2	8.3	8.5	8.8	68.0	69.9	69.3	10.0	11.0	11.5	38.0	38.5	38.8	39.0	39.2	40.0
16	F	14	2.3	7.7	7.8	7.9	72.0	75.0	76.7	10.0	11.0	11.5	36.0	38.0	39.0	40.0	41.0	41.0
17	F	14	2.1	9.0	9.3	9.5	88.0	89.0	89.3	13.0	13.5	13.6	39.0	39.3	39.4	40.0	40.0	42.0
18	F	15	2.2	10.0	10.3	10.4	88.0	88.3	88.5	10.0	10.2	10.3	39.0	40.0	41.0	40.0	41.0	41.0
19	M	15	2.3	8.8	8.6	8.8	90.0	90.9	92.0	12.0	12.5	13.0	40.0	40.0	42.0	38.0	37.0	38.0
20	M	15	2.2	8.0	8.5	8.8	85.0	86.7	88.3	13.0	13.5	13.8	37.0	40.0	42.0	38.0	37.0	38.0
21	M	15	2.2	8.0	8.0	8.5	89.0	91.0	93.0	10.0	10.5	10.6	36.0	38.0	39.0	38.0	39.0	40.0
22	M	15	2.1	7.0	7.3	7.3	90.1	90.3	90.5	13.0	13.5	14.0	39.0	36.5	36.5	36.0	36.2	36.8
23	M	15	2.2	7.0	7.4	7.8	85.0	86.5	88.3	10.0	10.8	11.0	37.0	39.8	40.0	38.0	39.0	39.8
24	M	15	2.1	10.0	10.2	10.2	79.0	77.8	78.2	10.0	11.0	12.0	38.0	36.0	39.0	38.0	37.0	38.0
25	M	15	2.1	9.0	9.3	9.3	89.0	89.9	91.2	11.0	11.5	12.5	39.0	39.3	39.3	38.0	39.0	39.2

			B.Wt.	Wt. (kg)			Ht. (cm)			MUAC (cm)			Head (cm)			Chest (cm)		
26	M	16	2.2	9.5	9.8	10.0	85.0	86.5	88.0	9.0	9.5	10.0	39.0	40.0	40.1	37.0	37.6	37.7
27	M	15	2.2	9.0	9.3	9.5	85.0	86.7	88.0	9.0	11.0	11.5	39.5	39.8	40.0	41.0	42.0	43.0
28	M	15	2.2	10.0	10.3	10.5	89.0	90.0	91.0	12.5	13.0	38.8	39.3	31.3	37.3	37.5	38.5	38.0
29	M	15	2.3	10.0	10.3	10.3	75.0	76.0	77.3	13.3	13.5	13.8	36.4	36.5	36.8	37.3	37.5	38.0
30	F	15	2.3	9.0	9.5	9.7	92.0	73.4	73.5	12.0	12.5	12.6	37.8	38.0	39.2	39.3	39.4	40.3
31	F	15	2.3	8.0	8.8	8.8	62.0	64.0	66.0	12.0	12.9	12.9	34.0	34.8	35.0	37.0	38.0	39.0
32	F	15	2.3	7.0	7.5	7.7	82.0	83.0	83.9	10.0	11.0	12.0	38.0	39.3	39.5	37.0	38.4	38.9
33	F	15	2.2	14.4	14.4	14.5	84.0	84.4	85.0	10.0	10.0	11.0	38.8	39.3	39.5	40.0	42.0	42.0
34	F	15	2.2	13.8	13.8	13.9	85.0	86.0	88.0	12.0	13.0	14.0	38.9	40.0	40.0	37.0	38.0	39.0
35	F	15	2.1	8.8	8.9	9.0	89.0	90.0	92.0	11.0	11.5	12.0	36.4	36.8	37.2	37.0	37.5	37.5
36	F	15	2.2	7.7	9.8	9.9	89.0	90.0	92.0	13.0	13.8	14.0	39.2	39.8	39.8	40.0	41.0	41.0
37	F	15	2.1	8.6	8.8	8.8	92.0	93.0	95.0	14.0	14.3	14.5	40.0	40.0	40.0	38.0	38.9	38.9
38	F	15	2.2	10.0	10.2	10.6	75.0	76.5	77.0	13.0	13.5	13.8	40.0	40.0	42.0	41.0	41.0	41.5
39	F	15	2.1	8.3	8.2	8.3	72.0	87.5	78.0	10.0	10.3	10.3	34.0	39.2	34.5	37.0	88.0	88.0
40	F	15	2.1	8.3	8.3	8.6	88.0	88.3	88.8	12.0	12.0	12.2	38.4	38.5	38.5	38.0	38.2	39.9
41	F	15	2.2	8.3	8.3	8.5	90.0	90.5	90.5	11.3	11.4	11.5	36.4	36.6	37.0	39.0	39.4	39.8
42	F	15	2.2	7.0	7.3	7.6	88.0	88.8	89.3	11.5	12.0	12.5	40.3	40.5	40.7	38.0	39.3	39.5
43	F	16	2.3	8.7	8.8	8.9	84.0	85.5	86.7	13.0	13.5	14.0	39.3	39.5	39.7	38.0	38.4	38.5
44	M	16	2.3	8.0	8.3	8.3	90.0	93.0	93.8	10.0	10.5	10.6	36.3	36.8	36.9	40.0	42.0	43.0
45	M	16	2.0	9.0	9.2	9.3	86.0	88.0	89.3	11.0	11.5	12.0	40.0	40.0	40.0	38.0	37.3	37.3
46	M	16	2.1	8.0	8.4	8.8	80.0	82.0	83.0	11.0	11.5	11.8	39.0	39.7	40.0	40.0	40.2	40.4
47	F	16	2.1	8.0	8.5	8.5	79.0	80.0	83.0	12.0	12.5	13.3	37.3	37.5	39.9	36.0	36.4	36.5
48	F	15	2.2	9.0	9.3	9.8	82.0	82.3	82.5	12.0	12.5	12.5	38.2	38.4	39.2	36.0	36.4	36.5
49	F	16	2.1	10.0	10.3	10.5	92.0	94.0	95.0	13.0	13.5	14.0	38.9	38.9	39.2	40.0	41.0	42.0
50	F	16	2.2	11.0	11.2	11.3	95.0	98.0	98.3	13.0	13.5	14.5	39.4	39.7	39.9	40.0	41.0	42.0

Anthropometric measurements - Toddlers

			B.Wt.	Wt. (kg)			Ht. (cm)			MUAC (cm)			Head (cm)			Chest (cm)		
1	12	M	2.3	6.9	6.9	6.8	88	89.2	90.0	12.3	12.5	13.0	45.0	45.3	45.8	42.0	42.3	43.0
2	13	M	2.4	6.8	6.7	6.8	90	92.0	95.0	14.0	14.3	14.3	43.2	44.0	44.0	40.0	42.0	44.0
3	13	F	2.2	8.3	8.5	8.7	87	87.0	89.0	10.0	11.0	11.3	43.0	43.3	44.0	40.3	40.4	40.5
4	14	M	2.4	9.2	9.8	9.5	87	90.0	92.0	15.0	15.2	15.5	43.3	43.5	43.8	40.3	41.0	42.0
5	14	M	2.4	10.5	10.8	10.8	80	83.0	84.0	16.0	16.5	17.0	43.6	43.8	44.0	38.0	39.3	39.5
6	14	F	2.4	8.3	8.7	8.8	92	93.0	95.0	11.0	11.5	12.0	39.0	39.4	39.5	39.9	39.9	40.0
7	15	M	2.3	8.5	8.8	9.0	90	93.0	95.0	12.5	12.8	13.0	43.4	43.5	43.9	39.0	40.0	41.0
8	15	M	2.3	8.3	8.4	8.4	88	89.9	90.9	10.0	11.6	12.2	42.0	42.4	43.0	40.3	40.5	40.5
9	15	M	2.3	8.8	8.7	8.6	89	90.0	92.0	10.3	10.6	10.8	41.3	42.0	43.0	40.8	41.0	41.0
10	15	M	2.3	9.8	9.8	10.0	88	88.9	90.1	10.0	11.0	12.5	40.0	40.8	40.8	38.7	38.7	38.8
11	15	F	2.3	8.8	8.7	8.8	90	90.4	90.4	13.0	13.2	13.5	40.0	41.0	42.0	41.2	41.3	42.0
12	15	F	2.2	8.0	8.9	9.0	79	81.0	82.3	14.3	14.5	15.0	42.3	42.3	42.4	40.4	40.8	40.9
13	15	F	2.2	9.8	9.8	10.0	78	78.5	78.9	14.0	14.8	15.0	43.1	43.0	43.4	42.4	43.0	43.0
14	16	M	2.4	10.8	10.9	11.0	95	96.7	96.9	12.0	12.5	12.5	38.0	38.9	36.9	40.2	41.0	42.0
15	16	F	2.4	10.3	10.3	10.8	94	94.5	94.9	10.0	10.0	10.0	39.7	40.0	40.3	41.6	41.6	42.0

Body weight and height of mothers - Infants

Age	Body weight of mothers of infants	Standard	Height	Standard
23	40	~~50~~	143	~~151~~
28	29		140	
23	30		148	
22	28.5		138	
21	26		139	
28	32		142	
29	30	50	140	151
32	31		145	
27	33		149	
29	32.5		145	
31	33		143	
30	35		140	
28	36		148	
23	32		148	
26	30		142	

Body weight and height of mothers - Toddlers

Age	Body weight of mothers of infants	Standard	Height	Standard
32	33		138	
30	32		143	
30.5	31		142	
28	25		139	
24	26		142.5	
31	29		139.8	
32	28	50	145.5	151
23	26		140	
24	30		142	
26.5	32		144	
28	35		139	
30	34		140	
29	30		139	
31	32		145	
30	30		140	

XI

Head/chest circumference ratio - Infants

Sl.No.	Ratio	Sl.No.	Ratio	Sl.No.	Ratio
1	0.94	24	0.36	47	1.27
2	0.97	25	1.11	48	1.23
3	1.00	26	1.43	49	1.29
4	0.96	27	1.43	50	1.16
5	1.02	28	1.03	1	1.12
6	1.11	29	1.15	2	1.03
7	1.06	30	0.98	3	1.03
8	1.03	31	1.00	4	1.15
9	0.90	32	1.03	5	1.10
10	0.99	33	1.00	6	1.01
11	0.11	34	0.99	7	0.97
12	1.32	35	0.95	8	1.00
13	1.09	36	1.07	9	1.06
14	1.03	37	1.05	10	1.09
15	1.01	38	1.13	11	1.09
16	1.02	39	0.99	12	1.09
17	1.02	40	1.93	13	0.94
18	0.89	41	1.03	14	0.95
19	1.10	42	0.95	15	1.03
20	1.16	43	1.10		
21	1.05	44	0.93		
22	1.09	45	1.16		
23	1.00	46	1.12		

Head/chest circumference ratio - Toddlers

Sl.No.	Ratio	Sl.No.	Ratio	Sl.No.	Ratio
1	0.95	24	1.05	47	0.95
2	0.97	25	1.03	48	1.04
3	0.90	26	0.90	49	1.00
4	1.12	27	1.10	50	1.00
5	1.02	28	1.05	1	0.93
6	0.93	29	0.97	2	1.02
7	1.04	30	0.92	3	0.90
8	0.98	31	0.91	4	1.11
9	1.06	32	0.98	5	1.10
10	1.05	33	0.94	6	0.98
11	0.94	34	0.98	7	0.96
12	0.98	35	1.02	8	0.98
13	0.99	36	1.02	9	1.05
14	1.09	37	1.11	10	1.01
15	1.09	38	1.01	11	0.87
16	1.09	39	1.08	12	0.97
17	1.00	40	1.12	13	1.02
18	0.04	41	1.10	14	1.19
19	0.93	42	1.04	15	1.11
20	0.93	43	1.04		
21	0.98	44	1.00		
22	0.90	45	1.14		
23	0.97	46	0.99		

XII

Nutritional Status Index (NSI)

Sl.No.	NSI	Sl.No.	NSI	Sl.No.	NSI
1.	46.29	26.	46.52	1.	46.61
2.	48.73	27.	46.53	2.	46.73
3.	48.33	28.	46.66	3.	46.76
4.	46.45	29.	44.67	4.	44.83
5.	44.65	30.	46.51	5.	46.82
6.	42.55	31.	44.73	6.	44.89
7.	48.37	32.	46.62	7.	48.81
8.	46.49	33.	46.54	8.	46.98
9.	44.40	34.	46.43	9.	44.95
10.	44.43	35.	48.49	10.	46.84
11.	44.54	36.	44.49	11.	44.87
12.	42.54	37.	44.38	12.	46.68
13.	44.63	38.	46.39	13.	46.78
14.	44.64	39.	46.59	14.	46.68
15.	46.52	40.	46.56	15.	46.59
16.	44.55	41.	46.54		
17.	46.59	42.	44.85		
18.	44.64	43.	46.77		
19.	44.68	44.	43.94		
20.	44.49	45.	44.92		
21.	44.55	46.	46.68		
22.	44.55	47.	46.80		
23.	46.56	48.	48.76		
24.	46.43	49.	42.76		
25.	44.72	50.	46.64		

Nutritional status index (NSI) - Toddlers

Sl.No.	NSI	Sl.No.	NSI	Sl.No.	NSI
1	25.55	24	24.74	47	24.45
2	24.60	25	24.84	48	25.76
3	23.33	26	24.76	49	25.72
4	24.61	27	22.57	50	26.83
5	24.48	28	23.69	1	25.77
6	25.53	29	24.60	2	26.84
7	25.60	30	23.70	3	26.91
8	24.51	31	23.54	4	25.87
9	24.46	32	23.72	5	25.80
10	28.53	33	25.76	6	24.81
11	25.67	34	25.66	7	25.75
12	25.67	35	23.56	8	25.86
13	24.68	36	24.69	9	25.00
14	24.57	37	23.62	10	24.92
15	25.65	38	24.60	11	26.76
16	24.75	39	24.66	12	26.67
17	25.75	40	24.63	13	26.71
18	25.62	41	24.75	14	26.85
19	23.81	42	25.76	15	26.66
20	23.74	43	24.71		
21	24.82	44	23.61		
22	25.79	45	25.61		
23	23.71	46	22.67		

ABSTRACT

FEEDING PRACTICES AND NUTRITIONAL STATUS OF CHILDREN BELONGING TO HIGH RISK FAMILIES

By

SREEJA. K. P.

ABSTRACT OF THE THESIS
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ABSTRACT

A study was conducted at Kalikavu Panchayat of Malappuram district to assess the feeding practices and nutritional status of children belonging to high risk families.

The socio economic and dietary back ground of the selected families from the area was ascertained to assess their influence the feeding and current dietary pattern.

The study was conducted at two levels; one on a macrosample of 130 children consisting of 100 children belonging to the experimental group (50 infants and 50 toddlers) and 30 children in the control group (15 infants and 15 toddlers). Out of these children a subsample of 30 children constituting 20 per cent of the total sample, selected at random from the macro sample.

At the onset of the study an attempt was made to identify the at risk families of the area with the scale developed by Srilatha and Gopinathan (1995) and from about 200 families thus identified, 130 families having at least one child in the age group between 6 months and 23 months were selected for the study. This initial survey revealed that presence of children below 5 years of age, lack of access to safe drinking water and low employment status were the major family risk factors observed among 60 per cent of the families.

Another survey was again conducted among the 130 children to find out the extent of prevalence of child risk factors identified by Ghosh (1992). Low birth weight, lesser spacing between children, repeated infections and working mother were identified as major child risk factors prevalent among 65 per cent of families.

To find out the socio economic background of the subjects an interview was conducted. The data obtained on these lines revealed that all the subjects belonged to backward communities with a majority belonging to scheduled caste communities. A joint family system with the predominance of females children was found in the area. The occupational status revealed that majority (51.33 per cent) were agricultural labourers with a monthly income below Rs. 1000. They were found to be living in their own small katcha houses without electricity. They had no potable water supply and sanitary latrines. The above facts revealed that all factors except religion and caste could negatively influence the nutritional status of the subjects.

Feeding practices of the infants and toddlers were in the habit of giving prelacteal feeds and breast feeding was initiated from the first day itself. They fed their children 4-6 times a day.

Majority of the mothers (more than 50 per cent) had started supplementary feeding between 4 and 7 months. Ragi, banana flour, rice flour, cow's/goat's/buffaloe's milk were given as the first supplement. The dietary pattern of toddlers were found to be inadequate.

Problems related to weaning such as vomiting, diarrhoea, constipation and colic pain were common among the children. Participation in nutrition intervention programmes by the infants and toddlers selected as subjects was found to be most unsatisfactory.

An enquiry on the pattern of immunization revealed that majority (60 per cent) of the subjects were only partially immunized.

The growth of the subjects were assessed by anthropometry. The anthropometric measurements such as weight, height, mid upper arm, head, and chest circumferences of the subjects when compared with standards revealed that they were significantly lower than that of standards. Further analysis of the data revealed that only 19 per cent of infants and toddlers were normal, while the remaining 81 per cent suffered from different grades of malnutrition. When the rate of growth of these children were measured over a period of 3 months, three times, during the study also revealed that 95 per cent of infants and toddlers did not exhibit significant increments, indicating limitation in growth which has been identified as a risk factor.

Detailed dietary survey conducted on a subsample of 20 per cent of total subjects by one day recall among infants and by weighment among toddlers revealed that diets of infants and toddlers were found to be ill balanced both in terms of quantity as well as quality.

The clinical examination of the subjects revealed that non specific symptoms such as sparse hair, discolouration as well as oedema and specific symptoms such as anaemia were found among 64 per cent of infants and 54 per cent of toddlers of experimental and control groups.

In a nutshell the study revealed that more than 80 per cent of children belonging to selected high risk families were malnourished. All the subjects were living with several risk factors which could deteriorate or negatively influence their nutritional status. Statistical analysis of the data pertaining to NSI as well as the presence of risk factors, revealed that illiteracy, unemployment, lack of access to safe drinking water, absence of sanitary latrine, working mother, low income, low birth weight, as well as inadequate weight gain during a period of 3 months, repeated infections, short birth interval between two children, birth order of four and above, late initiation of breast feeding, and late introduction of supplementary food, weaning problems and nature of caretakers were all found to have significant negative impact on nutritional status of the subjects under focus.

Based on the general observations of the study the nutritional status of these selected infants and toddlers were found to be poor. To improve the nutritional status it is essential to improve the dietary practices as well as the socio economic and living conditions of the families to which the subjects belong, through constant motivation, education and monitoring.