

**NUTRITIONAL STATUS AND HOME ENVIRONMENT AS
DETERMINANTS OF ATTAINMENT OF DEVELOPMENTAL
MILESTONES IN CHILDREN**

SOUMYA.M.S

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**Department of Home Science
COLLEGE OF AGRICULTURE
VELLAYANI, THIRUVANANTHAPURAM – 695 522**

DECLARATION

I hereby declare that this thesis entitled “Nutritional Status and Home Environment as Determinants of Attainment of Developmental Milestones in Children” is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, associate ship, fellowship or other similar title, of any other university or society.

Vellayani,
2007

SOUMYA.M.S
(2005-16-103)

CERTIFICATE

Certified that this thesis entitled “Nutritional Status and Home Environment as Determinants of Attainment of Developmental Milestones in Children” is a record of research work done independently by Ms. Soumya. M.S. (2005-16-103) under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associate ship to her.

**Vellayani
2007**

**Dr. B.PrasannaKumari
(Chairperson,Advisory Committee)
Associate Professor
Department of Home Science
College of Agriculture, Vellayani,
Thiruvananthapuram**

Approved by

Chairperson:

Dr. B.Prasanna Kumari
Associate Professor
Department of Home Science
College of Agriculture, Vellayani,
Thiruvananthapuram

Members:

Dr. Mary Ukkuru. P
Professor & Head
Department of Home Science
College of Agriculture, Vellayani,
Thiruvananthapuram

Dr. S. Syama Kumari
Professor
Department of Home Science
College of Agriculture, Vellayani,
Thiruvananthapuram

Dr. Vijayaraghava Kumar
Professor
Department of Agricultural Statistics
College of Agriculture, Vellayani,
Thiruvananthapuram

External Examiner:

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Dedicated to
MY HUSBAND

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LIST OF ABBREVIATIONS

| | | |
|--------|---|---|
| BMI | - | Body Mass Index |
| CDPO | - | Child Development Project Officer |
| CED | - | Chronic energy deficit |
| DMR | - | Developmental Milestone Ratio |
| HOME | - | Home Observation For Measurement Of Environment Scale |
| IAP | - | Indian Academy of Pediatrics |
| IIPS | - | International Institute of Population Sciences |
| IMHFW | - | Indian Ministry of Health and Family Welfare |
| MUAC | - | Mid Upper Arm Circumference |
| NFHS | - | National Family Health Survey |
| NNMB | - | National Nutrition Monitoring Bureau |
| ORS | - | Oral Rehydration Solution |
| SC/ST | - | Scheduled caste/ Scheduled tribe |
| UNICEF | - | United Nations Children's Fund |
| WHO | - | World Health Organisation |

Introduction

1. INTRODUCTION

Today's infants are the gems of future generation and are the future inheritants of this planet. Providing better care and nutrition to the children is an essential pre requisite to the building up of a better nation and their physical and educational development determine the extent to which they can contribute to the national growth and prosperity.

Childhood is a dynamic phase of life and is characterized by rapid growth and development. Every child is said to be the interplay between genetic and environmental factors, the genes setting the limits of achievement and the environment determining whether he or she achieves it or not. The first three years of life is the most vulnerable period in a child's life. This is the critical stage for brain development and the stage when the child is at risk of growth faltering. At this stage the critical factors include nutrition adequacy including breast feeding and responsive and timely complementary feeding. In fact this stage is so critical for development that developmental lags in this period may often prove to be irreversible (Ghosh, 1989).

The astonishing rates of growth during early infancy are never again matched, even at peak height velocity during adolescence. Thus the capacity for catch-up growth in children may be largely limited to the degree of developmental delay, which predicts how much growing time is left.

Patterns of development in the earliest years of life are sequential and predictable. Development can be viewed as a series of milestones normally achieved at specific ages or a series of critical tasks to be mastered within certain ages of life. Developmental delay which is the failure to reach developmental milestones at the expected age range for normal children is considered to be the result of the interaction of both biologic and environmental factors.

Family is the basic institution, which is vital to the healthy development of children. In early years of child's life, the home environment plays an important role in laying proper foundations for overall development of children (Patnam and Pawar, 2003). Nurturing and stable relationships with caring adults are essential to healthy human development beginning from birth. Secure and stable relationships with caring adults assure that young children are adequately nourished, protected from dangerous illnesses, toxins and hazards that can lead to preventable injuries; provided preventive health checkups, protected from excessive stress and afforded predictable daily routines that convey a sense of security (Gunnar et al, 1996). The eventual nutritional status of a child depends not only household resources and food availability but also on the actions of the family members, primarily of the parent and especially of the mother's which substantially determine the health and nutritional status of children in developing countries.

Malnutrition during infancy and early childhood is found to have long term repercussions on both physical growth and intellectual performance in later life. During these developmental periods there is high demand for energy to meet biological and social challenges of growth and malnutrition. Malnutrition increases the susceptibility to infection which adversely affects the nutritional status and in turn affects the intellectual and physical development. A child who is growing well will in all probability be more physically active and interact more intensely with his or her environment than one who is growing poorly. Listlessness and apathy, whether induced by energy dietary deficits or infection, place a child at risk of developmental retardation. The conditions that improve growth will also improve cognitive development.

The major thrust of all child health schemes including the Maternal and Child Health services has been on the monitoring and support of the physical growth of the child. Subtle developmental deficits occurring in children may go undetected until they reach school going age. Developmental delay has not

received the due attention of planners and policy makers, because of the general feeling that the problem is so big in a vast country like India that nothing much can be done. In states like Kerala where the low infant mortality rate is comparable with that of developed countries, not only survival but the quality of survival becomes very important.

The present study aims to ascertain the nutritional status of children below 2 years (infants and toddlers), their home environment and their attainment of developmental milestones and to find out the relationship between their nutritional status and home environment with the attainment of their developmental milestones.

Review of literature

2. REVIEW

Nutrition is one of the indispensable factors that are closely associated with the physical and mental development of young children (Rana and Hussain, 2001). According to Kumar and co workers (2006) proper nutrition of children leading to adequate growth and good health is the essential foundation of human development. Murray and Lopez (1997) has viewed child malnutrition as a significant health problem in developing countries and one of the main causes of infant and child mortality.

National Family Health Survey data-2 (1998-1999) highlights the critical period when growth faltering occurs to be six months to 2 years. UNICEF (1990) has opined that in terms of age group, the incidence of severe malnutrition appears to be higher among children of 0-3 years than other groups in almost all states. For the majority of children, growth faltering starts at four to six months and the critical period for growth faltering is between six months and two years (Chaudhari et al, 2006).

Kilaru and co workers (2002) pointed out that as malnutrition reaches its highest prevalence in the second year of life, growth faltering often begins in first year of life. According to NFHS -3 (2005-2006) data 46 per cent of children under three years were underweight, 19 per cent were wasted and 38 per cent were stunted.

Review of literature related to the present study are given under the following heads:

2.1. PREVALENCE OF MALNUTRITION IN CHILDREN

Malnutrition has been identified as the main factor retarding human development and hindering further reductions in infant mortality in India (Measham and Chatterjee, 1998). Mosley and Becker (1991) viewed malnutrition to be the underlying cause or exacerbating factor in many post neonatal and child deaths in developing countries.

A recent appraisal of diet and nutrition situation in rural India by NNMB (2001) revealed that about 45 percent of the preschool children are undernourished while about 62 percent are stunted.

Malnutrition alone is estimated to account for over half of children's deaths annually (Pelletier and Frongillo, 2003). Malnutrition is a factor in an estimated 54 per cent of all childhood deaths globally (Arnold et al, 1996).

Administrative Committee on Coordination /Standing Committee on Nutrition (2004) reported that 47 percent of children under three were underweight or severely underweight and a further 26 percent were mildly under weight such that in total underweight afflicted almost three quarters of Indian children.

Diarrhea and pneumonia account for approximately half the child deaths in India, and malnutrition is thought to contribute to 61 per cent of diarrheal deaths and 53 per cent of pneumonia deaths((Black et al, 2003).

A study conducted by Li and co workers (2005) in China to estimate the prevalence of malnutrition in children revealed that the prevalence of severe and

moderate malnutrition was 3.1 per cent and 15.8 per cent respectively. The study found that stunting was most common in children aged two years.

A study conducted by Brahman (2006) to assess the prevalence of undernutrition among 6-24 months children in nine states of India revealed that the overall prevalence of underweight was 50.6 per cent, of which 17 per cent was severe and 33 per cent was moderate. The overall underweight ranged from 26 per cent in the state of Kerala to a high rate of 65 per cent in Madhya Pradesh. The study also found that the prevalence of undernutrition was relatively high among children in Madhya Pradesh and Gujarat.

A study conducted by Geetha and co workers (2002) to find out the nutritional status of rural preschool children of age 9 months to 3 years in Dharward revealed that higher percentage of children below one year of age was suffering from severe degrees of malnutrition.

In a study conducted by Khokhar and co workers (2003) in Delhi on children from 6 months to two years found that 60.7 per cent of them were malnourished. Saxena and co workers (1997) in their study found that the prevalence of stunting was maximum in the first three years of age.

Rajaram and co workers (2003) reported that in Kerala and Goa there is a high prevalence of under weight and stunting among children. A study conducted by Rajasree and Soman (1994) in two villages in Kerala found a sharp increase in stunting and wasting in children of two years of age. They reported that in Kerala, there is low mortality and high morbidity prevalent among the children below the age of two.

Beaton and co workers (1990) opined that child malnutrition in developing countries like India can be viewed as a syndrome of developmental impairment caused by a complex of multifactorial factors.

World wide research has well established inadequate dietary intake and recurrent infections to be the immediate cause of child malnutrition. In addition to these factors, superstitious beliefs, faulty feeding habits, poor environmental conditions, exclusive breast feeding with out proper supplementation further deteriorate the condition of children in traditional rural families (Jyothilakshmi and Prakash, 2004). Pelletier (1994) pointed out that malnutrition among children is often caused by the synergistic effects of inadequate or improper food intake and repeated episodes of parasitic or other childhood diseases such as diarrhea, and improper care during illness.

Nutritional vulnerability during this period results from the poor nutritional quality of the foods offered relative to nutritional requirements, high prevalence of diarrhea and respiratory infections and their interaction (Pelto etal, 2002). It is also the result of the quantity of foods offered, frequency with which they are fed and responsiveness of the mother or caregiver to the needs of the child during feeding (Dewey and Brown, 2003).

The low prevalence and duration of exclusive and partial breast feeding increase the risk of infant and childhood morbidity and mortality in both developed and developing countries (Betran etal, 2001).

Kumar and co workers (2006) had observed delayed initiation of breast feeding, deprivation from colostrum and improper weaning to be the risk factors for undernutrition in children.

2.2. INFANT FEEDING PRACTICES AND CHILD MALNUTRITION

The nutritional and health status of the infants mainly depends on the feeding practices of the community (Ram et al, 2000). Infant feeding practices constitute a major component of child caring practices apart from socio-cultural, economic and demographic factors. Appropriate feeding practices are extremely important for the growth and development of the child (Kumar et al, 2006). These practices are age specific, with poorer adherence to the age brackets for feeding recommended (Pascale et al, 2007). A study conducted by Taneja and Gupta (2001) in Madhya Pradesh to assess the association between feeding practices and malnutrition in infants on 430 mothers found inappropriate feeding practices to be the major reason for malnutrition in infants.

WHO (2003) recommends exclusive breast feeding for the first six months, addition of complementary food at six months with continued breast feeding till at least 2 years. Breast feeding is an extremely ancient process and is universally recommended way of providing infant nourishment. Human milk is an ideal food for normal neonate providing nutrients and energy for rapid growth and development and gives unique immunity against many pathogens (Wagner et al, 2006). Mother's milk has been the mainstay of the infant's diet in very beginning of life on earth (Bhan et al, 2004). Several studies have shown that the breast milk composition is unique, is best for the growing baby and helps keep the baby healthy (Monika et al, 2004). A study conducted by Bahl and co workers (2005) confirms a strong protective effect of breast feeding against death among infants in Ghana, India and Peru.

Sethi and co workers (2003) and Vaahtera and co workers (2001) reported that in majority of the lower income countries, exclusive breast feeding rates are lesser than fifty percent. The initiation of breast feeding and the timely introduction

of adequate, safe and appropriate complementary foods in conjunction with continued breast feeding are of prime importance for the growth, development, health and nutrition of infants and children everywhere (Kulkarni et al, 2004).

Although India is a country very supportive of breast feeding, truly exclusive feeding is quite uncommon, as mothers begin to supplement with top milks and water in the child's first months (Engle, 2002). One formative research by the Academy for Educational Development in Uttar Pradesh identified behavioral practices in breast feeding and complementary feeding that could reduce intake of complementary foods. The study found that initiation of breast feeding was delayed by the mothers, prelacteal foods were usually given, breast feeding continued only through the second month and feeds were generally short.

A study conducted by Giashuddin and co workers (2003) in Bangladesh to assess the exclusive breast feeding practice and to examine the factors that affect the nutritional status of children from 0-24 months revealed that only 16 per cent of mothers exclusively breast fed their children for less than 6 months. The study also found that exclusively breast fed children were better off than their counterparts.

A study conducted by Devadas and coworkers (1999) in Tamil Nadu to assess the trends in breast feeding revealed that majority of the mothers resorted to partial breastfeeding within forty days of breast feeding. The study found that the incidence of common ailments were more common among partially breastfed than the exclusively breast fed infants.

Studies conducted in South East Asia revealed that exclusive breast feeding rate was about 28 per cent (Zohoori et al, 1993). Betran and co workers (2001) have reported that in both developing and developed countries the low prevalence and

duration of exclusive and partial breastfeeding increase the risk of infant and childhood morbidity and mortality.

Sethi and co workers (2003) studied the infant feeding practices in Delhi. They found that 54.3 per cent initiated breast feeding after three days of child birth, 77 per cent discarded colostrum considering it unfit for the baby. A study conducted by Yadav and Singh (2004) among eight thousand mothers in Bihar found that about one third of the mothers discarded colostrum. Nanda and co workers (1999) in a study in Varanasi reported that colostrum is discarded by almost all mothers.

Delayed breastfeeding is one of the reasons that precipitate malnutrition among infants (Banerjee, 1995). The initiation of breast feeding and the timely introduction of adequate, safe and appropriate complementary foods in conjunction with continued breast feeding are of prime importance for growth.

According to NFHS-2 (1998-99) data the prevalence of breast feeding in India is 99 per cent in rural areas and 96 per cent in the urban areas. A study conducted by Indian Ministry of Health and Family Welfare (1991) in North India found that breast feeding was almost universal and it was carried on for about 21 months but the introduction of complementary food was too late. NFHS 3 (2005-2006) data shows that only 46.3 per cent children are exclusively breast fed till the age of 4 months and introduction of complementary feeding is delayed for most the children.

A study conducted by Yagammai and coworkers (2002) in Coimbatore found that 50 per cent of the infants were given exclusive bottle feeding within ten days of delivery. IMHFW (1991) reported that in North India more mothers started artificial feeding from birth and to the other extreme children are breast fed till the 5 years.

Huffman and Martin (1994) reported that poor weaning diet characterized by inadequate calories, proteins and micro nutrients accounts for high levels of malnutrition, morbidity and mortality among 6-24 months of age. UNICEF (1997) has reported that the physical and mental development of the child is significantly influenced by the feeding and rearing practices.

A study conducted by Gathwala and Narayan (1992) found that the prevalence of breast feeding was 42 per cent during the first month falling to 20 per cent by 4 months and 10 per cent by six months. Ogunba (2006) studied the breast feeding practices, complementary feeding practices and attitude towards child feeding of 384 women of children between 0-24 months. They reported that only 24 per cent of women practiced exclusive breastfeeding and 89.2 per cent used bottle for feeding. Majority of the mothers terminated breastfeeding because they feel that children were old enough at age 12 months.

When the baby attains 6 months of age, milk alone is no longer sufficient to meet its calorie requirements. She needs some more calories and other nutrients as supplement to milk till the baby is ready to eat fully the adult food. This is the weaning stage, when baby is weaned from a diet based on milk to a diet based on milk and other solid foods. Weaning begins from the moment supplementary food is started and continues till the child is taken off the breast completely (Srilakshmi, 2004). The supplementary foods may be either liquid or semi solid or solid foods (IIPS, 1995). Complementary foods can be defined as any non breast milk foods or nutritive liquids given to young children during the period of breast feeding (Brown and Sharma, 1999). Complementary feeds bridge the energy gap, vitamin A gap and iron gap which arises in breast fed infants at six months (WHO, 2002). Too long a delay in introducing appropriate complementary foods may, however lead to

nutritional deficiencies of iron, zinc, calcium and sometimes vitamin A and riboflavin (Gibson et al, 1998).

Subbulakshmi and co workers (1990) reported that between one third and one-half of the children studied in Maharashtra and Gujarat were not given complementary food until after one year of age.

Ghosh (1997) has argued that the high rates of malnutrition in India are not primarily caused by poverty; rather, the behaviors of delayed initiation of breast feeding, early introduction of water and liquids and delay in complementary feeding results in a period of perpetual hunger for the child. According to the NFHS (1998-1999) data only 33 per cent of children are reported to receive foods other than breast milk from 6-9 months. Parmer and coworkers (2000) in a study conducted in Chandigarh reported that the types and frequency of complementary food fed by the mothers were poor.

A study conducted by Kumar and Nair (1993) found that weaning was delayed in one third children for more than one year of age. A study conducted by Aggarwal and co workers (2008) in Delhi on 200 mothers found that majority (77%) of the mothers had delayed complementary feeding and 16 per cent had not started complementary feeding at the age of two years. The study also found that majority of the feeds were of thin consistency and the quantity of complementary feeds was less than recommended in 75 per cent of children.

2.3. MATERNAL FACTORS AND CHILD NUTRITION

2.3.1 MATERNAL NUTRITIONAL STATUS AND CHILD NUTRITION

In any community, the mother and child have always been considered as one unit - be it biologically, socially or culturally. The biological support that the mother

gives to the child during its growth and development through pregnancy and lactation, in turn, depends on her own nutritional status (Gourangie and Ahmed, 2007). Singh (2001) reported that the health and nutritional status of mother during pregnancy has significant effect on the development of brain during fetal life

The health status of pregnant mothers invariably determine the health status of the generations to come, which in turn determines the health of the entire community. In India, poor fetal growth has been attributed to widespread maternal undernutrition (Gopalan, 1994). Dietary intakes of energy and protein of rural Indian mothers are known to be low (Hutter, 1996).

Infants suffering from proportionate IUGR are less likely to catch up in growth and more likely to suffer continued impaired immunocompetence thereby leading to higher rates of illness and mortality compared with normal infants (Villae, 1990). Fetal growth is important in determining the birth weight of the infant and at least in part of health and height as well as the gestational age and birth weight of the infant largely determines the ability of the infants to adapt to extra uterine life (Kaushik, 1997).

Increased perinatal and neonatal mortality, a higher risk of low birth weight babies, still births and miscarriage are some of the consequences of malnutrition in women (Krasovec and Anderson, 1991). Gogoi and Ahmed (2007) studied in a cohort of non pregnant currently married women in Assam for a period of one year. The study found that 88 per cent of women had a pre pregnant weight of less than 45kg and 61 per cent had birth weight less than 2500gm. Maternal depletion of energy and protein resulting from short inter pregnancy intervals or early pregnancies lead to a reduction in maternal nutritional status at conception and alter pregnancy outcomes (Smitz and Essed, 2001). King (2003) stated that maternal

nutrition depletion may contribute to the increased incidence of preterm births and fetal growth retardation.

Women with short pregnancy intervals or early pregnancies are at increased risk for delivering pre term, low birth weight or small for gestational age infants (Zhu et al, 1999). A study conducted by Thame and coworkers (1997) in Jamaica reported that poor maternal nutrition is associated with smaller, shorter babies with smaller heads.

2.3.2 MATERNAL EDUCATION AND NUTRITIONAL STATUS OF CHILDREN

Christiaensen and Alderman (2004) has viewed that parental education, especially mothers' education, is a key element in improving children's nutritional status. The level of education of female and male members of the household could be particularly important in indirectly influencing child nutritional status (Basu and Foster, 1998; Gibson, 2001).

Maternal literacy status is recognized as an important determinant of health and nutritional status of children right from birth of the children (Dhanalakshmi and Murthy, 1993).

Education facilitates mother's learning about the causation, prevention, recognition and cure of diseases as well as nutritional requirements that can subsequently affect their health behaviour (Defo, 1997).

Alderman and Garcia (1994) points out that maternal education emerges as a key element of an overall strategy to address malnutrition. Reddy and co workers (1992) reported that the percentage of children who were fully immunized increased by nearly 20 percent with every four years of maternal schooling.

Roy (1997) observed that timely introduction of qualitative supplementary foods were higher by 2.5 times among infants of literate mothers compared to those of illiterate mothers. NNMB (1999) reported that child nutrition fell monotonically with the maternal education. Bavdekar and co workers (1994) opined that better nutritional status and feeding practices among children in the under-privileged societies is attributed to increased maternal education.

Dhanalakshmi and Murthy (1993) observed that new borns of illiterate mothers were lighter than those of literate mothers. Bhattacharya (1999) opined that a 10 per cent reduction in female illiteracy would result in reduction of infant mortality rate by 12.5 percent. A study conducted by Medha and co workers (2002) reported that infant mortality rate was lower among the literate mothers.

Frost and coworkers (2005) opined that by giving an environment with sufficient resources, maternal education can influence child nutritional status by promoting the utilization of modern health care as well as improving health care knowledge and reproductive behavior. He also opined that maternal education influences health seeking behaviors which in turn influence stunting. Studies point out strong influence of the low level of female education on child mortality in developing countries (Caldwell, 1990).

A study conducted by Kunwar and coworkers (1998) revealed that maternal education had positive relationship with awareness and adoption of child health care practices.

A study conducted by Jyothilakshmi and Prakash (2004) found that the health care seeking pattern to sick children was better among literate mothers than illiterate mothers. The study also found that the knowledge and utility of ORS for diarrhea

and vomiting was found to be twice higher among literate mothers. A study conducted by Sharma (1997) to assess the association between home environments with educational status of parents revealed that parents with higher education provide more stimulating environment than illiterate and less educated parents. The more a mother is knowledgeable the more she shall be able to help her child to grow nutritionally healthy as a young adult (Smith and Haddad, 2000).

In a study done by Liaqat and co workers (2006) in Pakistan revealed that mother's education play a vital role in increasing receptivity to nutritional requirements of their infants and improved complementary feeding practices. The study revealed that majority of the infants falling in various degrees of malnutrition belonged to uneducated mothers. The study also revealed that educated women started giving complementary feeding to their infants at appropriate age as compared to those who were uneducated.

Rafiquzzaman (1992) in a survey conducted in Bangladesh among 188 mothers reported that majority of educated respondents were likely to introduce complementary foods to their infants feed at proper age than uneducated ones. A study conducted by Rawal and co workers (2004) in Nepal found that 64.4 percent women were illiterate and their practice on maternal and child health care were found to be poor. Another study conducted by Sharma (1997) to assess the association between home environments with educational status of parents revealed that parents with higher education provide more stimulating environment than illiterate and less educated parents.

2.3.3 MATERNAL EMPLOYMENT AND NUTRITIONAL STATUS OF CHILDREN

Women's employment increases household income, with consequent benefit to household nutrition in general and the woman's nutritional status in particular (Genebo et al, 1998).

Although women's employment enhances the household accessibility to income, it may also have negative effects on the nutritional status of children, as it reduces a mother's time for child care. Studies reveal that mothers of the most malnourished children work outside their home (Abbi et al, 1991). Paine and Dorea (2001) endorse the view that the employment and the breast feeding practices period have non linear relationship that cause a reduction in the period of breast feeding.

A study conducted by Earland and co workers (1997) found that maternal employment does influence infant feeding practices and consequently have repercussions on future health. Igbedioh (1994) in a study conducted in Nigeria reported that occupation influenced the frequency and duration of breastfeeding, in addition to the nutritional quality and the type of weaning food fed. Shinde and Kamble (2000) in a study conducted in Maharashtra on 150 working and non working mothers revealed that 50.9 per cent working mothers adopted exclusive breast feeding while 74.2 per cent gave breast milk.

A study conducted by Dahiya and Sehgal(2002) in Haryana found that the duration of exclusive breast feeding by working mothers were only eight weeks. Maternal employment in the child's first year may have negative effects for both boys and girls, poor and non poor (Baydar and brooks-gunn, 1991).

Socio-economic status begins to have its effect on the nutritional status right from in utero and continues in the rapid stages of development leading to malnourished children. Maddah and co workers (2007) conducted a study in Iran and reported that children of employed mothers were likely to be underweight, stunted and wasted than children of non employed mothers.

2.4. HOME ENVIRONMENT OF CHILDREN

Childhood is a dynamic phase of life and is characterized by rapid growth and development. The developmental problems in the child are greatly determined by the biological variable, but the environment has the potential for influencing early developmental difficulties and hence a child's environmental risk may sometimes present with developmental delay phase. Healthy development depends on the quality and reliability of a young child's relationships with the important people in his or her life, both within and outside the family. Even the development of a child's brain architecture depends on the establishment of these relationships (Reis et al, 2000).

Family being the first and major agency of socialization plays a pivotal role in styling child's life (Kanani et al, 2005). The role of family as an important influence for nutritional status of children has been increasingly emphasized during the past few years (Reyes et al, 2004).

Shonkoff and Phillips (2000) has pointed out that as higher the quality and greater the quantity of positive environmental interactions and experiences, the greater the positive impact of this environment on children's development. Child care is generally a codified system of beliefs that evolve overtime as formulas that optimize the probability of accomplishment of the parents multiple long and short term goals (Zeitlin, 1994). In UNICEF's conceptual model for child nutrition, the

care behaviors for both the child and mother are included as underlying factors to the two direct determinants of child nutrition and also directly impact on child growth (Engle 1992). Improving the quality of psychosocial care and interaction increases the mental ability of malnourished children more than that with nutrient supplementation alone. In addition, there is also a beneficial effect on physical growth and development of children by improving the quality of psychosocial care and interactions (Chavez et al, 1971).

Engle (1995) has emphasized the "transactional" model of child care in which care is as much an effect as a determinant of child's nutritional status. Quality as well as the extent of interactions between the caretaker and the child is known to promote growth and development of the child (Engle et al, 1990).

The eventual nutritional status of a child depends not only on household resources and food availability but also on the actions of the family members, primarily of the mother which substantially determines the health and nutritional status of the children in developing countries (Engle, 1995). The parent child relationship is the first content in which children learn about the world. Thus early interactions and experiences between young children and their parents have a critical impact on children's future development. (Barnard, 1997).

Young children experience their world as an environment of relationships, and these relationships affect virtually all aspects of their development-intellectual, social, emotional, physical, behavioural and moral. Relationships are the 'active ingredients' of the environment's influence on healthy human development. Relationships engage children in the human community in ways that help them define who they are, what they are, what they can become and how and why they are important to other people. For an infant his whole environment is the home and most

of the influences of the environment on infant's development are mediated through the social and non social experiences directly encountered by the child during the parenting at home (Thompson, 1998).

There are different types of home environment that affects the growth of the child. They include physical home environment which include toys, learning materials, level of visual and auditory input and the extent to which environment is organized; cognitive home environment which include the quality and quantity of language used in the home, the variety of sensory and social experiences available and extent to which parents encourage achievement; social home environment which include the degree of parental responsiveness, the amount of warmth and nurturance, the level of encouragement provided for independence of maturity, the extent that parents restrict child behavior and the type of discipline used and the supportive home environment which provide a strong social support networks which provides a buffer against the negative consequences of stressful circumstances (Nair, 1998).

Singh (2003) has pointed out that environmental stimulation, interaction with parents and environment, playful activity and fun games are important for the growth of neurons and proliferation of network of synapses, dendrites and receptors.

A study conducted by Reyes and co workers (2004) in Mexico revealed that greater risk of stunting is associated with presence of family network for child care. Greatest protective effect was found in children cared for exclusively by their mothers.

A study conducted by Carrick and co workers (2006) on the correlates of neglect of children revealed that children who were substantiated for neglect were exposed to greater environmental risk and caregivers who had poor parenting skills.

Responsibility for the provision of child care and socialization has always rested with the household and the mother has been considered the primary caretaker of young children both by families and society at large (Rajalekshmi, 1994). A study conducted by Baharudin and Luster (1998) among African Americans and Caucasians to find out the factors related to the quality of home environment and children's achievement indicated that the quality of home environment that mothers provided was related to their child's achievement.

A study conducted by de Villiers and Senekal (2002) in South Africa to find out the determinants of growth failure among 12-24 months observed that growth failure was associated with mother's caring capacity. A study conducted by Wright and co workers (1991) in Egypt found a significant association between home environment and diarrhea in infants.

Maria and Piper (1980) concluded that early home environment is a significant prediction of mental development and at the same time the home is of extraordinary importance in the development of social intelligence. Bradley and co workers (2001) pointed out that environmental factors that influence the types and amount of interactions, materials, and experiences young children have within their environment. A secure attachment relationship between the infant and the caregiver can complement the relationship between parents and young children and facilitate early learning and social development (Howes, 1999). When relationships are nurturing, individualized, responsive, and predictable, they increase the odds of desirable outcomes – building healthy brain architecture that provides a strong foundation for learning, behavior and health (Raikes, 1993).

2.5. DEVELOPMENTAL MILESTONES OF CHILDREN

Healthy development in a child depends on the quality and reliability of a young child's relationships with the important people in his or her life, both within and outside the family. Even the development of a child's brain architecture depends on the establishment of these relationships (Reis et al, 2000).

Developmental milestones are a set of functional skills or age specific tasks that most children can do at a certain age range. Milestones are the definite landmarks in the growth and development of the child (Verma, 1988).

The timing and attainment of developmental milestones are important markers of neurological integrity and the identification of developmental delay is important for the prevention of problems such as abnormal behaviors and long term disability. Delay is said to occur when a child does not reach developmental milestones at expected age, with leeway for levels of normal variation among the population (First and Palfrey, 1994).

Developmental delay is defined as a condition in which functional aspects of the child's development are significantly delayed relative to the expected level of development (Simeonson and Sharp, 1992).

Although delay may result from a biological factor such as a chromosomal disorder or an environment factor such as maternal depression, the primary model for the pathogenesis of developmental delay is a transactional one with the process of development viewed as an interaction between the child and the environment, which can have profound effects on the other. Aylward (1992) opined that mother child interaction is more influential during early infancy and the preschool period.

Case studies done in Child Guidance clinic in Medical College Hospital, Thiruvananthapuram showed that a majority of children had a diagnosis of behavioural problems, mental retardation or developmental delay (Nair, 1998). A survey done in a coastal village of Kerala showed a prevalence of 3 per cent developmental delay among babies of less than 2 years (Nair et al, 1991). A study of developmental delay in children less than two years of age conducted at Medical College hospital showed that 50 per cent of the babies had one or other form of cerebral palsy (Kumar and Nair, 1993).

Areas of concern include biological risk due to a prenatal or perinatal insult, environment risk due to a poor care taking environment, and established risk due to a clearly diagnosed disorder in infancy (Bennett and Guralnick, 1991).

The attainment of gross motor milestones is an important indicator of child development. Such milestones include turning over from back to belly, crawling on hands and knees and sitting, standing and walking without support (Thelen, 2000).

Kuperus and co workers (1993) have found birth weight and social support as the contributing factors for the development of motor and mental development of premature infants. A study conducted by Zahr (1999) among African Americans and Hispanics found a significant relationship with the mental ability of premature infants with the home environment. Sonnander and Claesson (1999) found that developmental delay in infants is associated with maternal education. A study conducted by Zimmer (2006) found a prevalence of 33 per cent developmental delay in children belonging to 0 to 2 years age group.

Environmental factors such as adequate nutrition and the parent's ability to create a good and stimulating home environment have a positive influence on the child's cognitive development (Bacahrach and Baumeister, 1998). A meta analysis

by Anderson and co workers (1999) concluded that breast feeding is associated with significantly higher scores for cognitive development than was formula feeding. Bouwstra and co workers (2003) reported positive association between the duration of breast feeding and motor development in infants.

Materials and Methods

3. MATERIALS AND METHODS

This study on 'Nutritional status and home environment as determinants of attainment of developmental milestones in children' was undertaken to ascertain the nutritional status, home environment and developmental milestones in children below two years and to study their interrelationship. The study comprised of the following aspects:

- 1) Selection of area.
- 2) Selection of subjects.
- 3) Conduct of study.
 - 3.1) Socioeconomic status of the families.
 - 3.2) Assessment of child's characteristics.
 - 3.3) Assessment of infant and toddler feeding practices.
 - 3.4) Assessment of nutritional status of infants and toddlers.
 - 3.5) Assessment of home environmental factors.
 - 3.6) Assessment of age specific attainment of milestones in infants.
 - 3.7) Assessment of mother's knowledge regarding infant and child nutrition.
- 4) Analysis and consolidation of data.

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

1) *Selection of Area*

The study was conducted in Thiruvananthapuram ICDS Block. Anganwadi centers from Vellanad ICDS project were selected for the study, since this project has been reported as having maximum number of child beneficiaries. Six Anganwadi centers from this project having maximum number of child beneficiaries of age

below 2 years were selected for the study after discussion with the Child Development Project Officer.

2) Selection of Subjects

Infants and toddlers were selected at random in the ratio of 50:50 from the age group of 6-12 months and 12-24 months forming a total of 100 children as the study sample.

3) Conduct of the study

For the conduct of the study, permission was sought from the CDPO of the Vellanad ICDS project. Socio-economic conditions of the families, feeding practices of infants and toddlers and mother's knowledge regarding nutrition and child development was collected using a pretested structured questionnaire. Assessment of nutritional status of the infants and toddlers were done using anthropometry as well as clinical examination and assessment of BMI of their mothers was done using anthropometry.

The assessment of home environment of the selected subjects was done using Home Observation for Measurement of Environment Scale (HOME Inventory) by Caldwell and Bradley (1984) which was slightly modified for the conduct of the study. Assessment of age specific attainment of developmental milestones in children was made using a developmental screening chart designed for children upto two years of age by Child Development Centre, Government Medical College Hospital, Trivandrum. A pretested structured schedule was used to collect details from mothers.

The variables selected for the study are detailed below.

3.1) Socioeconomic status of families

The social and economic condition in which one lives is said to have a direct impact on food habits, feeding practices and nutritional status (Meer et al, 1995). Economic status is considered as the prime factor determining the purchasing power, there by household food security and in turn nutritional status of the community.

Socioeconomic conditions of the selected families were assessed by a survey using a suitably structured and pretested interview schedule. Details such as age, religion, caste, family composition, type of family, family income, educational and employment status of the family were assessed. The housing facilities such as availability of water supply, facility of latrine, type of the house etc were also assessed using interview schedule. The schedule is given in Appendix I.

3.2) Assessment of child's characteristics

The characteristics of children were assessed using a pretested structured schedule. The schedule developed included questions such as sex of the child, age, type of delivery, ordinal position, birth weight, immunization history and illness history. The questionnaire is given in Appendix II.

3.3) Assessment of infant and toddler feeding practices.

The feeding practices followed by the mothers may have a significant effect on the nutritional status of the children and may affect the attainment of developmental milestones. Hence the feeding practices followed by mothers were assessed. The interview schedule developed included questions for collecting information on breastfeeding such as giving colostrum to the new born, breast feeding pattern, breast feeding duration, introduction of bottle feeding, introduction

of complementary foods, type and quantity of food consumed and participation of child in supplementary feeding programmes. Scores were assigned for these different practices with highest scores assigned for the optimum practices followed. The total score thus obtained formed the feeding practices score of each infant and toddler respectively. The interview schedule is given in Appendix III.

3.4) Assessment of nutritional status of infants and toddlers

Nutritional status of any population is considered as the vital determining factor for its bio social development including both physical and mental well being. Nutritional status is the condition of health as influenced by the intake of food (Robinson, 1957).

Growth is a key component of nutritional status and indicator of health and well being of an individual and populations, with every aspect of a child's health being affected by his or her nutritional status. Here the assessment of nutritional status of infants and toddlers was done using anthropometry and clinical examination. The questionnaire to elicit information on anthropometric data is given Appendix IV.

3.4.a) Anthropometry

Changes in body dimensions reflect the overall health and welfare of individuals. Anthropometry is used to assess and predict performance, health and survival of individuals (Cogill, 2003). It is a simple valuable tool and the gold standard for evaluating nutritional status (Elizabeth, 1998).

Anthropometric measurements namely height, weight, mid upper arm circumference and head and chest circumference were taken in the present study to assess the nutritional status of the subjects.

3.4.a.1) Height For Age

Height is considered to reflect the intake of nutrients over considerable period of time especially protein nutrition (Pattanaik, 1994). Height for age serves as a good indicator of long term child health, reflecting prenatal and early childhood investments (Martorell and Habicht, 1986).

In the present study the height of the children were taken using an infantometer. At first the infantometer was placed on a table with a flat surface. The subject was laid on the board with the help of the mother, so that the child's head was against the base of the board. The assistant was asked to cup her hands over the child's ears and the ankles of the child were pressed firmly to the board. With the right hand of the investigator the foot piece was placed firmly against the child's heels. The measurement was made to the nearest 0.1 cm. The foot piece was removed and the child was taken from the board and the measurement was recorded.

For taking the height of the mothers, a flexible measuring tape was used. The respondent was made to stand erect and barefoot on a flat floor against a wall, with feet parallel and with heels, buttocks, shoulders and back of the head touching the wall. The head was held comfortably erect and a mark was made on the wall with the help of a book touching the top of the head horizontally; height was then measured using a flexible tape. Height was recorded to the nearest 0.5 cm. An average of three measurements was taken as the final measurement of the height of the mother.

3.4.a.2) Weight For Age

Body weight is the most widely used sensitive and simplest reproducible anthropometric measurement for the evaluation of nutritional status of young children (Srilakshmi, 2004). According to Anderson and coworkers (1997)



A. Height



B. Weight

Plate 1. Anthropometric Assessment

weight, the single most common measure taken in developing countries, reflects the degree of adequacy of both linear growth and mass to length status.

In the present study weight of the subjects who were below one year of age was taken using a pan balance. The balance was kept on a flat surface and was corrected for zero error. The child was kept in the balance with minimum clothing and weight was taken. The weight was recorded in kilograms with an accuracy of 0.1 kg. For subjects who were above one year, the weight was taken using a Salter scale. The scale was adjusted to zero error. The child was placed on the scale with minimum clothing, and then the weight was taken to the nearest 0.1kg.

The weights of the mothers were taken using a platform-weighing scale. The weighing balance was adjusted to zero before taking measurement. The respondent was made to stand on the weighing balance with minimum clothing and without foot wears. The respondent was asked to look straight. The weight was then recorded to the nearest 0.25 kg.

● **Computation of body mass index (BMI):** BMI was computed for the mothers using the weight and height measurements. BMI is considered to be a good indicator of nutritional status and functional status (Nutrition News, 1991). BMI is defined as a person's weight in kilograms divided by the square height in meters (Nube etal, 1998).

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height}^2 \text{ (m)}}$$

BMI provides direct nutritional information. Based on the BMI the respondents were graded following the procedure cited by James and co workers (1988).

- **Comparison of weight for height of infants and toddlers with the standard:**

Weight for height is considered as a good index for the evaluation of current nutritional status (Rao and Vijayaraghavan, 1986). Hence weight for height of the subjects was calculated. The percentage of deviation from the NCHS standards was computed and further classified as suggested by Waterlow (1987). Using this classification, children with low weight for height was categorized as ‘Wasted’ and those with height deficit were labeled as ‘Stunted.’

- **Computation of Z scores or SD scores:** Z score is used to grade undernutrition which allows us to measure all the three indices such as height for age, weight for age and weight for height and express the results in terms of Z scores or standard deviation units from the median of the international reference population (WHO, 1983).

The Z score or standard deviation unit (SD) is defined as the difference between the value for an individual and the median value of the reference population for the same age or height, divided by the standard deviation of the reference population. This can be written in equation form as:

$$\text{Z score} = \frac{(\text{observed value}) - (\text{median reference value})}{\text{Standard deviation of reference population}}$$

The Z score value of <1SD is considered normal, -1SD to -2SD is classified as mild malnutrition, -2SD to -3SD is classified as moderate malnutrition and >-3SD value is classified as severe malnutrition.

3.4a.3) Mid-Upper Arm Circumference

Mid-upper arm circumference (MUAC) is an easy and inexpensive way to detect childhood malnutrition (Roy, 2000). The arm circumference can give a fairly reliable assessment of nutritional status as deficit of muscles and fat is a constant clinical feature in malnutrition (Pattanaik, 1994).

Mid arm circumference of the subjects was taken in the left hand using a non-stretchable fiberglass tape. The child's elbow was flexed to 90 degree, with the palm facing upwards and midpoint between the shoulder was marked between the end of the shoulder and the tip of the elbow. The arm was then allowed to hang freely and the measuring tape was placed around the arm at the midpoint mark with out pressing the soft tissues and the measurement was taken. The reading was corrected to the nearest 0.1 cm.

3.4.a.4) Head and Chest Circumference

The measurement of head circumference has been shown to be associated with nutritional status in the first two years of life. These are guide to the degree of growth retardation (Pattanaik, 1994).

The chest in a normally nourished child grows faster than head during the second and third year of life. The chest circumference overtakes head circumference by about one year of age. If the child is malnourished, the head circumference remains to be higher than chest even at 2.5 years.

The measurement of head circumference of the subjects was taken using a fiber glass tape by steadying the subject's head. The measurement was done by passing the tape around the head over the supra-orbital ridges of the frontal bone in front and the most protruding point of the occiput on the back of the head. Measurements were made to the nearest 0.1 cm.

Measurements of chest circumference were also done using flexible fiber glass tape. The chest circumference was taken at the nipple level during mid inspiration. Measurements were made to the nearest 0.1 cm.



C. Mid-upper arm circumference



D. Head circumference



E. Chest circumference

Plate 1. Anthropometric Assessment

3.4.b) Clinical Examination

Clinical examination is the most important part of nutritional assessment as direct information of signs and symptoms of dietary deficiencies prevalent are obtained (Swaminathan, 2004). By this method physical signs denoting to deficiency nutrients in the diet can be ascertained.

In the present study, clinical examination of infants and toddlers was done with the help of a qualified physician using the proforma developed by National Institute of Nutrition. The incidence of the clinical signs and symptoms were then tabulated. The proforma used for clinical examination is given in Appendix V.

• Developing Nutritional status Index

Nutritional status index of the beneficiaries was computed using the parameters such as height, weight, MUAC, head circumference and chest circumference. The formula of NSI developed for the i^{th} sample was

$$NSI_j = \frac{\sum_{j=1}^k w_i X_{ij}}{\sum_{i=1}^n w_i}$$

$$w_i = \frac{1}{s_i^2}$$

s^2 = Variance of the i^{th} variables

| | | |
|-----------------|-------------------|-----------------------|
| X _{ij} | i = 1, 2, n | n = no of variables |
| | j = 1, 2, k | k = no of respondents |



Plate 2. Clinical examination

3.4) Assessment of home environment factors

Home is the place where the child starts to enrich his experiences. The whole environment for the child under three is the home and an optimal home environment will greatly promote normal child development. If a family has strong social support networks, it is more often able to provide the stimulating, nurturing and predictable environment needed for good development (Nair et al, 2004). Babies and young children need special attention because the care and attention a child receives in the first five years of life will influence his/her whole development.

In the present study, the home environment factors were assessed using the Home Observation for Measurement of the Environment (HOME Inventory) (Caldwell, & Bradley, 1984) standardized by Child Development Centre, Medical College. This tool is used to measure the quality and quantity of stimulation and support available to a child in the home environment. The focus is on the child in the environment, child as a recipient of inputs from objects, events, and transactions occurring in connection with the family surroundings. It is composed of items clustered into six subscales: parental responsiveness, acceptance of child, organization of the environment, learning materials, parental involvement and variety in experience. The scale was slightly modified for the purpose of this study, and two sets of items were selected, one for the infants (6-12 months) and the other for the toddlers (12-24 months). In this scale the total score possible for the infants was 19 and the total score possible for toddlers was 21. The home screening questionnaire is given in Appendix VI.

3.5.a) Development of Home Environment Index

A Home Environment Index was computed to measure the degree to which the environment at home is conducive to the healthy and regular growth of the child. The home environment index was computed as follows:

Let X_{ij} be the score obtained for the j th statement of the i th child and X_j be the maximum score that could be attained for the statement, then

$$HEI = \frac{\sum_{j=1}^n X_{ij}}{\sum_{j=1}^n X_j}$$

where, HEI = Home Environment index

Σ_j = Summation over j

n = No. of statements

Based on the mean and standard deviation of the home environment index, the subjects were classified into low, medium and high.

3.6) Assessment of Age Specific Attainment of Milestones in Children

In the present study, age specific attainment of milestones were assessed using a chart known as Trivandrum Developmental Screening Chart which has been developed by Child Development Centre, Medical College, Thiruvananthapuram (shown in Appendix VII) which is currently being used in the ICDS blocks. The chart consists of 17 items which is designed for children up to 24 months of age. The chart consists of vertical and horizontal lines in which vertical lines represent the age of child in months and horizontal lines represents the corresponding milestones which the child has to reach with in the given period. A vertical line is drawn at the level of the age of the child under study. The child is considered to have a developmental delay if the child falls short on the left side of the vertical line. The total score obtained by the child was then computed and developmental mile stone ratio was calculated using the formula

$$DMR_i = \frac{X_i}{n_t}$$

DMR_i = Developmental Milestone Ratio Index

n_t = No: of developmental milestones applicable for a t year old child

X_i = No: of developmental milestones child has achieved

Based on the mean and standard deviation of the developmental milestone index, the milestone achievement of the subjects was classified into delayed, subnormal and timely/normal.

3.7) Mother's knowledge regarding nutrition and child development

Studies demonstrate positive association between mother's knowledge and their children's health and nutritional status. Based on review of literature and discussion with ICDS supervisors and workers, a teacher made test on developmental aspects of child nutrition was prepared and administered to the mothers. Twenty three items were collected from the available literature and on consultation with child development experts. Out of this, fifteen items were selected after conducting a pilot study in two anganwadis. It is given in Appendix VIII. The mothers were asked to go through the fifteen statements of the test and to mark the statement as correct or incorrect. A score of 1 was assigned for correct answer and 0 for wrong answer. The maximum score that could be obtained for the knowledge test was 15.

$$\text{Knowledge score} = \frac{X_i}{15}$$

X_i = Number of items that was stated correctly by a mother of the i^{th} child

4) Analysis and Consolidation of Data

The data collected was coded and consolidated and subjected to statistical analysis. The statistical procedures used were mean, percentage, correlation and chi square.

Results

4. RESULTS

The results of the study entitled ‘Nutritional status and home environment as determinants of attainment of developmental milestones in children’ are presented under the following heads.

- 4.1 Personal and socio-economic characteristics of the subjects.
- 4.2 Child’s characteristics.
- 4.3 Feeding practices of the subjects.
- 4.4 Nutritional status of the subjects.
- 4.5 Home environment of the subjects.
- 4.6 Milestone attainment of the subjects.
- 4.7 Knowledge of mothers regarding nutrition and child development.
- 4.8 Relationship between dependant variables and selected independent variables.
- 4.9 Inter-relationship between the dependant variables.

4.1 PERSONAL AND SOCIOECONOMIC CHARACTERISTICS OF THE RESPONDENTS

Personal and socioeconomic characteristics of respondents surveyed were assessed in order to elicit information regarding their age, type of family, family size, educational status and monthly income. Details regarding their physical amenities were also collected.

4.1.1 Personal characteristics

Age: Table 1: Age wise distribution of mothers of subjects

| Age in years | Infants | Toddlers | Total |
|--------------|----------|----------|-----------|
| <20 | 1 (2) | 2 (4) | 3 (3) |
| 20-25 | 30 (60) | 22 (44) | 52 (52) |
| 25-30 | 16 (32) | 21 (42) | 37 (37) |
| >30 | 3 (6) | 5 (10) | 8 (8) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage

The table shows that, among the respondents surveyed, two percent of mothers among the infant group and 4 per cent of the mothers among the toddler group belonged to less than 20 years of age group. Among the 20-25 years of age group, 44 percent of mothers belonged to toddler group. Thirty two percent of mothers in the infant group belonged to 25-30 age group and 42 per cent belonged to toddler group. Mothers above 30 years among the infant group were 6 per cent and 10 per cent were from toddler group.

Table2: Age wise distribution of fathers of infants and toddlers

| Age in years | Infants | Toddlers | Total |
|--------------|---------|----------|-----------|
| 25-30 | 19 (38) | 21(42) | 40 (40) |
| 30-35 | 27 (54) | 18 (36) | 45 (45) |
| 35-40 | 4 (8) | 11 (22) | 15 (15) |
| Total | 50(100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

Table 2 shows that 38 per cent of fathers of infant group and 42 per cent of fathers of toddlers belonged to 25-30 age group. Fathers of 54 per cent of infant group and 36 per cent toddler group belonged to 30-35 age group. The table depicts

that only 8 per cent of fathers of infants group and 22 per cent from toddler group belonged to 35-40 of age.

Religion: Table 3 depicts the religion wise distribution of infants and toddlers.

Table 3: Religion wise distribution of the families

| Religion | Infants | Toddlers | Total |
|-----------|----------|----------|-----------|
| Hindu | 31 (62) | 27 (54) | 58 (58) |
| Muslim | 7 (14) | 9 (18) | 16 (16) |
| Christian | 12 (24) | 14 (28) | 26 (26) |
| Total | 50 (100) | 50(100) | 100 (100) |

Figures in parenthesis indicates percentage

Table 3 reveals that of most of the families (58%) were Hindus while 26 per cent were Christians. Only 16 per cent of the families belonged to Islam community.

Caste: Table 4: Caste wise distribution of families

| Caste | Infants | Toddlers | Total |
|----------|----------|----------|-----------|
| Forward | 12 (24) | 18 (36) | 30(30) |
| Backward | 25 (50) | 16 (32) | 41 (41) |
| SC/ST | 13 (26) | 16(32) | 29 (29) |
| Total | 50 (100) | 50(100) | 100 (100) |

Figures in parenthesis indicate percentage.

From table 4, it can be noticed that majority (41 per cent) of the families belonged to backward castes. It can be seen that 30 percent of the families belonged to forward castes and 29 per cent belonged to SC/ST groups.

4.1.2. Social characteristics

Family Type: Family type was classified into nuclear, joint and extended based on composition. Joint families included parents, children, grandparents and other relatives, where as extended families had parents, their children and one or two relatives residing in the family and nuclear families had only parents and their children under the same roof.

Table 5: Type of family

| Type of family | Infants | Toddlers | Total |
|----------------|----------|----------|-----------|
| Nuclear | 27 (54) | 21 (42) | 48 (48) |
| Joint | 12 (24) | 10 (20) | 22 (22) |
| Extended | 11 (22) | 19 (38) | 30 (30) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

Table 5 above shows that 48 per cent of the subjects belonged to nuclear families, 30 per cent belonged to extended family type and only 22 percent of families belonged to joint family type.

Family Size: Family size represents the total number of members in the family.

Table 6: Family size

| Size of Family | Infants | Toddlers | Total |
|----------------|---------|----------|-----------|
| 1-4 members | 29 (58) | 18 (36) | 47 (47) |
| 5-6 members | 14 (28) | 22 (44) | 36 (36) |
| >7 members | 7 (14) | 10 (20) | 17 (17) |
| Total | 50 | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

Table 6 depicts that 47 per cent of the families were small families comprising four members, 36 percent were medium families having 5-6 members and 17 percent were large families having more than seven members.

Educational status of parents: The parental educational level of the sample when assessed ranged from illiterate to pre-degree level.

Table 7: Educational status of mothers

| Educational level | Infants | Toddlers | Total |
|-------------------|----------|----------|-----------|
| Illiterate | | 3 (6) | 3 (3) |
| Lower primary | 10 (20) | 8 (16) | 18 (18) |
| Upper primary | 13 (26) | 15 (30) | 28 (28) |
| High School | 27 (54) | 24 (46) | 50 (50) |
| Pre Degree | - | 1 (2) | 1 (1) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage.

Table 7 shows that majority of the mothers were literate. Only 3 per cent of the mothers were found to be illiterate while 50 per cent had studied till S.S.L.C. and 18 per cent had lower primary educational level.

Table 8: Educational level of Fathers

| Educational level | Infants | Toddlers | Total |
|-------------------|----------|----------|-----------|
| Illiterate | - | 3 (6) | 3 (3) |
| Lower Primary | 10 (20) | 13 (26) | 23 (23) |
| Upper Primary | 27 (54) | 25 (50) | 52 (52) |
| High School | 11 (22) | 9 (18) | 20 (20) |
| Pre Degree | 2 (4) | - | 2 (2) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

The educational status of fathers presented in table 7 reveals that 52 per cent had completed upper primary level and only 3 per cent were illiterate. The table reveals that 23 per cent had completed lower primary and 20 per cent had done their high school. Only 2 percent of fathers had studied up to Pre Degree level.

Parental Employment Status: The employment pattern gives an idea about the nature of activities and the extent to which the parents of the subjects are employed or unemployed which gives an indication about their family income.

Table 9: Occupational status of fathers

| Occupation | Infants | Toddler | Total |
|-----------------|----------|----------|-----------|
| Casual Labourer | 39 (78) | 43 (86) | 82 (82) |
| Part Time | 11 (22) | 7 (14) | 18 (18) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

Table reveals that majority (82%) of the fathers were casual labourers while 18 per cent were engaged in part time jobs.

Table 10: Occupational status of mothers.

| Occupation | Infants | Toddlers | Total |
|-----------------|----------|----------|-----------|
| Housewives | 43 (86) | 37 (74) | 80 (80) |
| Self employment | 7 (14) | 11 (22) | 18 (18) |
| Casual Laborers | - | 2 (4) | 2 (2) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

Table 10 reveals that majority (80%) of the mothers was housewives and only 2 per cent were casual laborers while 18 per cent of mothers were self employed.

Family Income: Examination of monthly income of families gives an indication of their purchasing capacity and economic status.

Table 11: Total income of the family

| Total monthly Income | Infants | Toddlers | Total |
|----------------------|----------|----------|-----------|
| 1000-1500 | 39 (78) | 35 (70) | 74 (74) |
| 1501-2000 | 8 (16) | 6 (12) | 14 (14) |
| 2001-2500 | 3 (6) | 9 (12) | 12 (12) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

Data presented in table 11 depicts that the monthly income of the families ranged from Rs.1000-2500. Majority of the families (74 %) had an income between Rs. 1000-1500 and 12 per cent of the families had a monthly income between Rs.2001 to 2500. Forteen percent of the families belonged to the income group of Rs.1501-2000.

4.1.3. Physical Amenities at the house hold level: Table 12 depicts the physical amenities at the house hold level of the respondents.

Table 12: Physical amenities at the household level

| Type of house | Infants | Toddlers | Total |
|---------------|----------|----------|-----------|
| Thatched | 16 (32) | 13 (26) | 29 (29) |
| Tiled | 17 (34) | 16 (32) | 33 (33) |
| Terrace | 4 (8) | 6 (12) | 10 (10) |
| Sheet | 13 (26) | 15 (30) | 28 (28) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage.

Table depicts that 29 per cent of the families had thatched roofing, 33 per cent had tiled roofing, 28 per cent had sheeted roofing and only 10 per cent had terraced roofing.

Table 13: Facility of water supply

| Drinking Water | Infants | Toddlers | Total |
|-----------------|----------|----------|-----------|
| Well | 23(46) | 27 (54) | 50 (50) |
| Tap | 18 (36) | 7 (14) | 25 (25) |
| Public Well/Tap | 9 (18) | 16 (32) | 25 (25) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage.

From the above table, it can be seen that 50 per cent of the families fetched water from well. Tap water was used by 25 per cent of the families and another 25 per cent families got drinking water from public well or tap.

Table 14: Facility of Latrine

| Latrine | Infants | Toddlers | Total |
|---------|----------|----------|-----------|
| Yes | 39 (18) | 41 (82) | 80 (80) |
| No | 11 (22) | 9 (18) | 20 (20) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage

As summarized in table14, it can be found that 80 per cent of the families had latrine facility while 20 per cent had no facility of latrine of their own.

4.2 CHILD'S CHARACTERISTICS

The subjects selected for the study were 50 infants and 50 toddlers forming a total of hundred children.

Sex wise distribution of infants revealed that in the infant group there were 26 (52%) males and 24 females (48%). In the toddler group there were 29 (58%) males and 21 (42%) females.

Table15: Sex wise distribution of subjects

| Subjects | Male | Female | Total |
|----------|---------|---------|----------|
| Infants | 26 (52) | 24 (48) | 50 (100) |
| Toddlers | 29 (58) | 21 (42) | 50 (100) |

Figures in parenthesis indicate percentage.

4.2.1 Ordinal Position.

The ordinal position of children as revealed from table 16 shows that 13 (26 percent) infants belonged to 3rd birth order while 20 (40percent) were of 2nd birth order and 17 (34 percent) were of first birth order. Enquiry on the ordinal position of toddlers revealed that 16 (32 percent) were of 3rd birth order while 9 (18 percent) were of 2nd birth order and 25 (50 percent) were of first birth order.

Table16: Ordinal position of subjects

| Ordinal Position | Infants | Toddlers | Total |
|------------------|----------|----------|-----------|
| 1 | 17 (34) | 25 (50) | 42 (42) |
| 2 | 20 (40) | 9 (18) | 29 (29) |
| 3 | 13 (26) | 16 (32) | 29 (29) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage

4.2.2 Birth Weight

The birth weight of the subjects were collected from the health cards and the children were classified into four groups based on weight in kilograms viz., very low (≤ 1.5), low (1.5-2.5 kg), normal (2.5-3.7kg) and above normal (>3.7 kg) as explained by Ghai (1998).

Table 17: Birth weight of subjects

| Birth Weight | Infants | Toddlers | Total |
|----------------------|---------|----------|-----------|
| Very low (<1.5) | 1 (2) | - | 1 (1) |
| Low (1.5-2.5) | 8 (18) | 11 (26) | 19 (19) |
| Normal (2.5-3.75) | 37 (74) | 33 (66) | 70(70) |
| Above normal (>3.75) | 4 (8) | 6 (12) | 10 (10) |
| Total | 50 | 50 | 100 (100) |

Figures in parenthesis indicates percentage

It can be observed from table16 that 74 percent of infants and 66 percent of toddlers had normal birth weight. It can also be noted that 8 per cent of the infants and 12 per cent of the toddlers had a birth weight above 3.75kg. Low birth weight was seen among 18 per cent of the infants and 26 per cent of the toddlers. Only 2 per cent of the infants were found to have low birth weight.

4.2.3 Type of Delivery

Table 18: Type of delivery

| Type of Delivery | Infants | Toddlers | Total |
|------------------|----------|----------|-----------|
| Normal | 39 (78) | 41 (82) | 80 (80) |
| Caesarian | 11 (22) | 9 (18) | 20 (20) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage.

From table 17 it can be seen that 78 percent of infants were born of normal delivery and 22 percent were born of caesarian delivery. Among toddlers 82 percent were born of normal delivery and 18 percent were born of caesarian section.

4.2.4 Immunization

Enquiry on immunization schedule revealed that 100% of infants were given immunization against the major killer diseases as per schedule.

4.2.5 Illness History

An enquiry on the incidences of childhood diseases was done. It was seen that 22 percent of infants and 26 percent of toddlers had frequent illnesses like fever and cough. Diarrhoea was common among 20 percent of the infants and 26 percent of toddlers. Every time there was an incidence of disease, the child was taken to the hospital immediately.

4.3. FEEDING PRACTICES OF THE SUBJECTS

4.3.1 First Feed: Table 19 depicts the feeds that were given at first after birth.

Table 19: Items given as first feed

| Items | Infants | Toddlers | Total |
|-------------|----------|----------|----------|
| Colostrum | 43 (86) | 42 (84) | 85 (85) |
| Honey | 4 (8) | 4 (8) | 8 (8) |
| Sugar water | 3 (6) | 3 (6) | 6 (6) |
| Plain Water | - | 1 (2) | 1 (1) |
| Total | 50 (100) | 50 (100) | 100(100) |

Figures in parenthesis indicates percentage

From table 18, it is revealed that 86 percent of infants and 84 percent of toddlers were found to be given colostrum as the first feed. While 8 per cent were given honey, 6 per cent were given sugar water and 1 per cent just plain water.

4.3.2 Breast feeding pattern

When enquired about the introduction of breast feeding it was revealed that 85 percent of mothers breast fed within half an hour.

Table 20: Distribution of subjects according to the breast feeding pattern.

| Breast Feeding Pattern | Infants | Toddlers | Total |
|-------------------------------|----------|----------|-----------|
| Convenient time of the mother | 9 (18) | 7 (14) | 16 (16) |
| Forced Feeding | 10 (20) | 6 (12) | 16 (16) |
| Demand Feeding | 31 (62) | 37 (74) | 68 (68) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage.

As summarized in table 19, 62 percent of the infants and 74 percent of the toddlers were fed breast milk on demand. While 20 percent of the infants and 12 percent of the toddlers were given forced feeding, 18 percent among the infants and 14 percent among the toddlers were fed according to the convenience of the mother.

4.3.3 Duration of Breast Feeding:

The details pertaining to the duration of breast feeding are given in the table,

Table 21: Duration of breast feeding

| Months | Infants | Toddlers | Total |
|--------|----------|----------|-----------|
| 3 | 12 (24) | 17 (34) | 29 (29) |
| 4 | 11 (22) | 14 (28) | 25 (25) |
| 5 | 27(54) | 19(38) | 46 (46) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

As depicted above, it can be noticed that 24 percent of the infants and 34 percent of the toddlers were given breast milk upto 3 months. It can be also noted that 54 percent of the infants and 38 percent of the toddlers were breast fed upto five months.

4.3.4 Weaning and Supplementary Feeding

4.3.4.a Bottle feeding

Table 22: Distribution of subjects based on the initiation of bottle feeding

| Initiation of Bottle feeding | Infants | Toddlers | Total |
|------------------------------|---------|----------|---------|
| 3 months | 17 (34) | 19 (38) | 36 (36) |
| 4 months | 15 (30) | 15 (30) | 30 (30) |
| 5 months | 18 (36) | 16(32) | 34 (34) |

Figures in parenthesis indicate percentage.

As shown in table 21, bottle feeding were initiated to 34 percent of infants and 14 percent of toddlers at 3 months. It can be seen that 32 percent of the toddlers and 36 percent of infants were bottle fed at 5 months.

When the reason for giving bottle feed was assessed, most of the mothers told that there was lack of breast milk. Some mothers reported that the mothers felt breast milk alone is insufficient to meet the requirements of the child.

Table 23: Distribution of subjects according to the frequency of bottle feeding

| No. of Feeds | Infants | Toddlers | Total |
|--------------|---------|----------|---------|
| 1-2 | - | 43 (86) | 43 (43) |
| 3-4 | 31 (62) | 7 (14) | 38 (38) |
| 5-6 | 8 (14) | - | 8 (8) |
| 7-9 | 11 (22) | - | 11 (11) |

Figures in parenthesis indicate percentage.

From table 22, it can be seen that 86 percent of the toddlers were given bottle feed 1-2 times a day. It can also be seen that 62 percent of the infants and 14 percent of the toddlers were bottle fed 2-3 times a day.

When enquired about the type of bottle feeds given, it was revealed that 78 percent of infants and 90 percent of the toddlers were given cows milk while 22 percent of infant and 12 percent of toddlers were given goat's milk.

Table 24: Distribution of the subjects according to the problems associated with bottle feeding

| Problems | Infants | Toddlers | Total |
|--------------|---------|----------|---------|
| Diarrhoea | 8 (16) | 5 (10) | 13 (13) |
| Vomiting | 6 (12) | 3 (6) | 9 (9) |
| Constipation | 5 (10) | 5 (10) | 10 (10) |

Figures in parenthesis indicate percentage.

From table 23, it can be noted that 16 percent of the infants and 10 percent of the toddlers suffered from diarrhoea. Vomiting was seen among 12 percent of infants and 6 percent of toddlers and constipation was seen among 10 percent of the subjects.

Table 25: Distribution of the subjects according to the time of introduction of complementary feeding

| Time of introduction | Infants | Toddlers | Total |
|----------------------|----------|----------|-----------|
| After 3 months | - | 7 (14) | 7 (7) |
| After 4 months | 23 (46) | 21(42) | 44 (44) |
| After 5 months | 19 (38) | 14 (28) | 33 (33) |
| After 6 months | 8 (16) | 8 (16) | 16 (16) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage.

Table 24 revealed that 14 percent of the toddlers were given complementary feeding after 3 months. While 46 percent of infants and 42 percent of toddlers were given complementary feeding after 4 months, 38 percent of infant and 28 percent of the toddlers were given complementary feeding after 5 months and only 16 percent of infants and toddlers were complementary food after 6 months.

Table 26: Distribution of the subjects according to the type of weaning food given

| Type of food | Infants | Toddlers | Total |
|-----------------------|----------|----------|-----------|
| Ragi | 11 (22) | 12 (24) | 23 (23) |
| Banana Flour | 7 (14) | 15(30) | 22 (22) |
| Ragi and Banana flour | 29 (58) | 23 (36) | 52 (52) |
| Cerelac | 3 (6) | - | 3 (3) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

From table 25, it is revealed that 58 percent of the infants and 36 per cent of toddlers were given ragi and banana flour while 22 percent of infants and 24 per cent of toddlers were given ragi alone. Banana flour was given to 14 percent of infants and 30 per cent of toddlers. It was also noted that only 6 per cent of infants were given cerelac.

Table 27: Consistency of weaning food.

| Consistency | Infants | Toddlers | Total |
|----------------|----------|----------|-----------|
| Liquid form | 23(42) | 10 (20) | 33 (33) |
| Semisolid form | 27 (54) | 40 (80) | 67 (67) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

It can be seen from table 26 that 54 percent of infants and 80 per cent of toddler group were given complementary food in semisolid form while 42 percent among infant group and 20 per cent among toddler group were given in liquid form.

4.3.5 Feed Management

It was found that mothers of 85 percent of infants and 78 percent of toddlers fed their children themselves. In the absence of mother, grand parents or relatives

took care of children. It was seen that 80 percent of mothers boiled the bottle before feeding.

4.3.6 Information regarding food supplements from Anganwadi

Among the subjects 14 percent of the infants and 12 percent of toddlers were found to be beneficiaries of anganwadi.

4.4 NUTRITIONAL STATUS OF THE SUBJECTS

Assessment of nutritional status of mothers and children in the present study was done using anthropometric measurements and clinical examination.

4.4.1 Anthropometric Measurements

Anthropometry is concerned with the measurements of the variations of physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition. It is one of the simplest methods of assessment of growth and development, especially of infants (Bisali and Bhan, 2005).

Anthropometric measurements recorded in the present study include weight, height, head and chest circumference and mid-upper arm circumference. Mother's anthropometric measurements such as height and weight were also taken and BMI was calculated. The data obtained with respect to anthropometric parameters and the prevalence and extent of malnutrition among the children and mothers based on anthropometry are presented below.

4.4.1.1 Height and weight profile of mothers

Heights of the mothers of infants and toddlers were measured and these ranged from 148-165cms and their weights ranged from 40-67 kg. Heights and weights of the mothers of toddlers ranged from 137-168cm and 33.76 kg respectively.

4.4.1.1.2 Body Mass Index

Body mass index of the mothers was computed in order to classify them according to different categories like chronic energy deficit (CED), normal and obese.

Table 28: Distribution of mothers based on their BMI

| BMI classification* | Number | Percentage |
|-----------------------------------|--------|------------|
| <16.0 CED Grade III (severe) | 7 | 7 |
| 16.1-17.0 CED Grade-II (Moderate) | 4 | 4 |
| 17.1-18.5 CED Grade I (Mild) | 11 | 11 |
| 18.5-20.0 (Low weight, Normal) | 17 | 17 |
| 20.0-25.0 (Normal) | 47 | 47 |
| 25.0-30.0 (Obese-Grade I) | 13 | 13 |
| <30.0 (Obese-Grade II) | 1 | 1 |
| Total | 100 | 100 |

*Source-James et al, 1988.

Table 28 reveals that 7 percent of the mothers belonged to chronic energy deficit grade III and 4 per cent belonged to chronic energy deficit grade II. Chronic energy deficit grade I was found in 11 per cent of the mothers and 17 per cent belonged to low weight normal category. Mothers who belonged to normal category were 47 per cent and those belonging to obese grade I were 13 per cent. Only 1 per cent of the mothers were found to be in obese grade I category.

4.4.1.2 Weight for age profile of infants and toddlers

Weight for age measurement represents a convenient synthesis of both linear growth and body proportion clinically (WHO, 1995). In the present study details of body weight of infants and toddlers were recorded. The body weight of infants and toddlers ranged from 5-13 kg. The weight

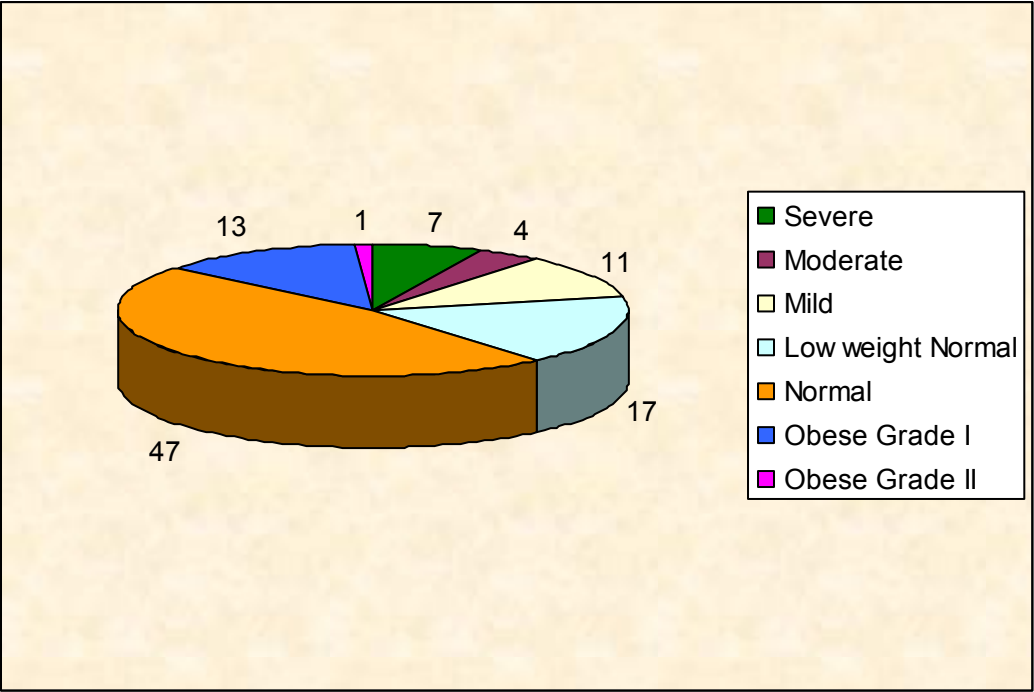


Fig. 1 Distribution of mothers based on BMI (in %)

for age data was used to categorize the subjects into different grades of malnutrition based on Gomez (1956) classification, classification based on Indian Academy of Pediatrics (1972) and weight for age Z score (WHO,1983).

Table29: Distribution of infants and toddlers based on Gomez classification

| Type/ Degree of malnutrition | Infants | Toddlers | Total |
|------------------------------|---------|----------|-----------|
| Normal (>90) | 25 (50) | 14 (28) | 39 (39) |
| Mild (75-90) | 15 (30) | 10(20) | 25 (25) |
| Moderate (60-75) | 9 (18) | 17(34) | 26 (26) |
| Severe (<60) | 1 (2) | 9 (18) | 10 (10) |
| Total | 50 (50) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage.

The weight for age data of the respondents was used to classify them into different grades of malnutrition following Gomez classification. The distribution of the subjects' current nutritional status as per Gomez classification revealed that 50 per cent of the infants and 28 per cent of the toddlers were normal. Mild malnutrition was seen among 30 per cent of the infants and 20 per cent of the toddlers. Moderate degrees of malnutrition were seen among 18 per cent of the infants and 34 per cent of the toddlers 26. It may also be noted that 2 per cent of children in the infant group and 18 per cent of the toddler group belonged to severe degrees of malnutrition.

Table 30: Distribution of subjects based on IAP classification

| Type/Degree of malnutrition | Infants | Toddlers | Total |
|-----------------------------|----------|----------|-----------|
| Normal (>80) | 37 (74) | 21 (42) | 58 (58) |
| Grade I (70-80) | 7 (14) | 7 (14) | 14 (14) |
| Grade II (60-70) | 5 (10) | 13 (26) | 18 (18) |
| Grade III (50-60) | 1 (2) | 3 (6) | 4 (4) |
| Grade IV (<50) | - | 6 (12) | 6 (6) |
| Total | 50 (100) | 50 (100) | 100 (100) |

*Source: IAP, 1972. Figures in parenthesis indicates percentage.

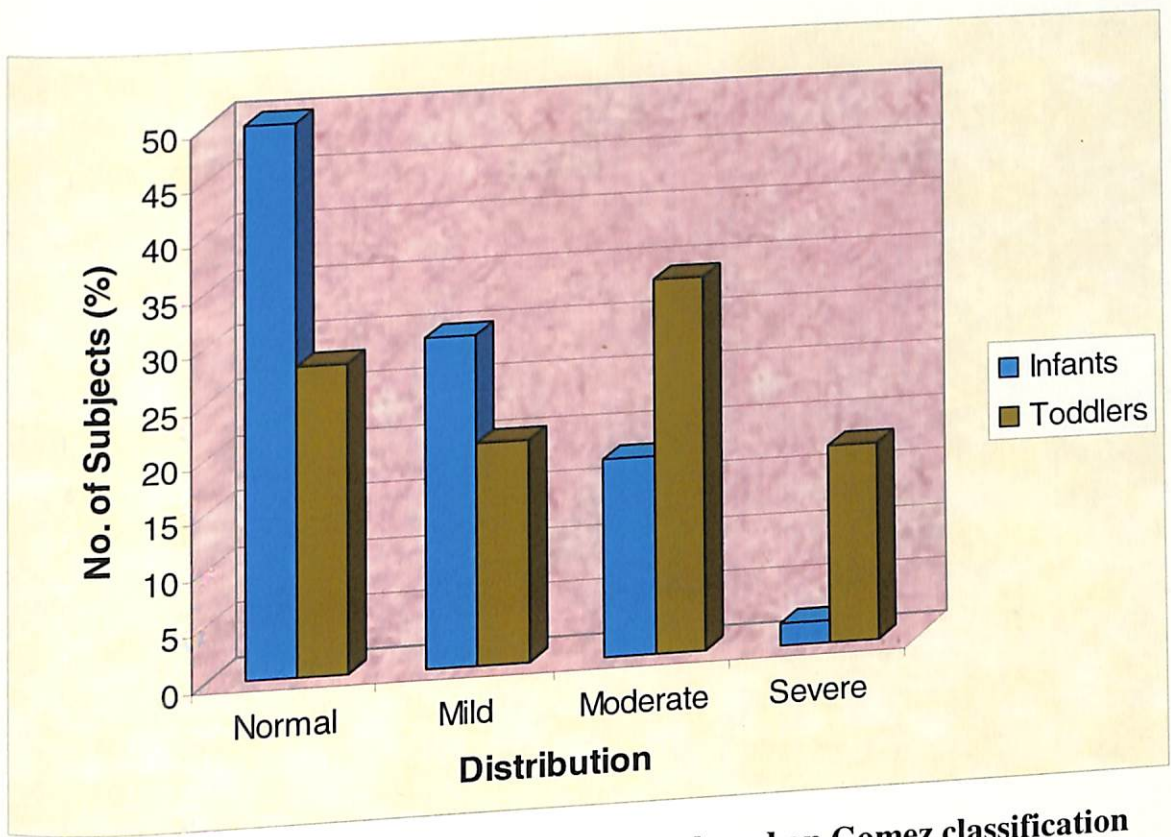


Fig.2 Distribution of infants and toddlers based on Gomez classification

Data presented in the table reveals that 58 per cent of the infants and toddlers were normal. The table also revealed that 14 per cent of infants and toddlers were suffering from Grade I malnutrition. While 18 per cent of the subjects came under Grade II malnutrition, 4 per cent were seen to be suffering from grade III malnutrition. It was found that in the infant group no one suffered from IVGrade malnutrition but 12 per cent in the toddler group were found to be suffering from Grade IV malnutrition.

Table 31: Distribution of subjects based on weight for age Z score

| Grades of malnutrition | Type of malnutrition | Infants | Toddlers | Total |
|------------------------|----------------------|----------|----------|-----------|
| > -1 SD | Normal | 30 (60) | 15 (30) | 45 (45) |
| -1SDU to 2SD | Mild | 9 (18) | 14 (28) | 23 (23) |
| -2SDU to 3SD | Moderate | 8 (16) | 11 (22) | 19 (19) |
| <-3SD | Severe | 3 (6) | 10 (20) | 13 (13) |
| Total | | 50 (100) | 50 (100) | 100 (100) |

*Source: WHO, 1983. Figures in parenthesis indicate percentage.

It can be seen from table 31 as per weight for age Z score classification that 60 per cent of the infants and 30 per cent of the toddlers were normal. Mild degree of malnutrition was seen in 18 per cent and 28 per cent of the two groups respectively. It can be found that 19 per cent of the groups were suffering from moderate degree of malnutrition. While 20 per cent of the toddlers came under severe degree of malnutrition, only 6 per cent of infants were found to coming under severe degree of malnutrition.

4.4.1.3 Height for age profile of infants and toddlers

Height for age data of children was used to classify malnutrition as per height for age Z score.

Table 32: Distribution of infants and toddlers based on height for age Z score

| Grades of malnutrition | Type of malnutrition | Infants | Toddlers | Total |
|------------------------|----------------------|----------|----------|-----------|
| > -1 SD | Normal | 31 (62) | 25 (50) | 56 (56) |
| -1SDU to 2SD | Mild | 8 (16) | 9 (18) | 17 (17) |
| -2SDU to 3SD | Moderate | 7 (14) | 9 (18) | 16 (16) |
| <-3SD | Severe | 4 (8) | 7 (14) | 11 (11) |
| Total | | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage

From table 32, it can be seen that as per height for age Z score classification, 62 per cent of infants and 50 per cent of toddlers had normal height for age. Mild malnutrition was found in 16 and 18 per cent of infants and toddlers respectively while moderate malnutrition was found in 14 per cent of the infants and 18 per cent of the toddlers. Eight per cent of infants and seven per cent of toddlers were found to have severe malnutrition.

4.4.1.4 Weight for height profile of infants and toddlers

Weight for height is reported to be a good prognostic indicator, particularly of severe malnutrition. The data on weight for height of the subjects were used to classify malnutrition as per Waterlow's classification (1987) and weight for height Z score.

Table 33: Distribution of subjects based on Waterlow's classification

| Type of malnutrition | Infants | Toddlers | Total |
|----------------------|----------|----------|-----------|
| Normal | 29 (58) | 16 (32) | 45 (45) |
| Wasting | 6 (12) | 3 (6) | 9 (9) |
| Stunting | 11 (22) | 12 (24) | 23 (23) |
| Wasting and Stunting | 4(8) | 14 (28) | 23 (23) |
| Total | 50 (100) | 50 (100) | 100 (100) |

*Source: Waterlow, 1987 Figures in parenthesis indicates percentage.

The data given in the table reveals that 58 per cent of the infants and 32 per cent of the toddlers were normal. Wasting was observed among 12 per cent of infants and 6 per cent of toddlers which indicates short duration malnutrition associated with low weight gain. Stunting was observed among 22 per cent of infants and 24 per cent of toddlers which reveal that there was height deficit which is an indication of previous events of malnutrition. It may also be noted that 23 per cent of subjects had stunting along with wasting which indicates acute and chronic malnutrition.

Table 34: Distribution of subjects based on weight for height Z score.

| Grades of malnutrition | Type of malnutrition | Infants | Toddlers | Total |
|------------------------|----------------------|----------|----------|-----------|
| > -1 SD | Normal | 31 (62) | 24 (48) | 55 (55) |
| -1SD to -2SD | Mild | 5 (10) | 13 (26) | 15 (15) |
| -2SD to -3 SD | Moderate | 10 (20) | 7 (14) | 19 (19) |
| <-3 SD | Severe | 4 (8) | 6(12) | 11 (11) |
| Total | | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicate percentage.

As depicted in table 33, based on weight for height Z scores, it can be found that 55 per cent of the children were normal. In the infant group 10 percent and 26 per cent in the toddler group were having mild malnutrition. Moderate malnutrition was more among infants with 20 percent and 14 per cent from the toddlers. While 12

per cent in the toddler group were severely malnourished, only 8 per cent among the infants were severely malnourished.

4.4.1.5. Mid- upper arm circumference profile of infants and toddlers

Table 35: Distribution of the subjects based on MUAC

| Grades | Type of malnutrition | Infants | Toddlers | Total |
|-----------|----------------------|----------|----------|-----------|
| >13.5 | Normal | 35 (70) | 31 (62) | 66 (66) |
| 12.5-13.5 | Mild malnutrition | 10 (20) | 9 (18) | 19 (19) |
| <12.5 | Severe malnutrition | 5 (10) | 10 (20) | 15 (15) |
| Total | | 50 (100) | 50 (100) | 100 (100) |

*Source: Gopaldas, 1987. Figures in parenthesis indicate percentage.

Table 34 revealed that based on MUAC, 70 per cent of the infants and 62 per cent of the toddlers were normal. Mild malnutrition was seen among 19 per cent of the subjects. Of the subjects 10 per cent among infants and 20 per cent of the toddlers were found to be suffering from severe degree of malnutrition which is an indication of wasting.

4.3.1.5 Head and chest circumference

The head and chest circumference of the infants ranged from 41 to 47cms and that of the toddlers ranged from 40-48cms. The chest circumference of the infants ranged from 41cms to 47cms and that of the toddlers ranged from 41 to 49cms.

4.3.1.5.1 Head/ chest circumference ratio

Utilizing the measurements pertaining to head and chest circumferences, 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). According to Gopaldas and Sheshadri (1987) head/chest circumference ratio is classified as ≤ 1 as malnourished and ≥ 1 as normal.

Table 36: Distribution of the subjects based on head/chest circumference ratio.

| Grades | Infants | Toddlers | Total |
|-----------------|----------|----------|-----------|
| ≥1 Normal | 46(92) | 39(78) | 85 (85) |
| <1 Malnourished | 4 (8) | 11(22) | 15(15) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figure in parenthesis indicate percentage.

As revealed from table 35, 92 per cent of the infants and 78 per cent of toddlers were found to be normal. Among infants 8 per cent were found to be malnourished and 22 per cent of the toddlers were found to be malnourished.

4.3.2. Clinical Examination

Table 37: Clinical symptoms of deficiency diseases observed.

| Clinical signs of deficiency | Infants | Toddlers | Total |
|------------------------------|---------|----------|---------|
| Anemia | 3 (6) | 9 (18) | 12 (12) |
| Sparse hair | 2 (4) | 4 (8) | 6 (6) |
| Discoloration of hair | 1 (2) | 7 (14) | 8 (8) |
| Angular stomatitis | - | 5 (10) | 5 (5) |

Figures in parenthesis indicate percentage

It can be seen from table 36 that 6 per cent among infants and 18 per cent among the toddlers were having anemia. Sparse hair was seen among 4 per cent of infants and 8 per cent of toddlers. Among infants 2 per cent and 14 per cent of the toddlers were found to have discoloration of hair. Symptoms of angular stomatitis were seen among 10 per cent of the toddlers.

4.3.3. Nutritional Status Index

A nutritional status index of infants and toddlers were developed using parameters such as height, weight, mid-upper arm circumference, head circumference and chest circumference.

Table 38: Distribution of subjects based on their Nutritional Status Index

| NSI | Infants | Toddlers | Total |
|--------|----------|----------|-----------|
| Low | 4 (8) | 7 (14) | 11 (11) |
| Medium | 38 (76) | 31 (62) | 69 (69) |
| High | 8 (16) | 12 (24) | 20 (20) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage.

The mean value of NSI of infants was 33.89 and standard deviation was 0.72. The infants were classified based on their NSI as those above mean + S.D as high, those between \pm S.D as medium and infants below mean- S.D as low NSI.

Table 38 depicts that 76 per cent of the infants had medium NSI, 16 per cent had high NSI and 8 per cent had low NSI.

The mean value of NSI for toddlers was 28.9 and S.D was 1.27. Table 37 depicts that 62 per cent of the toddlers had medium NSI, 24 per cent had high NSI and 14 per cent had low NSI.

4.5. HOME ENVIRONMENT OF THE SUBJECTS

Home environment of infants and toddlers were assessed using modified version of HOME inventory by Caldwell and Bradley (1984) comprising of six subscales covering areas like parental responsiveness, acceptance of the child, organization of the environment, learning materials, parental involvement and variety in experience. Based on the above, those infants and toddlers having home environment index above mean + standard deviation were classified as having highly positive environment, those having home environment index equal to mean \pm standard deviation as moderately positive home environment and those having home environment index equal to mean – standard deviation were classified as having least positive home environment.

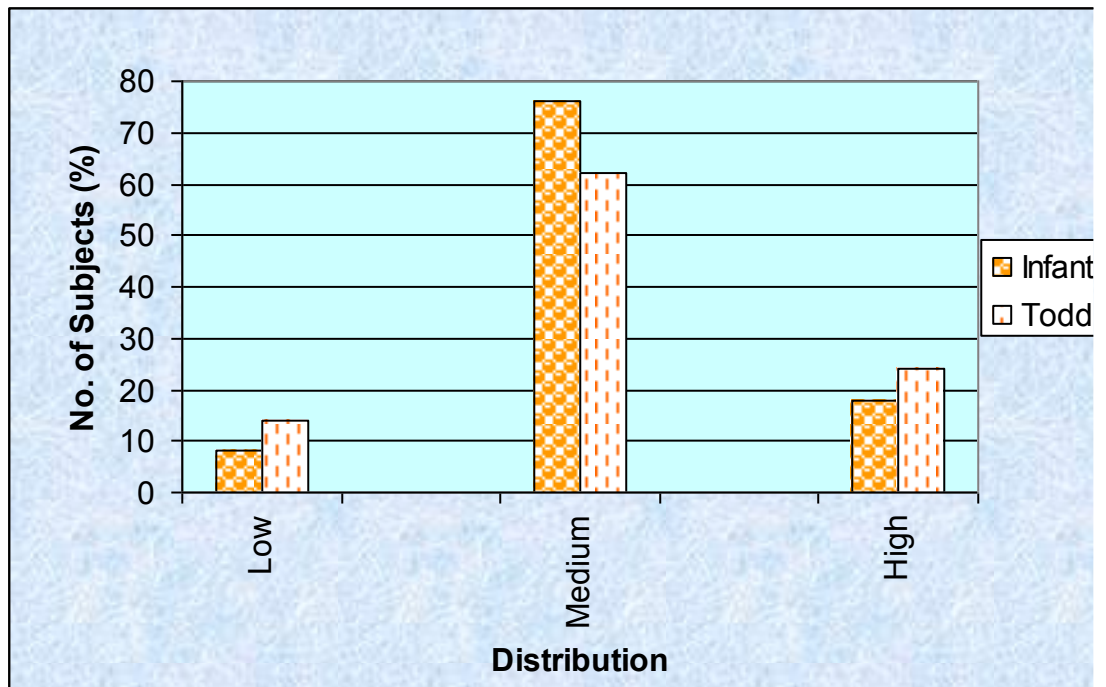


Fig.3 Distribution of infants and toddlers based on NSI

The mean value of home environment index for infants was .55 with S.D of .09 and the mean value of home environment index of toddlers was .62 with S.D of 14.

Table 39: Distribution of subjects based on home environment index

| HEI | Infants | Toddlers | Total |
|--------|---------|----------|-----------|
| Low | 7 (14) | 8 (16) | 15 (15) |
| Medium | 34 (68) | 33 (66) | 67 (67) |
| High | 9 (18) | 9 (18) | 18 (18) |
| Total | 50(100) | 50(100) | 100 (100) |

Figures in parenthesis indicates percentage

From table 38, it can be seen that 14 per cent of the infants and 16 per cent of the toddlers had least positive home environment and 18 per cent of the infants and toddlers had high positive home environment. It can also be seen that 68 per cent of the infants and 66 per cent of the toddlers had moderate home environment.

4.6. MILESTONE ATTAINMENT OF THE SUBJECTS

Developmental milestones of children were assessed using the Trivandrum Development Screening Chart of Child Development Centre, Thiruvananthapuram. The developmental milestones ratio was computed, and based on mean and SD of developmental milestone ratio (DMR) the subjects were classified as having delayed and, slightly delayed and timely/normal.

Table 40: Distribution of the subjects according to developmental milestone ratio

| Developmental milestone ratio | Infants | Toddlers | Total |
|-------------------------------|----------|----------|----------|
| Delayed | 1 (2) | 3 (6) | 4 (4) |
| Slightly delayed | 8 (16) | 14 (28) | 22 (22) |
| Timely/Normal | 41 (82) | 33 (66) | 74 (74) |
| Total | 50 (100) | 50 (100) | 100(100) |

Figures in parenthesis indicate percentage.

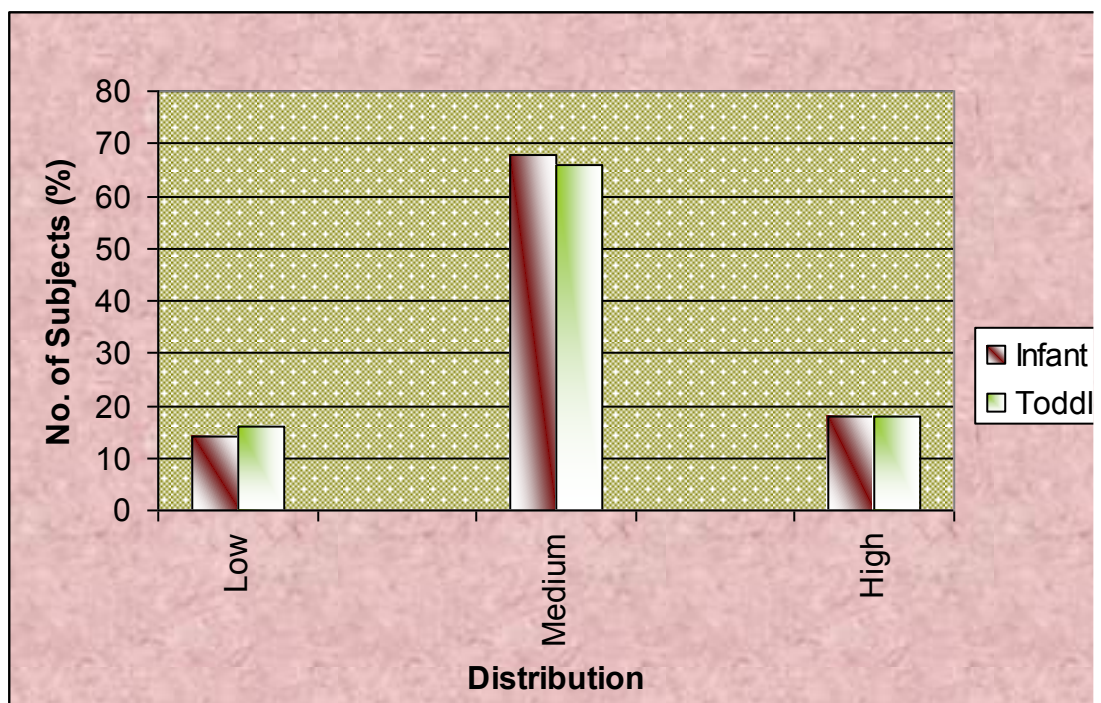


Fig.4 Distribution of infants and toddlers based on home environment

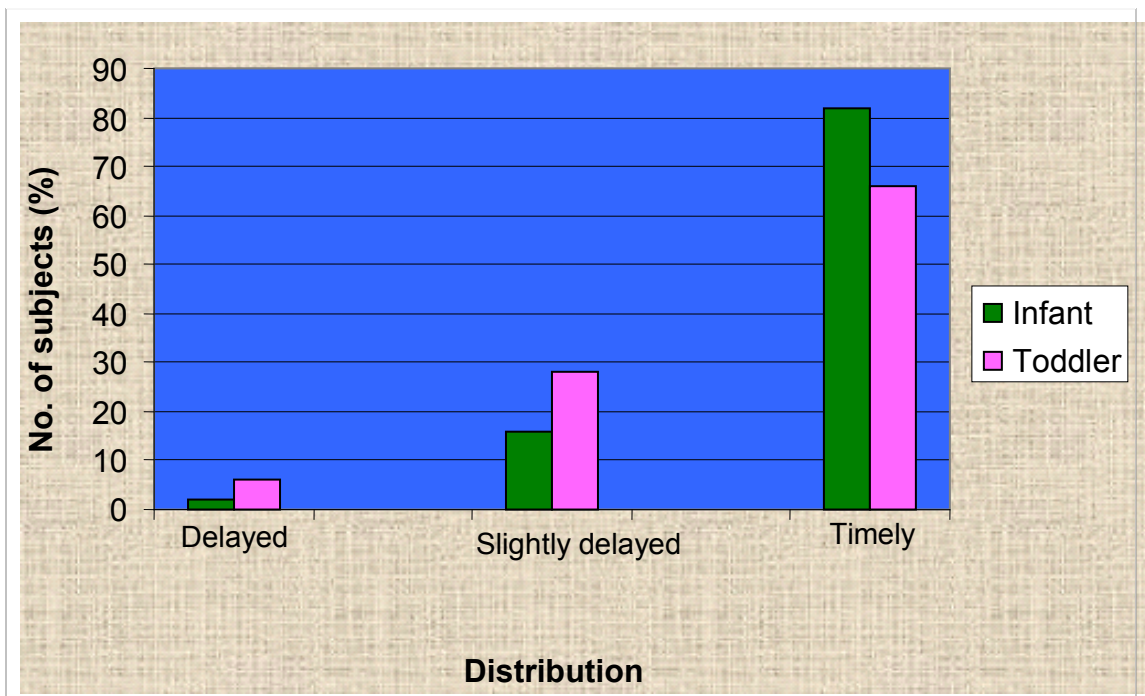


Fig.5 Distribution of infants and toddlers based on milestone attainment

The mean value of the developmental milestone ratio of infants were 0.84 and that of toddlers were 0.93. The infants and toddlers were classified based on their developmental milestone ratio as those above mean as timely those between S.D to mean as slightly delayed and those below mean –S.D as delayed. From table 40 it can be seen that 2 percent of the infants had delayed milestone development. While 82 percent of the infants had normal milestone development, 16 percent of infants have slightly delayed milestone development.

It can be seen from table 39 that 66 percent of the toddlers were having timely development and 28 percent had slightly delayed developmental milestone. It can also be seen that 6 percent of toddlers were delayed in their development.

4.7. KNOWLEDGE OF MOTHERS REGARDING NUTRITION AND CHILD DEVELOPMENT

The table below shows the knowledge of mothers regarding nutritional aspects belonging to children. The mothers were administered a knowledge test consisting of fifteen items with a score of one for correct answer and zero for wrong answer. The total scores obtained by each mother was calculated. The mothers were classified as having high, medium and low knowledge regarding nutrition of children and child development based on mean and standard deviation.

The respondents were classified as those above mean + standard deviation as having higher levels of knowledge, those between mean \pm standard deviation as having medium knowledge and respondents below mean – standard deviation as having low knowledge. The mean value of knowledge score of mothers of infants was 9.78 and SD was 1.40. The mean value of knowledge score of mothers of toddlers was 9.96 and SD was 1.81.

Table 41: Distribution of mothers based on knowledge score

| Knowledge score | Infants | Toddlers | Total |
|-----------------|----------|----------|-----------|
| Low | 6 (12) | 7 (14) | 13 (13) |
| Medium | 39 (78) | 33 (66) | 72 (72) |
| High | 5 (10) | 10(20) | 15 (15) |
| Total | 50 (100) | 50 (100) | 100 (100) |

Figures in parenthesis indicates percentage

As given in table 27, it can be seen that 78 per cent of the mothers of infants and 66 per cent of mothers of toddlers had medium level of knowledge regarding nutrition and children development. Ten per cent of mothers of infants and 20 per cent of mothers of toddlers had higher knowledge. Mothers of 12 per cent of infants and 14 per cent of toddlers fell in low category.

4.8. RELATIONSHIP BETWEEN DEPENDENT VARIABLES AND SELECTED INDEPENDENT VARIABLES

Relationship between the dependent variables viz. nutritional status, home environment and milestone attainment and independent variables was ascertained using correlation technique.

The independent variables selected were mother's age, mother's education, mother's body mass index, total income, family education, family size, mother's knowledge about nutrition and child care, infant feeding practices, birth weight and ordinal position.

Table 42: Relationship between nutritional status and selected independent variables

| Independent Variables | Nutritional Status | |
|-----------------------|--------------------|----------|
| | Infants | Toddlers |
| Mothers Education | 0.176 | 0.148 |
| Mother's BMI | 0.391** | 0.285* |
| Family Education | 0.297* | 0.153 |
| Mothers Knowledge | 0.217 | -1.80 |
| Infant Feeding | 0.287* | 0.371** |
| Birth Weight | 0.220 | 0.152 |
| Family Income | 0.285* | 0.374** |

*Significant at 5 percent level

** Significant at 1 per cent level

From the table, it can be seen that there is a significant relationship between mother's BMI, infant feeding and total income of the family with nutritional status of infants and toddlers

Table 43: Relationship between home environment index and selected independent variables

| Independent variables | Home environment | |
|--------------------------|------------------|----------|
| | Infants | Toddlers |
| Mothers Education | 0.212 | 0.119 |
| Mother's BMI | -0.417 | -0.147 |
| Total Income | 0.291* | 0.281* |
| Family Education | 0.263 | 0.042 |
| Mothers Knowledge | 0.245 | 0.268 |
| Infant feeding practices | 0.034 | 0.143 |
| Birth weight | 0.153 | 0.123 |

* Significant at 5 percent level.

The above table indicates that there is a significant relationship between total income of the family and home environment of children, both infants and toddlers.

Table 44: Relationship between milestones attainment and selected independent variables.

| Independent Variables | Milestone Attainment | |
|-----------------------|----------------------|----------|
| | Infants | Toddlers |
| Mothers Education | 0.233 | 0.187 |
| Mother's BMI | -0.137 | 0.165 |
| Family Income | 0.296* | .368** |
| Family Education | 0.032 | 0.214 |
| Feeding | 0.132 | 0.124 |
| Birth Weight | 0.286* | 0.28* |

* Significant at 5 percent level

** Significant at 1 per cent level

From table 44 it can be found that family income and birth weight had significant correlation with mile stone attainment.

4.8.1 Association of mother's education, family size and income with dependant variables

The dependence between the dependent variables with education, family size and income obtained through χ^2 values are presented below

Table 45: Association of independant variables with dependant variables (infants)

| Dependent variables | Mother's education | Family size | Ordinal position |
|----------------------|--------------------|-------------|------------------|
| Home Environment | 4.21* | NS | NS |
| Milestone attainment | 3.92* | NS | NS |
| Nutritional status | NS | NS | 9.63** |

* 4 degrees of freedom

** 1 degree of freedom

χ^2 test showed that there is dependence between mother's education with home environment and milestone attainment and ordinal position with nutritional status.

Table 46: Association of independent variables with dependent variables (toddlers)

| Dependent variable | Education | Family size | Ordinal position |
|----------------------|-----------|-------------|------------------|
| Home Environment | 3.97* | NS | NS |
| Milestone attainment | 4.21* | NS | NS |
| Nutritional status | NS | NS | 9.49** |

* 4 degree freedom **1 degrees of freedom

χ^2 test revealed that there is dependence between home environment and milestone with and there is significant association between nutritional status and ordinal position.

4.9. INTERRELATIONSHIP BETWEEN DEPENDANT VARIABLES

Inter correlation matrix of the variables of infants and toddlers are given in the following tables.

Table 47: Inter correlation matrix of the variables of Infants

| | Home environment | Milestone attainment | NSI |
|----------------------|------------------|----------------------|-----|
| Home Environment | 1.0 | - | - |
| Milestone attainment | 0.297* | 1.0 | - |
| NSI | 0.281* | 0.286* | 1.0 |

* Significant at 5 percent level.

Table 45 shows the inter correlation of the three variables home environment, milestone and NSI with regard to infants. From the table, it can be seen that milestone development had a significant correlation with home environment and nutritional status.

Table 48: Inter correlation matrix of variables of toddlers

| | Home environment | Milestone attainment | NSI |
|----------------------|------------------|----------------------|-----|
| Home environment | 1.0 | - | - |
| Milestone attainment | 0.283* | 1.0 | - |
| NSI | 0.298* | 0.285* | 1.0 |

*Significant at 5 percent level

Table 46 shows the intercorrelation matrix of variables with regard to toddlers. The table depicts that milestone attainment was significantly correlated with home environment and nutritional status.

Discussion

5. DISCUSSION

The results presented in the previous chapter are discussed in this section with relevant empirical evidence, under the following headings.

- 5.1 Personal and socio-economic characteristics of the subjects.
- 5.2 Child's characteristics.
- 5.3 Feeding practices of the subjects.
- 5.4 Nutritional status of the subjects.
- 5.5 Home environment of the subjects.
- 5.6 Milestone attainment of the subjects.
- 5.7 Knowledge of mothers regarding nutrition and child development.
- 5.8 Relationship between dependant variables and selected independent variables.
- 5.9 Interrelationship between the dependant variables.

5.1 PERSONAL AND SOCIO ECONOMIC CHARACTERISTICS OF THE SUBJECTS

In the present study, socio-economic and personal variables such as age, religion, caste, family size, type of family, educational status of the family and family income were taken into consideration.

Data on age of the mothers revealed that majority of the mothers (52 per cent) were in the age group 20-25 years. However 37 per cent of the mothers were in the age group 25-30 years. It was seen that 8 per cent of the mothers were above the age of 30 years and 3 per cent of the mothers were below 20 years.

Among fathers, 45 per cent were between 30-35 years and 40 per cent were in the age group 20-25 years. Fifteen per cent were in the age group of 35-40 years.

Assessment of the religion of the subjects (Table 3) revealed that 58 per cent of the subjects belonged to Hindu community. This agrees with the census data (2001) which found that vast majority of the population of the Thiruvananthapuram District is predominated by Hindu religion, followed by Christians and Muslims. Earlier study done by Kannan and coworkers (1997) also found that Hindus constitute 57 per cent of the total population in rural Kerala.

Caste is an unique system in India (Kerala Statistical Institute, 2000). The caste wise distribution of subjects revealed that majority (41 per cent) belonged to backward community. While 30 per cent of the subjects belonged to forward community, 29 per cent belonged to SC/ ST.

Concerning the family type, it could be seen that 48 per cent belonged to nuclear family. Bulliya and coworkers (2002) has reported that nuclear family has become a prevalent norm in Kerala. In Kerala joint family is not very common now a days, even though 22 per cent were found to be from joint family. The study is in concurrence with the findings reported by Reshmi (2007) and Sheela (2004).

Regarding the family size it could be seen that 47 per cent have small families i.e. 1 to 4 members and 36 per cent belonged to medium sized families while 17 per cent belonged to large families. Park (1997) had reported that the average family size in India is four. The findings of the study are in conformity with the studies reported by Reshmi (2007), Jaimy (2001) and Razeena (2000).

Literacy and educational attainments are indicators of quantitative improvements in human resources and female literacy is an indicator of better nutritional status. Maternal education is the single most important factor in explaining differentials in child health outcomes, more important than paternal education, health service available and socio-economic status (Bicego and Ahmed, 1996).

With regard to family educational status, it can be seen that most of the parents were literate (table 7 and 8). Most of the mothers (50 per cent) and 20 per cent of the fathers had an education up to S.S.L.C. level.

Employment is the best and cheapest guarantee to enhance the nutritional status as it supplements to the household income and paves for better purchasing power (Hemalatha et al, 2000). Regarding the occupational status of fathers majority (82 per cent) were casual laborers and the rest (18 per cent) had part time job. Women's employment increases household income, with consequent benefit to household nutrition in general and the woman's nutritional status in particular (Genebo et al, 1999). In the present study most of the mothers were housewives. The present study agrees with the earlier observation that the work participation of females has not increased as much as males in the last decades in Kerala particularly in Thiruvananthapuram (Eapen, 2000). It has been observed that parent's occupation will affect parent child relationship and thus home climate (Singh, 1997).

The economic status of a household is an indicator of access to adequate food supplies, use of health service, availability of improved water sources and sanitation facilities which are prime determinants of child and maternal nutritional status. In the case of total family income of the subjects, it could be seen from the Table 11 that 74 per cent of the subjects had a monthly income between Rs.1000-1500 while 14 per

cent had a monthly income between 2001-2500. The study is in concurrence with findings of Razeena (2000) and Sheela (2004).

Housing conditions are used as socio-economic indicators of health and well being (Shaw, 2004). Regarding the physical amenities present, it was found that 10 per cent of the respondents live in a pucca house. According to the NFHS 3 (2005-2006), in Kerala 84 per cent live in a pucca house. On assessing the source of drinking water, it was revealed that 50 per cent had their own well and the rest depends on pipe water from panchayat. As far as toilet facility was concerned, 80 per cent had toilet facility. As reported by NFHS 3 (2005-2006) 25 per cent had access to pipe water and 96 per cent had access to toilet facility. Bashir (2002) has reported that poor quality housing have direct relationship to poor mental health, developmental delay, heart disease and even short stature.

5.2. CHILD'S CHARACTERISTICS

In the present study sex wise distribution of the subjects revealed that 52 per cent of the infants and 58 per cent of the toddlers were males. It was found that 48 per cent were females among infants and 42 per cent among toddlers.

Ordinal position of infants and toddlers revealed that 42 per cent were of first birth order. It was seen that 29 per cent of the subjects were of second and third birth order.

The birth weight in all population groups is the single most determinant of the chances of the new born to survive and experience normal growth and development (Joshi and Pai, 2000). Naik and coworkers (2003) observed birth weight as not only a critical determinant of survival, growth and development of baby but also a valuable indicator of maternal health, nutrition and quality of

antenatal services. In the present study 19 per cent of the subjects had low birth weight and 1 per cent had very low birth weight. This is almost in line with the findings of Ramankutty (2004) where there was a prevalence of 15.3 per cent of low birth weight in the children studied. Another study conducted by Radhakrishnan and coworkers (2000) in Thiruvananthapuram found a prevalence of 17.3 per cent of low birth weight among children. A study conducted by Idris and coworkers (2000) reported that maternal diseases, maternal dietary intake, past obstetric history and antenatal care status were associated with low birth weight among infants. Long term studies conducted by Child Development Centre (1999) had suggested that low birth weight children continue to grow and develop both physically and mentally at lower rates as compared to his or her normal weight counterpart. Nair (1995) has stated that low birth weight has a lasting impact on the subsequent growth performance of the infant.

On analysis of the type of delivery, it was found that 20 per cent had caesarean section. Kumar (2006) reported that caesarean section in the Southern part of Kerala is much higher than that for the state as a whole. According to the NFHS-3 data, 69 per cent of children in the rural area has got full immunization. In the present study cent per cent of children has got full immunization. It may be due to the coverage of ICDS program in the rural areas and also due to increased female literacy level.

5.3. FEEDING PRACTICES OF THE SUBJECTS

Optimal infant and young child feeding practices- especially early initiation and exclusive breast feeding for the first six months of life, help to ensure young children the possible start to life (Ministry of Women and Child Development, 2006). Madise and Mpoma (1997) has opined that infant feeding can have long lasting effect on development and behavior of an individual.

An analysis on the first feed given to new born revealed that 8 per cent of the subjects were given honey as the first feed and 1 per cent were given water. In a study conducted by Gupta and Gupta (2003) among the various states of India revealed that the most common first food was honey, followed by sugar water and plain water. In the present study 6 per cent were given sugar water. It is encouraging to note that 85 per cent of the subjects were given colostrum as the first feed. It may be due to the increased awareness of the importance of colostrum. A study conducted by Kulkarni and coworkers (2004) in Mumbai reported that 36.1 per cent of the mothers gave prelacteal feeds such as plain water, honey with water, sugar water etc. Similar findings have been reported by Srivastava and coworkers (1994), Mishra and coworkers (1997), Devadas (1999) and Sethi and coworkers (2003).

An inquiry on the breastfeeding pattern revealed that 68 per cent of the mothers fed breast milk only on demand. This could be due to the mother's feeling that the child is hungry. The findings in this study are in concurrence with study by Bandopadhyay (2000).

Information on duration of breastfeeding revealed that 44 per cent of the subjects received breast milk upto 5 months. According to NFHS 3 data 56.5 per cent of children were exclusively breastfed till five months. Similar findings have been reported by Sreeja (1999). Gupta and Rohde (2004) reported that breastfeeding is the single most effective preventive intervention, which could prevent 13-16 per cent of all childhood deaths in India.

In the present study bottle feeding was given to 36 per cent of the subjects by 3 months. Gupta and Gupta (2003) reported that in India, the rate of bottle feeding is 23 per cent. A study conducted by Banapurmath and coworkers

(1996) found that 17 per cent of the mothers started bottle feeding by four months of age and 24.9 per cent by six months of age which identifies with the study.

On analysis of the frequency of bottle feeding it was revealed that 43 per cent of the subjects were bottle fed 1 to 2 times a day while 38 per cent gave 2 to 3 times 1-2 times. It was seen that 11 per cent gave bottle feed 7 to 9 times a day.

Enquiry on the type of bottle feeds given revealed that 78 per cent of the infants and 90 per cent of the toddlers were given cow's milk. This is consistent with the findings of Sreeja (1999). This can be due to easy availability of cow's milk.

When problems associated with breastfeeding were assessed it was seen that 13 per cent of the subjects suffered from diarrhoea and 10 per cent suffered from constipation. This study is consistent with the study done by Ram and coworkers (2000) in which 17.8 per cent of children had diarrhoea episodes.

When introduction of complementary feeding was assessed, it was found that 7 per cent started complementary feeding after 3 months while 16 per cent started complementary feeding after 6 months. Simondon and Simondon (1997) found that complementary feeding by 2- 3 months was associated with low nutritional status and complementary feeding by 4-5 months was associated with slower linear growth compared to later introduction. A study conducted by Singh and coworkers (1997) in Rajasthan found that 15.6 per cent of mothers initiated complementary feeding at 3-6 months and 36 per cent started complementary feeding at 6 months

It was found that ragi and banana flour were given to 52 percent of the subjects. Commercial weaning food that is cerelac was given by 3 per cent of the mothers. Similar findings have been reported by Sreeja (1999).

Consistency of complementary food was assessed and it revealed that 33 per cent gave it in liquid form. This is in line with findings of Aggarwal and coworkers (2008) where 62.2 per cent mothers gave complementary food in liquid form.

In the present study it was found that 85 per cent of the infants and 78 per cent of the toddlers were fed by their mothers themselves. A study conducted by Jain and Choudhry (1993) found that children cared by mother had better nutritional status than those children who were cared by any other family members in the absence of mother.

5.4. ASSESSMENT OF NUTRITIONAL STATUS

Anthropometry is widely used as a tool to estimate the nutritional status of population and to monitor the growth and health of individuals (Gorstein et al, 1994).

Anthropometric measurements such as height, weight, mid-upper arm circumference, head circumference, chest circumference were taken into for assessing the nutritional status of the subjects.

The body build of an individual can be more accurately assessed through body mass index (Bhalla, 2002). BMI is an indicator of body's energy stores as reported by Choudhari and Solanki (1999). In the present study height and weight measurements of the mothers were taken and BMI was calculated. In the present study 7 per cent of mothers had BMI below 16. A study conducted by Sheila and coworkers (2001) in Uttar Pradesh found that 4.9 per cent of the mothers had a BMI below 16 and 30 per cent had a BMI below 18.5. Studies conducted by Karuna

(1993) reported that 33.33 per cent of women were found to be deficient in energy. While in a study conducted by Paul (1999) among pregnant women in Thiruvananthapuram found that only 5.5 per cent had a BMI below 20. Kramer and coworkers (1995) reported that maternal short stature, low pre-pregnancy BMI and low rate of gestational weight gain may lead to shortened gestation by increasing the risk of idiopathic preterm labour. Studies done by Paul (1999) found that as the nutritional status of the pregnant women increased the number of babies with low birth weight decreased.

Weight for age of subjects was calculated and classified according to Gomez classification, IAP classification and weight for age Z score. Gomez classification revealed that 39 per cent of the children were normal while 25 per cent had mild malnutrition and 26 per cent had moderate malnutrition. A study conducted by George and coworkers (2000) in rural areas of Kerala found that 46.7 per cent of children were normal, 11.78 per cent had mild malnutrition and 16.37 per cent had moderate malnutrition. IAP classification of infants and toddlers revealed that 6 per cent had severe malnutrition and 4 per cent suffered from moderate malnutrition. In a study conducted by Bamji (2000) it was found that 20 per cent of the children had moderate and severe malnutrition. Sen and coworkers (1997) in Uttar Pradesh observed that 3.4 per cent children suffer from severe malnutrition and 23.85 per cent had moderate malnutrition. Z score classification of subjects revealed that 13 per cent were suffering from severe malnutrition. A study conducted by Seetharaman and coworkers (2007) in Coimbatore revealed that 21.7 per cent of the children were severely malnourished. The Z score classification has been recommended for establishing the profile of malnutrition in a population as it reflects the reference distribution and is also comparable across ages and indicators

Stunting in children was classified according to height for age Z score. It was found that 56 per cent of the subjects were normal. A study conducted by Kaur and coworkers (2005) in Punjab found that 11.42 per cent of the children had stunting. In the present study stunting was seen in 16 per cent of the subjects and severe degrees of stunting were seen in 11 per cent of the subjects.

Wasting indicates a deficit in tissue and fat mass (WHO, 1995). Weight for height of the subjects was worked out and weight for height computation was taken as per Waterlow's classification. It was found that 45 per cent of the subjects were normal while, 9 per cent were wasted and 23 per cent suffered from wasting and stunting. This is in line with findings of Sreeja (1999) in which 24 per cent of the children were normal and the remaining were malnourished. NFHS (2005-2006) reported that in Kerala 21 per cent were stunted and 16 per cent of children were wasted. Weight for height Z scores was computed and it was found that 11 per cent were severely malnourished and 19 had moderate malnutrition. In their study in Bihar, Yadav and Singh (1999) found that 33 per cent of the rural children had wasting and 19.5 per cent had severe wasting. The prevalence of wasting as reported by Saxena and coworkers (1997) in Delhi was 11.9 per cent.

Mid-upper arm circumference is a reliable method for screening children to identify those who are seriously malnourished. Data on mid upper arm circumference found that 66 per cent of the subjects were normal while 19 per cent suffered from mild malnutrition and 15 per cent suffered from severe malnutrition. This is in line with the findings of Sreeja (1999) in Malappuram. A study conducted by Kaur and coworkers (2005) in Punjab found that 38.5 per cent of the children were malnourished.

The head and chest circumference ratio of the subjects revealed that 85 per cent of the subjects were normal while 15 per cent were malnourished. Similar results were observed in a study conducted by Sreeja (1999) in which 62.3 per cent were normal. Study conducted by Bisati and Bhan (2005) had also found similar results.

The presence or absence of clinical deficiency symptoms in children which can be attributed to malnutrition was assessed by a qualified physician. From the clinical examination it was noted that anemia was the most common clinical deficiency symptom. Nutritional anemia is associated with impaired performance of a range of mental and physical functions in children; along with increased morbidity (Sinha et al, 2008). The percentage of children who were anemic was 12 per cent. This finding was consistent with results of Rao and coworkers (2005), George and coworkers (2000) and Sreeja (1999). Discoloration of hair was seen among 8 per cent of the subjects followed by sparse hair (6 per cent) and angular stomatitis (5 per cent).

Assessment of nutritional status indices was done using various parameters such as height weight, head circumference, chest circumference and MUAC. Nutritional status index indicated that the mean value for infants was 33.89 and nutritional status index ranged between 31.08 and 34.84. The mean value of nutritional status index for toddlers was 28.9 and nutritional status index ranged from 25.23 to 31.3. It was found that majority of the infants had medium NSI (76 per cent), 16 per cent had high NSI and 8 per cent had low NSI. Among the toddlers 62 per cent had medium NSI, 24 per cent had high NSI and 14 per cent had low NSI. A Study conducted by Sreeja (1999) in Malappuram also found that nutritional status index of infants were better than toddlers.

5.5. HOME ENVIRONMENT OF SUBJECTS

Assessment of home environment revealed that 14 per cent of the families of infants and 16 per cent of the families of toddlers lack stimulating home environment. A study conducted Ahuja and coworkers (2004) found that rural home environment lacks stimulation for infants and young children.

5.6. MILESTONE ATTAINMENT OF THE SUBJECTS

Assessment of developmental milestones indicated that 2 per cent of infants and 6 per cent of toddlers had delayed attainment of developmental milestones. This is in line with the findings of Nair (2002). In his study in Kerala he found a prevalence of 3.9 per cent. Sadaphal and coworkers (1993) observed 7 per cent delay among children less than three years in Delhi.

5.7. KNOWLEDGE OF MOTHERS REGARDING NUTRITION AND CHILD DEVELOPMENT

Mother's knowledge on nutrition and child development was assessed and it revealed that 72 per cent of the mothers had medium knowledge on child nutrition. It can be due to knowledge provided by the anganwadi workers and also due to the increased literacy level. Similar results have been obtained by Sharma and Nagar (2006).

5.7. RELATIONSHIP BETWEEN DEPENDENT VARIABLES AND SELECTED INDEPENDENT VARIABLES

In the present study the socio economic variables such as income had a correlation with home environment of children. This study is in line with the findings of Sheeba and coworkers (2003).

When nutritional status and independent variables were correlated mother's BMI was found to have correlation with nutritional status. This is in line with the findings of Sanghvi and coworkers (2001). Infant feeding practices had a correlation with nutritional status of subjects. This is in line with the findings of Agarwal and coworkers (2001). Kapur and coworkers (2005) found that late introduction to complementary feeding, high reliance on diluted top milk, and delay in putting the child on to the family food causes under nutrition. Income had a correlation with nutritional status. The finding of the study is also in line with the findings of Nnyepi (2007).

In the present study socioeconomic variables such as economic status and had correlation with milestone attainment. Talwar and Choudhary (2001) found that as the economic status improved there is improvement in the development of infants. It was found that and birth weight had correlation with milestone attainment. This is in agreement with the findings of Gunn (1997).

It was found that maternal education had significant association with home environment and milestone development. This is in line with the findings of Patnam and Pawar (2003) and Duncan and coworkers (1994). Sharma (1997) found that parents with higher education provide more stimulating environment than illiterate and less educated parents. Birth order was found to have an association with nutritional status. This is in line with the findings of Lakshmi and coworkers (2003).

5.6 INTER-RELATIONSHIP BETWEEN THE DEPENDANT VARIABLES.

When intercorrelation was done it was seen that there was relation between the three dependant variables that is nutritional status, home environment and milestone. Similar results were observed by Vazir and co workers (1998) in Andhra Pradesh.

Thus the present study indicates that as the child enters the weaning stage, the child become more susceptible to malnutrition and when combined with a non stimulating environment limit the child's learning and cause delay in the attainment of developmental skills.

Summary

6. SUMMARY

The early years of life are essential as the foundation for later development. Development is multidetermined, varying as a function of nutritional and biomedical status, genetic inheritance and social and cultural context. Under nutrition, poor health and non optimal care giving affect a broad range of outcomes, including cognitive, motor, psychosocial and affective development.

The present study entitled "Nutritional status and home environment as determinants of attainment of developmental milestones in children" was conducted with an objective to find out whether nutritional status and home environment are associated with milestone development in children below two years. For this purpose fifty infants and fifty toddlers were selected randomly from Vellanad ICDS project of Thiruvananthapuram district.

Information on the personal and socio economic characteristics such as age, religion, type of family, family size, educational status of the family and family income and housing conditions were ascertained. The existing knowledge of the respondents towards child care and nutrition were also identified. Characteristics of the subjects such as birth weight, birth order, immunization schedule and illness history, home environment of the subjects such as acceptance of the child, maternal responsiveness, organization of the environment, provision of appropriate play material, and variety of stimulation were assessed for the study. Milestone development of children was assessed using Trivandrum Developmental Screening Chart. Relationship of the selected independent variables such as family income, feeding practices, birth weight, mother's BMI and maternal education with the dependant variables that is milestone development, home environment and nutritional status and the intercorrelation between dependant variables were also studied.

The findings of the study are summarized below.

Assessment of personal and socio-economic variables of the subjects revealed that majority of the respondents belonged to the age group of 20-25 years. The age group of fathers ranged from 30-40 years. Majority of the subjects belonged to Hindu religion and about 41 per cent belonged to backward caste. Analysis of family structure revealed that majority of the respondents belonged to nuclear family and majority had a family size of 1-4 members.

Regarding the family educational status it was seen that majority of parents had education upto secondary level. The occupational status of fathers revealed that 82 per cent were casual labourers and most of the mothers were housewives. About 74 per cent of the families had a family income between Rs.1000-1500. Assessment of physical amenities revealed that majority of the families live in kutcha houses. Regarding drinking water it was found that 50 per cent had their own well and about 80 per cent had toilet facility.

When child's characteristics were assessed, it was found that majority of the children were males. Data regarding birth order showed that majority of the children were of first birth order. It was found that 20 per cent had low birth weight. Majority of the children were of normal delivery.

Assessment of feeding practices revealed that majority of the subjects were given colostrum as the first feed. Breastfeeding pattern of the mothers revealed that majority of the mothers practiced demand feeding and 46 per cent received breast milk upto 5 months. Regarding bottle feeding 34 per cent received top milk by 5 months and majority of the children were given cow's milk. Assessment of problems associated with bottle feeding revealed that 13 per cent of the subjects suffered from diarrhoea. Complementary feeding was started by four months in majority of the subjects. Majority of the subjects were given home made weaning food.

Anthropometric measurements of the respondents revealed that 47 per cent of the mothers had normal BMI and 7 per cent had a BMI below 16 and only 1 per cent was found to be obese. Weight for age assessment of subjects revealed that majority of the children were normal while 26 per cent were moderately malnourished based on Gomez classification, while 6 per cent were severely malnourished based on IAP classification and 13 per cent were found to be severely malnourished according to Z score classification. Stunting was seen among 16 per cent of the subjects and 11 per cent were severely stunted. Wasting was seen among 9 per cent of the subjects and 23 per cent suffered from wasting and stunting according to Waterlow's classification. Data on mid-upper arm circumference found that 15 per cent suffered from severe malnutrition. Assessment of head and chest circumference ratio of 15 per cent of the subjects were below normal.

Assessment of clinical status of the subjects revealed that majority had anemia. Other symptoms like discoloration of hair and angular stomatitis were also reported.

Nutritional status index of the respondents was computed incorporating relevant parameters like height, weight, head and chest circumference and mid upper arm circumference. It was found that eight per cent of infants and fourteen per cent of toddlers had low nutritional status index.

Assessment of home environment of subjects were done by developing home environment index and based on this it was revealed that 14 per cent of the families of infants and 16 per cent of the families of toddlers did not provided stimulating environment.

Developmental milestones of children were assessed using the Trivandrum Developmental Screening Chart. Then developmental milestone ratio was computed and based on mean and standard deviation of developmental milestone ratio the subjects it

was found that 2 per cent of the infants and 6 per cent of toddlers had delayed developmental milestones.

Assessment of knowledge of mothers regarding nutrition and child development revealed that seventy eight per cent of the mothers of infants and sixty six per cent of the mothers of toddlers had medium level of knowledge.

A significant correlation was found between nutritional status and mother's BMI, infant feeding practices, birth order and income. A significant correlation was found between developmental milestone and economic status, maternal education and birth weight. Significant correlation was seen among home environment and maternal education. It was found that there was intercorrelation between nutritional status, home environment and developmental milestones.

On the whole it was revealed that the attainment of developmental milestones was dependant on nutritional status and home environment of the subjects. It was also observed that lack of awareness about proper infant feeding practices among mothers and poor stimulation in the home environment can also lead to delayed developmental milestones in children. The study highlights the importance of creating more awareness among parents of the children below two years about the importance of proper feeding practices and also providing them a stimulating home environment for their holistic development. The developmental status of infants and toddlers must be improved by initiating mother oriented early intervention programmes and also by insisting on the timely and systematic detection of developmental milestones in children by all the anganwadi workers in the state.

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7. REFERENCES

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Appendices

APPENDIX I

**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE**

**QUESTIONNAIRE TO ELICIT INFORMATION ON THE
SOCIOECONOMIC STATUS**

A. Socioeconomic status of families of the respondent (The following details will be collected from the mother of the infant/toddler)

- 1. Name of the respondent :
- 2. Full address :
- 3. Religion :
- 4. Caste :
- 5. Type of family :
- 6. Family composition

| Name | Age | Relationship with the child | Educational qualification | Occupation | Monthly income |
|------|-----|-----------------------------|---------------------------|------------|----------------|
| | | | | | |

7. Total income of the family from all sources :

8. Type of house: (a) Thatched (b) Tiled (c) Terrace

9. Kind of water supply available:

(a) Tap (b) Well (c) Public well/Tap

10. Do you have the facility of latrine in your house?: Yes/ No

APPENDIX – II**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE****QUESTIONNAIRE TO ASCERTAIN INFORMATION REGARDING
CHILD'S CHARACTERISTICS**

1. Name of the child:

2. Age:

3. Sex:

4. Ordinal position of the child:

5. Birth weight:

6. Whether immunization was given to the child?

7. Was the immunization given at right time?
 - a. DPT: Yes/ No
 - b. Polio: Yes/No
 - c. BCG: Yes/ No
 - d. Measles: Yes/ No

APPENDIX – III**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE****QUESTIONNAIRE TO ELICIT INFORMATION ON INFANT AND
TODDLER FEEDING PRACTICES**

Serial No. :
Name of the child :
Informant's name and
relation to the child :
Name of the child :
Sex :
Age :

- 1) What was the first food given to the child (soon after delivery)?
- 2) When did you start breastfeeding the child?
(a) Soon after delivery (b) Two days after delivery
- 3) Did you feed colostrum to your new born child?
If no why?
- 4) What was the pattern of breastfeeding?
(a) Convenient time of the mother (b) Forced feeding
(c) Feeding on demand
- 5) At what age breastfeeding was completely withdrawn?

- 6) When did you start bottle feeding?
- 7) Why did you start bottle feeding?
- 8) What type of bottle feeds do you give to the child?
a) Formula milk b) Commercial milk
- 9) How many times do you bottle feed your child per day?
- 10) If formula feeding is followed, what formula is used?
- 11) If animal milk is given what kind of animal milk is given
- 12) Does the infant have any problem in bottle feeding? Yes/ No
If yes what problem?
- 13) Have you introduced complementary food to your child? : Yes/ No
If yes, when did you start complementary feeding?
a) Three months b) After four months c)After six months
d) A year after birth
- 14) Do you prepare any weaning food at home to feed your child?
If yes what kind of weaning food
- 15) Do you feed the child with commercial weaning foods? Yes/ No
If yes, what type?

16) Feed Management

- 1) Who feeds the child?
- 2) Who cares for the child if you go outside?
- 3) What is the consistency of the complementary food given?
 - a) Liquidform
 - b) Semisolid
 - c)Solid

17) Feeding practices continued

| 5 th Month | | 6 th Month | | 7 th Month | | 8 th Month | |
|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|
| Foods given | No. of times | Foods given | No. of times | Foods given | No. of times | Foods given | No. of times |
| | | | | | | | |

17) Feeding practices continued

| 13 th Month | | 14 th Month | | 15 th Month | | 16 th Month | |
|------------------------|--------------|------------------------|--------------|------------------------|--------------|------------------------|--------------|
| Foods given | No. of times | Foods given | No. of times | Foods given | No. of times | Foods given | No. of times |
| | | | | | | | |

17) Feeding practices continued

| 13 th Month | | 14 th Month | | 15 th Month | | 16 th Month | |
|------------------------|--------------|------------------------|--------------|------------------------|--------------|------------------------|-------------|
| Foods given | No. of times | Foods given | No. of times | Foods given | No. of times | Foods given | No.of times |
| | | | | | | | |

17) Feeding practices continued

| 17 th Month | | 18 th Month | | 19 th Month | | 20 th Month | |
|------------------------|--------------|------------------------|--------------|------------------------|--------------|------------------------|--------------|
| Foods given | No. of times | Foods given | No. of times | Foods given | No. of times | Foods given | No. of times |
| | | | | | | | |

17) Feeding practices continued

| 21 st Month | | 22 nd Month | | 23 rd Month | | 24 th Month | |
|------------------------|--------------|------------------------|--------------|------------------------|--------------|------------------------|--------------|
| Foods given | No. of times | Foods given | No. of times | Foods given | No. of times | Foods given | No. of times |
| | | | | | | | |

APPENDIX IV**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE****QUESTIONNAIRE TO ELICIT INFORMATION ON THE
ANTHROPOMETRIC STATUS OF INFANTS AND TODDLERS**

1. Name :

2. Age :

3. Sex :

4. Length/ Height of the child :

5. Weight of the child :

6. Mid upper arm circumference :

7. Head circumference :

8. Chest circumference :

APPENDIX V

**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI, TRIVANDRUM
DEPARTMENT OF HOME SCIENCE**

NUTRITIONAL ASSESSMENT SCHEDULE

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:
 Source: Parents/ Record Age: ... Yrs ... Mths.
 Breast fed/ DF + Supplements/ Hot BF Pregnant/ Lactating ... mths
 (DF)

CLINICAL EXAMINATION:

| | |
|--|--|
| Hair: 01. Sparse 02. Discoloured 03. Easily plucked 04. Moon face 05. Parotid enlargement (bilateral, painless) 06. Oedema 07. Emaciation 08. Marasmus 09. Conjunctival xerosis 10. Bitot's spots 11. Corneal xerosis/ 12. Keratomalacia 13. Corneal opacity 14. Night blindness 15. Photophobia 16. Anemia 17. Nasolabial dyssebacia 18. Angular stomatitis 19. Cheilosis: red & raw | Tongue: 20. Papillae-atrophic 21. Papillae-hypertrophic 22. Pellagra 23. Craz pavement dermatosis 24. Pigmentation at fingers/toes 25. Phrynoderma 26. Koilonychia 27. Gums-spongy bleeding 28. Craniotabes 29. Epiphyseal enlargement 30. Brooding of ribs 31. Knock knees/ bow legs Teeth: 32. Caries 33. Mottled enamel 34. Enlargement of liver Soft Firm Hard 35. Thyroid enlargement 36. Others |
|--|--|

* For children below 5 years only

APPENDIX VI**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE****HOME SCREENING QUESTIONNAIRE (INFANTS)**

1. How often do you and your child see relatives?
 - never
 - at least once a year
 - at least six times a year
 - at least once a month
 - at least once a week
2. Do you subscribe to any magazines?
 - No
 - home and family magazines
 - news magazines
 - children's magazines
 - other
3. About how many hours each day does your child spend in a play pen, jump chair, infant swing or infant seat?
 - none
 - upto 1 hour
 - 1 to 3 hours
 - more than 3 hours
4. How often does someone take your child to a grocery store?
 - hardly ever
 - at least once a month
 - at least twice a month
 - at least once a week

5. Do you have any pets?
- yes
 - no
6. Did you start talking to your child when he/she was
- 0-3 months
 - 3-9 months
 - 9-15 months
 - when he/she was old enough to understand
7. Do you talk to your child as you are doing house work?
- yes
 - no
8. When your child gets a new toy do you usually
- explore it with him/her
 - let him/her explore it on his/her own
 - save it for a special occasion
9. What do you usually do when your child gets bored?
- give him a cookie or something to eat
 - put him /her to bed for a nap
 - offer him/her a toy
 - encourage him/her to keep himself/herself busy
 - play with him
10. Do you have any plants in your house?
- yes
 - no
11. About how often do you take your child to the doctor?
- once in two weeks
 - once in a month
 - 2-3 months

12. Do you have any friends with about the same age as your child?

----- yes

----- no

13. Do you sometimes try new recipes that you find in the news paper or in magazines?

----- yes

----- no

14. Does the father provide some care giving?

----- no

----- at least once in a month

----- at least once in a week

----- at least 3 or 4 times a week

----- every day

15. How often does your child get out of the home?

----- at least once a month

----- at least once a week

----- at least four times a week

----- at least once a day

16. Check the things which you have helped your child to learn

----- rolling over

----- crawling

----- walking

----- saying new words

----- song , prayers or nursery rhymes

----- none of the above

17. Most of the decision about how the family income is to be spent are made by

----- mother

----- father

----- grand parents

----- mother and father

18. How often do you actively play with child at this age?

----- hardly ever

----- at least once a week

----- at least 3 or 4 times a week

----- every day

19. About how many hours do you watch T.V each day?

----- less than 1 hour

----- 1-2 hours

----- 2-3 hours

----- more than 3 hours

APPENDIX VI CONTINUED
KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE

HOME SCREENING QUESTIONNAIRE (TODDLERS)

1. How often do you and your child see relatives?
 - never
 - at least once a year
 - at least six times a year
 - at least once a month
 - at least once a week
2. Do you subscribe to any magazines?
 - No
 - home and family magazines
 - news magazines
 - children's magazines
 - other
3. About how many hours each day does your child spend in a play pen, jump chair, infant swing or infant seat?
 - none
 - upto 1 hour
 - 1 to 3 hours
 - more than 3 hours
4. How often does someone take your child to a grocery store?
 - hardly ever
 - at least once a month
 - at least twice a month
 - at least once a week

5. Do you have any pets?
- yes
 - no
6. Did you start talking to your child when he/she was
- 0-3 months
 - 3-9 months
 - 9-15 months
 - when he/she was old enough to understand
7. Do you talk to your child as you are doing house work?
- yes
 - no
8. When your child gets a new toy do you usually
- explore it with him/her
 - let him/her explore it on his/her own
 - save it for a special occasion
9. What do you usually do when your child gets bored?
- give him a cookie or something to eat
 - put him /her to bed for a nap
 - offer him/her a toy
 - encourage him/her to keep himself/herself busy
 - play with him
10. Do you have any plants in your house?
- yes
 - no
11. About how often do you take your child to the doctor?
- once in two weeks
 - once in a month
 - 2-3 months

12. Do you have any friends with about the same age as your child?
- yes
 - no
13. Do you sometimes try new recipes that you find in the news paper or in magazines?
- yes
 - no
14. Does the father provide some care giving?
- no
 - at least once in a month
 - at least once in a week
 - at least 3 or 4 times a week
 - every day
15. How often does your child get out of the home?
- at least once a month
 - at least once a week
 - at least four times a week
 - at least once a day
16. Check the things which you have helped your child to learn
- rolling over
 - crawling
 - walking
 - saying new words
 - none of the above
17. Most of the decision about how the family income is to be spent are made by
- mother
 - father
 - grand parents
 - mother and father

18. How often do you actively play with child at this age?

- hardly ever
- at least once a week
- at least 3 or 4 times a week
- every day

19. About how many hours do you watch T.V each day?

- less than 1 hour
- 1-2 hours
- 2-3 hours
- more than 3 hours

20. How many children's books does your child have of his/her own?

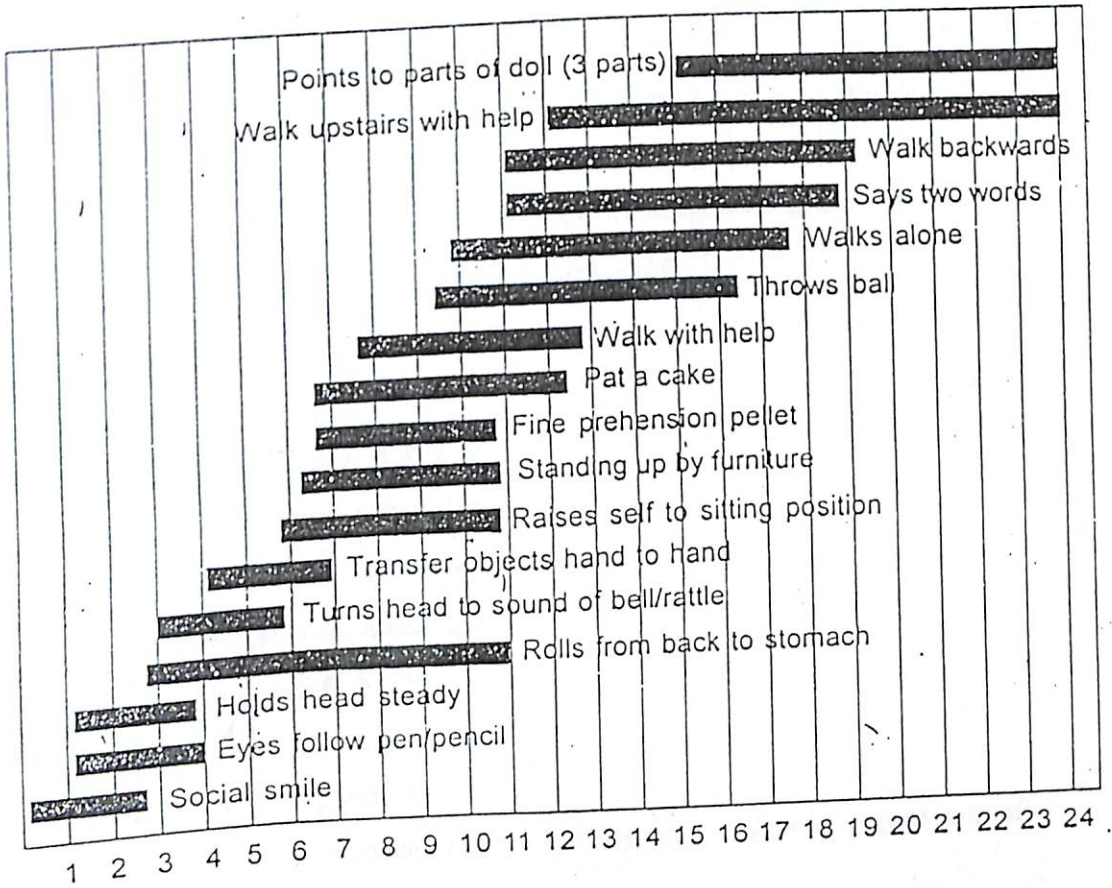
- 0: too young
- 1 or 2
- 3 or 4
- 5-9
- 10 or more

21. How many books do you own?

- 0-9
- 10-20
- More than 20

APPENDIX-VII

KERALA AGRICULTURAL UNIVERSITY
 COLLEGE OF AGRICULTURE, VELLAYANI, TRIVANDRUM
 DEPARTMENT OF HOME SCIENCE
 TRIVANDRUM DEVELOPMENTAL SCREENING CHART



APPENDIX-VIII
KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI, TRIVANDRUM
DEPARTMENT OF HOME SCIENCE

ശിശുക്കളുടെ പോഷകനിലവാരത്തെപ്പറ്റി അമ്മമാരുടെ അറിവ്
നിർണ്ണയിക്കുന്നതിനുള്ള ചോദ്യാവലി

അമ്മയുടെ പേര്:

കുഞ്ഞിന്റെ പേര്:

താഴെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനകൾ വായിച്ച ശേഷം അവ ശരിയോ ()
തെറ്റോ () എന്ന് രേഖപ്പെടുത്തുക

1. പനിയുള്ളപ്പോൾ കുഞ്ഞിന് നേർപ്പിച്ച് പാൽ മാത്രം കൊടുക്കണം.
2. അമ്മ കഴിയ്ക്കുന്ന ഭക്ഷണത്തിന്റെ പകുതിയോളം കുഞ്ഞ് കഴിക്കേണ്ടതാണ്.
3. എട്ടുമാസമാകുമ്പോൾ കുഞ്ഞിന് പരസഹായമില്ലാതെ ഇരിക്കാൻ പറ്റും.
4. നവജാതശിശുവിന്റെ ഹൃദയമിടിപ്പ് സാവധാനത്തിലാണ്.
5. പാൽപ്പല്ല് സാധാരണയായി 6 മാസത്തിനും 8 മാസത്തിനും ഇടയിൽ മുളയ്ക്കുന്നു.
6. ഗർഭിണിയുടെ പോഷകകുറവ് കുഞ്ഞിന് തൂക്കക്കുറവുണ്ടാകാൻ കാരണമാകുന്നു.
7. മുലയൂട്ടൽ അമ്മയുടെ ഗർഭധാരണം തടയാൻ സഹായിക്കുന്നു.
8. 6 മാസം വരെ കുഞ്ഞിന് മുലപ്പാൽ മാത്രമേ നൽകാവൂ.
9. മുലയൂട്ടുന്ന സമയത്ത് അമ്മ ഊർജ്ജം കൂടുതലുള്ള ആഹാരം കഴിക്കണം.
10. കുഞ്ഞ് കരയുമ്പോൾ മാത്രം മുലപ്പാൽ നൽകണം.
11. മുലയൂട്ടൽ അമ്മയുടെയും കുഞ്ഞിന്റെയും ഇടയിൽ വൈകാരിക ബന്ധം ഉറപ്പിക്കാൻ സഹായിക്കുന്നു.
12. പോഷകകുറവുള്ള കുഞ്ഞുങ്ങളിൽ ഇരിക്കാനും നടക്കാനുമുള്ള ശേഷി യഥാസമയത്ത് ഉണ്ടാകുന്നില്ല.
13. നവജാതശിശുവിന് മഞ്ഞപ്പാൽ നൽകരുത്.
14. ശിശുഭക്ഷണത്തിൽ ഖരപദാർത്ഥത്തിന്റെ അളവ് കൂടുതലും വെള്ളത്തിന്റെ അളവ് കുറഞ്ഞുമിരിക്കണം.
15. കടകളിൽ വാങ്ങാൻ കിട്ടുന്ന ശിശുഭക്ഷണത്തേക്കാൾ വീട്ടിലുണ്ടാക്കുന്ന ശിശുഭക്ഷണത്തിലാണ് കൂടുതൽ പോഷകങ്ങൾ ഉള്ളത്.

APPENDIX – IX

**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE**

BODY MASS INDEX OF MOTHERS

| S.No | Ht. (cm) | Wt (kg) | BMI | S.No | Ht. (cm) | Wt. (kg) | BMI |
|------|----------|---------|-------|------|----------|----------|-------|
| 1. | 156 | 41 | 16.84 | 1. | 163 | 55 | 20.70 |
| 2. | 153 | 37 | 15.81 | 2. | 150 | 47 | 20.88 |
| 3. | 155 | 37 | 15.41 | 3. | 150 | 62 | 27.58 |
| 4. | 155 | 38 | 15.81 | 4. | 157 | 53 | 21.50 |
| 5. | 149 | 35 | 14.34 | 5. | 153 | 49 | 20.93 |
| 6. | 156 | 37 | 15.22 | 6. | 153 | 62 | 26.49 |
| 7. | 154 | 39 | 16.44 | 7. | 153 | 49 | 20.93 |
| 8. | 157 | 39 | 15.85 | 8. | 148 | 46 | 21.00 |
| 9. | 162 | 42 | 15.14 | 9. | 148 | 38 | 17.35 |
| 10. | 161 | 45 | 17.36 | 10. | 151 | 48 | 21.05 |
| 11. | 161 | 45 | 17.36 | 11. | 151 | 50 | 21.92 |
| 12. | 137 | 33 | 17.58 | 12. | 152 | 49 | 21.20 |
| 13. | 149 | 37 | 16.52 | 13. | 159 | 54 | 21.35 |
| 14. | 146 | 45 | 18.75 | 14. | 159 | 54 | 21.35 |
| 15. | 157 | 45 | 18.25 | 15. | 150 | 53 | 20.88 |
| 16. | 153 | 43 | 18.36 | 16. | 154 | 51 | 21.50 |
| 17. | 153 | 39 | 16.66 | 17. | 155 | 52 | 21.64 |
| 18. | 152 | 43 | 18.61 | 18. | 160 | 57 | 22.26 |
| 19. | 152 | 43 | 18.61 | 19. | 164 | 60 | 22.30 |
| 20. | 157 | 40 | 18.26 | 20. | 164 | 60 | 22.30 |
| 21. | 146 | 40 | 18.76 | 21. | 149 | 50 | 22.52 |
| 22. | 146 | 40 | 18.74 | 22. | 160 | 58 | 22.65 |
| 23. | 146 | 40 | 18.76 | 23. | 150 | 51 | 22.66 |
| 24. | 159 | 48 | 18.98 | 24. | 158 | 57 | 22.83 |
| 25. | 153 | 45 | 19.22 | 25. | 155 | 55 | 22.89 |
| 26. | 152 | 45 | 19.47 | 26. | 155 | 55 | 22.89 |
| 27. | 156 | 48 | 19.72 | 27. | 150 | 40 | 17.79 |
| 28. | 156 | 48 | 19.72 | 28. | 154 | 56 | 23.61 |
| 29. | 156 | 48 | 19.72 | 29. | 162 | 62 | 23.62 |
| 30. | 162 | 52 | 19.81 | 30. | 151 | 54 | 23.68 |
| 31. | 154 | 47 | 19.84 | 31. | 152 | 55 | 23.80 |
| 32. | 154 | 47 | 19.81 | 32. | 152 | 55 | 23.80 |
| 33. | 153 | 52 | 21.66 | 33. | 156 | 59 | 24.24 |
| 34. | 150 | 45 | 20.00 | 34. | 148 | 53 | 24.42 |
| 35. | 150 | 57 | 24.31 | 35. | 165 | 67 | 24.60 |

| | | | | | | | |
|-----|-----|----|-------|-----|-----|----|-------|
| 36. | 161 | 52 | 20.06 | 36. | 168 | 71 | 25.15 |
| 37. | 156 | 52 | 21.39 | 37. | 159 | 76 | 30.06 |
| 38. | 156 | 49 | 20.13 | 38. | 152 | 61 | 26.40 |
| 39. | 159 | 57 | 22.61 | 39. | 149 | 62 | 27.92 |
| 40. | 156 | 49 | 20.13 | 40. | 158 | 73 | 29.31 |
| 41. | 162 | 53 | 20.19 | 41. | 158 | 66 | 26.43 |
| 42. | 159 | 59 | 23.41 | 42. | 158 | 66 | 26.43 |
| 43. | 154 | 48 | 20.23 | 43. | 158 | 44 | 17.67 |
| 44. | 163 | 54 | 20.32 | 44. | 158 | 66 | 26.43 |
| 45. | 158 | 51 | 20.42 | 45. | 154 | 49 | 20.66 |
| 46. | 154 | 49 | 20.66 | 46. | 154 | 65 | 27.40 |
| 47. | 151 | 61 | 26.75 | 47. | 150 | 39 | 17.33 |
| 48. | 154 | 49 | 20.66 | 48. | 150 | 62 | 27.55 |
| 49. | 154 | 49 | 20.66 | 49. | 152 | 41 | 17.74 |
| 50. | 163 | 55 | 20.70 | 50. | 162 | 67 | 25.53 |

APPENDIX – X

**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE**

NUTRITIONAL STATUS INDEX (NSI) VALUES OF SUBJECTS

| S.No. | NSI values of infants | S.No. | NSI values of toddlers |
|-------|-----------------------|-------|------------------------|
| 1. | 32.56 | 1. | 31.30 |
| 2. | 34.79 | 2. | 27.62 |
| 3. | 34.11 | 3. | 30.42 |
| 4. | 34.52 | 4. | 29.36 |
| 5. | 33.77 | 5. | 30.50 |
| 6. | 34.83 | 6. | 29.25 |
| 7. | 33.68 | 7. | 26.01 |
| 8. | 33.75 | 8. | 30.34 |
| 9. | 33.15 | 9. | 30.80 |
| 10. | 35.14 | 10. | 27.69 |
| 11. | 33.44 | 11. | 28.60 |
| 12. | 31.08 | 12. | 28.94 |
| 13. | 34.32 | 13. | 28.26 |
| 14. | 32.58 | 14. | 28.43 |
| 15. | 33.97 | 15. | 30.79 |
| 16. | 33.89 | 16. | 28.70 |
| 17. | 34.39 | 17. | 28.50 |
| 18. | 33.4 | 18. | 30.42 |
| 19. | 33.4 | 19. | 28.73 |
| 20. | 33.46 | 20. | 30.97 |
| 21. | 34.76 | 21. | 28.91 |
| 22. | 34.25 | 22. | 30.38 |
| 23. | 34.43 | 23. | 29.88 |
| 24. | 34.04 | 24. | 29.24 |
| 25. | 33.36 | 25. | 27.43 |
| 26. | 33.73 | 26. | 28.69 |
| 27. | 33.66 | 27. | 28.26 |
| 28. | 34.44 | 28. | 27.62 |
| 29. | 33.83 | 29. | 28.26 |
| 30. | 33.53 | 30. | 28.42 |
| 31. | 33.73 | 31. | 30.34 |
| 32. | 34.02 | 32. | 30.45 |
| 33. | 33.48 | 33. | 28.26 |

| | | | |
|-----|-------|-----|-------|
| 34. | 33.37 | 34. | 28.30 |
| 35. | 33.48 | 35. | 28.87 |
| 36. | 33.42 | 36. | 29.49 |
| 37. | 33.33 | 37. | 27.69 |
| 38. | 34.26 | 38. | 28.64 |
| 39. | 33.36 | 39. | 27.62 |
| 40. | 33.78 | 40. | 25.23 |
| 41. | 34.35 | 41. | 27.28 |
| 42. | 34.14 | 42. | 28.87 |
| 43. | 34.84 | 43. | 29.51 |
| 44. | 33.17 | 44. | 30.45 |
| 45. | 34.78 | 45. | 29.81 |
| 46. | 34.71 | 46. | 27.56 |
| 47. | 34.76 | 47. | 29.64 |
| 48. | 34.59 | 48. | 28.73 |
| 49. | 34.42 | 49. | 27.63 |
| 50. | 34.27 | 50. | 28.44 |

APPENDIX – XI

**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE**

HOME ENVIRONMENT INDEX VALUES OF INFANTS AND TODDLERS

| S No. | HEI values of infants | S No. | HEI values of toddlers |
|-------|-----------------------|-------|------------------------|
| 1. | 0.535211 | 1. | 0.824324 |
| 2. | 0.633803 | 2. | 0.662162 |
| 3. | 0.661972 | 3. | 0.824324 |
| 4. | 0.71831 | 4. | 0.824324 |
| 5. | 0.704225 | 5. | 0.810811 |
| 6. | 0.690141 | 6. | 0.824324 |
| 7. | 0.591549 | 7. | 0.527027 |
| 8. | 0.647887 | 8. | 0.797297 |
| 9. | 0.521127 | 9. | 0.756757 |
| 10. | 0.492958 | 10. | 0.472973 |
| 11. | 0.56338 | 11. | 0.486486 |
| 12. | 0.71831 | 12. | 0.540541 |
| 13. | 0.704225 | 13. | 0.432432 |
| 14. | 0.647887 | 14. | 0.445946 |
| 15. | 0.71831 | 15. | 0.418919 |
| 16. | 0.661972 | 16. | 0.486486 |
| 17. | 0.676056 | 17. | 0.5 |
| 18. | 0.450704 | 18. | 0.459459 |
| 19. | 0.56338 | 19. | 0.445946 |
| 20. | 0.464789 | 20. | 0.72973 |
| 21. | 0.464789 | 21. | 0.756757 |
| 22. | 0.549296 | 22. | 0.72973 |
| 23. | 0.56338 | 23. | 0.743243 |
| 24. | 0.464789 | 24. | 0.743243 |
| 25. | 0.43662 | 25. | 0.418919 |
| 26. | 0.464789 | 26. | 0.635135 |
| 27. | 0.507042 | 27. | 0.635135 |
| 28. | 0.43662 | 28. | 0.702703 |
| 29. | 0.478873 | 29. | 0.175676 |
| 30. | 0.605634 | 30. | 0.594595 |
| 31. | 0.619718 | 31. | 0.540541 |
| 32. | 0.507042 | 32. | 0.648649 |

| | | | |
|-----|----------|-----|----------|
| 33. | 0.464789 | 33. | 0.608108 |
| 34. | 0.478873 | 34. | 0.635135 |
| 35. | 0.450704 | 35. | 0.648649 |
| 36. | 0.507042 | 36. | 0.594595 |
| 37. | 0.619718 | 37. | 0.662162 |
| 38. | 0.507042 | 38. | 0.594595 |
| 39. | 0.464789 | 39. | 0.648649 |
| 40. | 0.43662 | 40. | 0.675676 |
| 41. | 0.464789 | 41. | 0.554054 |
| 42. | 0.43662 | 42. | 0.540541 |
| 43. | 0.464789 | 43. | 0.689189 |
| 44. | 0.43662 | 44. | 0.459459 |
| 45. | 0.619718 | 45. | 0.648649 |
| 46. | 0.521127 | 46. | 0.702703 |
| 47. | 0.521127 | 47. | 0.743243 |
| 48. | 0.71831 | 48. | 0.797297 |
| 49. | 0.71831 | 49. | 0.824324 |
| 50. | 0.605634 | 50. | 0.824324 |

APPENDIX – XI

**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE**

DEVELOPMENTAL MILESTONE RATIO OF INFANTS AND TODDLERS

| S No. | DMR values of infants | S No | DMR values of toddlers |
|-------|-----------------------|------|------------------------|
| 1. | 0.7777 | 1. | 0.9215 |
| 2. | 0.8887 | 2. | 0.9419 |
| 3. | 1 | 3. | 1 |
| 4. | 0.8356 | 4. | 0.9753 |
| 5. | 1 | 5. | 1 |
| 6. | 0.8 | 6. | 1 |
| 7. | 0.8456 | 7. | 1 |
| 8. | 1 | 8. | 1 |
| 9. | 0.8754 | 9. | 0.9654 |
| 10. | 1 | 10. | 1 |
| 11. | 1 | 11. | 1 |
| 12. | 1 | 12. | 1 |
| 13. | 1 | 13. | 1 |
| 14. | 1 | 14. | 0.9031 |
| 15. | 1 | 15. | 1 |
| 16. | 1 | 16. | 0.9578 |
| 17. | 1 | 17. | 1 |
| 18. | 0.8965 | 18. | 1 |
| 19. | 1 | 19. | 0.9645 |
| 20. | 0.8876 | 20. | 1 |
| 21. | 1 | 21. | 1 |
| 22. | 1 | 22. | 1 |
| 23. | 0.8 | 23. | 1 |
| 24. | 1 | 24. | 0.9427 |
| 25. | 1 | 25. | 1 |
| 26. | 1 | 26. | 1 |
| 27. | 1 | 27. | 1 |
| 28. | 1 | 28. | 1 |
| 29. | 1 | 29. | 0.9537 |
| 30. | 1 | 30. | 1 |
| 31. | 1 | 31. | 1 |
| 32. | 1 | 32. | 0.9314 |

| | | | |
|-----|---------|-----|--------|
| 33. | 1 | 33. | 1 |
| 34. | 0.9139 | 34. | 1 |
| 35. | 1 | 35. | 1 |
| 36. | 1 | 36. | 1 |
| 37. | 0.75 | 37. | 1 |
| 38. | 1 | 38. | 0.9324 |
| 39. | 1 | 39. | 1 |
| 40. | 0.88889 | 40. | 0.9425 |
| 41. | 1 | 41. | 1 |
| 42. | 1 | 42. | 0.8932 |
| 43. | | 43. | 1 |
| 44. | 0.8 | 44. | 0.9675 |
| 45. | 1 | 45. | 1 |
| 46. | 1 | 46. | 1 |
| 47. | 1 | 47. | 0.9365 |
| 48. | 1 | 48. | 1 |
| 49. | 1 | 49. | 1 |
| 50. | 1 | 50. | 0.9436 |

Abstract

**NUTRITIONAL STATUS AND HOME ENVIRONMENT AS
DETERMINANTS OF ATTAINMENT OF DEVELOPMENTAL
MILESTONES IN CHILDREN**

SOUMYA.M.S

**Abstract of the
thesis submitted in partial fulfillment of the requirement
for the degree of**

**Master of Science in Home Science
(Food Science and Nutrition)**

**Faculty of Agriculture
Kerala Agricultural University, Thrissur**

2008

**Department of Home Science
COLLEGE OF AGRICULTURE
VELLAYANI, THIRUVANANTHAPURAM – 695 522**

8. ABSTRACT

A study on 'Nutritional status and home environment as determinants of attainment of developmental milestones in children' was carried out to find out the relationship between milestone attainment, nutritional status and home environment of children.

The present study was done in Vellanad ICDS project of Thiruvananthapuram District among fifty infants and fifty toddlers.

The data pertaining to the socioeconomic and child's characteristics, health and nutritional profile was assessed using a suitably structured pretested schedule. Home environment of the subjects was assessed using the modified version of Caldwell's HOME INVENTORY standardized by Child Development Centre, Govt. Medical College, Thiruvananthapuram. Developmental milestones of the subjects were assessed using Trivandrum Developmental Screening Chart also developed by Child Development Centre, Thiruvananthapuram. The data collected were tabulated, analyzed statistically and the results were interpreted.

Majority of the mothers interviewed were in the age group of 20-25 years. The age group of fathers was between 30-40 years. Socioeconomic data of the subjects indicated that majority of the families were Hindus with a majority belonging to backward caste. Most of the participants were from nuclear family with medium level of education, low monthly income and moderate physical amenities.

Data collected about child's characteristics revealed that majority of the subjects were males. Majority of them were of first birth order and were delivered normally.

Feeding practices of infants and toddlers revealed that colostrum was given as the first feed. About sixty eight per cent of mothers followed demand feeding.

Problems related to weaning such as diarrhea, vomiting and constipation were common among the children.

Analysis on knowledge of mothers regarding nutrition and child care revealed that majority of them had only medium level of knowledge.

Anthropometric measurements revealed that BMI of twenty two per cent of mothers fell below normal range and one per cent were obese. Anthropometric data on children revealed that majority of the children were normal according to weight for age based on Gomez classification. Based on IAP classification fifty eight per cent of the subjects were normal and forty five per cent were normal based on Z score classification. Based on height for age Z score classification, fifty six per cent of the subjects were normal and eleven per cent were found to have severe malnutrition. Wasting was seen among nine per cent of the subjects and twenty three per cent suffered from wasting and stunting according to Waterlow's classification. Data on MUAC found that fifteen per cent suffered from severe malnutrition. Twenty per cent were found to be malnourished when head to chest circumference ratio was assessed.

Clinical examination of the subjects revealed non specific symptoms such as discolouration of hair and angular stomatitis in eight and five per cent of children respectively. Anemia was found to be the most common clinical deficiency symptom prevalent.

Nutritional status index of the subjects indicated that 8 per cent of infants and 14 per cent of toddlers had low NSI.

Home environment of the subjects were studied using the HOME INVENTORY scale consisting of 19 items for infants and 21 items for toddlers. The scale consisted of statements grouped under six subscales which included parental responsiveness, acceptance of the child, organization of the environment, learning materials, parental involvement and variety in experience. Analysis of home environment based on the modified version of

HOME inventory revealed that 14 per cent of the infants and 16 per cent of toddlers did not get adequate home environment.

Developmental milestones were assessed using the Trivandrum Developmental Screening Chart. The chart consisted of 17 items of milestones which is designed for children upto 24 months of age. The child is said to have developmental delay if the child falls short on the vertical line of the left side of the chart. Assessment of developmental milestone ratio in the studied subjects showed that 2 per cent of infants and 6 per cent of toddlers had delayed developmental milestones.

A significant correlation was found between nutritional status and BMI, infant feeding practices, birth order and income and between developmental milestone ratio and economic status and home environment with birth weight. Intercorrelation between dependant variables revealed that there is significant relationship among them. The study highlights the importance of creating more awareness among parents of infants and toddlers about the importance of proper feeding practices and also providing them a stimulating environment for their holistic development.