NUTRITIONAL PROFILE AND MENTAL FUNCTIONS OF PRESCHOOL CHILDREN BELONGING TO AGRICULTURAL LABOURER FAMILIES IN THRISSUR DISTRICT

By

SHYNA P. K.

THESIS

Submitted in partial fulfilment of the
requirement for the degree of

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Faculty of Agriculture
Kerala Agricultural University

DEPARTMENT OF HOME SCIENCE
COLLEGE OF HORTICULTURE
VELLANIKKARA, THRISSUR - 680 654

1996

DECLARATION

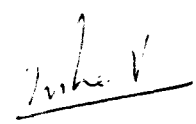
I hereby declare that this thesis entitled **"Nutritional profile and mental functions of preschool children belonging to agricultural labourer families in Thrissur district"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Vellanikkara
21/12/96

SHYNA, P.K.

CERTIFICATE

Certified that the thesis entitled "**Nutritional profile and mental functions of preschool children belonging to agricultural labourer families in Thrissur district**" is a record of the research work done independently by Miss.Shyna, P.K. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.



Dr.V.Usha
Chairperson
Associate Professor
Department of Home Science
College of Horticulture

Vellanikkara
21-12-96

CERTIFICATE

We, the undersigned members of the Advisory Committee of **Miss.Shyna,P.K.** candidate for the degree of **Master of Science in Home Science** with major in **Food Science and Nutrition**, agree that the thesis entitled "**Nutritional profile and mental functions of preschool children belonging to agricultural labourer families in Thrissur district**" may be submitted by Miss.Shyna, P.K. in partial fulfilment of the requirement for the degree.

Dr.V.Usha
Chairperson
Associate Professor
Department of Home Science
College of Horticulture
Vellanikkara

Dr.C.Bhaskaran
Associate Professor
Department of Agrl. Extension
College of Horticulture
Vellanikkara

Smt.Norma Xavier, C.
Assistant Professor
Department of Home Science
College of Horticulture
Vellanikkara

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

21/12/96
EXTERNAL EXAMINER

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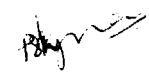

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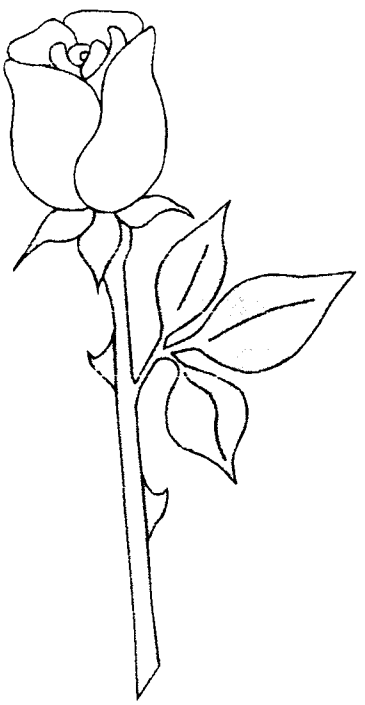

Dedicated to my loving parents

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Introduction

INTRODUCTION

The quality of human resources of any country is largely determined by the quality of its children. India has often been referred to as a nation of the young. In India 40 per cent (297 million) of its population belonged to the group of 1-5 years, out of them infants and preschool children are nearly 110 million (Gopalan, 1992).

From the nutritional stand point children below the age of 5 years are the most vulnerable group. Majority of the preschool children belonging to the poor income groups in developing countries suffered from various degrees of growth retardation due to nutritional deprivation. Malnutrition, especially among preschool children is one of the important public health problems in our country. India has the second highest incidence of clinical measures of malnutrition among all the countries surveyed by UN (1993).

Mortality and morbidity levels are high in malnourished children and even common infectious diseases can often become catastrophic. The foundation of good health and sound mind are laid during the preschool age. Nutrition is one of the most important factors responsible for proper growth in infancy and childhood.

Undernourished children if they survived are ultimately stunted with poor attainment and poor productivity. In recent years marked interest has arisen in whether chronic under nutrition during the preschool years modifies behaviour and mental capacity. This problem is of extra ordinary importance because almost 70 per cent of the world population now suffered from chronic undernutrition of varying

degrees. If these statements are valid, it would be obvious that undernutrition constitutes one of the major obstacles to the progress of developing countries, since for their advancement, they need highly qualified individuals at all levels.

The health situation in Kerala is different from other parts of the country. It is believed that in Kerala the health situation as measured by infant mortality is far superior to any other state in India, mainly because of high social status. Infant mortality rate in India was 80/1000 live births while in Kerala it was much reduced to 13/1000 live births (Harichandran, 1995). Inspite of low IMR and high life expectancy the morbidity of children is high. This calls for an indepth study on the dietary intake and growth pattern of children under the heterogeneous condition in Kerala and such a study seems to be very meaningful.

Mental functions and its relation to the degree of growth retardation is relatively a new concept. However, studies have been carried out mostly on severe cases of Kwashiorkor, marasmus or marasmic Kwashiorkor in some countries. There have been very few research attempts in India especially in Kerala relating the mental functions of children with various grades of growth retardation without manifestation of clinical signs. An attempt was therefore made to assess

a) The nutritional status of preschool children (4-5 age group) belonging to agricultural labourer families and
b) The association, if any between nutritional status and mental functions.

Review of Literature

2. REVIEW OF LITERATURE

Preschool years are the most vulnerable period when the child has to get adequate nutrition, since the foundation and sustenance of good health (both physical and mental) is laid during the preschool age. A child who has failed to grow during this crucial period, may not make up the loss in growth even with an excellent diet in later life. A brief review of literature on the significance of preschool age - the need for good nutrition, prevalence of malnutrition among preschool children, factors contributing to malnutrition, food consumption pattern of preschool children, mortality and morbidity pattern, consequences of malnutrition, malnutrition and mental abilities and malnutrition and physical growth pattern is discussed in this chapter.

2.1 Significance of preschool age: The need for good nutrition

Preschool years are otherwise known as the "foundation years", because it is during these years that the fundamental attitudes are formed, and this formed the basis for future growth and development (Gopalan, 1992). The period between birth and five years has a crucial influence on further development of the child. It is during these preschool years that foundation of the childs life is laid, and it determines whether a child will grow into a healthy strong adult or not (World Bank, 1994). It is during the first five years, the child grows rapidly, physically and mentally. Malnutrition during this period resulted in stunted growth which affected on his later development (Easwaran and Devadas, 1984; UNICEF, 1990 and Anand, 1994).

Nagi and Sharmath (1991) and Murthy (1993) highlighting the significance of preschool age stated that preschool age next to infancy is the most vulnerable period. Hence the need for good nutrition during preschool years gained immense importance. As reported by Khanna and Krishnamurthy (1989) and Harris (1992) this most vulnerable period required proper nourishment for normal growth and development. Lack of proper nourishment lead to many diasterous consequences like stunted physical growth, generalised functional impairment, disability, diminished productivity and increased chances for infections.

Normal health and development during childhood years is mainly based on a sound nutritional intake. The interaction between the growth of the mind and the body has been observed and experimented by various investigators (Muller, 1981; Monteiro *et al.*, 1987; Ukoko, 1988; Devadas, 1991; NIPCCID, 1992; UNICEF, 1992; Saouma, 1992; Vella *et al.*, 1994 and Kanbur, 1995).

To ensure proper nourishment during preschool years for growing to his or her genetic potential, a balanced diet is essential. Faulty nutrition during early life has been incriminated as a cause for diseases during adulthood (Ali, 1987; Taitz and Wardly, 1989; Shiva, 1993 and Chandran, 1994).

Depending on the highly variable conditions of living in India, the first few years of life could be an exciting phase of rapid growth and development of the budding brain and body. Lack of good nutrition during these years lead to poor health and high rate of mortality (Varadarajan, 1989; Kumar *et al*, 1990; Lucas, 1992 and World Bank, 1993). Optimum nutrition in terms of quality and quantity is essential for growth and development of children. (McLarane, 1980; Lansdown, 1985; Neal, 1988; Baveja *et al.*, 1993 and Ampofo, 1994.)

According to Ashwell (1990), Pollitt (1990) and Choksi (1995), nutritional factors played a significant role in resistance to infection among infants and children. Adequate nutrition is needed for proper functioning of the immune system for the defensive mechanism of the body, during preschool years. But an excessive intake of nutrients also have immune suppressive effect. Therefore balanced nutrition is very important for the normal functioning of the immune system (Chen *et al.*, 1980 and Awasthi *et al.*, 1990).

If the nutritional foundations are not provided adequately to the child during his early years, it will affect his overall development (DHS, 1991; Cohen, 1993 and Choksi, 1995). From the nutritional stand point, infants and children constituted the most vulnerable segment of any population. Most of the mental and physical development of the human being occured in the first few years of life. The world summit for children on September 30, 1990 held in New York, brought together 159 nations and set out overall goals for 1990-2000 AD. One of the major promise of the world summit for children was, to bring forth an one-third reduction in under five death rates and halving of severe and moderate malnutrition among the worlds' under fives (UNICEF, 1992).

2.2 Malnutrition - Its prevalence among preschool children

Malnutrition is a condition when one or two nutrients are less or are in excess in the body (Robinson, 1990 and Begum, 1991). Malnutrition has been described as a biological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients (WHO, 1993).

Malnutrition and infections are the two major shackles to development and survival. Poverty and ignorance lead to this dismal and appalling situation. Children were exposed to longer term consequences of malnutrition, and malnutrition was described as the disease of the poor (Pelletier *et al.*, 1995).

WHO (1990) had estimated that there were at any point of time approximately 10 million children under the age of five who were afflicted with the most severe form of protein energy malnutrition and another 90 million who showed moderate degrees of its prevalence. Srikantia (1989) and Gopalan (1992) had observed that the most important nutritional disease in the developing countries is, protein energy malnutrition (PEM). It is mainly because of its high prevalence, and its relationship with child mortality rate, impaired physical growth and inadequate social and economical development.

A survey conducted by UN (1993) revealed that India had the second highest incidence of clinical measures of malnutrition among all the countries surveyed. In India it was reported that 27 per cent of 1-2 years of old children were under wasting, and 65 per cent of 2-5 years were stunted (Uvin, 1994).

The magnitude of malnutrition in India as reported by UNICEF (1990), Swaminathan (1991) and Gopalan (1992) revealed that the most serious nutritional problems among preschool children were protein energy malnutrition, nutritional anaemia, vitamin A deficiency and iodine deficiency. About 110 million children under five years old were underweight and more than 20 million suffered from vitamin A deficiency, some of them became blind and eventually died.

UNICEF (1992) conducted studies on the prevalence of malnutrition among preschool children in 7 major states in India viz. Kerala, Tamil Nadu, Karnataka, Andra Pradesh, Maharashtra, Gujarat and Orissa. The proportion of children with severe malnutrition declined from 18.0 per cent to 9.3 per cent during the period, except in case of Gujarat and Orissa. However, the prevalence of malnutrition increased from 25.5 per cent to 34.1 per cent.

National Nutrition Monitoring Bureau (1991) reported that about 17 per cent of children below 5 years suffered from severe malnutrition linked to a weight deficit of over 40 per cent and nearly 45 per cent of children of this age group were estimated to suffer from moderate malnutrition. As reported by UNICEF (1991) about 20 per cent of children were borne with low birth weight, 40 per cent under five years manifested protein energy malnutrition, 2.5 lakhs lost their sight, 42,000 became totally blind and 72,000 suffered from poor vision.

According to UNICEF (1991), WHO (1991) and ICMR (1995) the major nutritional deficiency in India are protein energy malnutrition and Vitamin A deficiency among children and iron and B complex deficiency among all groups. NNMB (1989) in their studies revealed that the prevalence of mild malnutrition increased from 25.5 per cent to 34.1 per cent though the severe malnutrition declined from 10.0 per cent to 9.3 per cent during the period 1975 to 1989.

One of the major health problem in the developing world is vitamin A deficiency. Vitamin A deficiency has long been recognised as a serious and preventable nutritional disease. The impact of vitamin A deficiency - xerophthalmia is widely recognised as a leading cause of childhood blindness (WHO, 1987).

In India 15-20 per cent of all preschool children in rural areas showed signs of vitamin A deficiency (Vijayaraghavan, 1990). Sommer *et al.* (1984) and Pelletier (1994) estimated that in Asia alone, about 5,00,000 children under 6 years of age developed potentially blinding corneal xerophthalmia in each year.

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

It has been estimated that of the children belonging to 37 developing nations, about 250,000 preschool children in the world died due to complications associated with vitamin A deficiency every year (UN, 1992). Reddy *et al* (1993) reported that the prevalence of xerophthalmia identified by the presence of bitot's spot was 1.8 per cent in children aged between 1-5 years.

Anaemia is another serious public health problem. It has impact on psychological and physical development, behaviour and work performance. Muratee (1990) and Morene (1993) has opined that young children and pregnant women are the most affected groups with an estimated global prevalence of about 40 per cent and 50 per cent respectively.

Rajajee (1989) estimated that nearly 35-50 per cent of children in India in rural areas belonging to low income groups had anaemia due to iron deficiency.

The problem of iron deficiency anaemia is world wide. Soekirmn and Jalal (1991) reported that nearly 200 millions of preschool and school children suffered from anaemia and they had learning disabilities which resulted in suboptimal scholarstic performance.

Gopalan (1988) conducted studies on preschool children and it was observed that 40 per cent of the preschool children in India were inadequately nourished, nearly 50 per cent children were affected by iron deficiency anaemia and an estimated 40,000 children became blind every year mainly due to vitamin A deficiency.

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

The study conducted by Lina (1980) in Trichur District revealed that the prevalence of nutritional deficiency disease was of the order of one to two per cent of PCM, 0.29 to 0.76 for nutritional anaemia and 0.09 to 0.25 for vitamin A deficiency.

Thomas (1989) reported that the prevalence of moderate malnutrition was 70 per cent and under nutrition 13 per cent among preschool children belonging to agricultural labourer families of Trivandrum district. Begum (1995) in her studies among preschool children belonging to different socio economic groups in Thiruvananthapuram urban area revealed that the rate of prevalence of mild and moderate malnutrition was 46 and 34 per cent respectively.

2.3 Factors contributing to malnutrition

The term malnutrition is an outcome of multifarious factors which included social, economical and environmental factors. Rao (1993) reported that

varying levels of such factors will therefore show different prevalence rates of malnutrition. According to Abbi *et al.* (1988) socio economic environment (including nutritional and health inputs) was the ultimate determinant of growth and development of human organism.

According to Geetha and Devadas (1986) socio economic status had a very dominant role on the growth and physical development of children. There was found to be considerable difference in the average body size, at all ages even at birth, among children from different socio economic classes within the same community.

Over the years malnutrition has been found mostly in the poor socio economic groups of the developing countries with a connotation of under or deficient nutrition, caused by inadequate quantity and unsatisfactory quality of food, energy and other nutrients (Dutre-J.E.de-Oliveira, 1991 and Kanbur, 1995).

ICSSR (1980) and Gopalan (1990) reported that with favourable social and political factors even a comparitively limited economic growth can lead to an outstanding improvement in health status. It is clear evidence in Kerala where the improvement in health status is far better than in the more affluent Rajasthan or Punjab.

Cohen (1993) from the available world wide data concluded that dietary and environemntal constraints were the major determinants of differences between the growth performance of children of developing and developed countries.

Favourable environmental factors which included preventive health care, purchasing power, feeding pattern, food availability and various socio cultural

factors were very important for the full genetic potential for growth (Geetha and Devadas, 1986; Ramachandran, 1989; Mahan and Arli, 1992; Gopalan, 1991 and Alderman, 1993).

Human malnutrition is an ecological problem. It is the end result of multiple overlapping and interacting factors in the community which included physical biological social and cultural environment including economic constrains (Antia, 1987; Robinson, 1990 and Begum, 1991).

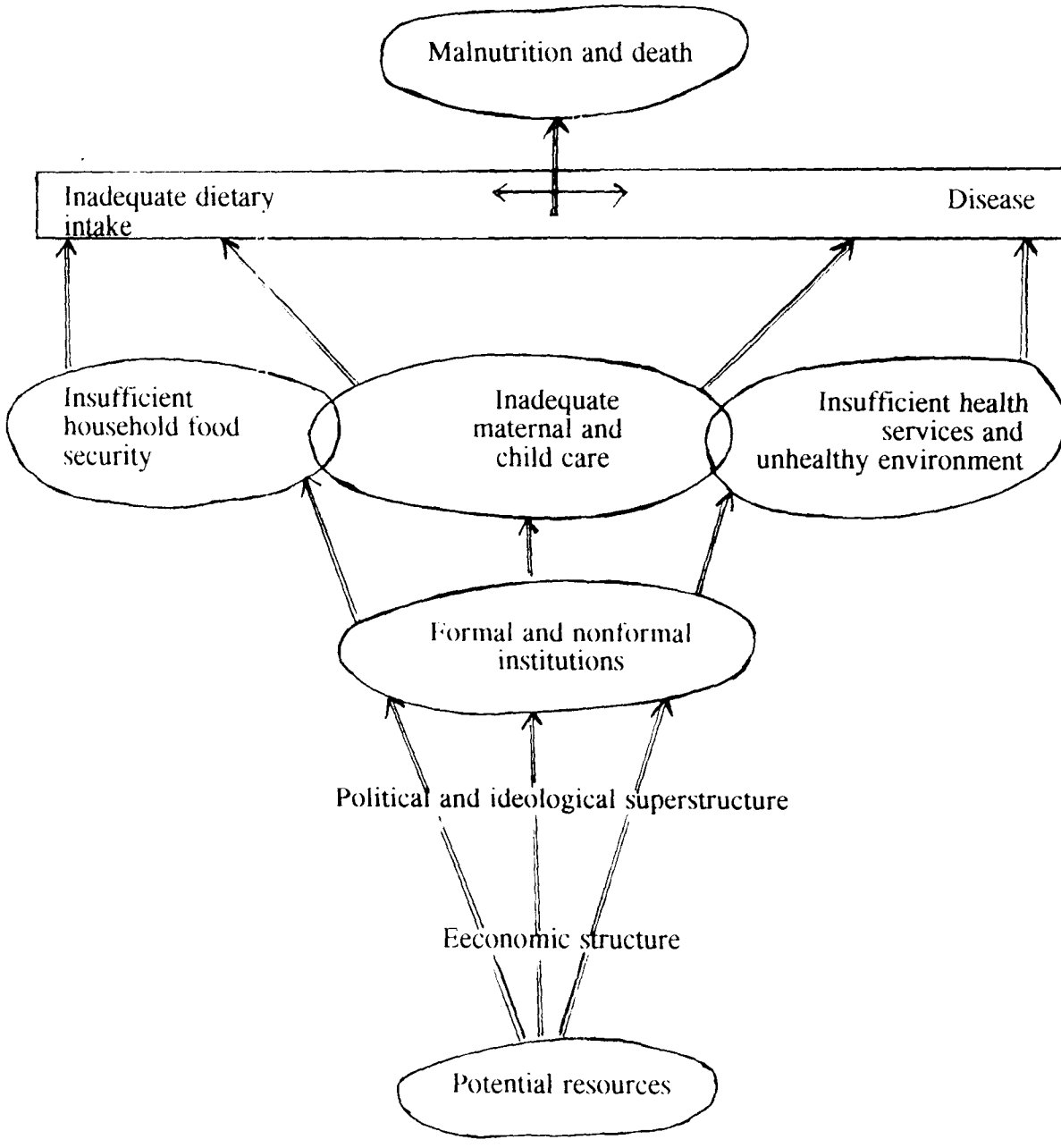
According to Rao (1989), Manan (1991), Young (1995) and WHO (1993), poor environmental hygiene, illiteracy, false beliefs and deep rooted customs, improper weaning practices, lack of maternal knowledge on childcare and child rearing practices were the factors contributing to malnutrition of preschool children (Fig. 1).

WHO (1990) has estimated that millions of children residing in the third world suffered from malnutrition as a result of poverty, unavailability of available foods, lack of knowledge and superstition.

One third to half of the children in the developing world remained undernourished due to an interplay of ignorance, inappropriate feeding practices, inadequate diet and infections (Lina and Reddy, 1984; Geetha and Devadas, 1986; Ghosh, 1986 and Gopalan, 1989).

Gopalan (1992) suggested that action was needed in large scale for the removal of female illiteracy, improvement in environmental sanitation and health care, encouraging increased participation of women in health and welfare programmes, inorder to maintain sustained betterment of growth and development of children, which will contribute to nutritional upliftment. UNICEF (1990) and

Fig. 1. Underlying causes of malnutrition



Source: UNICEF (1991)

Gopalan (1991) stated that the distribution between illiteracy and basic literacy seemed to make a substantial difference to child survival.

World Bank (1995) stated that child health can best be protected when families acquired more knowledge, skill and motivation in those practices that defended against illness, disability and death.

Infections were another factor which posed a great risk among preschool children. Severely malnourished children developed severe cases of measles and measles in turn contributed to malnutrition. Measles related diarrhoea is an important factor in the interaction between measles and malnutrition (World Bank, 1995).

Diarrhoea, killed approximately 1 million (10 lakhs) children every year in India. Diarrhoea was also a major cause of child malnutrition (UNICEF, 1990 and Gopalan, 1991). Recurrent parasitic infestation lead to nutritional deficiency diseases and the general immune response of the body was also impaired (Sheshadri and Gopaldas, 1987 and Chowdhury, 1992).

2.4 Food consumption pattern of preschool children

The normal well fed child who is protected from infections, grows quickly particularly during the first few years. Children must consume sufficient high quality proteins, vitamins, minerals and energy in their diets if acceptable growth has to occur (Cameron and Hofvander, 1988).

A child required more calories/kg of the body when they are active and growing fast (Lucas, 1992). In the growing infant a prime need is for protein though the amount needed is not as much as it was once thought (Antia, 1987).

Gopalan *et al.* (1995) revealed that the habitual diets of preschool children in India was adequate in proteins but deficient in energy or food inadequacy. UNICEF (1991) has estimated that the percentage of children dificient of calories was far higher than that of children deficient in protein.

According to Garfield (1990), in low income population, children were fed by a small quantity of adult diet itself. Irvin (1994) stated that in rural India introduction of food supplements to children was delayed and in more than 90 per cent of the children, complete weaning took place only after 3 years.

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

Food consumption studies on preschool children in Chandigarh by Metha *et al.* (1980) revealed that the intake of proteins was adequate and cereals were the chief source of proteins in their diet. Calorie deficit was observed and this varied from 113-446 K cal/day. There was a marginal deficiency of iron and calcium in their daily diet.

Komalavally *et al.* (1988) in a one year follow up study of 200 preschool children in Surat city revealed that their diet provided 72-79 K cal/kg body weight and 2.2 g protein/kg bodyweight/day.

Food and nutrient intake data of 420 preschool children belonging to urban slums of Coimbatore city indicated that intake of all foods except fleshy foods fall short of RDA (Usha and George, 1990).

The dietary pattern of preschool children attending the Institute of Child Health in Coimbatore revealed that the intake of calories, proteins, calcium, iron and ß carotene was very much lower than the RDA (Geetha, 1986).

The results of the food consumption survey conducted by Begum (1995) in urban (poor) preschool children in Thiruvananthapuram indicated that the mean dietary intake of energy, protein, calcium, iron and vitamin A were below the RDA of nutrients.

2.5 Mortality and Morbidity pattern

Preschool children are subjected to high rates of mortality and morbidity due to various reasons. Underfive mortality rate according to UNICEF (1990) has been chosen as a measure of end result of the development process resulting from wide variety of inputs such as nutritional and health status, mothers health awareness, level of immunization and ORT use, MCH Service, availability of clean water, sanitation and overall safe environment for a child. In India reduction of underfive mortality by 7.1 per cent by 2000 AD is beyond expectations.

An inverse relationship has been documented between maternal literacy status and infant mortality by ICMR (1990). Gabr (1990) reported that mortality in under 5 decreased by 9 per cent in children born to mothers who have been educated even for one year. He had also pointed out that child mortality was about five times more among illiterate mothers compared to graduate mothers.

US Agency for International Development (1989) reported that the higher morbidity and mortality in the undernourished were due to lack of sanitation, impaired immunity and infectious diseases. Every minute eight children under the age of five died in the developing world and eight more were handicapped by one of the six communicable diseases viz. measles, polio, whooping cough, diphtheria, tetanus and tuberculosis (World Bank, 1995).

Diarrhoea caused dehydration, which killed approximately 1 million (10 lakhs) children every year in India (UNICEF, 1990). Morbidity due to diarrhoel disease was more among children whose weight for height was less than 70 per cent of standard (Tomkins, 1981 and Chandra, 1983).

Diarrhoea killed majority of infants and young children. The frequency of occurrence of diarrhoea increased with increase in undernutrition (Cameron and Staveren, 1988; UNICEF, 1991; Anand *et al.*, 1992 and Uppal, 1994). UNICEF (1991) has estimated that about five million diarrhoeal deaths occurred among pre-school children.

Acute respiratory infections (ARI) were leading causes of morbidity and mortality in children under five in India. ARI accounted for one third of all deaths among underfives in India. Severe infections such as pneumonia killed as many as 72,000 children each year (Steinhoff, 1988).

According to WHO (1985), diphtheria was the least well documented of the six diseases in the developing countries and threaten in the absence of immunization to emerge as an epidemic disease.

One of the indicators of health status of children is to have a close view on the communicable diseases viz. measles, Tuberculosis, pertusis, diarrhoea, polio and malaria that occured during specific periods, and India is the worlds largest reservoir of many of these diseases (Who, 1995). Out of the vaccine preventable diseases measles was the most important cause of childhood morbidity and mortality in developing countries (Srinivasan, 1991). World Bank (1995) reported that about 12 million children under the age of five died in the developing world in 1990, and a quarter of it were linked to infection.

The extent of contribution of vitamin A to morbidity and mortality among children has been the subject of considerable attention. Reddy (1991) had reported that most children with corneal xerophthalmia also had other conditions such as severe protein energy malnutrition, history of measles, diarrhoea, respiratory illnesses and a variety of other infections which independently contributed to high mortality.

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

A wide gap existed in the demographic indicators like infant mortality rate, under five mortality rate, expectancy of life etc. of developing and developed countries (Kapil, 1990, Srivastava, 1991 and Saibaba, 1992). World Bank (1994) has estimated that about 40 per cent of all deaths occured under the age of 5 years.

World Bank (1990) revealed that the underfive mortality rate in low income countries to be 191 but in the middle income countries mortality rate was reduced to 84. Increased number of premature and still born infants were also found in the deprived communities (Ebrahim, 1989; Taitz and Wardly, 1989; Gopalan, 1990 and WHO, 1993). The conventional indices of child health status are infant and child mortality rates, since high infant and child mortality goes hand in hand with high prevalence of malnutrition (Gopalan, 1986 and World Bank, 1995).

WHO (1990) has indicated that malnutrition directly or indirectly was responsible for 56 per cent of the mortality of children between 0 and 4 years of age.

Ministry of Health and Family Welfare (1994), indicated that the Universal Immunization Programme in India was aimed at protecting all infants against six killer diseases namely measles, poliomyelitis, diptheria, pertussis (whooping cough), tetanus and childhood tuberculosis. The increase in immunization coverage levels since 1985-86 after the launching of the Universal Immunization Programme has prevented 16.8 lakh deaths in 1990 in children under five year of age (WHO, 1990; WHO, 1991 and NIPCCID,1992).

Lack of immunization caused death of three out of every hundred children born due to measles, two from whooping cough and one from tetanus. Of the two hundred children born one will be disabled by polio. Therefore a thorough knowledge about immunization should be acquired by the parents (UNICEF, 1990; World Bank, 1994).

Large scale prevention of death among under five is mainly based on providing proper knowledge to parents on the preventive and remedial measures and on the widest application of practical low cost measures like breast feeding, oral rehydration, immunization and improved weaning practices (World Bank, 1986; Murthy, 1989 and World Bank, 1994).

It is believed that in Kerala the health situation as measured by infant mortality rate is far superior to any other state in India mainly because of high social status. Infant mortality rate in India was 80/1000 live births while in Kerala it was much reduced to 13/1000 live births (Harichandran, 1995).

2.6 Consequences of Malnutrition

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

More than 10 million babies suffered from malnutrition every year. Approximately half of the death in India among children under 6 years of age were directly due to severe malnutrition (Ravindran, 1984).

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

The foundation of the personality of a man was laid in the formative years of life. Any deficiency during this period of rapid growth and development caused irrepairable damage to the future development of the child and no subsequent

attention may make up for this loss (ICSSR, 1980; Mohanram, 1982 and Ghosh, 1986).

Improper nourishment resulted in stunted physical growth and development which lead to generalised functional impairment, disability, diminished productivity and inability to cope with environmental hazards, including resistance to infection (Harris, 1992). Good nutrition ensured protection while poor nutrition increased susceptibility to infections (Ashwell, 1990; Pollitt, 1990 and Choksi, 1995).

Growth is a key indicator of child health and malnutrition is a key determinant of the high childhood mortality (Murthy, 1993). Flattering of growth was strongly associated with poor health and malnutrition (Alderman, 1993 and Anand *et al*, 1994).

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

According to Reddy (1989) severe PEM was often preceeded by an episode of infection, diarrhoea and respiratory infection being the common precipitating factors. Apart from inadequate dietary intake recurrent infections contributed to wide spread malnutrition in young children. It was seen that parasitic infestation was more common in malnourished children than normal children (over one billion people).

A large number of young children in developing countries suffered from malnutrition either in mild, moderate or severe form. The malnourished children had

poor physical growth and experienced high rate of infection than those who were well nourished. Chen *et al.*, 1980; Kadam *et al.*, 1983 and 1984; Aswathi *et al.*, 1990 and Reddy, 1991).

Gopalan (1992) estimated that about 40,000 children turned blind each year mainly due to vitamin A deficiency. Vitamin A deficiency in children contributed to the development of respiratory diseases and diarrhoea at a higher rate than the normal children (Somer *et al.*, 1984).

According to UNICEF (1990) and Gopalan (1991), diarrhoea was also a major cause of child malnutrition. The main causes of diarrhoea were poor hygiene and lack of clean drinking water.

One of the major health problem in the developing world was vitamin A deficiency and xerophthalmia was one of the leading causes of childhood blindness (WHO, 1987). About 42,000 children in India became blind every year resulting from vitamin A deficiency. In Asia alone 500,000 young children lost their sight every year because of vitamin A deficiency and two third of them died within two weeks of becoming blind (UNICEF, 1991).

Anaemia was another important problem of serious public health significance which has impact on psychological and physical development, behaviour and work performance (World Bank, 1995). Deficiency of iron in the body caused functional disturbances in various tissues. The effects of iron deficiency on immune functions, mental function and physical work performance were of practical importance (Rajajee, 1989 and WHO, 1990).

Iodine deficiency disorders were another important disorder which have severe impact on children and adults. With every passing hour, 10 children were being born in India who did not attain their optimal mental and physical potential due to neonatal hypothyroidism. Over 100 million people in the South East Asian Region suffered from endemic goitre, 6 million suffered cretinism and more than 35 million were mentally or physically disabled (Ramm, 1992).

2.7 Malnutrition and mental abilities

The human brain has long been accepted as the seat of intellect. Evidence for structural and chemical changes in the brain as a consequence of severe malnutrition, probably leading to intellectual retardation has been a matter of concern to research workers and policy makers (NIN, 1988).

Further they reported that nutrition is a critical factor for the central nervous system during the period of brain growth. It has been found that severe nutritional deprivation during this period can lead to structural and chemical changes in the brain. Chavez *et al.* (1974) observed that poor nutritional status affected social, physical and intellectual development of an individual.

Upadhyay and Agarwal (1988) studied the relationship of intellectual function to that of nutrition, learning environments and status and family variables in 400 rural preschool children (6-8 years) of Varanasi district. The results indicated that intellectual development of children was associated more strongly with learning environments at home compared to nutritional status.

Monckberg (1972) stated that poor nutritional status and socio cultural factors were reflected in poor mental performance of children.

According to a report by NIN (1989) severe malnutritional during the early years of life retarded physical and mental development and behavioural disturbances that persisted into adult life and these malnourished individuals were having low IQ scores.

Sathy *et al.* (1991) reported that malnutrition during the period of rapid brain growth affected the growth of the brain; and the performance of these malnourished children was reported to be poor in a variety of intelligence tests than normal children. Klein *et al.*, (1972) found a close relationship between malnutrition and cognitive development in children.

In a study conducted by NIN (1990) among 123 rural preschool children (3 to 5 years) using the psycho social development test battery, which was standardized for assessment of development, it was found that well nourished children attained higher scores than the undernourished children irrespective of their participation in the various developmental programmes.

Nair (1990) reported that iodine deficiency was a great threat to optimal physical and mental development of several millions of children.

Recent evidence indicated that anaemia in infants and children lead to impairment in work capacity reduced learning ability and immune responses (NIN, 1982 and ICN, 1992). Patiroglu and Dogan (1991) conducted studies on the effects of iron deficiency anaemia on human behaviour and it was found that iron

deficiency anaemia adversely affected the cognitive development, performance and behaviour in children.

The effect of nutritional anaemia on mental functions was studied by Oski (1978) and it was revealed that children with anaemia or even mild iron deficiency showed poor attentiveness, memory and academic performance. Their mental functions improved after the iron deficiency was corrected. Verghese (1995) in her study on iron deficiency and behaviour pattern in preschool children in Thiruvananthapuram, revealed that children with iron deficiency obtained lower scores (below 60%) when compared to normal children.

According to Grantham-Mc-Gregor (1982) there was found to be a well known association between shortness and impairment of mental development. A comparison of the anthropometric measurements and mental development measured in terms of Somatic Quotient (SQ), Development Quotient (DQ), Motor Quotient (MoQ) and Mental Quotient (MeQ) in 136 preschool children with varying degrees of malnutrition, with an equal number of comparable well nourished children showed that there was a progressive reduction in SQ, DQ, MoQ and MeQ as the degrees of malnutrition advanced. There was found to be a linear correlation between height and DQ in 4° protein energy malnutrition (Sathy *et al.*, 1991).

A study was conducted by NIN (1987) on the relative importance of factors namely the nutritional status, socio economic status and maternal nuritional status with mental functions of preschool children. It was found that the best set of indicators related to mental functions were height, arm circumference, head and chest circumference and maternal nutrition.

Choudhry and Rao (1984) in their study on the association of growth status and mental functions in preschool children revealed that the mean IQ of the children was 84.6, which was lower than the IQ suggested for normal intelligence. This lower performance was attributed to the higher prevalence of various forms of malnutrition, poor growth and poor socio economic status and environment of the children. Children with better IQ were seen to have better anthropometric measurements.

A study was conducted by Kamath (1989) on the nutritional status and intelligence of preschool children in a NES block of Trivandrum and found that the children were normal in height and weight for age but they performed poor in intelligence tests. When the data was statistically analysed the correlation between anthropometric indices and intelligence scores showed that 32.2 per cent variation in intelligence was due to the influence of nutrition.

2.8 Malnutrition and physical growth pattern

Malnutrition stunted physical growth and development of children and lead to functional impairment, disability diminished productivity and inability to cope with environmental hazards including resistance to infection (Harris, 1992).

Sharma and Kalia (1990) conducted studies on anthropometric measurements of preschool children in Ghumarwin Block of Himachal Pradesh and they opined that nutritional anthropometry was one of the important and simple method of assessment of growth and development especially in the rapidly growing children and hence the degree of malnutrition, can be assessed through anthropometric measurements.

An important quantifiable manifestation of undernutrition is growth retardation. Measurement of growth therefore has always been considered as a valuable tool for the assessment of the nutritional satus of children (Gopalan, 1992).

Severe and acute protein energy malnutrition resulted in early weight loss in children. If protein energy malnutrition was less severe, it resulted in a failure to gain the weight for a given height. Height was relatively less affected by acute and short episodes of malnutrition, but was affected by chronic or long duration malnutrition (NIN, 1983).

Although an underweight child may have some catch up growth, for the most part of a child, whose growth has flattered in the first 2 years of life, will be on a different growth trajectory, during the rest of his or her life (Alderman, 1993 and Anand *et al.*, 1994).

ICMR (1994) has indicated that in field studies to assess the nutritional status, heavy reliance must be placed on measurement of the external morphology of the body. According to Gurvey (1969) and Narins (1992) nutritional anthropometry was based on height for age and weight for age index. NIN (1983) had revealed that in assessing the physical growth pattern of children, indices like wt/ht^2 and height and arm circumference was found to have significant power of discrimination between normal and children with different grades of malnutrition.

Studies have shown that the growth of previleged groups of children in developing countries did not differ significantly from the United States National Centre for Health Statistics reference value (UNICEF, 1990).

In the early childhood years growth is rapid and deviation from "normal" can be detected easily (Gopalan, 1986; Manan, 1991 and Leach, 1988). Growth and physical development of infants and children were widely used as indicators of the overall health and nutritional status (Srikantia, 1989).

Gopalan (1967) conducted studies on the growth pattern of 1014 children aged 1 month to 6 years belonging to low socio economic groups and revealed that these children were much lower in height and weight for all the age groups, compared to western standards.

Ogus *et al.* (1990) studied the incidence of malnutrition among 1000 children aged 0-6 years in Turkey. The general malnutrition rate observed was 30.5 per cent access to weight for age, 27.7 per cent for weight for height, and 33.7 per cent for mid upper arm to head circumference ratio. The rates of severe malnutrition were 1.2-2.2 per cent.

Anderson *et al.* (1990) undertook a study on assessment of nutritional status of 5509 Indian children (1-5 years of age group). The findings indicated that arm circumference was not constant over the age range from 1-5 years.

Gopalan (1994) has observed that about 44 per cent of preschool population in India were estimated to suffer from moderate malnutrition associated with weight dificit and growth retardation.

Satyanarayana *et al.* (1980) had observed that while about one fifth of children at 5th year of life had height for age in the normal limits of Boston children, 60 per cent had stunting. Most of these stunted children were also found to be underweight for age.

Seckler (1982) claimed that half to 3/4th of children from developing countries, possessed normal anthropometric measurements and also observed that, malnourished children were short for their age, but had proper weight for their short height.

The results of a community survey conducted by Usha and Beegum (1985) had shown that 70 to 80 per cent of children in preschool years suffered from various forms of growth retardation due to protein energy malnutrition.

A study was conducted by Choudhry and Rao (1984) on the association of growth status and mental functions in preschool children, among 214 male and female preschool children of four to five years of age from rural and urban areas of Jaipur city. The results showed a high prevalence of various forms of malnutrition among children. Weight as percentage of standard using Gomez classification showed that normal children were 16.7 per cent, grade I 51.6 per cent, grade II 27 per cent and grade III 4.7 per cent. A high prevalence of various forms of malnutrition was also observed when composite anthropometric measurements were taken.

NFI (1991) in a study on the physical growth pattern of Indian affluent children (Birth - 6 years) in 7 centres (Bangalore, Culcutta, Delhi, Kota, Ludhiana and Varanasi) revealed that the growth performance of children of Ludhiana, and to some extent, of those of Delhi nearly corresponded to the growth performance as represented by the International Growth Standard based on the NCHS data.

Thomas (1989) in a study on the effect of birth order and spacing on the nutritional status of mother and child revealed that anthropometric measurements of

preschool children with more birth spacing was found to be better when compared to closely spaced children.

Verghese (1995) conducted studies on iron deficiency and behaviour pattern in preschool children in Thiruvananthapuram district. The anthropometric measurements revealed that in the normal group about 44 per cent of males and 8 per cent of females had head circumference higher than the standard values whereas in the iron deficient group both males (40%) and females (20%) were having head circumference values lower than the standard values. Chest circumference measurements also revealed that the normal group of children had values higher than the standard, while those children who were iron deficient showed lower chest circumference values when compared to the standard values.

Material and Methods

3. MATERIALS AND METHODS

The study on the nutritional profile and mental functions of preschool children belonging to agricultural labourer families in Thrissur district was undertaken to,

1. Assess the nutritional status of preschool children (4-5 age group) belonging to agricultural labourer families and to

2. Find out the association, if any, between the nutritional status and mental functions of preschool children

3.1 Area of study

The study was conducted at the three agricultural sub divisions of Thrissur district viz., Irinjalakuda, Thrissur and Wadakanchery. Two panchayats were selected from each sub division based on 1991 census report, where there was maximum agricultural activities. From each panchayat, two wards were selected at random. Thus from each sub division two panchayats and four wards were selected. A total of six panchayats and 12 wards, constituted the study area from Thrissur district.

3.2 Plan of action (Research plan)

Plan of action of the present study comprised,

1. A pilot survey to locate families with children in the 4-5 age group.

2. A base line survey to elicit information on the socio economic and cultural background of the families and also to collect details regarding the index child and the use of health care facilities.
3. A dietary survey of the families to assess the food consumption pattern of the family members especially of the preschool children.
4. Assessment of nutritional status of preschool children by conducting

a) A food weighment survey, to determine the actual food and nutrient intake of preschool children (4-5 age group).

b) An anthropometric survey to monitor the height, weight, head circumference, chest circumference and mid upper arm circumference of preschool children.

5. Assessment of mental functions of preschool children (4-5 age group).
6. Analysis of the data using suitable statistical techniques.

3.3 Selection of samples

From each ward selected, 10 agricultural families having children with at least one child in the 4-5 age group were selected for the study. This was based on a pilot survey among the labourers to locate the families with children in the 4-5 age group. A total of 40 children in the age group 4-5 years were selected from each sub division and a total of 120 children (families) were selected from Thrissur district for the study.

3.4 Method selected for the study

Oral questionnaire or interview is the most commonly used method of diet survey (Begum, 1991). The same method can also be adopted to elicit information regarding socio economic details of the families. Hence in this study also, data

were collectd using pretested interview schedules through house visits. The advantages of the interview method is that, it consists of face to face verbal inter-change, it is not a time consuming method and therefore large number of families can be covered within a specific time.

3.5 Development of tools

Tools are certain instruments which are used in research, for gathering new facts. Hence selection of suitable tools is vital in conducting a research work (Sidhu, 1985; Best, 1989). To elicit informations regarding the socio economic and dietary pattern of the families oral questionnaire method was used.

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

The dietary survey questionnaire was also framed to collect details re-garding the dietary habits of the families mainly food expenditure pattern, intra family food distribution, vegetarian/non vegetarian, frequency of use of various foods, foods on special occasions, food related behaviours and infant feeding practices, diets during illnesses, participation in supplementary feeding programmes etc. The pretested questionnaire structured for the dietary survey is presented in Appendix II.

Separate schedules were devised for food weighment survey. Food weighment was carried out using a standardized food weighing balance and standard measuring cups and spoons. The questionnaires are presented in Appendix III-A and III-B.

Suitably structured questionnaires were also developed for anthropometric survey. The questionnaire is presented in Appendix IV.

Mental functions of preschool children were measured using "Mathews Test of Mental Abilities" (Mathew, 1973). By conducting these tests, Intellegence Quotient (IQ) of the index child was calculated. The details are given in Appendix V.

3.6 Conduct of the study

3.6.1 Survey of socio economic and dietary pattern of families

The questionnaires that were formulated were pretested among agricultural labourers.

Socio economic and dietary pattern of the families were obtained by interview method. Here the respondent was mainly the mother of the preschool child selected for the study. The accuracy of the answers were checked by supplementary questions wherever necessary.

3.6.2 Food weighment survey

For assessing the nutritional status of preschool children a one day food weighment survey was conducted in a sub sample (12 children). Since the diets

consumed by rural low income categories are more or less uniform with negligible variations in their day to day intakes, the food intake pattern and quantities of food consumed can be obtained by following a one day weighment method (Jansi and Sarojini, 1993). Hence a one day food weighment survey was conducted in the present study.

This method is the most reliable one for assessing the actual food consumption pattern. In this method the investigator weighed the raw foods included in the meal for a day, and the cooked weights of each preparation was also recorded (Plate 1 and 2). The amount of each food consumed by the child was also weighed, so also the plate waste, to get the exact amounts of foods consumed (Plate 3). Any other extra foods consumed by the child like toffee, biscuits etc. was also taken into account. All these weighments were done using standard measuring cups and spoons and also by means of a food weighing balance. The amount of cooked food items consumed by the child was then converted to its raw equivalents. The nutritive value of the foods consumed was calculated using the Food Composition Table (ICMR, 1995).

3.6.3 Anthropometric survey

Anthropometry has been accepted as an important tool for assessment of nutritional status particularly of children (Vijayaraghavan, 1987). In the anthropometric survey the height, weight, head circumference, chest circumference and mid upper arm circumference of the preschool children were recorded.

Heights of the children were measured using a fiber glass tape. The subject was asked to stand erect without shoes, with the heels, buttocks, shoulders

and occipit against the wall. The height was read off from the scale on the wall (Plate 4).

Weights of the children were recorded using a bathroom balance, which was checked by caliberation with standard weights. Weight was recorded with minimum clothing on the subject (Plate 5).

Head circumference (Plate 6) was measured using a tape, placing the tape round the frontal bones just superior to the supra orbital ridges, passing it round the head at the same level on each side and laying it over the maximum occipital prominence of the back (Mayers, 1972).

Chest circumference was also taken using the same tape. The measurement was taken at the level of xiphisternum and in a place at right angles to the vertebral column below the inferior angle of the scapula (Plate 7).

Mid upper arm circumference gives an assessment of muscle mass, subcutaneous tissue and hence indirectly to the nutritional status. Mid upper arm circumference of children, were measured (Plate 8) using a tape at the level mid way between the acromial and olecranon process with the arm hanging freely relaxed, with the tape applied at right angles to the long axis of the humerous (Malina, 1972).

3.6.4 Mathews Test of Mental Abilities (MTMA)

In this test the preschool child has to work his brain to solve the problems given to him. According to Rao (1990) undernutrition is one of the most common and serious condition that are likely to affect the postnatal development of

brain. So this test helps to get an appropriate idea of the varying degrees of intelligence in the selected preschool children.

This test consisted of a set of 12 problems and has a plastic base plate which is of rectangular shape. The time limit to solve each problem by the child is 3 minutes. The problems consisted of broken pieces of plastics of varying sizes and shapes, which when put together on the base plate, acquired the rectangular shape as the base plate.

The investigator conducted this tests on children through house visits. Each child was made to understand to solve the 'problem' through a demonstration 'problem'. The child was asked to arrange the demonstration pieces correctly without overlapping, within the stipulated time. The demonstration was repeated till he understood to arrange th pieces on the base. Then the first set of problem was given to the child and the time taken was recorded using a stopwatch. This was followed by the remaining 11 problems (Plate 9). The scores obtained by each child was used for calculating the IQ of each child. IQ was then interpreted as described by the author.

3.6.5 Interpretation of data collected

The data collected were analysed using suitable tests such as student 't' test and multiple regression analysis for the interpretation and presentation of results.

Plate 1. Weighing raw foods

Plate 2. Weighing cooked foods


MSU

Plate 3. Weighing amount of cooked foods consumed by the preschool child

Plate 4. Measuring height

Plate 5. Measuring weight

Plate 6. Measuring head circumference

Plate 7. Measuring chest circumference

Plate 8. Measuring mid upper arm circumference

Plate 9. Mathews Test on Mental Abilities

Results

4. RESULTS

The results of the research work entitled 'Nutritional profile and mental functions of preschool children belonging to agricultural labourer families in Thrissur district are projected under the following headings.

1. Demographic details of the families selected which included socio economic and cultural background of the families and details regarding the index child
2. Dietary habits of the families
3. Nutritional status of the selected preschool children assessed by

a) Actual food and nutrient intake of preschool children

b) Anthropometric measurements of the preschool children

4. Mental functions of preschool children
5. Association between mental functions and nutritional status

4.1 Demographic details of the families

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

Of the 120 families surveyed 55.83 per cent were nuclear families with 2 adults. A joint existence was exhibited by 44.17 per cent of the families. Seventeen point five one per cent of the families were having more than 2 adults and 13.33 per cent were having 4 or more than 4 adults respectively in their families.

Table 1. Distribution of the families according to type of family, family size and number of children (n = 120)

Variable	Category	Number	Percentage
Type of family	Joint	53	44.17
	Nuclear	67	55.83
Family size (No. of adults)	2	67	55.83
	3	21	17.5
	4	16	13.33
	5 and above	16	13.33
No. of children	1	34	28.33
	2	58	48.33
	3	21	17.5
	4	5	4.17
	5 and above	2	1.67

Most of the families studied (48.33 per cent) were having 2 children and 28.33 per cent of the families had only one child in their family. Seventeen point five per cent of the families had 3 children, 4.17 per cent having 4 children and about 1.67 per cent of the families had more than 5 children.

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

Table 2. Distribution of the families based on religion (n = 120)

Community	Number of families	Percentage
Hindu	97	80.83
Nair	6	5.0
SC	21	17.5
OBC	70	58.33
Christian	20	16.67
Muslim	3	2.5
Total	120	100.00

As revealed in Table 2, majority of the families surveyed were Hindus i.e., 80.83 per cent, which included Nair (5%), Other Backward Community (OBC) (58.33%) and Scheduled Castes (SC) (17.5%). Sixteen point six seven per cent of the families where Christians and only a smaller segment formed the Muslims (2.5%).

Age of the mothers were enquired and the details are given in Table 3.

Table 3. Distribution of mothers according to age (n = 120)

Age group (in years)	Number	Percentage
22-25	20	16.67
26-29	73	60.83
30-33	22	18.33
34-37	3	2.5
38-40	2	1.67
Total	120	100.00

Majority of the mothers (60.83%) where in the age group 26-29 years, while 18.33 per cent of the mothers where in the age group 30-33 years. About 16.67 per cent of the mothers were 22-25 years of age. Only a very small per cent (2.5% and 1.67% respectively) of mothers were in the age group 34-37 years and 38-40 years.

Educational status of the families were studied separately for both the parents and is given in Table 4.

Table 4. Educational status of the parents (n = 120)

Educational status	Mother		Father	
	Number	Percentage	Number	Percentage
Illiterate	--	-	--	-
L.P.S.	--	-	--	-
U.P.S.	41	34.17	85	70.83
High school	78	65.00	35	29.17
College	1	0.83	--	-
Total	120	100.00	120	100.00

As depicted in Table 4, 65 per cent of the families had mothers with high school education while only 29.17 per cent of the families had fathers with high school education. In majority of the families, the fathers were educated upto UPS (70.83%).

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

Table 5. Distribution of the families based on average monthly income (n = 120)

Income level (Rs.)	Number of families	Percentage
1001-2500	95	79.17
2501-4000	24	20.00
4001-5500	1	0.83
Total	120	100.00

As revealed in Table 5, 79.17 per cent of the families had monthly income ranging between Rs.1001-2500. This group mainly consisted of local

agricultural labourers. Twenty per cent of the families had income in the range Rs.2501-4000, who were mainly permanent agricultural labourers of the University. Only 0.83 per cent had income in the range Rs.4001-5500, mainly because both husband and wife in the family are permanent agricultural labourers.

Monthly expenditure pattern of the families were studied and the details are presented in Table 6.

From Table 6, it can be observed that 79.17 per cent of the families spent 61-70 per cent of their monthly income on food, 18.33 per cent spent 51-60 per cent of their income and a few families (2.5%) spent only 41-50 per cent of their monthly income on food. Almost all the families had a monthly expenditure of 0-10 per cent of their income on clothing, transport and on health. Majority (62.83%) of the families saved about 11-20 per cent of their monthly income, while 2.5 per cent saved 21-30 per cent of their monthly income. About 7.5 per cent of the families could save only 0-10 per cent. Expenditure on entertainment was found to be restricted to only 16.67 per cent of families who spent 0-10 per cent of their income for entertainments. About 69.17 per cent of the families had a monthly expenditure of 0-10 per cent of their income for childrens education. It was found that 0-10 per cent of the monthly income was utilised for the repayment of loans by 23.33 per cent of the families and 16.67 per cent of the families utilised 0-10 per cent of their monthly income for crediting in kuries.

Living situations of the families were assessed by observing their housing conditions like the type of house, type of roof, structure of house and separate rooms in the house etc. The details are presented in Table 7.

Table 6. Distribution of the families according to monthly expenditure pattern (n = 120)

Range of monthly expenditure (in per cent)	Food %	Clothing %	Houseing %	Rent %	Transport %	Education %	Entertainment %	Health	Savings	Repayment of loan	Kuries
0-10	-	100	93.33	-	100	69.17	16.67	100	7.5	23.33	16.67
11-20	-	-	-	-	-	-	-	-	62.83	-	-
21-30	-	-	-	-	-	-	-	-	2.5	-	-
31-40	-	-	-	-	-	-	-	-	-	-	-
41-50	2.5	-	-	-	-	-	-	-	-	-	-
51-60	18.33	-	-	-	-	-	-	-	-	-	-
61-70	79.17	-	-	-	-	-	-	-	-	-	-
71-80	-	-	-	-	-	-	-	-	-	-	-
81-90	-	-	-	-	-	-	-	-	-	-	-

Table 7. Housing conditions of the families (n = 120)

Housing conditions	Number of families	Percentage
1. Own House	120	100
Rental House	-	-
2. Type of house		
2 rooms	17	14.17
3-5 rooms	98	81.67
6-8 rooms	5	4.16
> 8 rooms	-	-
3. Type of roof		
Tiled	106	88.3
Concrete	6	5.0
Thatched	8	6.67
4. Structure of house		
Mud built	1	0.83
Brick built	119	99.17
Thatched	-	-
5. Separate rooms		
Drawing rooms	38	31.67
Study rooms	-	-
Bed rooms	116	96.67
Store room	-	-
6. Separate kitchen	120	100

As depicted in Table 7 all the families were living in their own houses.About 81.67 per cent of the families had 3-5 rooms. House with 2 rooms were found in 14.17 per cent of the families and only 4.16 per cent of the families possessed house with 6-8 rooms. No families had house with more than 8 rooms. Most of the families (88.33%) had their roof tiled. Even thatched roof were observed in 6.67 per cent of the families. Concrete roofing was observed in 5 per cent of the families studied. Majority of the families (99.17%) had their houses built of brick. All the families studied had separate kitchen. About 31.67 per cent of the families used drawing rooms and 96.67 per cent of the families had separate bed rooms for their houses.

Other living facilities which included electricity, lavoratory facilities, drainage facilities, drinking water and transport facilities by the families are presented in Table 8.

From Table 8 it can be observed that 93.33 per cent of the families had electric connections in their houses. All the families studied had good drainage and lavoratory facilities. Ninety per cent of the families had their own wells, while 6.67 per cent were dependent on public wells and 3.33 per cent of the families on public tap. About 69.17 per cent of the families used bicycle for transport purposes.

Exposure of the families to various information sources were analysed and is presented in Table 9.

Table 8. Other living facilities of the families (n = 120)

Other facilities	Number of families	Percentage
1. Electricity facilities		
Yes	112	93.33
No	8	6.67
2. Lavoratory	120	100.00
3. Drainage facilities	120	100.00
4. Source of drinking water		
Our well	108	90.00
Public tap	4	3.33
Public well	8	6.67
Tank		
River		
5. Transport facilities		
Bicycle	83	69.17
Motor bike	-	-
Bus	-	-
Jeep	-	-

Table 9. Information source utilisation by the families (n = 120)

Sources	Number of families	Percentage
Radio	117	97.5
T.V.	-	-
Newspaper	108	90.0
Magazine	78	65.0

As revealed in Table 9, most of the families possessed a radio (97.5%) where as 90 per cent of the families bought daily newspaper for their information source. About 65 per cent of the families where in the habit of reading magazines. No families possessed television as their source of information.

When enquired about their participation in social organisation such as mahila samajams, co-operative society, youth clubs etc. it was observed that nobody was participating in any of these social organisations.

4.2 Details regarding the index child

The preschool child (4-5 age group) in the family was considered as the index child and details regarding the index child is presented in the following tables.

Distribution of index children according to their gender is given in Table 10.

Table 10. Gender distribution of Index children (n = 120)

Gender	Number of children	Percentage
Male	53	44.17
Female	67	55.83
Total	120	100.00

As shown in Table 10, about 44.17 per cent of the index children were male children and 55.83 per cent were female children.

Birth order of the index children is presented in Table 11.

Table 11. Birth order of Index children (n = 120)

Birth order of index children	Number of children	Percentage
Ist	77	64.17
2nd	29	24.17
3rd	13	10.83
4th	-	-
5th	1	0.83
Total	120	100.00

About 64.17 per cent of the preschool children selected belonged to the 1st birth order, 24.17 per cent in the 2nd birth order and 10.83 per cent in the 3rd birth order. Only one child belonged to the fifth birth order.

The mortality rate of the children were enquired and it was found that in any of the families no death of children were reported. Regarding the birth weight of the index child, mothers were not remembering the birth weights of their children.

The immunization status of the preschool children selected for the study are presented in Table 12.

Table 12. Immunization status of preschool children (n = 120)

Immunization status	Number of children	Percentage
Complete	104	86.67
Partially complete	13	10.83
Not taken	3	2.5
Total	120	100.00

From the table, it was revealed that 86.67 per cent of the children had followed their complete immunization schedule whereas 10.83 per cent of the children were only partially immunized. About 2.5 per cent of the children had not taken any of the immunization.

The relationship between the immunization status of children and the educational level of the mothers and fathers (separately) were analysed and is presented in Tables 13 and 14.

Table 13. Immunization status and mothers educational level (n = 120)

Mothers educational level	Complete		Partially complete		Not taken		Total	
	No. of children	(%)	No. of children	(%)	No. of children	(%)	No. of children	(%)
U.P.	33	(27.5)	7	(5.83)	2	(1.67)	42	(35.00)
High School	71	(59.17)	6	(5.0)	1	(0.83)	78	(65.00)
							120	100.00

Table 14. Immunization status and fathers educational status (n = 120)

Educational level	Complete		Partially complete		Not taken		Total	
	No. of children	(%)	No. of children	(%)	No. of children	(%)	No. of children	(%)
U.P.	65	(53.33)	10	(8.33)	3	(2.5)	77	(64.17)
High School	40	(33.33)	3	(2.5)	-	-	43	(35.83)
							120	100.00

Analysis of the relationship of immunization status and mothers educational level showed that for mothers who were educated upto high school, about 59.17 per cent of the children were completely immunized. About 5 per cent of children were partially immunized and 0.83 per cent had not taken any immunization. Even though fathers were educated upto high school level only 33.33 per cent of the children were completely immunized.

As stated by the mothers, the incidence of various diseases for the past one year among the selected preschool children were recorded and is given in Table 15.

Table 15. Incidence of diseases occured in preschool children (n = 120)

Disease	Number of children	Percentage
T.B.	5	4.17
Jaundice	5	4.17
Mumphs	1	0.83
Total	11	9.17

Only about 9.17 per cent of the children were found to be affected by serious infectious diseases. About 4.17 per cent of the children were reported to be affected with tuberculosis and 4.17 per cent with jaundice and one child with mumphs during the past one year.

Participation of the preschool children in various feeding programmes were enquired and the details are presented in Table 16.

Table 16. Participation of children in feeding programmes (n = 120)

Participation	Number of children	Percentage
Ist child	19	15.8
2nd child	6	5.0
3rd child	2	1.67
4th child	-	-
5th child	-	-
Total	27	22.47

Table 16 revealed that only 22.47 per cent of preschoolers participated in supplementary feeding programmes. About 15.8 per cent of children who participated were children of the first birth order, 5.0 per cent were of 2nd birth order and 1.67 per cent were of the third birth order child in the family.

Health facilities were utilised, by all the families studied. Majority (95%) of the families were adhering to allopathic treatments. While a minority (5%) resorted to ayurvedic medicines. The nearest health centre available was within 2-8 kms reach, by the families.

Family planning measures of one kind or other was adopted by 65.01 per cent of the families. While 35.0 per cent of families had not taken any family planning measures. It was observed that in families who had adopted family planning measures, it was the women who had taken these measures and information regarding these measures were gained through friends, neighbours and primary health centres.

4.3 Dietary habits of the families

Food habits of the families were studied and is presented in Table 17.

Table 17. Distribution of the families according to food habits (n = 120)

Food habits	Number of families	Percentage
Vegetarian	-	-
Non-vegetarian	120	100

From the above table, it was observed that all the families studied consumed non vegetarian diet.

Meal pattern of the families studied is presented in Table 18.

Table 18. Distribution of the families according to meal pattern (n = 120)

Meal pattern	Number of families	Percentage
One major meal	-	-
Two major meal	9	7.5
Three major meal	111	92.5
Total	120	100.00

Out of the 120 labourer families studied majority (92.5%) of the families adopted a 3 major meal pattern, while 7.5 per cent of the families followed a 2 major meal pattern.

The monthly expenditure pattern of the families on food was studied, and it was observed that 79.17 per cent of the families spent about 600-1750 rupees of their monthly income on foods.

The frequency of use of various food items by the families were enquired and is presented in Table 19.

As revealed in Table 19, all the families included cereals like rice and wheat in their daily diet. About 57.5 per cent of the families consumed pulses/dhals four times a week. Pulse consumption was restricted to once in a week for about 30 per cent of the families. Frequency of consumption of green leafy vegetables revealed that for 25 per cent of the families it was only an occassional item in their dietaries. About 1.67 per cent of the families never included this item in their diet. Most of the families (34.17%) consumed green leafy vegetables only once in a week.

With regard to roots and tubers about 36.67 per cent of the families consumed this item only once in a week and 25 per cent consumed it occassionally. In about 10 per cent of the families, the frequency of consumption of roots and tubers was found to be thrice a week.

Frequency of consumption of other vegetables showed that about 41.67 per cent of the families consumed vegetables for about four days in a week. Daily

Table 19. Percentage distribution of families according to the frequency of use of food items (n = 120)

Food items	Daily (%)	Weekly				Ocassionally (%)	Never (%)
		Once (%)	Twice (%)	Thrice (%)	Four times (%)		
Cereals	100.00	-	-	-	-	-	-
Pulses	-	30.00	-	12.50	57.5	-	-
Green leafy vegetables	-	34.17	30.83	8.33	-	25.00	1.67
Roots and tubers	-	36.67	28.33	10.00	-	25.00	-
Other vegetables	2.50	13.33	-	24.17	41.67	18.33	-
Fruits	-	25.83	17.50	3.33	-	48.33	5.00
Milk and milk products	100.00	-	-	-	-	-	-
Meat	-	7.50	-	-	-	-	-
Fish	-	35.00	1.67	-	-	63.30	-
Egg	-	22.50	5.00	-	-	55.83	-
Fats and oils (Coconut oil)	100.00						
Sugar and Jaggery	100.00						
Nuts and oil seeds (Coconut)	100.00						

consumption of vegetables was found to be in 2.5 per cent of the families and in 18.33 per cent of the families the consumption pattern of vegetables was only occassional.

Regarding the frequency of use of fruits in the daily meal pattern, it was found that 48.33 per cent of the families consumed it only occassionally. About 5 per cent of the families never included this item in their diateries. About 25.83 per cent of the families consumed this only once in a week.

In all the families studied daily inclusion of milk and milk products was observed which was mainly used for the preparation of coffee/tea.

With respect to the consumption pattern of flesh foods about 92.5 per cent of the families consumed meat only occassionally. Inclusion of fish also showed the same pattern with 63.3 per cent families with occassional consumption. About 35 per cent of the families consumed fish once in a week. Egg was also included as an occassional item (55.83%) and 22.5 per cent consumed eggs once in a week.

Daily consumption of foods such as fats and oils (cooking oils) sugar and jaggery and nuts and oil seeds mainly in the form of coconut was observed in all the families studied.

The various foods taken on special religious occassion like birth day, marriage etc. by the families are presented in Table 20.

Table 20. Foods consumed on special occassion (n = 120)

Occassions	Food prepared			
	Payasam per cent of families	Non-vegetarian per cent of families	Kanji per cent of families	Special vegetable preparation per cent of families
Birth day	93.33	-	-	-
Marriage	100.00	-	-	100
Death	-	-	100	-
Festivals	100.00	-	-	100
Feasts	-	47.5	-	-

From the above table one special food item prepared during various occassions was found to be payasam. Most of the families prepared payasam for birthdays (93.33%) and almost all families prepared it for marriage and festivals. Non-vegetarian foods were prepared by 47.5 per cent of the families during feasts. Only kanji was strictly prepared in families were death has occured, because of social taboos.

Foods given during special physiological conditions of the family members indicated that only during infancy some special foods were given. Home made cereal porridge was the weaning food given for all the children studied. About 15 per cent of families prepared banana powder at home as weaning food where as 6 per cent of the families went for commercial weaning foods. No special foods were given during adolescence, pregnancy and lactation.

Dietary pattern of the children was changed during diseased conditions. During fever no solid foods were given to the children. In the case of diarrhoea and vomiting also, no solid foods were provided. During these conditions inclusion of more liquids and liquid foods were observed in all the families studied. Medicines were also given to cure these illness.

Regarding breast feeding practices followed by the mothers, it ws observed that all the 120 preschool children studied were breast fed. Supplementary foods like cereal based porridge were given to these children at the age of weaning which was around 4-6 months.

About 66.67 per cent of the families studied were not having any supplementary feeding centers in their locality. About 33.33 per cent of the families had ICDS programmes in their localities and only 10.83 per cent of the women were found to be participating in these programmes. About 22.5 per cent of the preschool children were attending the anganwadi centres.

4.4 Nutritional status of selected preschool children

4.4.1 Acutal food and nutrient intake of the preschool children selected for the study

Weighment survey

The actual food intake of preschool children belonging to 12 families (sub sample) were found out by weighment survey and the nutrients present in the diet were computed using nutritive value table and is presented in Table 21.

Table 21. Average food consumption of children

Food groups	RDA* (g)	Quantity consumed (g)	Percentage of RDA
Cereals	270	161.3	59.8
Pulses	35	11.6	33.1
Green leafy vegetables	50	-	-
Other vegetables	30	7.9	26.4
Roots and tubers	20	6.6	33.3
Fruits	60	-	-
Milk	250	103.3	41.3
Meat/Fish	30	20.8	69.4
Fats and oils	25	19.3	77.3
Sugar/Jaggery	40	29.7	74.2

* IMCR (1981)

As seen in Table 21 more than 50 per cent of the RDA was met for food groups like cereals, meat/fish, fats and oils and sugar. The inclusion of food groups like green leafy vegetables and fruits was found to be nil. Regarding roots and tubers only about 33 per cent of the RDA was met. Milk consumption was found to be 41.3 per cent of RDA. No food groups included met the RDA levels.

The mean nutrient intake of preschool children were compared with RDA and is presented in Table 22.

Table 22. Average nutrient intake of children (4-5 years)

Nutrients	RDA*	Quantity consumed	Percentage of RDA
Energy (K Cal)	1690	1064	62.9
Protein (g)	30	26	86.9
Iron (mg)	18	7.9	44.4
ß-carotene (μg)	1600	58.5	3.7
Thiamine (mg)	0·9	0·7	77.7
Riboflavin (mg)	1.0	0·41	41.0
Niacin (mg)	11	7·40	67.4
Vitamin C (g)	40	5.2	13.0

* ICMR (1994)

From the values projected in Table 22 in case of energy only 62.9 percentage of RDA was met, protein was only 86.9 per cent of RDA. Other nutrients like iron, ß-carotene, thiamine, riboflavin, niacin and vitamin C were all found to be far below the RDA levels.

Average percentage contribution of meals to the total daily intake of major nutrients were analysed and is presented in Table 23.

As depicted in the table, the energy contribution from breakfast was only 15.8 per cent of the total intake but for lunch and supper it was found to be 37.8 and 30.4 respectively. With regard to protein also the same trend was observed with 19.2 per cent from breakfast and 34 and 33.8 per cent respectively from lunch and supper. A significant contribution of iron was observed during breakfast (20%) and from lunch and supper the contribution was more or less same. The contribution of

Table 23. Percentage contribution of meals to daily intake of major nutrients (4-5 years)

Nutrients	Total	Meals											
		Early morning		Breakfast		Mid morning		Lunch		Tea		Supper	
		Qnty.	(%)	Qnty.	(%)	Qnty.	(%)	Qnty.	(%)	Qnty.	(%)	Qnty.	(%)
Energy (K Cal)	1064	82.8	7.8	169.1	15.8	-	-	402.7	37.8	86.2	8.1	3.23	30.4
Protein (g)	26	1.56	6.0	4.99	19.2	-	-	8.84	34.0	1.82	7.0	8.78	33.8
Iron (mg)	7.9	0.12	1.54	1.58	20.0	-	-	3.03	38.4	0.12	1.54	3.05	38.61
ß-carotene (μg)	58.5	-	-	7.96	13.6	-	-	25.27	43.19	-	-	25.27	43.19
Thiamine (mg)	0.7	0.35	5.12	0.056	8.03	-	-	0.28	41.03	0.035	5.12	0.287	41.03
Riboflavin (mg)	0.41	0.029	7.16	0.04	9.83	-	-	0.15	37.43	0.029	7.16	0.157	38.33
Niacin (mg)	7.4	0.093	1.26	1.04	14.12	-	-	3.08	41.71	0.093	1.26	3.08	41.71
Vitamin C (g)	5.2	-	-	1.2	23.07	-	-	2.8	53.8	1.2	23.07	-	-

nutrients such as ß-carotene, thiamine, riboflavin, niacin and vitamin C was found to be very low especially from breakfast, when compared to lunch and supper.

4.4.2 Anthropometric measurements of preschool children (4-5 age group)

Anthropometric measurements of preschool children were taken to assess the nutritional status. Anthropometric standards used in this study for comparison are presented in Table 24. Measurements like height, weight, head circumference, chest circumference and mid upper arm circumference were taken and the values were then compared with the standards.

Table 25 and Table 25(a) revealed the comparison of heights and weights of preschool children with the standards and 't' values respectively.

The above table showed that the growth pattern of preschool children belonging to agricultural labourer families were at a lower rate than those of the Indian standards as well as the NCHS standards and the difference was statistically significant.

Comparison of the head circumference, chest circumference and mid upper arm circumference is presented in Table 26 and 't' values in Table 26(a).

As dipicted in the table, head circumference and chest circumference of both boys and girls were comparable to Indian standards, where there was no significant difference. With regard to MUAC there was significant difference in the case of boys and girls when compared to Indian standards.

The most common combinations of measurements to find out the prevalence of malnutrition among preschool children are height for age and weight

Table 24. Anthropometric standards (4-5 age group - boys and girls)

Measurements	Indian standards							
	*ICMR		**NFI		**Ghosh		****NCHS	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Height (cm)	109.1	108.2	106.3	104.2	103.4	102.3	106.5	105.0
Weight (kg)	17.7	17.2	17.7	16.8	16.18	15.4	17.6	16.8
Head circumference (cm)	-	-	50.0	49.1	49.9	48.9	-	-
Chest circumference (cm)	-	-	53.0	52.1	-	-	-	-
MUAC (cm)	-	-	16.0	-	-	-	-	-

* ICMR (1994). Study on well to do Hyderabad children.

** NFI (1991). Study on urban affluent children from Bangalore, Calcutta, Delhi, Kola, Ludh and Varanasi by Agarwal *et al.*

*** Ghosh (1986). A longitudinal study of the outcome of a birth cohort project no 01-658-2.

****NCHS (1976). NCHS growth charts, Rockvilla, MD.

Table 25. Comparison of mean heights and wiehgts with Indian and NCHS standards (4-5 age group)

Measurements	Mean ±SD		Indian standards						NCHS	
	Boys	Girls	ICMR		NFI		Ghosh		Boys	Girls
			Boys	Girls	Boys	Girls	Boys	Girls		
Height (cm)	102.1 ±0.796	100.1 ±0.560	109.1	108.2	106.3	104.2	103.4	102.3	106.5	105.0
Weight (kg)	14.9 ±0.28	14.2 ±0.246	17.7	17.2	17.7	16.8	16.1	15.4	17.6	16.8

Table 25(a). 'T' values for comparison of height and weight with Indian and NCHS standards

Measurements	Indian standards						NCHS	
	ICMR		NFI		Ghosh, S.			
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Height (cm)	** 8.79	** 14.4	** 5.27	** 7.32	** 1.63	** 3.39	** 5.52	** 8.75
Weight (kg)	** 10.00	** 12.19	** 10.00	** 10.56	** 4.57	** 4.87	** 9.6	** 10.56

** Significant at 0.01 per cent level

Table 26. Comparison of head circumference, chest circumference and mid upper arm circumference with standards

Measurements	Mean ±SD		Indian standards						NCHS	
	Boys	Girls	ICMR		NFI		Ghosh		Boys	Girls
			Boys	Girls	Boys	Girls	Boys	Girls		
Head circumference (cm)	44.08 ± 2.00	48.8 ± 0.283	-	-	50.0	49.1	49.9	48.9	-	-
Chest circumference (cm)	49.0 ± 1.40	49.7 ± 0.37	-	-	53.1	52.1	-	-	-	-
MUAC (cm)	14.8 ±0.486	14.7 ±0.227	-	-	16.0	16.0	-	-	-	-

Table 26(a). 'T' values for comparison of Head, Chest and Mid upper arm circumference with NFI and Ghosh standards

Measurements	Indian standards			
	NFI		Ghosh	
	Boys	Girls	Boys	Girls
Head circumference (cm)	1.46	1.06	1.41	0.35
Chest circumference (cm)	2.9	2.35	-	-
	**	**		
MUAC (cm)	3.03	5.72	-	-

** Significant at 0.01 per cent level

for age. Observations on these data were interpreted according to these combinations and is presented below.

Prevalence of malnutrition among preschool children in the present study as per height for age according to Mclaren's classification is given in Table 27.

As depicted in the Table 27, according to ICMR standards 50.94 per cent of boys were found to have normal height for their age and 49.06 per cent of boys were having less heights for their age. In the case of girls most of them (52.24%) belonged to the short stature group. Whereas only 47.76 per cent of girls were found to have normal heights for their age. When compared to NFI standards majority of the boys (83.02%) were having normal heights for their age. Only 16.98 per cent of boys were having short stature. The same trend was observed in the case of girls also, were 82.08 per cent were having normal height for their age. Only 17.9 per cent belonged to short stature group. The same pattern i.e., 86.79 per cent of boys with normal heights and 13.21 per cent with short stature and 95.52 per cent of girls with normal height for their age and 4.48 per cent having short stature, was observed when compared to Ghosh standards. When compared with NCHS standards 67.92 per cent of the boys had normal height while 32.08 per cent were having short stature. Meanwhile majority of the girls (80.6%) were having normal heights for their age and only 19.4 per cent were having short stature. When compared with both Indian and NCHS standards none belonged to the dwarf group.

Prevalence of malnutrition among preschool children as per height for age according to Waterlow's classification is given in Table 28.

Table 27. Prevalence of malnutrition among children (4-5 age group)
(Height for age - Mclarens classification)

Mclarens classification		Indian standards						NCHS	
		ICMR		NFI		Ghosh		Boys	Girls
		Boys	Girls	Boys	Girls	Boys	Girls		
< 80%	Dwarf	-	-	-	-	-	-	-	-
80-93%	Short	26 (49.06)	35 (52.24)	9 (16.98)	12 (17.91)	7 (13.21)	3 (4.48)	17 (32.08)	13 (11.40)
93-105%	Normal	27 (50.94)	32 (47.76)	44 (83.02)	55 (82.08)	42 (86.79)	64 (95.52)	36 (67.92)	54 (80.60)

Figures in parentheses are percentages

As revealed in Table 28, acording to ICMR standards most of the boys and girls (50.94% and 50.74%) were having marginal malnutrition. But according to NFI and Ghosh standards majority of the boys and girls [67.92% boys and 58.21% girls (NFI) and 83.02% boys and 79.11% of girls (Ghosh)] belonged to normal height for their age group. In the case of NCHS standards majority of the boys were having normal height while in the case of girls 50.75 per cent were having marginal malnutrition. No one belonged to the severely malnourished group with Indian as well as NCHS standards (Fig. 2).

Prevalence of malnutrition among children as height for age according to Vishveshwara Rao's classification is given in Table 29.

From Table 29, according to ICMR standards majority of the boys and girls (81.13% and 80.6%) were having normal height for their age. Using NFI, Ghosh and NCHS standards the same trend was observed with more children belonging to the normal group. [NFI - Boys 94.34%, girls 98.51%; Ghosh - Boys 100%, girls 98.51%; NCHS - Boys 94.34%, girls 98.51%]. Mild retardation was found to be more in children when ICMR standards were used for comparison [18.87% in boys and 19.4% in girls].

Prevalence of malnutrition among preschool children in the present study, as per weight for age is presented in the Table 30.

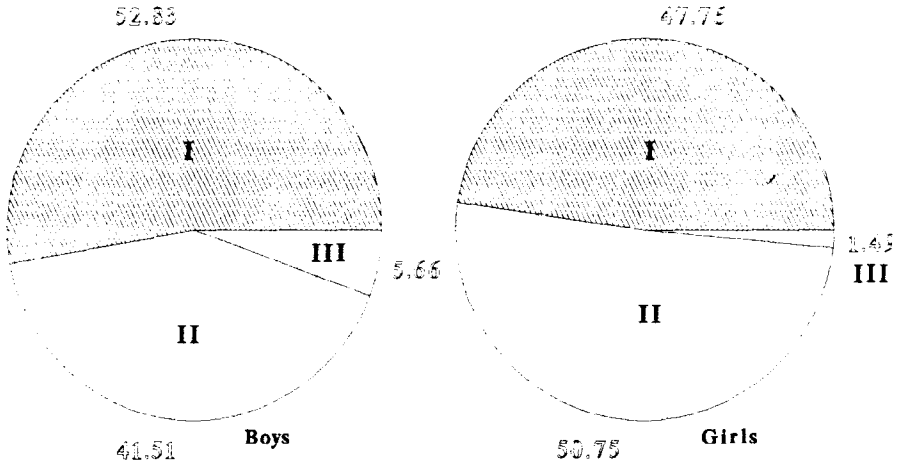
As presented in Table 30, according to ICMR standards most of the boys (43.4%) were having normal body weights for their age. Grade I malnutrition was observed in 39.62 per cent and only 16.98 per cent belonged to grade II malnutrition group. In the case of girls majority of them (71.64%) were having grade I

Table 28. Prevalence of malnutrition among children (4-5 age group)
(Height for age - Waterlow's classification)

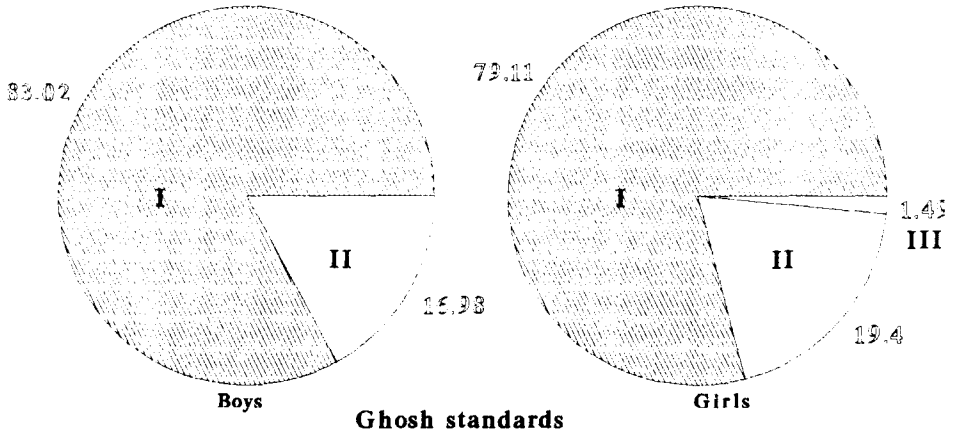
Waterlow's classification		Indian standards						NCHS	
		ICMR		NFI		Ghosh		Boys	Girls
		Boys	Girls	Boys	Girls	Boys	Girls		
< 85%	Severe malnutrition	-	-	-	-	-	-	-	-
85-90%	Moderate malnutrition	9 (16.98)	14 (20.9)	3 (5.66)	1 (1.49)	-	1 (1.49)	3 (5.66)	1 (1.49)
90-05%	Marginal malnutrition	27 (50.94)	34 (50.74)	14 (26.42)	27 (40.30)	9 (16.98)	13 (19.40)	22 (41.51)	34 (50.75)
> 95%	Normal	17 (32.08)	19 (28.36)	36 (67.92)	39 (58.21)	44 (83.02)	53 (79.11)	28 (52.83)	32 (47.76)

Figures in parentheses are percentages

Fig.2. Prevalence of malnutrition among children (4-5 age group) (Height for age - Waterlow's classification)



NCHS standards



Ghosh standards

I - Normal
II - Marginal malnutrition
III - Moderate malnutrition

Table 29. Prevalence of malnutrition among children (4-5 age group)
(Height for age - Vishveshwara Rao's classification)

Vishveshwara Rao's Classification		Indian standards						NCHS	
		ICMR		NFI		Ghosh		Boys	Girls
		Boys	Girls	Boys	Girls	Boys	Girls		
< 80%	Poor	-	-	-	-	-	-	-	-
80-90%	Mild	10 (18.87)	13 (19.4)	3 (5.66)	1 (1.49)	-	1 (1.49)	3 (5.66)	1 (1.49)
91-100%	Normal	43 (81.13)	54 (80.6)	50 (94.34)	66 (98.51)	53 (100)	66 (98.51)	50 (94.34)	66 (98.51)

Figures in parentheses are percentages

Table 30. Prevalence of malnutrition among children (4-5 age group) (Weight for age - Gomez classification)

Gomez classification		Indian standards						NCHS	
		ICMR		NFI		Ghosh		Boys	Girls
		Boys	Girls	Boys	Girls	Boys	Girls		
< 60%	Grade III malnutrition	-	-	-	-	-	-	-	-
61-75%	Grade II malnutrition	9 (16.98)	6 (8.96)	9 (16.98)	6 (8.96)	4 (7.54)	-	9 (16.98)	6 (8.96)
76-90%	Grade I malnutrition	21 (39.62)	48 (71.64)	21 (39.62)	33 (49.25)	16 (30.19)	19 (28.36)	21 (39.62)	48 (71.64)
> 90%	Normal	23 (43.4)	13 (19.4)	23 (43.4)	28 (41.79)	33 (62.27)	48 (71.64)	23 (43.4)	13 (19.4)

Figures in parentheses are percentages

malnutrition, 19.4 per cent were having normal weight for age whereas 8.96 per cent were having grade II malnutrition. When compared with NFI standards, in the case of boys most of them (43.4%) were having normal body weights for their age. But in the case of girls most of them (49.25%) were having grade I malnutrition. Grade II malnutrition was observed in 8.96 per cent of girls and 16.98 per cent of boys. In the case of Ghosh's standards 62.27 per cent of boys and 71.64 per cent of girls were having normal weight for their age. Grade I malnutrition was observed in 30.19 per cent of boys and 7.54 per cent were having grade II malnutrition. In the case of girls 28.36 per cent belonged to grade I malnutrition group. None belonged to grade III malnutrition using both Indian as well as NCHS standards.

Prevalence of malnutrition among children as given by wieght for age according to Indian Academy of Paedictrics is revealed in Table 31.

When followed the classification suggested by the Indian Academy of paediatrics, with ICMR standards it was found that majority of the boys (62.26%) and girls (71.64%) were having normal weight for their age. The same trend was observed with NFI and Ghosh standards where majority of children belong to normal weight for age group (NFI - Boys 62.26%, girls 91.04%, Ghosh - Boys 92.45%, girls 91.04%). Following NCHS standards, with regard to girls 28.36 per cent of girls were having grade I malnutrition and rest of them (71.64%) belonged to normal weight for age group. With regard to boys 62.26 per cent belonged to normal group, 30.19 per cent under grade I malnutrition and 7.55 per cent were found to be in grade II malnutrition group (Fig. 3).

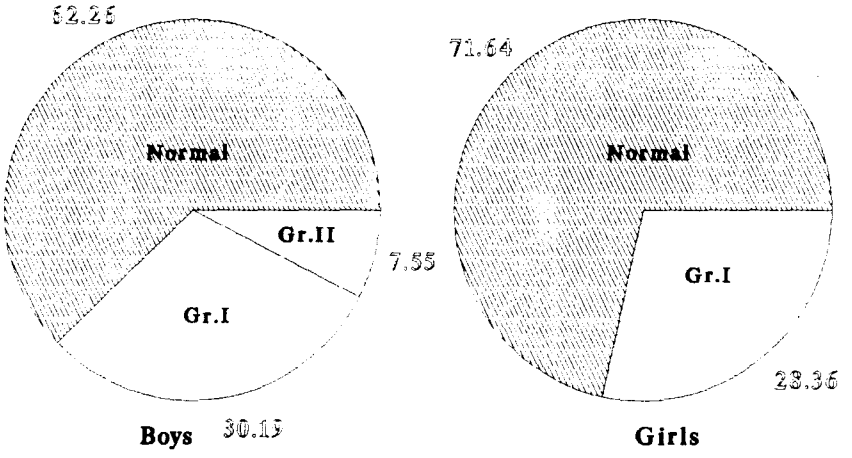
Anthropometric ratios were worked out using the data and weight/height^2 ratio as suggested by Rao and Singh is given in Table 32.

Table 31. Prevalence of malnutrition among children (4-5 age group)
(Weight for age - IAP classification)

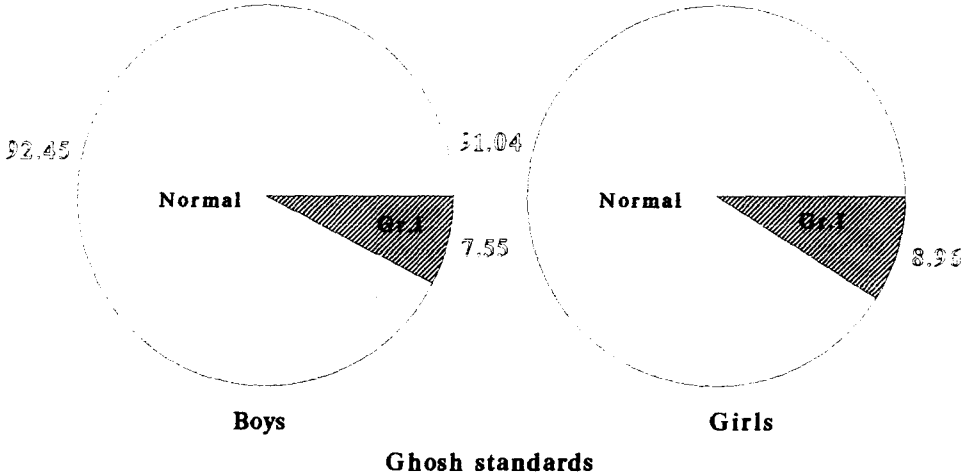
IAP classification		Indian standards						NCHS	
		ICMR		NFI		Ghosh		Boys	Girls
		Boys	Girls	Boys	Girls	Boys	Girls		
< 50%	Grade IV malnutrition	-	-	-	-	-	-	-	-
51-60%	Grade III malnutrition	-	-	-	-	-	-	-	-
61-70%	Grade II malnutrition	4 (7.55)	6 (8.96)	4 (7.55)	-	-	-	4 (7.55)	-
71-80%	Grade I malnutrition	16 (30.19)	13 (19.4)	16 (30.19)	6 (8.96)	4 (7.55)	6 (8.96)	16 (30.19)	19 (28.36)
> 80%	Normal	33 (62.26)	48 (71.64)	33 (62.26)	61 (91.04)	49 (92.45)	61 (91.04)	33 (62.26)	48 (71.64)

Figures in parentheses are percentages

Fig.3. Prevalence of malnutrition among children (4-5 age group) (Weight for age - IAP classification)



NCHS standards



Ghosh standards

Table 32. Distribution of children by nutritional status (4-5 age group) (weight/height^2 ratio - Rao and Singh) (n = 120)

Anthropometric ratio	Classification	Total number of children	Percentage
Wt/ht^2	Normal (> 0.0015)	8	6.67
	Moderate malnutrition (0.0013-0.0015)	110	91.67
	Under nutrition (< 0.0013)	2	1.66
Total		120	100.00

From Table 32, it was found that 91.67 per cent of children were moderately malnourished, 6.67 per cent were having normal growth while 1.66 per cent were under nourished.

Head/chest circumference ratio were worked out as suggested by Tara Gopaldas and is presented in Table 33.

Table 33. Distribution of children by nutritional status (4-5 age group) (Head/chest circumference ratio - Tara Gopalda) (n = 120)

Anthropometric ratio	Classification	Total number of children	Percentage
Head/chest circumfrence	Normal (< 1)	87	72.5
	Malnourished (≥ 1)	33	27.5
Total		120	100.00

As revealed in Table 33, 72.5 per cent of preschool children were coming under normal group while 27.5 per cent were found to be malnourished.

Observations of the mid upper arm circumference of the children were interpreted according to Tara Gopaldas classification and is presented in Table 34.

Table 34. Distribution of children by nutritional status (4-5 age group) (MUAC - Tara Gopaldas classification) (n = 120)

Anthropometric measurements	Classification	Total number of children	Percentage
MUAC	Normal (> 13.5)	104	86.67
	Moderate malnutrition (12.5-13.5)	16	13.33
	Severe malnutrition (< 12.5)	-	-
	Total	120	100.00

Table 34 revealed that 86.6 per cent of the preschool children belonged to the normal group while 13.3 per cent were moderately malnourished. None of the children were severely malnourished.

Table 35 revealed the percentage of RDA of calories and anthropometric measurements (Height and weight) of preschool children (4-5 age group).

When the nutritional status of children (height and weight) and their nutrient intake was compared it was observed that boys who met 60 per cent of the RDA of energy had met 96.24 per cent of NCHS standard with regard to height and 85.33 per cent of NCHS standard with regard to weight. As the energy intake increased up to 90 per cent there was an increase in the percentage of NCHS standard with regard to height (97.77%) and weight (88.63%). The same trend was

also observed with girls but the percentage of NCHS standard met was more for girls when compared to boys.

Table 35. Percentage of RDA of calories and anthropometric measurements (Height and weight) of preschool children (4-5 age group)

Percentage of RDA	Male	% of NCHS standard	Female	% of NCHS standard
	Average Height		Average Height	
11-30				
31-60	102.5	96.24	101.5	96.19
61-90	103.5	97.7	103.6	98.17
> 91				
	Average Weight		Average Weight	
11-30				
31-60	15.0	85.33	15.0	89.28
61-90	15.6	88.63	15.3	91.07
> 90				

Percentage of RDA of proteins and anthropometric measurements (Height and weight) of preschool children (4-5 age group) are revealed in Table 36.

With regard to protein intake and anthropometric measurements as revealed in Table 36, it was found that among children who met about 30-90 per cent of RDA of protein, more than 90 per cent of NCHS standard for height was observed. With regard to weight also there was a steady increase in the percentage of the NCHS standard met from 85.22 per cent to 90.9 per cent in the case of boys, whose protein intake was found to be 30-90 per cent of RDA. With regard to girls as

the protein intake increased the percentage of NCHS standard met also increased from 77.38 to 93.7 per cent and this increase was found to be more among girls than boys.

Table 36. Percentage of RDA of proteins and anthropometric measurements (Height and weight) of preschool children (4-5 age group)

Percentage of RDA	Male	% of NCHS standard	Female	% of NCHS standard
	Average Height		Average Height	
11-30				
31-60	101.33	95.12	97.00	92.38
61-90	102.75	96.40	104.00	99.04
> 91				
	Average Weight		Average Weight	
11-30				
31-60	15.00	85.22	13.00	77.38
61-90	16.00	90.19	15.75	93.70
> 91				

4.5 Mental functions of preschool children

The mental abilities of 120 preschool children were tested using "Mathews Test of Mental Abilities". Their performance was scored and IQ was calculated and is presented in Table 37.

Table 37. Distribution of children according to their IQ (n = 120)

IQ range	Total number of children	Percentage
Below 70 (Very low)	-	-
70-79 (Low)	2	1.7
80-89 (Borderline)	34	28.3
90-109 (Average)	68	56.7
110-119 (Bright)	9	7.5
120-129 (Superior)	3	2.5
130 and above (Very superior)	4	3.3
Total	120	100.00

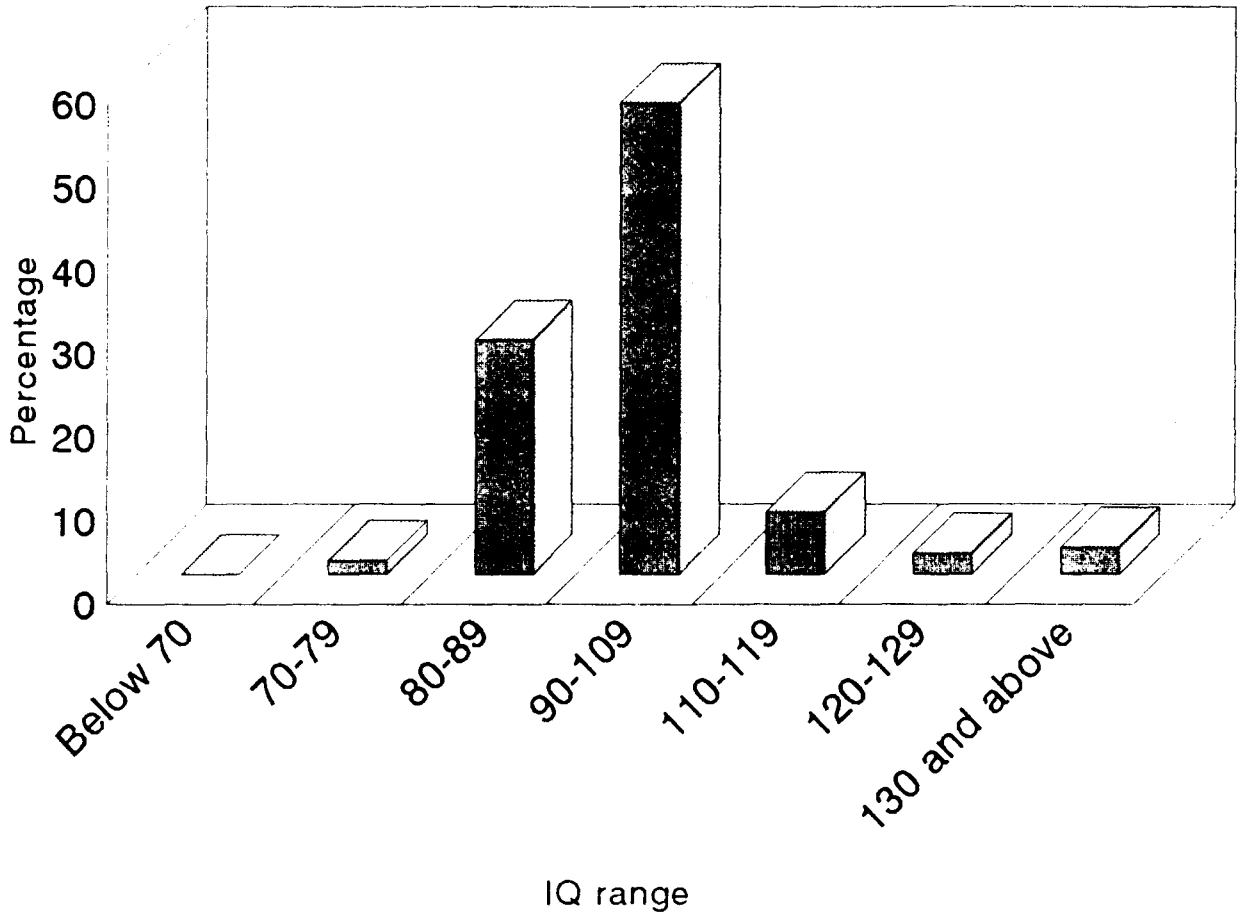
The above table revealed that 56.7 per cent of preschool children were with average IQ (90-109) and 28.3 per cent were in the boderline (80-89), 1.7 per cent of preschool children were found to have low IQ (70-79). About 7.5 per cent had IQ (110-119), which showed that they were bright, 2.5 per cent superior (120-129) and 3.3 per cent very superior (130 and above). Out of the 120 preschool children surveyed, majority were therefore in the average IQ group (Fig. 4).

4.6 Association between nutritional status and mental functions

Nutritional status of preschool children was assessed mainly by observing their food and nutrient consumption and anthropometric measurements and their interpretation.

Multiple regression of IQ on the nutrient consumption (Energy, protein and iron) was fit to the data collected and the parameters of the model were estimated.

Fig.4. Distribution of children according to their IQ



The coefficient of determination is 0.531 which shows that 53.1 per cent variation in IQ was explained by the nutrient consumption taken together. The regression was found to be nonsignificant.

Comparison of the various anthropometric indices with the IQ of pre-school children are presented in the following tables

Comparison of weight/height^2 ratio (Rao and Singh) with IQ is given in Table 38.

Table 38. Distribution of children by weight/height^2 ratio with IQ

Anthropometric index	Classification	IQ						
		Low (70-74)	Border line (80-89)	Average (90-109)	Bright (110-119)	Superior (120-129)	Very superior (130 and above)	Total
Weight/ Height^2	Normal (> 0.0015)	-	-	-	1 (0.83)	3 (2.5)	4 (3.3)	8 (6.66)
	Moderate malnutrition (0.0013-0.0015)	-	34 (28.33)	68 (56.67)	8 (6.67)	-	-	110 (91.67)
	Under nutrition (< 0.0013)	2 (1.67)	-	-	-	-	-	2 (1.67)

Figures in parentheses are percentages

As revealed in Table 38, 6.66 per cent of the children were having normal height and weight and all these children were having IQ above the average level. Among children with moderate malnutrition majority of them (56.67%) were having average IQ and 28.33 per cent where having boderline IQ. In the under-nourished group all the children were found to have low IQ.

Comparison of head circumference : chest circumference ratio of children with IQ is presented in Table 39.

Table 39. Distribution of children by head circumference : chest circumference ratio with IQ

Anthropometric index	Classification	IQ						
		Low (70-79)	Border line (80-89)	Average (90-109)	Bright (110-119)	Superior (120-129)	Very superior (130 and above)	Total
Head circumference: chest circumference	Normal (< 1)	-	9 (7.5)	62 (51.67)	9 (7.5)	3 (2.5)	4 (3.33)	87 (72.5)
	Malnourished (≥ 1)	2 (1.6)	24 (20)	7 (5.8)	-	-	-	33 (27.5)

Table 39 depicted that in the normal group of children 51.67 per cent were having average IQ, 7.5 per cent with bright and 2.5 per cent with superior IQ. About 3.33 per cent of the normal children were having very superior IQ. While in the malnourished group of children majority were in the class of boderline (20%) and average (5.8%). 1.6 per cent of children in the malnourished group were found to have low IQ.

Mid upper arm circumference measurements (MUAC) of preschool children were compared with IQ and is presented in Table 40.

From Table 40 it was observed that majority of the normal children (56.67%) where having average IQ. About 7.5 per cent belonged to bright, 2.5 per cent superior and 3.33 per cent very superior IQ group. About 16.67 per cent was found in the borderline IQ group. Among moderately malnourished group most of them (11.66%) were in the borderline IQ group 1.67 per cent were having low IQ.

Table 40 .Distribution of children by MVAC measurements with IQ

Anthropometric measurement	Classification	IQ						
		Low (70-79)	Border line (80-89)	Average (90-109)	Bright (110-119)	Superior (120-129)	Very Superior (130 and above)	Total
Mid upper arm circumference	Normal (> 13.5)	-	20 (16.67)	68 (56.67)	9 (7.5)	3 (2.5)	4 (3.33)	104 (86.67)
	Moderate malnutrition (12.5-13.5)	2 (1.67)	14 (11.68)	-	-	-	-	16 (13.33)
	Severe malnutrition (< 12.5)	-	-	-	-	-	-	-

Multiple regression of IQ on the anthropometric measurements viz. weight/height^2, head circumference : chest circumference and mid upper arm circumferance was fit to the data collected and the paramters of the model estimated was given in Table 41.

Table 41 . Multiple regression of IQ on anthropometric measurements

Variables	Regression coefficient	Standard partial regression coefficient	Student T value	Prob
Arm circumference	4.0241	.29268	3.668**	0.000
Weight/height^2	78534.0	.48407	7.292**	0.000
Head circumference: chest circumference	-75.413	-.165993	-2.107*	0.037

Intercept = -0.592310
R^2 = 0.585
** Significant at 1 per cent level
* Significant at 5 per cent

The coefficient of determination is 0.585 implying that 58.5 per cent of variation in IQ among the target group was explained by the three anthropometric measurements. The regression was found to be significant. The partial regression coefficients are also highly significant indicating high influence of each of these characters on the IQ.

Discussion

5. DISCUSSION

5.1 Demographic variables

The sample selected for the study consisted of 120 children in the age group of 4-5 years. Socio economic and demographic factors have great impact on the nutritional status of preschool children. Type and size of the families, religion, income and educational status of the parents etc. are some of the important factors which indirectly influence the nutritional status of preschool children.

The above study indicated that majority of the families (55.83 per cent) lived in nuclear families. About 44.17 per cent of the sample resided in joint families. Urbanisation and changes in social values might have brought about this phenomenon, in the family structure of modern societies. The same family structure pattern was observed by Thomas (1989) and Joseph (1993), who conducted studies among agricultural labourers in Thiruvananthapuram. Size of the family is an important factor in deciding the nutritional status of the child. In the present study the average size of majority of the families were found to be 4 (2 adults and 2 children), which still falls below 5.3, the average size of the families in Kerala (According to 1991 Census report). About 28.33 per cent of the families were having only one child. In Kerala small family norm is getting high practice even among the low income groups, as established by NNMB studies (1989) and Gopalan (1988). This study agrees with the above data which revealed that about 48.33 per cent of the families were with only 2 children.

Majority of the families surveyed consisted primarily of backward class Hindus (58.33%) and scheduled class (17.5%). Christian (16.67%) and muslim (2.5%) families were found to be a minority in the present study.

Most of the mothers surveyed were in the reproductive age of 26-29 years.

According to Bhatia (1972) educational level of parents was a major factor which influenced growth and development of children. The present study revealed that women were more educated than men. About 65 per cent of women in the family had high school education whereas 70.83 per cent of the men had upper primary education. The literacy rate of the sample is cent per cent. This is a very special feature of Kerala. According to 1991 census report, literacy rate in Kerala is 94 per cent and female literacy - 86.93 per cent. The present study also indicated a high educational level for female population and as suggested by UNICEF (1991) the level of education of the mothers also seemed to effect the nutritional status of preschool children.

The wage rate of agricultural labourers in Kerala are admittedly high, higher than in most other states. About 79.17 per cent of the families surveyed had monthly income ranging between Rs.1001-2500/- and about 20 per cent of the families were having income between Rs.2501-4000/-, who were permanent agricultural labourers of University, who had a fixed wage rate including holi-days. About 0.83 per cent of the families were found to have an income between Rs.4001-5500, where both the husband and wife were permanent agricultural labourers of the University.

The monthly expenditure pattern of the majority of the families revealed that about 61-70 per cent of their monthly income was spent on foods. Generally higher the level of income, lower is the percentage of income spent on food items and vice-versa. The present study is in line with the study conducted by Rai and Sarup (1995), who found that in Kerala 62.15 per cent of the total income was spent for food by the rural families while 58.45 per cent was spent on food by urban families.

Home environment is one of the factors responsible for poor intellectual development of children (Upadhyay and Agarwal, 1984). According to Chitra *et al.* (1988) poor housing facilities and poor learning environment lead to poor intellectual development. In the study conducted here all the families were residing in their own houses. Majority of the houses were tiled (88.33%), built with brick (99.17%) with 3-5 rooms (81.67%) and with a seperate kitchen (100%). Good sanitary conditions like lavoratory facilities and draingage facilities were observed in all the families. Drinking water source for most of the families (90%) were from their own wells and about 93.33 per cent of the families where having electricity connection for their houses. The living conditions of the families were therefore found to be more or less satisfactory.

Due to the high literacy rate of the people, newspaper reading is a characteristic feature in Kerala even among labour class families. In the present study also about 90 per cent of the families bought daily newspapers and 65 per cent of the families bought magazines regularly. Listening to radio was found to be another main source of information for most of the families (97.5%).

5.2 Details regarding the index child

Out of the 120 preschool children selected for the study 67 were girls and 53 children were boys. Most of these children selected for the study (64.17%) were found to be of the 1st birth order. Child mortality was not reported from any of the families surveyed. Mojority of the children had followed their complete immunization schedule and partial immunization was observed in 10.83 per cent of the children. It was heartening to note that about 2.5 per cent of the children were not at all given any of the immunizations.

In the present study mother's educational level was found to have a positive bearing on complete immunization pattern of children. Out of 86.67 per cent of children who were completely immunized were with mothers having high school level education and 27.5 per cent were children with mothers having upper primary level of education.

The high literacy rate of mothers have its influence on their awareness about its importance though some of them neglected to give their children complete immunization. The occurence of various childhood diseases also revealed that only a very small per cent of children (9.17%) were affected with infectious diseases like tuberculosis (4.17%), jaundice (4.17%) and mumphs (0.83%). The same health indices of Kerala children was observed by Kutty (1990), who revealed that Kerala occupied an unique position in the worlds public health map. A look at some of the health indices showed that though in the scale of economic development, Kerala occupied a place inferior to other states in India, the health status of its people would place it second only to western industrialised nations. This is

especially true to child survival statistics. Everyone who has studied this paradox has appreciated the unique role that Kerala's women had played in bringing about this state of affairs. The comparitively better educational status of Keralas women and greater status they have enjoyed in the society might have contributed towards better child survival.

For better child survival, the presence of supportive infrastructures mainly provision of greater health care services and nutritional intervention programmes are also necessary. In the present study the participation of preschool children in ICDS programmes was found to be unsatisfactory, with only 22.5 per cent of participation of children. This was mainly because, off the three study areas selected, ICDS feeding centres were in operation only in one sub division. This may be a reason for the low level of participation of children in ICDS programmes in the present study. Health care facilities provided by the primary health centres of the localities were utilised by majority of the families (95%), and about 5 per cent of the families resorted to ayurvedic system of medicines for their health problems.

Family planning measures of one kind or other was adopted by 65.01 per cent of the families and it was the women in the family who had taken these measures which again reflected her better literacy and health awareness, which lead to better child survival.

5.3 Dietary habits of the families

All the families studied were habitual non vegetarians. A three major meal pattern was observed by most of the families (92.5%) consisting of breakfast, lunch and supper, where as a few families (7.5%) resorted to a 2 major meal

pattern, consisting of only lunch and supper. In families with 3 major meals, breakfast was found to be the same item cooked for lunch and supper. Cooking of all the meals was done in the morning. Rice, pulses and vegetables formed the important items for lunch and supper and with occassional non vegetarian foods like fish and beef.

About 79.17 per cent of the families spent about Rs.600-1750/- on food, which was found to be about 60-70 per cent of their total income. About 18.33 per cent of the families spent Rs.1250-2400 for food (50-60% of income) and a few families (2.5%) spent Rs.1600-2750/- on food whose monthly income was 4001-5500. It can be noted that as the income of the families increased there is a decrease in the amount spent on food. The results indicated here are in line with the observations on expenditure pattern of Kerala people by Rai and Sarup (1995).

The frequency of use of various food items showed that their daily diet mainly comprised of the staple rice, coconut for making curries and coconut oil used for seasoning the curries. More frequent use of curries with pulses and vegetables (four times a week) was observed in 57.5 per cent and 41.67 per cent of the families respectively There were even families who never included green leafy vegetables (1.67%) and fruits (5%) in their daily dietary pattern. The daily use of food items like sugar and milk was also observed, the source of which was mainly from coffee or tea. All the families were with non vegetarian food habits but consumption of non vegetarian foods were restricted due to its high cost. About 35 per cent of the families consumed fish once in a week. Meat consumption was mainly in the form of beef which was found to be occassional in 92.5 per cent of the families.

Since all the families were non vegetarians, consumption of non vegetarian foods were preferred during feasts arranged mainly for entertaining guests in the family. During religious festivals like onam and vishu, payasam was the special food item prepared by all the families. Special food items were preapred on these occassions, as a mark of enjoyment. But during the occassion of a death in the family, kanji was prepared since it was insisted by the society as a mark of mourning.

Special foods given during different physiological states revealed that only during infancy some special foods were provided to children. Weaning foods for most of the families was mainly a cereal porridge made from wheat. Banana powder was also used as a weaning food by 15 per cent of the families and even 6 per cent of the families where in the habit of using commercial weaning foods. Bhat and Dahaya (1985) has pointed out that majority of Indian children received only ordinary home diets and these diets were deficient mainly in nutrients like vitamin A, C and iron. Similarly no special foods were given to adolscents pregnant women and nursing mothers.

During diseased conditions like diarrhoea, fever and vomiting dietary pattern of the children were changed by majority of the families. Exclusion of solid foods and inclusion of more liquids and liquid foods were observed. Mothers were aware of the importance of breast feeding and all the children studied were breast fed. Supplementary foods were introduced to the children from 4-6 months onwards, mainly in the form of home made wheat porridge.

Only 22.5 per cent of them were particiapting in the supplemetary feeding programmes of ICDS. This low lavel of participation is mainly because of the lack of anganwadi centres in the locality of most of the families studied.

5.4 Actual food and nutrient intake of the preschool children

The main observations emerging from food weighment survey of preschool children were that both foods as well as nutrient intakes were lower than the levels recommended by ICMR (1981 and 1994).

Comparison of intake of foods indicated that only 59.8 per cent of the RDA was met in the case of cereals and 33.3 per cent of RDA of roots and tubers. Since the main source of energy in a rural Indian diet is from cereals and roots and tubers, naturally, there was a calorie gap in their dietaries. Energy consumption levels of preschool children were found to be only 62.9 per cent of RDA. These findings are in agreement with the observations by Brahmam *et al.* (1988), who found in their studies that in rural households, the preschool child irrespective of gender received below the basic minimum amount of energy (70% of RDA) from the family food basket. Gopalan (1989) also stated that energy adequacy among preschool children is seen only among 70 per cent or below in Kerala.

Inclusion of protein rich foods like pulses, and meat/fish/egg was found to be unsatisfactory which met 33.1 per cent and 69.4 per cent respectively. As far as protein intake was concerned the intake was 86.9 per cent of RDA. In NNMB (1991) studies also the average protein intake of preschool children in Kerala was close to RDA upto the age of 6 years. The results of the present study agrees with the studies of NNMB that the among ten states, the pulse consumption is the lowest

in Kerala though fish consumption is high. The quantity of pulse and fish consumed is comparatively less, which can be admitted to the low intake of protein by children.

Inclusion of protective fodds like green leafy vegetables and fruits were found to be nil, whereas the food group - other vegetables -, met only 26.4 per cent of RDA. The main nutrients supplied by these protective foods are iron and ß-carotene which met only 44.4 per cent and 3.7 per cent respectively. In case of vitamin A and iron intake, according to NNMB (1991) in all the states the figures for preschool children are below the recommended levels of ICMR, the deficit being larger in Kerala and Andra Pradesh.

In Kerala as per the above study the intake of iron was very low, ie., below 50 per cent of RDA. It has been revealed by Singh *et al.* (1993) and NNMB (1991) in their studies on rural preschool children that these children suffered from iron deficiency basically due to inadequate cereal based food items.

With regard to other nutrients like thiamine, riboflavin, niacin and vitamin C, it was found to be far below thr recommended levels. NNMB survey in Kerala (1991) also revealed that nutrient intake of preschool children was much lower to the recommended levels.

The nutrient contribution from the meals revealed that the major source of all the nutrients were from lunch and supper whereas the contribution from break-fast was negligible. This is in accordance with the findings of Thimayamma *et al.* (1988) who observed that in the dietaries of middle, low and rural socio economic groups, it was lunch followed by dinner which contributed all the major nutrients.

5.5 Anthropometric measurement of preschool children

Growth is an outstanding characteristic of children. The pattern of growth is one of the most exciting studies and nothing can be more fascinating in life than the investigation of life itself. Anthropometric measurements such as height, weight and other measurements are classical tools for assessment of nutritional status. The following basic anthropometric measurements are made in nutrition surveys, like height, weight, head circumference, aram circumference and chest circumference (Gibson, 1990; Carlier and Ceale, 1991 and Keeskoslesmans, 1994).

For interpretation of anthropometric data it has to be compared with standards. Such standards should be prepared from well nourished population groups who experience no constrains on food intake and who are not exposed to adverse environmental factors (Easwaran and Devadas, 1981). In the present study also the data was compared with existing Indian standards such as ICMR (1994), NFI (1991) and Ghosh (1989) as well as internationally accepted NCHS standards. The National Centre for Health Statistics reference standards have been accepted by WHO as the international standard against which heights and weights of children by age can be compared throughout the world (Narin, 1992 and Gopalan, 1992).

Height for age of the preschool children was compared with the Indian and NCHS standards based on different grades of malnutrition suggested by various authors. According to Mclaren's clasification when compared to ICMR standards more than 50 per cent of the boys had normal height for age while 52.24 per cent of the girls had height deficit. But NFI standards revealed that 82.08 per cent of the girls had normal height while more than 80 per cent of boys had normal height.

When compared with Ghosh standards more than 95 per cent of the girls had normal height for age and only 4.48 per cent of girls were having short stature. While in the case of boys 13.2 per cent of boys had height dificit. According to NCHS standards more than 80.6 per cent of girls had normal height for their age while 67.92 per cent of boys were in the normal group.

Height is not normally modified by short duration (acute) malnutrition. Thus height deficit for age may be regarded as a measure of long duration (chronic) malnutrition. As a result the children may look apparently normal but when compared to their age it will be evident then that, there is considerable growth retardation. In the present study also when the height for age was compared with different standards, except for ICMR standard, more girls were found to have normal height for age when compared to boys.

When the data were interpreted according to Waterlow's grades of malnutrition using the same Indian and NCHS standards, when compared with Indian standards majority of the boys and girls belonged to normal group except for ICMR standard where most of the children were having marginal height retardation. When compared with NCHS standards, most of the boys were having normal height for age, whereas more than 50 per cent of girls belonged to marginal height deficit group.

According to Vishveshwara Rao's classification using the same standards for comparison it was found that majority of boys and girls belonged to the normal group.

Weight for age has been used as an index of malnuturition which reveals current nutritional status (Lucas, 1992; Narin, 1992; Sathi *et al.*, 1991). Weight for age was compared with the standards based on different grades of malnutrition given by Gomez and Indian Academy of Paediatrics.

Distribution of children based on different grades of malnutrition as suggested by Gomez using different standards, revealed that, according to ICMR and NCHS standards more than 40 per cent of boys were having normal weight for age and about 56.6 per cent of boys were having weight deficit (39.62% Grade I and 16.98% Grade II), whereas 80 per cent of the girls were having weight deficit. When compared to NFI standards the same trend was observed with regard to boys. The percentage of girls in the normal grade increased to 41.79 per cent and remaining with grade I (49.25%) and grade II (8.96%) malnutrition respectively. When compared to Ghosh standards more than 60 per cent of boys and more than 70 per cent of girls belonged to normal weight for age group. Weight deficit was observed more for boys with grade I malnutrition (30.19%) and grade II malnutrition (7.34%) whereas in girls weight deficit was observed but no one belonged to grade II malnutrition.

Distribution of children according to different grades of malnutrition according to IAP showed that majority of boys and girls belonged to normal group as per Indian and NCHS standards used.

In general, the pattern of the prevalence of malnutrition as shown by weight dificit in the present study is such that majority of the boys and girls were having normal growth but the prevalence of grade I and grade II malnutrition was more among girls. In the early childhood years, growth is rapid and any deviation

from normal can be detected easily. A slowing in the rate of growth indicated by height would take 6 months to manifest itself, while a slowing of weight gain or loss can be demonstrated within a month which indicate the current nutritional status (Mathur, 1972; Gopalan, 1994).

Comparison of weight/height^2 ratio with the classification of Rao and Singh for various grades of malnutrition revealed that 91.6 per cent of the children were having moderate malnutrition.

From the above observations it can be concluded that there was no incidence of severe grades of malnutrition among preschool children. This is in accordance with the results obtained as per NNMB studies in Kerala (1991) that there is a classic change of severely malnourished children from 10.3 per cent to 2.00 per cent by 1975 to 1990.

The chest and head circumference ratio is a good indication of the nutritional status of the child. The mean values of chest and head circumference when compared with available Indian standards (NFI and Ghosh standards) there was no significant difference from the standard values. When head circumference : chest circumference ratio was compared according to classification given by Gopaldas, about 72.5 per cent of the preschool children studied were in the normal group.

Mid upper arm circumference is another measure of nutritional status. Mean arm circumference of boys and girls when compared with available Indian standard values of MUAC (NFI) there was a significant deviation from the standard values. When the MUAC values of these children were distributed according to different grades of malnutrition suggested by Gopaldas, it was found that 86.6 per

cent of the children belonged to the normal group. Arm circumference runs a close second to body weight as an indicator of PEM. Since arm is composed of muscle and fat, any change in muscle and fat due to malnutrition is usually reflected in arm circumference. In the present study also the prevalence of moderate protein energy malnutrition among preschool children with regard to MUAC was observed among 13.33 per cent.

The relationship between nutrient intake and anthropometric measurements of children (height and weight) revealed that even though, the intake of all the nutrients were below the RDA levels, there was a steady increase in the percentage of NCHS growth standards met by the children, when the percentage of RDA of energy and proteins in the diet increased.

Nutrient intakes, anthropometric measurements and their classifications to different degrees of malnutrition can be explained by the report of Gopalan (1989). According to him, in Kerala, inspite of the intakes of energy and protein being the lowest, the prevalence of severe grades of malnutrition is also the lowest in the state. This may be due to the fact that better housing conditions and personal hygiene of the families were graded good and immediate medical attention was given to the children, as the state is fairly literate, (especially high female literacy) densely populated and esily available and better utilization of health care facilities.

5.6 Mental functions and its association with nutritional status of preschool children

Intelligence score of the children were assessed by using Mathew's Test of Mental Abilities and it was found that majority of the children (56.7%) were having average IQ, while 28.3 per cent were in the borderline.

Mental functions and its relation to nutritional status with regard to nutrient intake and anthropometric measurements were statistically analysed, and it was found that, in the present study there was no correlation between individual nutrient consumption such as energy, protein and iron with the IQ of children but 53 per cent of the variation in IQ can be attributed to the overall nutrient intake of the children. The rest of the variations may be due to other non-nutritional factors.

Both nutritional and non-nutritional factors have been implicated in the development of intellectual functions in the growing child. Non nutritional factors may be relatively more important than nutritional facotors, since these affect the nutrition and nutritional status of the subject indirectly ICMR (1980).

Mental functions and its relation to different grades of growth retardation was analysed and discussed below.

The degree of growth retardation as analysed by weight/height^2 revealed that about 91.6 per cent of the children were having moderate malnutrition and it was observed that majority of these children (56.67%) were having average IQ. Among normal children (6.66%) the IQ was found to be above average. Among undernourished children (1.67%) the IQ was found to be low.

The results of the work done by Usha *et al.* (1973) on "Nutritional growth failure and mental development" also revealed that there was a close relationship between IQ, height and weight. Gravioto and Robles (1963) also reported a decrease in IQ with the weight deficit. Similar relationships between height and intelligence was observed in normal school age children of Mexico, Inodnesia and

Phillipines (Cravioto *et al.*, 1967; Liang *et al.*, 1967 and Guthrie and Guthrie, 1969).

Head circumference : chest circumference ratio was compared with the IQ of children and it was seen that in the normal group majority (65.0%) had average and above average IQ while those children who belonged to malnourished group were having average (5.8%) and below average IQ (Borderline - 20% and low IQ - 1.6%).

When mid upper arm circumference values were compared with the IQ of children studied, it was found that in normal group most of them (85%) were having average IQ and above average IQ. About 3.3 per cent of the normal children showed very superior IQ. In case of moderately malnourished children 11.66 per cent were having borderline IQ. While 1.67 per cent were with low IQ.

When statistically analysed it was observed that 58.5 per cent variation in IQ among the target group were explained by the anthropometric measurements taken and the partial regression coefficients were found to be highly significant. This results are in agreement with the studies conducted by Choudhry (1984) who osberved a significant correlation between anthropometric measurements and indices like height, weight, arm circumference, chest circumference and head circumference of preschool children with intelligence quotient.

The conclusions reached in the present study on the "Nutritional Profile and Mental Functions of Preschool Children" can be supported with the findings of NIN (1990). According to their view the relationship between undernutrition and mental development of children is still controversial and has caused much global

concern. Many attempts have been made to quantify the actual contribution of malnutrition perse to poor mental development, in order to confirm a casual relationship, if any, between the two. Most of these attempts have failed to prove beyond doubt, that undernutrition causes retardation in mental development. What has been found however is that the total environment, in all its diversity exerts an influence on the growth and psyco-social development of children. Some of the well documented studied identified several factors which influence the development in children and these include inadequate nutrition, frequent infection, lack of attention from parents, low education and income levels and poor sanitation.

In the present study though the children were nutritionally deficient the socio economic conditions were found to be more or less satisfactory. Hence only a minority were having low or boderline IQ. None of the children were having very low IQ. Majority of the children studied were with average IQ. And there were even children with above average IQ.

Summary

6. SUMMARY

In the present study the nutritional status of preschool children (4-5 age group) belonging to agricultural labourer families from the three agricultural subdivisions of Thrissur was ascertained. A total of 40 children in the age group 4-5 years were selected from each sub division and a total of 120 children (families) were selected from Thrissur district for the study.

Information regarding the socio economic details of the families indicated that majority of the families were nuclear families with two adults and two children. Women were more educated in these families. Housing conditions and living facilities of the families were found to be satisfactory.

Details regarding the index child revealed that majority (64.17%) of the children were in the first birth order and most of them were completely immunised. Mortality and morbidity pattern was found to be very low in these children. Health care facilities through primary health centres were better utilized by these families.

Dietary habits of the families revealed that all the families were habitual non vegetarians. Their dietary pattern mainly comprised of the staple rice, coconut for making curries and coconut oil used for seasoning the curries. Vegetables and pulses were mainly used for curries. Consumption of green leafy vegetables and fruits by these families were found to be negligible. Daily consumption of sugar and milk was mainly from coffee and tea. Consumption of non vegetarian foods were restricted to occassions due to its high cost. Weaning foods were given to the pre-school children which mainly consisted of cereal based porridge.

Dietary profile of preschool children indicated that all the food groups included in their daily diet was far below the Recommended Dietary Allowance (RDA). Regarding nutrient intakes by the preschool children only 62.9 percentage of RDA for energy was met while 86.9 percentage of RDA for proetins was met. Intake of all the other nutrients was also not satisfactory.

The anthropometric profile of preschool children was interpreted by comparing with Indian as well as NCHS standards. Comparison of weight/height^2 ratio with the classification of Rao and Singh, with the various grades of malnutrition revealed that 91.6 per cent of the children were having moderate malnutrition. In general the pattern of the prevalence of malnurition as shown by weight deficit in the present study is such that majority of boys and girls were having normal growth but the prevalence of grade I and grade II malnutrition, was more among girls which indicated their current nutritional status. From the above observations it was concluded that there was no incidence of severe grades of malnutrition among preschool children.

Mental functions of preschool children were tested and it was found that majority of the children were with average IQ (56.7%) while 28.3 per cent were in the borderline.

Where food intake and mental functions were satistically analysed it was observed that there was no correlation between the individual nutrient intake and IQ of children. About 53 per cent of the variation in IQ can be attributed to the overall nutrient intake of the children. The rest of the variations may be due to other non nutritional factors.

The degree of growth retardation as analysed by weight/height^2 revealed that about 91.6 per cent of the children were having moderate malnutrition and it was observed that majority of these children (56.6%) were having average IQ. Among normal children (6.6%) the IQ was found to be above average. Among malnourished children (1.6%) the IQ was found to be low.

Mental functions and its relation to different grades of growth retardation were statistically analysed it was observed that 58.5 per cent variation in IQ among the target group were explained by the anthropometric measurements taken and the partial regression coefficients were found to be highly significant.

Hence from the results of the study it can be concluded that there existed a strong influence (above 50%) between nutritional status and mental functions of preschool children. But nutritional status alone is not a factor which determined their mental performance. Here comes the role of other non nutritional factors such as socio economic conditions, educational status of the parents, learning environments at home, which in turn influence the development of mental functions in children.

Even though majority of the children studied were having normal anthropometric measurements, when compared with the Indian and NCHS standard values, there was significant deviation from the standard values. Morbidity rates of these children were found to be very low. Growth needs to be studied in the context of a given community. For purposes of comparison with a heterogenous population in our country, local reference standards for anthropometric measurements need to be evolved and used, which would make the comparison realistic.

References

REFERENCES

Abbi, R., Christian, P. Gujaral, S. and Gopaldas, T. 1988. Nutrition knowledge of mothers and the nutritional status of children. *Proc. Nutr. Soc. India*, National Institute of Nutrition, Hyderabad. **34**:111

*Alderman, H. 1993. Including the poor, regional and sectoral studies. World Bank, NW Washington DC. p.115

Ali, A. 1987. Food Habit, Nutrition and Health Status of the Lanjia Sooras - A primitive Tribe of Orissa. *Proc. Nutr. Soc. India*, National Institute of Nutrition, Hyderabad. **33**:56

Anand, K., Kapoor, S.K., Lobo, J. and Sundaram, K.R. 1992. Knowledge and practices regarding diarrhoea in rural mothers of Haryana. *J. Indian Acad. Pediatr.*. **29**(7):914

Anand, R.K. 1994. Problems in feeding infants and children. *J. Indian Acad. Pediatr.* **31**(1):1229

Anand, T.., Kumar, A.G. and Lakshmi, N. 1994. Rota virus diarrhoea among infants and children at Thirupathi. *J. Indian Acad. Pediatr.* **3**(1):46-47

Anderson, A.M., Gopaldas, T., Abbi, R. and Gujra, S. 1990. Agreement between Arm circumference, weight for age and weight for height, measures of malnutrition in children. *J. Indian Acad. Pediatr.* **27**(3):247-256

Anita. 1987. *Clinical dietetics and nutrition*. 3rd edition. Oxford University Press, Bombay.

* Ampofo, D.A. 1994. Maternal, child health and family planning in Ghana. Population Impact project. Unviersity of Ghana, Lagon. p.4

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

Awashthi, C.P., Kalia, M. and Maurya, D.M. 1990. Nutritional profile of rural pre-school children of Sultanpure District of Eastern UP. Proceedings of Indian Institute of Rural Studies. p.19

Baveja, R., Agarwal, R. and Pal, A. 1993. Maternal nutritional assessment. *J. Obstet and Gynecol*, Bombay. **43**(4):469

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

Begum. 1995. A study on the relationship between dietary intake and nutritional status of preschool children in Trivandrum. Ph.D. thesis, University of Kerala.

*Best, J.W. 1989. *Research in Eduation*. Prentus Hall of India Pvt. Ltd., New Delhi.

Bhat, C.M. and Dahaya, S. 1985. Nutritional status of preschool children in Gangwa Village of Hissar District. *The Indian J. Nutr. Dietet.* 22(7):206-214

Bhatia, H.R. 1972. *General psychology*. Oxford and IBH Publishing Company, New Delhi.

*Brahmam, G.N.V., Sastry, J.G. and Pralhad Rao, N. 1988. Intrafamily distribution of dietary energy - An Indian experience Ecol. Food and Nutrition. 22(1):125-130

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

Cameron, M.E. and Staveren, V.M.A. 1988. Food and health. Oxford and IBH Publishing Company, Bombay.

Carlier and Cecile. 1991. Prevalence of malnutrition and vitamin A deficiency in the Diourbei, Fatick and Kaolack regions of Sengal feasibility of the method of impression cytology with transfer. *Amer. J. clin. Nutr.* **53**(1):66-69

Chandra, R.K. 1983. Breast feeding, diarrhoel disease, growth and development. *Nutr. Abs. Res.* 3:605

Chandran, R.P. 1994. Low Birth weight Infants, invention intelligence. National Research Development Corporation Report. 29(5):287

Chavez, N.M. and Bono, B.F. 1974. Early Nutrition and the development of intelligence in children. *UNICEF News.* 101:31

Chen, L., Choudhery, A.K. and Huffman, S.L. 1980. Anthropometric assessment of energy protein malnutrition. *Amer. J. clin. Nutr.* 18(7):782-787

Chitra, S., Desai, U.K., Bhavsar, F.S. and Kantharia, S.L. 1988. A preliminary observation on health and nutritional status of preschool children in relation to housing condition. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad. 34:121

*Choksi, M.A. 1995. Advancing social development. World Bank Contribution to the Social Summit. World Bank, Washington, DC.

Choudhery, A.R. 1992. Heath for the million. *J. Indian Acad. Pediatr.* 17(5):40

Choudhry, M. and Rao, K.V. 1984. Association of growth status and mental function in preschool children. *The Indian J. Nutr. Dietet.* 21(1):1-18

*Cohen, M. 1993. Hunger 1994. Fronds farming, the politics of hunger. Silver Spring. Bread for the world. 35

Cravioto, J., Gaona, C. and Brich, H.G. 1967. Early malnutrition and audio visual integration in school age children. *J. Spec. Educ.* 2:75-85

*Cravioto, J. and Robles, B. 1963. The influence of protein calorie malnutrition on psychological test behaviour. Mild-moderate forms of protein calorie malnutrition. Symposia Swedish Foundation, Uppsala.

Dsagupta, R. 1989. *Nutritional Planning in India.* Diamond Printers, New Delhi.

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

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

Dutre, J.E. de-Oliveira. 1991. Malnutrition in developing countries - The challenges to and the responsibilities of the experts. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad. **37**:29

Easwaran, P.P. and Devadas, R.P. 1981. Trends in growth performance of Indian children development of norms. *The Indian J. Nutr. Dietet.* **18**(2):155

Easwaran, P.P. and Devadas, R.P. 1984. Growth performance and secular trends among children of Coimbatore. *The Indian J. Nutr. Diete.* **21**(3):355

Ebrahim, G.J. 1989. *Paediatric practice in developing countries.* Macmillan Publishers Ltd., Hong Kong.

*Gabr, M. 1990. Ubran nutrition in developing countries with special emphasis on preschool children. *Europ J. Nutr.* **44**:612

Garfield, E. 1990. Agricultural Sciences; most fruitful journals and high yield research field, curr. contents. *Journal Citation Studies.* **21**(51):3

Geetha, G. and Devadas, R.P. 1986. Prevalence of malnutrition, morbidity pattern and nutritional status of 0-6 years of children in Coimbatore. *The Indian J. Nutr. Dietet.* **23**(6):148-157

Geetha, G. 1986. Prevalence of malnutrition morbidity pattern and nutritional status of 0-6 years old children in Coimbatore. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad. **32**:14

Ghosh, S. 1986. Anthropometric measurements of male and female Indian children from high socio economic group (0-10 years). Project No.01-658-2.

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

Gibson, R.S. 1990. *Principles of nutritional assessment*. Oxford University Press, New York.

* Gopalan, C. 1967. Map nutrition in childhood in the tropics. *Br. Med. J.* **4**:603

Gopalan, C. 1986. Nutritional status of Indian children. Has it improved in recent years. NFI Bulletin. 7(1):3

* Gopalan, C. 1989. Nutritional and education some lessons from Asian Exponents, MAL. **4**:1-28

Gopalan, C. 1989. Malnutrition among pre-school children. Food and Nutrition Bulletin, 6

Gopalan, C. 1990. Combating Vitamin A deficiency. Need for a revised strategy. Proceedings of the Fourth International Symposium of the Nutrition Foundation of India, ICMR. p.2

Gopalan, C. 1991. Prefaratory chapter in recent bonds in Nutrition. Proceedings of the first International Symposium of the Nutrition Foundation of India, ICMR. 3

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

Gopalan, C. 1992. Growth pattern of well to do Indian children. *J. Indian Acad. Pediatr.* **29**(5):1195.

Gopalan, C. 1992. Challenges and Frontiers in Nutrition in Asia. Proceedings of the Sixth Asian Congress of Nutrition. 4

Gopalan, C. 1994. *Nutrition in the nineties. Policies and Strategies*. Oxford University Press, Bombay.

Gopalan, G., Sastri, B.V.R. and Balasubramanian, S.C. 1995. Nutritional deficience - their prevention and control. Nutritive value of Indian foods. National Institute of Nutrition, Hyderabad. p.37

Gopalan, T. 1988. How well trained is the field level Anganwadi workers in detecting growth retardation and flattering in the under six. *J. Indian Acad. Pediatr.* **25**(1):41-45

*Grantham Mcgregor, S. 1982. Stunting protein energy malnutrition. Challenges and controversies. Hum Nutr. Clin. Nutr. **36**92):319

Gurvey, J.M. 1969. Anthropometry indication: "A sample tool for assessing the growth of school age children". *J. Trop. Pediatr.* **15**:9-12

*Guthrie, H.A. and Guthrie, G.M. 1969. Nutritional status and intellectual performance in a rural Phillippine community. *Phillip. J. Nutr.* **22**:2-10

Harichandran, C. 1995. *Health status of Kerala - an Overview Science for health.* STEK, 62

Harris, T.C. 1992. Environment and Health, State of Indians Health. Proc. Nutr. Soc. India, National Institute of Nutrition. **1**:14

ICMR. 1980. Oppurtunities and challenges in Nutrition Research. ICMR Bulletin. **6**:14

ICMR. 1981. Recommended Dietary intakes for Indians. Indian Council of Medical Research, New Delhi.

ICMR. 1990. ICMR task force study. New Delhi, 18-28

ICMR. 1994. *Nutrient requirements and recommended dietary allowances for Indians.* ICMR, Hyderabad.

ICMR. 1994. Studies on nutritional anthropometry. *Nutrition.* National Institute of Nutrition, Hyderabad. **28**(1):18

ICMR. 1995. *Nutritive value of Indian foods.* National Institute of Nutrition, Hyderabad.

* ICSSR. 1980. Health for all - An alternate strategy. Mortality and Mobidity, 2

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

Irvin, E.L. 1994. Implications of antimutritional components in soyabean foods. Critical Review on Science and Nutrition. **34**(1):31-37

Jhansi, G. and Sarojini, G. 1991. Analogy of Health and nutritional status of preschoolers in fishing families. *J. Res. APAU.* **21**(1):2-15

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

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

Kadam, S.S., Salunkhe, D.K., Jadhav, S.J. and Bhonsle, R.K.I. 1984. Protein calorie malnutrition. Brain development, intelligence and behaviour postnatal nutrition. *The Indian J. Nutr. Dietet.* **21**(2):75

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

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

Kapil, U. 1990. A feasible strategy for health care package. *J. Indian Acad. Pediatr.* **27**(11):1228

Kceskoslermans. 1994. Assessing the quality of anthropometric data background. Integrated guidelines for survey managers. The World Bank, Washington DC. 72

Khanna, S.S. and Krishnamurthy, K.G. 1989. Food and nutritional security by 2000 AD. National Workshop. p.1-2

* Kleni, R.E., Freeman, H.E., Kagan, J., Youbrough, C. and Bietch, J.P. 1972. The relation of growth to cognition. *Journal of Health and Social Behaviour.* 11791):219-225

Komalavally, N., Desai, V.K. and Mehta, N.R. 1988. A follow up study on health and nutritional status of preschool children attending SNP in Surat city. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad. **34**:121

Kumar, V.K., Ramankutty, V. and Soman, C.R. 1990. Trends in birth weights in Kerala, a hospital based study. Health and population - perspectures and issues. **18**(192):52-60

Kutty, V.R. 1990. Women's health and child health linkages: some lessons from Kerala. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad. **36**:44

Lansdow, R. 1985. *Child development.* William Heineman Ltd., London.

* Liang, P.H., Mio, T.T., Jan, O.M. and Giok, L.T. 1967. Evaluation of mental development in relation to early malnutrition. *Amer. J. Clin. Nutr.* **20**:1290-1294

Lina. 1980. Development and evaluation of low cost indigenous food mixes for preschoolers. Ph.D. thesis, Sri.Venkateswara University.

Lina and Reddy, P.R. 1984. A survey of nutritional adequacy among selected pre-schoolers and formulation of diets. *The Indian J. Nutr. Dietet.* 21(7):241-250

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

MacLarane, J.A. 1980. *Child Health.* Grant Melntyre Ltd., London.

Mohan, L.K. and Arlin, M.K. 1992. *Food, Nutrition and diet therapy*. W.B. Saunders Company, Philadilphia.

* Malina, R.N. 1972. "Weight, height and limb circumference in American Negro children. *Journal of Tropical Paediatrics and Environmental Child Health.*. **18**:280-281

Manan, A.W. 1991. Malnutrition and socio-economic deprivation among preschool children in Malayasia Recent advances in Nutriology. **3**:68

Mathew, V.G. 1973. Mathews test of mental abilities for testing Intelligence. Professor. University of Kerala, Department of Psychology.

Mathur, Y.C. 1972. Study of growth pattern of preschool children of low socio economi status in a rural area. *J. Indian Acad. Pediatr.* **9**:41

* Mayers, J. 1972. Human Nutrition - its physiological, medical and social aspects. Charles C. Thomas Illinors, U.S.A. p.257

Metha, S., Gambhir, S.K., Bhandari, S. and Kaur, S. 1980. Evaluation of supplementary feeding programmes for preschool children. *Proc. Nutr. Soc. India*. National Institute of Nutrition, Hyderabad. **25**:34-37

Ministry of Health and Family Welfare. 1994. Nutritional child survival and safe motherhood programme interventions - Child survival. MCH division, New Delhi.

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

Monckeberg, F. 1972. Malnutrition and mental capacity nutrition, the nervous system and behaviour. *Pan American organization*. **251**:48-53

* Monteiro, C.A., Zuniga, H.P.P., Benicio, M.D.H.A., Rea, M.F., Judico, E.S. and Sigulem, O.M. 1987. The recent revival of breast feeding in the city of Saw Parlo. *American Journal of Public Health,* Brazil, **77**:964-966

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

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

Murakee, S. 1990. All about anaemia. *Nutrition*. National Institute of Nutrition. **24**(2):3-12

Murthy, G.V.S. 1989. Maternal knowledge and child health: 'Future'. UNICEF. 26-27

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

Nagi, M. and Sharmath. 1991. Energy protein and protein quality in the nutritional improvement of preschool children. *Recent advances in Nutriology*. ICMR. p.3

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

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

NCHS. 1976. NCHS growth charts, Rockvilla, MD.

Neal, G. 1988. *Clinical Nutrition*. Heire Mann Medical Books, London.

NFI. 1991. Growth performance of affluent Indian children (under five). Scientific Report 11. p.69

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

NIN. 1983. Relative importance of various anthropometric measurements and indices for evaluation of nutritional status. Annual Report. Indian Council of Medical Research, New Delhi. p.219

NIN. 1987. Relative importance of factors associated with mental ability of pre-school children. Annual Report. Indian Council of Medical Research, New Delhi. p.112

NIN. 1988. Undernutrition - Does it compromise mental development. Nutrition news. National Institute of Nutrition, Hyderabad. 9(5)

NIN. 1989. Effect of early undernutrition on subsequent growth and psychosocial functioning. Annual Report. Indian Council of Medical Research. p.7

NIN. 1990. Undernutrition and Intelligence. Nutrition News, National Institute of Nutrition, Hyderabad. 11(5)

NIPCCD. 1992. Report of the SAARC Conference on South Asian Children, New Delhi. p.101

NNMB. 1989. *Children and women in India.* A situation analysis. UNICEF. p.37

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

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

Ogus, A., Gokalp, A.S. and Gultekin, A. 1990. Incidence of malnutrition in children aged 0-6 years in SIVAS, an eastern province of Turkey. *J. Indian Acad. Pediatr.* 17(3):257-261

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

Patiroglu, T. and Dogan, P. 1991. Iron deficiency anaemia and catecholamine metabolism. *Indian Pediat.* **28**:51-56

Pelletier, Z.D. 1994. The potentiating effect of malnutrition on child mortality. Epedemiologic evidence and policy implications. *Nutr. Rev.* 52(12):409-415

Pelletier, Z.D., Frongillo, F.A.J., Sctoweder, D.G. and Habicht, J.P. 1995. The effects of malnutrition on child mortality in developing countries. Bull WHO. 73(4):28,

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

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

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

Ramachandran, P. 1989. Nutrition in pregnancy, women and nutrition in India. Nutrition Foundation of India - Spcial publication series No.5

Ramm. 1992. *Nutrition.* Nutritional Problems in India. National Institute of Nutrition, ICMR. **19**, 2

Rao, M.N. 1989. Breast feeding and weaning. *Proc. Nutr. Soc. India.* National Institute of Nutrition, Hyderabad. **35**:118

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

Rao, S. 1990. Nutrition news. National Institute of Nutrition. ICMR. 11, 3

Ravindran, G. 1984. "Villages". The root of malnutrition. *Kurushetra.* **33**(2):12-14

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

Reddy, V. 1991. Strategies for anaemia control in India. Proceedings of 6th Asian Congress of Nutrition, Malaysia. 291-295

Reddy, V., Rao, N.P., Sastry, J.G. and Kashinath, K. 1993. Nutrition trends in India. National Institute of Nutrition, Hyderabad. 36-37

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

* Robinson, C.H. 1985. Anaemia and iron deficiency Normal and therapeutic nutrition. *Br. J. Med. Bull.* 37(1):25-30

Robinson, C.H. 1990. *Normal and Therapeutic Nutrition* Macmelon Publishing House, New York. p.68,

Saibaba, A. 1992. The story of growth Nutrition. NIN. **26**(4):8-19

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

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

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

Satyanarayana, K. Naidu, N.A. and Rao, N.B.S. 1980. Annals. Hum. Biol. 7:359

Seckler, D. 1982. New concepts in nutrition and their implications for policy. Maharashtra Association of the cultivation of Science Research Institute, Pune. p.127-137

Seshadri, S. and Gopaldas, T. 1987. *Nutrition monitoring and assessment.* Oxford University Press, New Delhi. p.219-220

Sharma, S.D. and Kalia, M. 1990. Anthropometric measurements of preschool children in Ghumarwin Block of Himachal Pradesh. *The Indian J. Nutr. Dietet.* 27:47

Shiva, M. 1993. Empowering women and health care. Voluntary Health Association of India. 1(1):2

Sidhu, K.S. 1985. *Methodology of Research in Education*. Sterling Publishings Pvt. Ltd., New Delhi. p.1985

* Singh, T., Puri, R. and Goyal, M. 1993. Nutritional profile of upper class pre-school children of Ludhiana, Punjab. Abstract of 4th World Congress on Chemical Nutrition. 8

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

Sommer, A., Katz, J. and Tarwotjo, T. 1984. Increased risk of respiratory diseases and diarrhoea in children with pre existing mild vitamin A deficiency. *Amer. J. Clin. Nutr.*, 37:146-154

Srikantia, S.G. 1989. Pattern of growth and development of Indian girls and body size of adult Indian women. Nutrition foundation of India, New Delhi. p.108-152

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

Srinivasan, S. 1991. Measles where ignorance could spell through. Health Action. 1(2):17

Srivastava, P. 1991. Education, nutrition and child development. Chugh Publications, Allahabad. p.18-19

* Steinhoff, C.M. 1988. Acute Respiratory Infections. The folk on India 72000 - a review. UNICEF. 2

Swaminathan, M. 1986. *Principles of Nutrition and Dietetics*. Bappco, Bangalore. p.273

* Swaminathan, M.S. 1991. Asia-Pacific Journal of rural development. ATMS, CIRAP, DHAKA-1000. p.112

Taitz, L.S. and Wardly, S.L. 1989. *Hand book on child nutrition*. Oxford University Press, New York. p.108-111

Thimmayamma, B.V.S., Rav, P. and Krishnan, T.P. 1988. Meal pattern and energy protein adequacy of preschool children from different socio-economic groups. *The Indian J. Nutr. Dietet.* 25(7):212

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

Tomkins, A. 1981. Nutritional guidelines. Nutrition and nutrition education. Lancet. 1(8387):860

UN. 1992. Administrative committee on coordination/subcommittee on nutrition. ACC/SCN News. 9.

UN. 1993. Second Report on the World Nutrition Situation - India. 2:12,

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

UNICEF. 1991. The World Summit for Children, a global event. UNICEF - Annual Report. 7,

UNICEF. 1992. *The State of Worlds Children*. UNICEF. Oxford University Press, New York.,

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

Upadhyay, S.K. and Agarwal, D.P. 1988. Home environment, malnutrition and Intellectual ability. *Proc. Nutr. Soc. India*. National Institute of Nutrition, Hyderabad. 34:93

Uppal, J. 1994. National strategy on promotion of environmental hygiene in India. Rajiv Gandhi National Drinking Water Mission, New Delhi, 12-15

US Agency for International Development. 1989. Crucial elements of successful community nutrition programmes. Report of the Fifth International Conference. Washington.

Usha, A. and Begum, M. 1985. "Nutritional status of children attending the U.A.S. School". *The Indian J. Nutr. Dietet.* **22**:221

Usha, B., Udani, P.M., Shah, P.M., Naik, P.A. and Ezhuthachan. 1973. Nutritional growth failure and mental development. *Indian J. Pediatr.* **10**:657

Usha, C. and George, B. 1990. Vitamin A nutrition among children of selected urban slums of Coimbatore and effect of interventions. *The Indian J. Nutr. Dietet.* **27**(8):229

Uvin. 1994. Studies on preschool children. Nutr. Rev. 52 ,

Varadarajan, S. 1989. Dietary and nutritional guidelines for agricultural planning national workshop. A-1

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

Varghese, A. 1995. Iron deficiency and behaviour pattern in preschool children. M.Sc.(FS & N) thesis, Kerala Agricultural University, Thrissur.

Vijayaraghavan, K. 1987. Anthropometry for assessment of nutritional status. *Indian J. Paed.* **54**(4):511-520

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

Vijayaraghavan, K. 1990. Vitamin A intake and vitamin A deficiency in rural children. *J. Indian Acad. Pediatr.* 2793):143-151

WHO. 1985. Ideas forum. World Health Organisation Newsletter. **23**:3

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

WHO. 1990. Programme for control of diarrhoeal diseases. Interim programmes report. WHO Geneva. 17

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

WHO. 1991. Expanded programme of Immunization. Global overview, Geneva. 2-41

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

* World Bank. 1986. Poverty and hunger; issues and options for food security in developing countries. Washington, DC. 120

World Bank. 1990. World development report by World Bank. Oxford University Press, New York.

World Bank. 1993. World development report. *Inventing in Health*. Oxford University Press, England. 128

* World Bank. 1994. Health section review. Republic of Yemen, World Bank, Washington, D.C. 8

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

* Young, E.M. 1995. Investing in young children. World Bank, discussion paper 275. Washington, D.C. 5

* Originals not seen

Appendices

APPENDIX-I
Kerala Agricultural University
Department of Home Science

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

1. Name of the head of the family :
2. Address :
3. Place of survey :
4. Block :
5. Panchayat :
6. Distance to nearby city :
7. Age of the respondent :
8. Type of family : Joint/Nuclear
9. Family size : Adults Children
10. Religion : Hindu

    1. Nair
    2. SC
    3. OBC

    Christian/Muslim
11. Educational level : Illiterate/LPS/UPS/High School/College

    Father :
    Mother :
    1st child :
    2nd child :
    3rd child :
12. Occupational status
    Head of the family (father) :
    Mother :
13. Source of income of the family : Agriculture

    Other sources : 1. Poultry
    2. Cattle wealth
    3. House rent

14. Total income (Rs./month) : Agriculture : Rs.
Others : Rs.
Total : Rs.

15. Details of housing condition

a) Type of house : 1 room/2 room/3-4 rooms/6-8 rooms
8 and more

b) Type of root : Thatched/Tiled/Concrete

c) Structure of the house : Mud-built/brick built/Thatched

16. Details of ownership

a) Staying in own house : Yes/No
b) Staying in rented house : Yes/No
c) Rent received if a portion as let out : Rs. ...../month

17. Other characteristics

a) Separate kitchen : Yes/No
b) Usage of different rooms in the house : 1. Drawing room
2. Study room
3. Bed room
4. Store room

c) Source of drinking swater : Own well/public tap/Public well/
Tank/River

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

e) Drainage faciligties : Yes/No

f) Electricity facilities : Yes/No

g) Information source utilisation or recreational facilities : Owns a radio/TV/transister/VCR etc.

h) Transport facilities : Bicycle/motor bike/bus/jeep

i) Are you a member of any social organization : 1. Mahila samajam
2. Co-operative society
3. Youth club
4. Others
5. Nil

Monthly expenditure pattern

Sl.No.	Item	Expenditure monthly
1	Food	
2	Clothing	
3	Shelter	
4	Rent	
5	Transport	
6	Education	
7	Entertainment	
8	Health	
9	Savings	
10	Own expenses	
11	Repayment of loans	
12	Kuries	
13	Others	

Details regarding index child : Male/Female Age:

1. No. of children : Birth order Age

1.
2.
3.
4.
5.

2. Did any child die, If yes, reason for death : Yes/No
First/Second/Third/Fourth/Fifth

3. Birth weight of index child ;

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

5. Did your child get any serious illness after birth : Yes/No

If yes, which child : 1.
2.
3.
4.

6. What type of illness :

7. Does it occur frequently : Yes/No

8. Immunisation details of children : Complete/partially complete/Not taken

	Age
1st child	:
2nd child	:
3rd child	:
4th child	:

9. Morbidity pattern of index child
(Details of epidemic that had affected your child (index child) during the past one year

Disease	Duration	Treatment
1. Diarrhoea and vomitting		
2. Measles		
3. Chicken pox		
4. Mumps		
5. Fever		
6. Jaundice		
7. Respiratory diseases		
8. Others		

10. Participation in feeding programmes

1st child	:
2nd child	:
3rd child	:
4th child	:

11. When anybody in your family is sick, do you make use of Health centres : Yes/No

If yes : 1. Hospital
2. Dispensary
3. Maternal and child health centre
4. Ayurvedic
5. Homoeo
6. Others

12. How far is the nearest health centre from home : ..... Kms

13. Details regarding family planning

1. From where did you get information about this : 1. Books
   2. Friends and neighbours
   3. Radio
   4. Health workers
   5. T.V
   6. Health programme
   7. Newspapers

2. What is your opinion :

3. Have you adopted family planning measures : Yes/no

   If yes, husband/yourself :

   If no, why didn't you adopt? :

APPENDIX-II
Kerala Agricultural University
Department of Home Science

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

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

Items	Frequency of purchase				Price % of food expenditure
	Daily	Weekly	Monthly	Occassionally	
1. Cereals					
2. Pulses					
3. Leafy vegetables					
4. Roots and tubers					
5. Other vegetables					
6. Fruits					
7. Milk and milk products					
8. Fleshy foods					
9. Nuts and oil seeds					
10. Spices and condiments					
11. Others					

8. Frequency of use of different food materials

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

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

Item	Qty. produced	Qty. consumed	Qty. sold	Profit obtained
1.				
2.				
3.				
4.				

10. Meal pattern of the family : One major meal/two major meals/ three major meals

11. Snacking habits of the child

    Type of snak :

    Snack foods : Prepared at home/shop

12. Do you give equal importance for family members in food distribution : Yes/No

If yes, what is the order of importance you give : Reasons

1.

2.

3.

4.

13. Do you prepare different foods on special occassion : Yes/No

Occassion	Food prepared	Reasons
Birthday		
Marriage		
Death		
Festivals		
Feasts		
Others		

14. Foods given during special conditions

Condition	Breakfast	Lunch	Dinner
Infancy			
Pre-school period			
School going children			
Adolescent			
Pregnancy			
Lactation			

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

If yes, Diseases

Diseases	Food items included	Reasons	Food items avoided	Reasons
1. Cholera				
2. Diarrhoea				
3. Fever				
4. Vomiting				
5.				
6.				
7.				
8.				

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

17. Have you breast fed your children : Yes/No

Index child : Yes/No
If no, reasons

18. Do you give supplementary foods to the child : Yes/No

Index child : Yes/No
If yes, what type of foods :
From which month onwards :

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

If yes, name of the programme : 1. ICDS
2. School lunch
3.
4.

2) Do you participate in that : Yes/No

3) If yes, from where did you get information about this	:	1. Friends and neighbours 2. Newspaper 3. T.V. 4. Radio
4) Do you get any benefits from this programme	:	Yes/No
5) If yes, what are the benefits you get from this programme	:	1. Food 2. Medicine 3. Immunization 4. Education
6) Does your child participat	:	Yes/No
7) If yes, what are the benefits he is getting	:	1. Food 2. Medicine 3. Immunization 4. Education
8) Are you satisfied with these programmes:		Yes/No
9) What is your opinion about this programme?	:	

APPENDIX-III(a)

FAMILY AND INDIVIDUAL FOOD CONSUMPTION SURVEY WEIGHTMENT METHOD

Name of the investigation :

Name of the head of the family :

Name of the subject :

Age of the subject :

Serial No. :

Address :

Date :

FOOD CONSUMPTION

Name of the meal	Menu	Weight of total raw ingredients used by the family (g)	Weight of total cooked food consumed by the family (g)	Amount of cooked food consumed by the family (g)	Raw equivalents used by the individuals (g)
Breakfast					
Lunch					
Tea					
Dinner					
Others					

APPENDIX-III(b)
FAMILY DIET SURVEY - ONE DAY WEIGHMENT

Family No : Name of the head of the family : Date :

Village : District : State :

Age and sex composition of those who have part taker the mean

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

Cereals

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

Pulses

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

Roots and tubers

15. Carrot
16. Onion big
17. Beet root
18. Tapioca
19. Potato
20. Sweet potato
21. Yam
22. Others

Nuts and oil seeds

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

Fruits

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

Fish

38. Fish, fresh
39. Fish, dry

Other flesh foods

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

Milk and milk products

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

Fats and oils

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

Other food stuff

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

APPENDIX-IV
Kerala Agricultural University
Department of Home Science

NUTRITIONAL ASSESSMENT SCHEDULE

State : District : Taluk : Village :

Serial No. : Family : Block :

Name of the child : Sex :

Name of guardian/parent :

Occupation of parent :

Annual income :

Date of birth of child : Years Months

Source - Parent/Record :

ANTHROPOMETRY

1. Height :
2. Weight :
3. Mid upper arm circumference (MUAC) :
4. Head circumference :
5. Chest circumference :

APPENDIX-V
MATHEWS TEST OF MENTAL ABILITIES

Date recording format

Sl. No.	Name	Age (in years)	Time in seconds										Raw score
			1	2	3	4	5	6	7	8	9	10	11	12	

Scoring

Raw Score (x) = (180 x N) - (T)

N = Number of problems attempted (including the 2 failures)

T = Total time taken for the N problems. Failures are taken as 180 seconds each.

$$\text{Intelligence Quotient (IQ)} = \frac{x - \bar{x}}{SD} \times 15 \times 100$$

x = Raw score

$\bar{x}$ = Mean of raw score

SD = Standard deviation

NUTRITIONAL PROFILE AND MENTAL FUNCTIONS OF PRESCHOOL CHILDREN BELONGING TO AGRICULTURAL LABOURER FAMILIES IN THRISSUR DISTRICT

By

SHYNA P. K.

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of the
requirement for the degree of

Master of Science in Home Science

(FOOD SCIENCE & NUTRITION)
Faculty of Agriculture
Kerala Agricultural University

DEPARTMENT OF HOME SCIENCE
COLLEGE OF HORTICULTURE
VELLANIKKARA, THRISSUR - 680 654

1996

ABSTRACT

A study was conducted among the preschool children belonging to agricultural labourer families in Thrissur district, to find out their nutritional profile and to analyse the association if any, between nutritional profile and mental functions of these children.

The socio economic details inferred through the survey were found to be satisfactory. Nuclear families with better housing facilities and good educational level was the striking feature observed. Immunization and other health care facilities were better utilized by the families.

Food consumption survey results revealed a dietary pattern of vegetables, pulses, coconut and coconut oil. The inclusion of green leafy vegetables and fruits by the families was found to be negligible. Dietary profile of preschool children revealed that the food groups and nutrient intakes were below the RDA levels.

Prevalence of malnutrition as revealed by anthropometric survey indicated that most of the children were normal. But prevalence of grade I and grade II malnutrition was observed in some children.

Majority of the preschool children were having average IQ. Association between nutrient intake and IQ of children when statistically analysed showed that 53 per cent variation in IQ could be explained by the overall nutrient intake (calorie, protein and iron). Association between nutritional status (anthropometric indices) and IQ of preschool children when statistically analysed, it was found that 58.5 per cent variation in IQ can be attributed their body measurements.